



Cisco Wide Area Application Services Configuration Guide

Software Version 4.1.1

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CONTENTS

Preface xvii

PART 1

WAAS Introduction and Planning

CHAPTER 1

Introduction to Cisco WAAS 1-1

- About Cisco WAAS 1-1
 - Cisco WAAS Overcomes Common WAN Challenges 1-2
 - Traffic Optimization Process 1-2
- Key Services of Cisco WAAS 1-4
 - TFO Optimization 1-4
 - Windows Scaling 1-4
 - TCP Initial Window Size Maximization 1-4
 - Increased Buffering 1-5
 - Selective Acknowledgment 1-5
 - BIC TCP 1-5
 - Compression 1-5
 - Application-Specific Acceleration 1-6
 - File Services for Desktop Applications 1-7
 - WAAS Print Services 1-8
 - Virtualization 1-8
- Overview of the WAAS Interfaces 1-8
 - WAAS Central Manager GUI 1-9
 - Accessing the WAAS Central Manager GUI 1-9
 - Components of the WAAS Central Manager GUI 1-9
 - WAAS Central Manager Navigation Pane 1-11
 - WAAS Central Manager Taskbar Icons 1-12
 - WAE Device Manager GUI 1-14
 - WAAS Print Services Administration GUI 1-15
 - WAAS CLI 1-16
- Benefits of Cisco WAAS 1-16
 - Preservation of Source TCP/IP Information 1-17
 - Autodiscovery of WAAS Devices 1-17
 - Centralized Network Monitoring and Management 1-17
 - Optimized Read and Write Caching 1-18
 - WCCP Support 1-19

- PBR Support 1-19
- Inline Interception Support 1-19
- Failure Resiliency and Protection 1-20
- Namespace Support 1-20
- RAID Compatibility 1-21
- Streamlined Security 1-21
- SNMP Support 1-21

CHAPTER 2

Planning Your WAAS Network 2-1

- Checklist for Planning Your WAAS Network 2-1
 - Planning Checklist 2-2
- Site and Network Planning 2-4
 - Windows Network Integration 2-5
 - Data Center WAE Integration 2-5
 - Branch WAE Integration 2-6
 - UNIX Network Integration 2-6
 - WAFS-Related Ports in a WAAS Environment 2-7
 - Port 4050 2-7
 - Ports 139 and 445 2-7
 - Ports 88 and 464 2-8
 - Port 50139 2-8
 - Firewalls and Directed Mode 2-8
- About Autoregistration and WAEs 2-8
 - Selecting Static IP Addresses or Using Interface-Level DHCP 2-10
- Identifying and Resolving Interoperability Issues 2-10
 - Interoperability and Support 2-11
 - Unicode Support for the WAAS GUI Interfaces 2-11
 - Unicode Support Limitations 2-11
 - WAAS and Cisco IOS Interoperability 2-12
 - WAAS Support of the Cisco IOS QoS Classification Feature 2-12
 - WAAS Support of the Cisco IOS NBAR Feature 2-13
 - WAAS Support of the Cisco IOS Marking 2-14
 - WAAS Support of the Cisco IOS Queuing 2-14
 - WAAS Support of the Cisco IOS Congestion Avoidance 2-14
 - WAAS Support of the Cisco IOS Traffic Policing and Rate Limiting 2-14
 - WAAS Support of the Cisco IOS Signaling 2-14
 - WAAS Support of the Cisco IOS Link-Efficiency Operations 2-14
 - WAAS Support of the Cisco IOS Provisioning, Monitoring, and Management 2-14
 - WAAS and Management Instrumentation 2-15

WAAS and MPLS	2-15
WAAS Compatibility with other Cisco Appliances and Software	2-16
WAAS Devices and Device Mode	2-16
Calculating the Number of WAAS Devices Needed	2-17
Supported Methods of Traffic Redirection	2-18
Advantages and Disadvantages of Using Inline Interception	2-18
Advantages and Disadvantages of Using WCCP-Based Routing	2-19
Advantages and Disadvantages of Using PBR	2-20
Configuring WCCP or PBR Routing for WAAS Traffic	2-20
Configuring WAEs as Promiscuous TCP Devices in a WAAS Network	2-23
Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers	2-23
Access Lists on Routers and WAEs	2-24
IP ACLs on WAEs	2-24
Static Bypass Lists on WAEs	2-25
WAAS Login Authentication and Authorization	2-25
WAAS Administrator Accounts	2-26
Logically Grouping Your WAEs	2-26
Data Migration Process	2-28

PART 2**Installing and Configuring WAAS****CHAPTER 3****Using Device Groups and Device Locations 3-1**

About Device and Baseline Groups	3-1
Working with Device Groups	3-2
Creating a Device Group	3-2
Creating a New Device Group	3-3
Configuring the Settings for a Device Group	3-4
Assigning Devices to a Configuration Device Group	3-5
Deleting a Device Group	3-6
Viewing Device Group Assignments	3-6
Viewing the Device Groups List	3-7
Enabling or Disabling Device Group Overlap	3-7
Overriding Group Configuration Settings	3-8
Forcing Device Group Settings on All Devices in the Group	3-8
Selecting Device Group Precedence	3-9
Overriding the Device Group Settings on a Device	3-9
Understanding the Impact of Assigning a Device to Multiple Device Groups	3-10
Working with Baseline Groups	3-11

- Configuring the Default Baseline Groups 3-11
 - Customizing the Baseline Group Settings 3-12
 - Configuring the Service Settings for a Baseline Group 3-13
- Switching the Baseline Group for a Service 3-13
- Working with Device Locations 3-14
 - Creating Locations 3-14
 - Deleting Locations 3-15
 - Viewing the Location Tree 3-15

CHAPTER 4

- Configuring Traffic Interception 4-1**
 - Request Redirection Methods 4-1
 - Request Redirection of All TCP Traffic 4-3
 - Using WCCP to Transparently Redirect TCP Traffic to WAEs 4-4
 - Guidelines for Configuring WCCP 4-5
 - Guidelines for File Server Access Methods 4-6
 - Configuring Advanced WCCP Features on a WCCP-Enabled Router 4-7
 - Configuring a Router to Support WCCP Service Groups 4-7
 - Configuring IP Access Lists on a Router 4-10
 - Setting a Service Group Password on a Router 4-11
 - Configuring a Loopback Interface on the Router 4-12
 - Managing WCCP Configurations for WAEs 4-12
 - Load Balancing and WAEs 4-12
 - Packet-Forwarding Methods 4-14
 - WCCP Flow Redirection on WAEs 4-17
 - Viewing or Modifying the General WCCP Settings on WAEs 4-17
 - Viewing a List of Currently Configured WCCP Services for WAEs 4-18
 - Modifying the Current Settings of a WCCP Service for WAEs 4-19
 - Creating a WCCP Service Mask for an Existing WCCP Service 4-23
 - Modifying WCCP Service Masks for WAEs 4-23
 - Viewing a WCCP Router List Configuration for WAEs 4-24
 - Modifying the Configuration of WCCP Router Lists for WAEs 4-24
 - Deleting a WCCP Router List from WAEs 4-25
 - Defining Additional WCCP Router Lists on WAEs 4-25
 - Configuring WAEs for a Graceful Shutdown of WCCP 4-27
 - Configuring Static Bypass Lists for WAEs 4-28
 - Configuring Egress Methods for Intercepted Connections 4-29
 - Configuring a GRE Tunnel Interface on a Router 4-31
 - Using Policy-Based Routing to Transparently Redirect All TCP Traffic to WAEs 4-32
 - Methods of Verifying PBR Next-Hop Availability 4-38

Using Inline Mode to Transparently Intercept TCP Traffic	4-41
Configuring Inline Interface Settings	4-43
Configuring an IP Address on an Inline Interface	4-45
Configuring VLANs for Inline Support	4-47
Clustering Inline WAEs	4-48
Request Redirection of CIFS Client Requests	4-48
Using Inline Mode to Transparently Redirect CIFS Client Requests	4-48
Using WCCP to Transparently Redirect CIFS Client Requests	4-49
Using Explicit Naming of Shares to Explicitly Intercept CIFS Client Requests	4-49
Using Microsoft DFS to Intercept CIFS Client Requests	4-50

CHAPTER 5**Configuring Network Settings 5-1**

Configuring Network Interfaces	5-1
Configuring a Standby Interface	5-2
Configuring the Interface Priority Setting	5-4
Configuring Multiple IP Addresses on a Single Interface	5-6
Modifying Gigabit Ethernet Interface Settings	5-6
Configuring Port-Channel Settings	5-8
Configuring Interfaces for DHCP	5-9
Configuring a Load-Balancing Method for Interfaces	5-10
Configuring TCP Settings	5-10
Explicit Congestion Notification	5-12
Congestion Windows	5-12
Retransmit Time Multiplier	5-13
TCP Slow Start	5-13
Enabling the MTU Discovery Utility	5-14
Configuring Static IP Routes	5-15
Aggregating IP Routes	5-15
Configuring CDP Settings	5-15
Configuring the DNS Server	5-16
Configuring Windows Name Services	5-17
Configuring Directed Mode	5-17

CHAPTER 6**Configuring Administrative Login Authentication, Authorization, and Accounting 6-1**

About Administrative Login Authentication and Authorization	6-1
Default Administrative Login Authentication and Authorization Configuration	6-4
Configuring Administrative Login Authentication and Authorization	6-6
Configuring Login Access Control Settings for WAAS Devices	6-7

- Configuring Secure Shell Settings for WAAS Devices 6-8
- Disabling and Reenabling the Telnet Service for WAAS Devices 6-10
- Configuring Message of the Day Settings for WAAS Devices 6-10
- Configuring Exec Timeout Settings for WAAS Devices 6-11
- Configuring Line Console Carrier Detection for WAAS Devices 6-12
- Configuring Remote Authentication Server Settings for WAAS Devices 6-12
 - Configuring RADIUS Server Authentication Settings 6-13
 - Configuring TACACS+ Server Authentication Settings 6-15
 - Configuring the TACACS+ Enable Password Attribute 6-16
 - Configuring Windows Domain Server Authentication Settings 6-17
 - LDAP Server Signing 6-23
- Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices 6-26
- Configuring AAA Accounting for WAAS Devices 6-30
- Viewing Audit Trail Logs 6-32

CHAPTER 7

Creating and Managing Administrator User Accounts and Groups 7-1

- Overview of Administrator User Accounts 7-1
- Creating and Managing User Accounts 7-2
 - Overview for Creating an Account 7-2
 - Working with Accounts 7-3
 - Creating a New Account 7-4
 - Modifying and Deleting User Accounts 7-6
 - Changing the Password for Your Own Account 7-7
 - Changing the Password for Another Account 7-8
 - Viewing User Accounts 7-8
 - Unlocking User Accounts 7-8
 - Working with Passwords 7-9
 - Working with Roles 7-10
 - Creating a New Role 7-10
 - Assigning a Role to a User Account 7-12
 - Modifying and Deleting Roles 7-13
 - Viewing Role Settings 7-13
 - Working with Domains 7-14
 - Creating a New Domain 7-14
 - Adding an Entity to a Domain 7-15
 - Assigning a Domain to a User Account 7-15
 - Modifying and Deleting Domains 7-16
 - Viewing Domains 7-16
 - Working with User Groups 7-17

Creating a New User Group	7-17
Assigning Roles to a User Group	7-18
Assigning Domains to a User Group	7-18
Modifying and Deleting a User Group	7-19
Viewing User Groups	7-19

CHAPTER 8**Creating and Managing IP Access Control Lists for WAAS Devices 8-1**

About IP ACLs for WAAS Devices	8-1
Precedence of IP ACLs and Application Definition Policies on WAEs	8-3
Creating and Managing IP ACLs for WAAS Devices	8-3
List of Extended IP ACL Conditions	8-8

CHAPTER 9**Configuring Other System Settings 9-1**

Modifying Device Properties	9-1
Managing Software Licenses	9-3
Enabling the Inetd RCP Services	9-4
Enabling the Inetd FTP Service	9-4
Configuring Date and Time Settings	9-5
Configuring NTP Settings	9-5
Configuring Time Zone Settings	9-5
Configuring Secure Store Settings	9-10
Secure Store Overview	9-10
Enabling Secure Store Encryption on the Central Manager	9-12
Enabling Secure Store Encryption on a Standby Central Manager	9-13
Enabling Secure Store Encryption on a WAE Device	9-13
Changing the Secure Store Encryption Key and Password	9-14
Disabling Secure Store Encryption on a Central Manager or WAE Device	9-15
Modifying the Default System Configuration Properties	9-16
Configuring Faster Detection of Offline WAAS Devices	9-18
About Faster Detection of Offline Devices	9-18
Configuring Alarm Overload Detection	9-19
Configuring the E-mail Notification Server	9-20

CHAPTER 10**Using the WAE Device Manager GUI 10-1**

Launching the WAE Device Manager	10-1
A Quick Tour of the WAE Device Manager	10-2
WAE Management Workflow	10-3

- Managing a Cisco WAE 10-4
 - Control Option 10-4
 - Starting and Stopping Components 10-5
 - Registering and Unregistering a WAE 10-6
 - Backing Up the Configuration Files 10-7
 - Restoring the Configuration Files 10-7
 - Configuration Option 10-8
 - Configuring SNMP Settings 10-8
 - Viewing Network Settings 10-9
 - Configuring Windows Authentication 10-10
 - Defining Notification Settings 10-15
 - Utilities Option 10-17
 - Running Support Utilities 10-17
 - Running the Cache Cleanup Utility 10-18
 - Running the File Server Rename Utility 10-18
- Managing a CIFS Accelerator Device 10-19
 - Preposition Option 10-19
 - Terminating a Preposition Task 10-22
- Managing a WAFS Core Device 10-22
- Managing a WAFS Edge Device 10-22
- Monitoring the WAE 10-23
 - Monitoring Graphs 10-23
 - Viewing Options 10-24
 - Monitoring the Cisco WAE Component 10-25
 - Monitoring a WAFS Core 10-26
 - Monitoring a Transparent CIFS Accelerator or a WAFS Edge Device 10-28
- Viewing WAE Logs 10-31
 - WAE Logs 10-31
 - Setting Display Criteria 10-32
 - Viewing Log Entries 10-32
 - Saving Log File Information 10-33
 - Viewing Cisco WAE Logs 10-33

PART 3

Configuring WAAS Services

CHAPTER 11

Configuring Wide Area File Services 11-1

- About File Services 11-1
- Overview of File Services Features 11-3
 - Automatic Discovery 11-4

Automatic Discovery with Legacy Mode	11-4
Prepositioning	11-4
Data Coherency	11-5
Data Concurrency	11-6
File-Locking Process	11-6
Microsoft Interoperability	11-6
Windows Shadow Copy for Shared Folders	11-7
Preparing for File Services	11-8
Using File Services on the NME-WAE	11-8
Configuring File Services	11-9
Configuring the Core Cluster	11-10
Configuring the Edge Devices	11-13
Setting Up File Servers to Export to the Edge WAE Cache	11-16
Registering a File Server with the WAAS Central Manager	11-16
Importing File Server Definitions Using a CSV File	11-17
Assigning a Core Cluster to a Registered File Server	11-19
Creating Dynamic Shares	11-20
Creating a Connection Between a Core Cluster and Edge WAEs	11-22
Creating a Preposition Directive	11-25
Creating a New Preposition Directive	11-25
Assigning Edge Devices to a Preposition Directive	11-30
Creating a New Preposition Schedule	11-31
Managing File Services	11-32
Checking the Preposition Status	11-32
Starting and Stopping Preposition Tasks	11-33
Preparing Your WAAS Network for WAN Failures	11-33
About Disconnected Mode	11-33
DNS and Domain Controller Requirements	11-34
Data Availability in Disconnected Mode	11-34
Configuring Disconnected Mode	11-34
Viewing Members of a Core Cluster	11-35

CHAPTER 12**Configuring Application Acceleration 12-1**

About Application Acceleration	12-1
Enabling and Disabling the Global Optimization Features	12-2
Configuring HTTP Acceleration	12-4
Configuring MAPI Acceleration	12-5
Configuring Video Acceleration	12-5
Creating a New Traffic Application Policy	12-7

- Preparing to Create an Application Policy 12-7
- Creating an Application Definition 12-8
- Creating an Application Policy 12-9
- Managing Application Acceleration 12-15
 - Viewing a List of Applications 12-15
 - Viewing a Policy Report 12-16
 - Viewing a Classifier Report 12-16
 - Restoring Application Policies and Classifiers 12-16
 - Monitoring Applications 12-17
 - Defining Default DSCP Marking Values 12-17
 - Defining the Default DSCP Marking Value 12-17
 - Modifying the Position of an Application Policy 12-18
 - Modifying the Acceleration TCP Settings 12-19
 - Calculating the TCP Buffers for High BDP Links 12-21
 - Modifying the TCP Adaptive Buffering Settings 12-21

CHAPTER 13

Configuring and Managing WAAS Legacy Print Services 13-1

- About WAAS Print Services 13-1
 - Branch Office Printing Topology 13-2
 - WAAS Print Services 13-3
 - Print Driver Support and Interoperability 13-3
 - Printer Clustering 13-4
 - Print Services Users 13-4
 - Feature Support 13-4
- Planning for Print Services 13-5
 - Identifying the Print Administration Users 13-5
 - Obtaining Printer Information 13-6
 - Planning Worksheets 13-6
- Configuring Print Services 13-7
 - Configuration Checklist 13-7
 - Preparing your WAE Device and Central Manager for Print Services 13-8
 - Creating Accounts with Print Admin Privileges 13-10
 - Enabling Print Services 13-11
 - Adding a Printer to the WAAS Print Server 13-12
 - Adding Printer Clusters 13-14
 - Setting Up the WAAS Central Manager as the Driver Repository 13-16
 - Installing Print Drivers on Individual WAAS Print Servers 13-18
 - Distributing Drivers to the WAAS Print Servers 13-19
 - Distributing a Single Driver to Multiple Devices or Groups 13-20

Distributing Multiple Drivers to a Single Device or Group	13-20
Verifying Print Driver Distribution	13-21
Associating a Driver with your Printer	13-22
Initializing Print Drivers	13-22
Adding the WAAS Print Server to Your Branch Office Clients	13-23
Managing Print Services	13-25
Viewing Print Server Details	13-25
Configuring Aggregate Settings	13-26
Using the Print Services Administration GUI	13-27
Opening the Print Services Administration GUI	13-28
Adding a Printer	13-28
Modifying the Printer Configuration	13-28
Enabling Print Banners	13-30
Setting Up Print Clusters	13-31
Viewing Print Jobs	13-31
Viewing the Print Server Page Log	13-32
Troubleshooting Print Services	13-33
General Known Issues	13-33
Login and Access Problems	13-34
Avoiding Print Problems	13-34
Understanding Interactions Between the WAAS Central Manager and the WAAS CLI	13-35

CHAPTER 14**Configuring Virtual Blades 14-1**

About Virtual Blades	14-1
Preparing to Use Virtual Blades	14-2
Configuring Virtual Blades	14-4
Enabling and Disabling Virtual Blades	14-7
Copying a Disk Image to a Virtual Blade	14-8
Backing Up and Restoring a Virtual Blade	14-8

PART 4**Maintaining, Monitoring, and Troubleshooting your WAAS Network****CHAPTER 15****Maintaining Your WAAS System 15-1**

Upgrading the WAAS Software	15-1
Determining the Current Software Version	15-3
Obtaining the Latest Software Version from Cisco.com	15-3
Specifying the Location of the Software File in the WAAS Central Manager GUI	15-4
Using the WAAS Disk Check Tool	15-6

- Ensuring RAID Pairs Rebuild Successfully 15-7
- Upgrading the WAAS Central Manager 15-8
- Upgrading Multiple Devices Using Device Groups 15-10
- Deleting a Software File 15-10
- Backing Up and Restoring your WAAS System 15-11
 - Backing Up and Restoring the WAAS Central Manager Database 15-11
 - Backing Up and Restoring a WAE Device 15-13
 - Using the Cisco WAAS Software Recovery CD-ROM 15-13
 - Recovering the System Software 15-17
 - Recovering a Lost Administrator Password 15-19
 - Recovering from Missing Disk-Based Software 15-20
 - Recovering WAAS Device Registration Information 15-21
- Performing Disk Maintenance for RAID-1 Systems 15-22
- Replacing Disks in RAID-5 Systems 15-23
- Switching a WAAS Central Manager from Standby to Primary 15-25
- Enabling Disk Encryption 15-26
- Configuring a Disk Error-Handling Method 15-28
- Activating All Inactive WAAS Devices 15-29
- Rebooting a Device or Device Group 15-29
- Performing a Controlled Shutdown 15-30

CHAPTER 16

Monitoring and Troubleshooting Your WAAS Network 16-1

- Viewing System Information from the System Dashboard Window 16-2
 - Monitoring Graphs and Charts 16-2
 - Alarm Panel 16-3
 - Device Alarms 16-5
- Troubleshooting Devices Using Alerts 16-6
- Viewing Device Information 16-7
 - Devices Window 16-7
 - Device Dashboard Window 16-9
- Customizing a Dashboard or Report 16-10
 - Adding a Chart 16-11
 - Configuring Chart Settings 16-17
- Using Predefined Reports to Monitor WAAS 16-18
 - Viewing Connections and Peer Devices 16-19
 - Monitoring Device TCP Connections 16-20
 - Viewing CPU Utilization 16-21
 - Viewing Disk Information 16-22

Configuring Flow Monitoring	16-23
Alarms for Flow Monitoring	16-24
Example Using NetQoS for Flow Monitoring	16-25
Managing Reports	16-25
Creating Custom Reports	16-25
Viewing and Editing Reports	16-27
Scheduling Reports	16-27
Managing Scheduled Reports	16-28
Configuring System Logging	16-29
Priority Levels	16-31
Multiple Hosts for System Logging	16-32
Configuring Transaction Logging	16-32
Enabling Transaction Logging	16-32
Transaction Logs	16-34
Viewing the System Message Log	16-35
Viewing the Audit Trail Log	16-36
Viewing the Device Log	16-37
Enabling the Kernel Debugger	16-37
Troubleshooting Using Diagnostic Tests	16-38
Troubleshooting Using the GUI	16-38
Troubleshooting Using the CLI	16-38
Using the show and clear Commands from the WAAS Central Manager GUI	16-39

CHAPTER 17**Configuring SNMP Monitoring 17-1**

About SNMP	17-1
SNMP Communication Process	17-2
Supported SNMP Versions	17-3
SNMP Security Models and Security Levels	17-3
Supported MIBs	17-4
ACTONA-ACTASTOR-MIB	17-5
CISCO-CDP-MIB	17-5
CISCO-CONFIG-MAN-MIB	17-5
CISCO-CONTENT-ENGINE-MIB	17-5
CISCO-ENTITY-ASSET-MIB	17-6
CISCO-SMI	17-6
CISCO-TC	17-6
ENTITY-MIB	17-6
EVENT-MIB	17-6

HOST-RESOURCES-MIB	17-6
MIB-II	17-7
SNMP-COMMUNITY-MIB	17-7
SNMP-FRAMEWORK-MIB	17-7
SNMP-NOTIFICATION-MIB	17-7
SNMP-TARGET-MIB	17-7
SNMP-USM-MIB	17-7
SNMPV2-MIB	17-7
SNMP-VACM-MIB	17-7
Downloading MIB Files to a WAAS Device	17-7
Enabling the SNMP Agent on a WAAS Device	17-8
Checklist for Configuring SNMP	17-8
Preparing for SNMP Monitoring	17-9
Enabling SNMP Traps	17-9
Defining SNMP Traps	17-12
Aggregating SNMP Traps	17-13
Specifying the SNMP Host	17-13
Specifying the SNMP Community String	17-14
Creating SNMP Views	17-16
Creating an SNMP Group	17-17
Creating an SNMP User	17-18
Configuring SNMP Asset Tag Settings	17-19
Configuring SNMP Contact Settings	17-20

APPENDIX A

Default Application Policies A-1

INDEX



Preface

This preface describes who should read the *Cisco Wide Area Application Services Configuration Guide*, how it is organized, and its document conventions. It contains the following sections:

- [Audience, page xvii](#)
- [Document Organization, page xvii](#)
- [Document Conventions, page xix](#)
- [Related Documentation, page xx](#)
- [Obtaining Documentation and Submitting a Service Request, page xx](#)

Audience

This guide is for experienced network administrators who are responsible for configuring and maintaining the Cisco Wide Area Application Services (WAAS) network.

You should be familiar with the basic concepts and terminology used in internetworking, and understand your network topology and the protocols that the devices in your network can use. You should also have a working knowledge of the operating systems on which you are running your WAAS network, such as Microsoft Windows, Linux, or Solaris.

Document Organization

This guide is organized as follows:

Chapter	Title	Description
Chapter 1	Introduction to Cisco WAAS	Provides an overview of the WAAS product and its features.
Chapter 2	Planning Your WAAS Network	Provides general guidelines and preparation information you should read before installing the WAAS product in your network.
Chapter 3	Using Device Groups and Device Locations	Describes how to create groups that make it easier to manage and configure multiple devices at the same time. This chapter also covers device locations.

Chapter	Title	Description
Chapter 4	Configuring Traffic Interception	Describes the WAAS software support for intercepting all TCP traffic in an IP-based network.
Chapter 5	Configuring Network Settings	Describes how to configure basic network settings like DNS and CDP.
Chapter 6	Configuring Administrative Login Authentication, Authorization, and Accounting	Describes how to centrally configure administrative login authentication, authorization, and accounting for WAEs in your WAAS network.
Chapter 7	Creating and Managing Administrator User Accounts and Groups	Describes how to create device-based CLI accounts and roles-based accounts from the WAAS Central Manager GUI.
Chapter 8	Creating and Managing IP Access Control Lists for WAAS Devices	Describes how to centrally create and manage Internet Protocol (IP) access control lists (ACLs) for your WAEs.
Chapter 9	Configuring Other System Settings	Describes how to perform various other system configuration tasks such as specifying an NTP server and setting the time zone on a device.
Chapter 10	Using the WAE Device Manager GUI	Describes how to use the WAE Device Manager GUI to configure and manage individual WAEs in your network.
Chapter 11	Configuring Wide Area File Services	Describes how to configure Wide Area File Services (WAFS), which allows branch office users to more efficiently access data stored at centralized data centers. The WAFS feature overcomes the WAN latency and bandwidth limitations by caching data on WAEs near branch office users.
Chapter 12	Configuring Application Acceleration	Describes how to configure the application policies on your WAAS system that determine the types of application traffic that is accelerated over your WAN.
Chapter 13	Configuring and Managing WAAS Legacy Print Services	Describes how to configure and manage the WAAS print services feature that allows WAEs to function as print servers in your branch offices.
Chapter 14	Configuring Virtual Blades	Describes how to configure virtual blades, which emulate another computer in your WAAS device.
Chapter 15	Maintaining Your WAAS System	Describes the tasks you may need to perform to maintain your WAAS system.
Chapter 16	Monitoring and Troubleshooting Your WAAS Network	Describes the monitoring and troubleshooting tools available in the WAAS Central Manager GUI that can help you identify and resolve issues with your WAAS system.

Chapter	Title	Description
Chapter 17	Configuring SNMP Monitoring	Describes how to configure SNMP traps, recipients, community strings and group associations, user security model groups, and user access permissions.
Appendix A	Default Application Policies	Lists the default applications and classifiers that WAAS will either optimize or pass through based on the policies that are provided with the system.

Document Conventions

Command descriptions use these conventions:

boldface font	Commands and keywords are in boldface.
<i>italic font</i>	Arguments for which you supply values are in italics.
[]	Elements in square brackets are optional.
[x y z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.

Screen examples use these conventions:

screen font	Terminal sessions and information the switch displays are in screen font.
boldface screen font	Information you must enter is in boldface screen font.
<i>italic screen font</i>	Arguments for which you supply values are in italic screen font.
< >	Nonprinting characters, such as passwords, are in angle brackets.
[]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

This document uses the following conventions:



Note

Means reader *take note*. Notes contain helpful suggestions or references to material not covered in the manual.



Caution

Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.



Tip

Means *the following information will help you solve a problem*. Tips might not be troubleshooting or even an action, but could help you save time.

Related Documentation

For additional information on the Cisco WAAS software, see the following documentation:

- *Release Note for Cisco Wide Area Application Services*
- *Cisco Wide Area Application Services Command Reference*
- *Cisco Wide Area Application Services Quick Configuration Guide*
- *Cisco Wide Area Application Services Configuration Guide* (this manual)
- *Cisco Wide Area Application Services API Reference*
- *Cisco WAAS Installation and Configuration Guide for Windows on a Virtual Blade*
- *Configuring Cisco WAAS Network Modules for Cisco Access Routers*
- *Regulatory Compliance and Safety Information for the Cisco Content Networking Product Series*
- *Cisco Wide Area Application Engine 511 and 611 Hardware Installation Guide*
- *Cisco Wide Area Application Engine 512 and 612 Hardware Installation Guide*
- *Cisco Wide Area Application Engine 7326 Hardware Installation Guide*
- *Cisco Wide Area Application Engine 7341, 7371, and 674 Hardware Installation Guide*
- *Cisco Network Modules Hardware Installation Guide*
- *Installing the Cisco WAE Inline Network Adapter*
- *Cisco Wide Area Application Services Online Help*
- *Using the Print Utilities to Troubleshoot and Fix Samba Driver Installation Problems*

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.



PART 1

WAAS Introduction and Planning



CHAPTER 1

Introduction to Cisco WAAS

This chapter provides an overview of the Cisco WAAS solution and describes the main features that enable WAAS to overcome the most common challenges in transporting data over a wide area network.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [About Cisco WAAS, page 1-1](#)
- [Key Services of Cisco WAAS, page 1-4](#)
- [Overview of the WAAS Interfaces, page 1-8](#)
- [Benefits of Cisco WAAS, page 1-16](#)

About Cisco WAAS

The WAAS system consists of a set of devices called wide area application engines (WAEs) that work together to optimize TCP traffic over your network. When client and server applications attempt to communicate with each other, the network intercepts and redirects this traffic to the WAEs so that they can act on behalf of the client application and the destination server. The WAEs examine the traffic and use built-in application policies to determine whether to optimize the traffic or allow it to pass through your network unoptimized.

You use the WAAS Central Manager GUI to centrally configure and monitor the WAEs and application policies in your network. You can also use the WAAS Central Manager GUI to create new application policies so that the WAAS system can optimize custom applications and less common applications.

Cisco WAAS helps enterprises meet the following objectives:

- Provide branch office employees with LAN-like access to information and applications across a geographically distributed network.
- Migrate application and file servers from branch offices into centrally managed data centers.
- Minimize unnecessary WAN bandwidth consumption through the use of advanced compression algorithms.

- Virtualize print and other local services to branch office users. Cisco WAAS allows you to configure a WAE with Windows in a virtual blade so that you do not need to deploy a dedicated system to provide local services such as Print Services, Active Directory Services, DNS, and DHCP services.
- Improve application performance over the WAN by addressing the following common issues:
 - Low data rates (constrained bandwidth)
 - Slow delivery of frames (high network latency)
 - Higher rates of packet loss (low reliability)

This section contains the following topics:

- [Cisco WAAS Overcomes Common WAN Challenges, page 1-2](#)
- [Traffic Optimization Process, page 1-2](#)

Cisco WAAS Overcomes Common WAN Challenges

[Table 1-1](#) describes how Cisco WAAS uses a combination of TCP optimization techniques and application acceleration features to overcome the most common challenges associated with transporting traffic over a WAN.

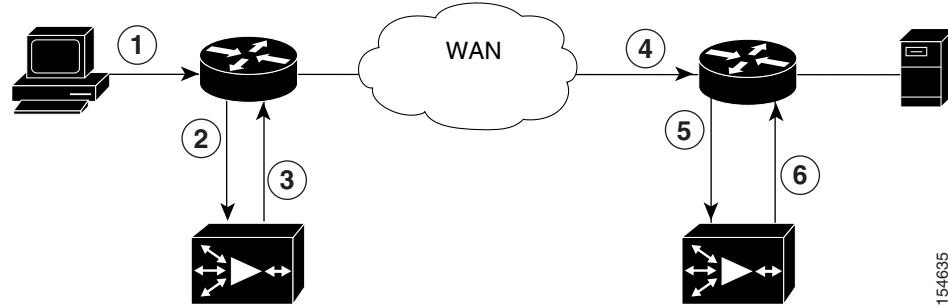
Table 1-1 *Cisco WAAS Solution*

WAN Issue	WAAS Solution
High network latency	Intelligent protocol adapters reduce the number of roundtrip responses common with chatty application protocols.
Constrained bandwidth	Data caching provided with the file services feature and data compression reduce the amount of data sent over the WAN, which increases data transfer rates. These solutions improve application response time on congested links by reducing the amount of data sent across the WAN.
Poor link utilization	TCP optimization features improve network throughput by reducing the number of TCP errors sent over the WAN and maximizing the TCP window size that determines the amount of data that a client can receive at one time.
Packet loss	Optimized TCP stack in WAAS overcomes the issues associated with high packet loss and protects communicating end points from the state of the WAN.

Traffic Optimization Process

[Figure 1-1](#) shows the process that Cisco WAAS follows to optimize application traffic.

Figure 1-1 Traffic Optimization Process



The following steps describe how your WAAS network optimizes a connection between a branch office client and a destination server:

1. A branch office client attempts to connect to the destination server over the native application port.
2. The WAAS network uses WCCP or PBR to intercept the client request, or if deployed on a WAE with a Cisco WAE Inline Network Adapter, WAAS can intercept the request directly using inline mode. For more information on inline mode, see the [“Using Inline Mode to Transparently Intercept TCP Traffic”](#) section on page 4-41.
3. The branch WAE performs the following actions:
 - Examines the parameters in the traffic’s TCP headers and then refers to the application policies to determine if the intercepted traffic should be optimized. Information in the TCP header, such as the source and destination IP address, allows the branch WAE to match the traffic to an application policy. For a list of the default policies, see [Appendix A, “Default Application Policies.”](#)
 - If the branch WAE determines that the traffic should be optimized, it adds information to the TCP header that informs the next WAE in the network path to optimize the traffic.
4. The branch WAE passes along the client request through the network to its original destination server.
5. The data center WAE performs the following actions:
 - Intercepts the traffic going to the destination server.
 - Establishes an optimized connection with the branch WAE. If the data center WAE has optimization disabled, then an optimized connection will not be established and the traffic passes over the network unoptimized.
6. WAAS optimizes subsequent traffic between the branch WAE and data center WAE for this connection.

Cisco WAAS does not optimize traffic in the following situations:

- The WAE intercepts non-TCP traffic (such as UDP or ICMP).
- The WAE is overloaded and does not have the resources to optimize the traffic.
- The intercepted traffic matches an application policy that specifies to pass the traffic through unoptimized.



Note

If unoptimized traffic reaches a WAE, the WAE forwards the traffic in pass-through mode without affecting the performance of the application using the passed-through connection.

Key Services of Cisco WAAS

Cisco WAAS contains the following services that help optimize traffic over your wide area network:

- [TFO Optimization, page 1-4](#)
- [Compression, page 1-5](#)
- [Application-Specific Acceleration, page 1-6](#)
- [File Services for Desktop Applications, page 1-7](#)
- [WAAS Print Services, page 1-8](#)
- [Virtualization, page 1-8](#)

TFO Optimization

Cisco WAAS uses a variety of transport flow optimization (TFO) features to optimize TCP traffic intercepted by the WAAS devices. TFO protects communicating clients and servers from negative WAN conditions, such as bandwidth constraints, packet loss, congestion, and retransmission.

TFO includes the following optimization features:

- [Windows Scaling, page 1-4](#)
- [TCP Initial Window Size Maximization, page 1-4](#)
- [Increased Buffering, page 1-5](#)
- [Selective Acknowledgment, page 1-5](#)
- [BIC TCP, page 1-5](#)

Windows Scaling

Windows scaling allows the receiver of a TCP packet to advertise that its TCP receive window can exceed 64 KB. The receive window size determines the amount of space that the receiver has available for unacknowledged data. By default, TCP headers limit the receive window size to 64 KB, but Windows scaling allows the TCP header to specify receive windows of up to 1 GB.

Windows scaling allows TCP endpoints to take advantage of available bandwidth in your network and not be limited to the default window size specified in the TCP header.

For more information about Windows scaling, refer to RFC 1323.

TCP Initial Window Size Maximization

WAAS increases the upper bound limit for TCP's initial window from one or two segments to two to four segments (approximately 4 KB). Increasing TCP's initial window size provides the following advantages:

- When the initial TCP window is only one segment, a receiver that uses delayed ACKs is forced to wait for a timeout before generating an ACK response. With an initial window of at least two segments, the receiver generates an ACK response after the second data segment arrives, eliminating the wait on the timeout.

- For connections that transmit only a small amount of data, a larger initial window reduces the transmission time. For many e-mail (SMTP) and web page (HTTP) transfers that are less than 4 KB, the larger initial window reduces the data transfer time to a single round trip time (RTT).
- For connections that use large congestion windows, the larger initial window eliminates up to three RTTs and a delayed ACK timeout during the initial slow-start phase.

For more information about this optimization feature, see RFC 3390.

Increased Buffering

Cisco WAAS enhances the buffering algorithm used by the TCP kernel so that WAEs can more aggressively pull data from branch office clients and remote servers. This increased buffer helps the two WAEs participating in the connection keep the link between them full, increasing link utilization.

Selective Acknowledgment

Selective Acknowledgement (SACK) is an efficient packet loss recovery and retransmission feature that allows clients to recover from packet losses more quickly than the default recovery mechanism used by TCP.

By default, TCP uses a cumulative acknowledgement scheme that forces the sender to either wait for a roundtrip to learn if any packets were not received by the recipient or to unnecessarily retransmit segments that may have been correctly received.

SACK allows the receiver to inform the sender about all segments that have arrived successfully, so the sender only needs to retransmit the segments that have actually been lost.

For more information about SACK, see RFC 2018.

BIC TCP

Binary Increase Congestion (BIC) TCP is a congestion management protocol that allows your network to recover more quickly from packet loss events.

When your network experiences a packet loss event, BIC TCP reduces the receiver's window size and sets that reduced size as the new value for the minimum window. BIC TCP then sets the maximum window size value to the size of the window just before the packet loss event occurred. Because packet loss occurred at the maximum window size, the network can transfer traffic without dropping packets whose size falls within the minimum and maximum window size values.

If BIC TCP does not register a packet loss event at the updated maximum window size, that window size becomes the new minimum. If a packet loss event does occur, that window size becomes the new maximum. This process continues until BIC TCP determines the new optimum minimum and maximum window size values.

Compression

Cisco WAAS uses the following compression technologies to help reduce the size of data transmitted over your WAN:

- Data Redundancy Elimination (DRE)
- LZ compression

These compression technologies reduce the size of transmitted data by removing redundant information before sending the shortened data stream over the WAN. By reducing the amount of transferred data, WAAS compression can reduce network utilization and application response times.

When a WAE uses compression to optimize TCP traffic, it replaces repeated data in the stream with a much shorter reference, then sends the shortened data stream out across the WAN. The receiving WAE uses its local redundancy library to reconstruct the data stream before passing it along to the destination client or server.

The WAAS compression scheme is based on a shared cache architecture where each WAE involved in compression and decompression shares the same redundancy library. When the cache that stores the redundancy library on a WAE becomes full, WAAS uses a FIFO algorithm (first in, first out) to discard old data and make room for new.

LZ compression operates on smaller data streams and keeps limited compression history. DRE operates on significantly larger streams (typically tens to hundreds of bytes or more) and maintains a much larger compression history. Large chunks of redundant data is common in file system operations when files are incrementally changed from one version to another or when certain elements are common to many files, such as file headers and logos.

Application-Specific Acceleration

In addition to the TCP optimization features that speed the flow of traffic over a WAN, Cisco WAAS includes these application acceleration features:

- Operation prediction and batching—Allows a WAAS device to transform a command sequence into a shorter sequence over the WAN to reduce roundtrips.
- Intelligent message suppression—Increases the response time of remote applications. Even though TFO optimizes traffic over a WAN, protocol messages between branch office clients and remote servers can still cause slow application response time. To resolve this issue, each WAAS device contains application proxies that can respond to messages locally so that the client does not have to wait for a response from the remote server. The application proxies use a variety of techniques including caching, command batching, prediction, and resource prefetch to increase the response time of remote applications.
- WAFS caching—Allows a WAAS device to reply to client requests using locally cached data instead of retrieving this data from remote file and application servers.
- Preposition—Allows a WAAS device to prefetch resource data and metadata in anticipation of a future client request.

Cisco WAAS uses application-intelligent software modules to apply these acceleration features.

In a typical Common Internet File System (CIFS) application use case, the client sends a large number of synchronous requests that require the client to wait for a response before sending the next request. Compressing the data over the WAN is not sufficient for acceptable response time.

For example, when you open a 5 MB Word document, about 700 CIFS requests (550 read requests plus 150 other requests) are produced. If all these requests are sent over a 100 ms round-trip WAN, the response time is at least 70 seconds (700 x 0.1 seconds).

WAAS application acceleration minimizes the synchronous effect of the CIFS protocol, which reduces application response time. Each WAAS device uses application policies to match specific types of traffic to an application and to determine whether that application traffic should be optimized and accelerated.

The following WAAS application accelerators are available:

- CIFS—Accelerates CIFS traffic exchanged with a remote file server. For more information, see the [“File Services for Desktop Applications” section on page 1-7](#).
- NFS—Accelerates Network File System (NFS) version 3 traffic exchanged with a remote file server. Secure NFS traffic is not accelerated.
- HTTP—Accelerates HTTP traffic.
- MAPI—Accelerates Microsoft Outlook Exchange traffic that uses the Messaging Application Programming Interface (MAPI) protocol. Microsoft Outlook 2000–2007 clients are supported. Secure connections that use message authentication (signing) or encryption are not accelerated and MAPI over HTTP is not accelerated.
- Video—Accelerates Windows Media live video broadcasts that use RTSP over TCP. The video accelerator automatically splits one source video stream from the WAN into multiple streams to serve multiple clients on the LAN. The video accelerator automatically causes a client requesting a UDP stream to do a protocol rollover to use TCP (if both the client and server allow TCP).
- Windows Print—Accelerates print traffic between clients and a Windows print server located in the data center. Server Message Block (SMB) signed traffic is not accelerated. The Windows print accelerator supports Windows 2000 and Windows Server 2003 print servers. It supports clients running Windows 2000, Windows XP, and Windows Vista.

To enable or disable application accelerators, see the [“Enabling and Disabling the Global Optimization Features” section on page 12-2](#).

You must enable the accelerator on both of the peer WAEs at either end of a WAN link for all application accelerators to operate.

File Services for Desktop Applications

The file services (CIFS accelerator) feature allows a WAE to store remote file server data in its local cache so that the WAE can quickly fulfill a client’s data request instead of sending that request over the WAN to the file server. By fulfilling the client’s request locally, the WAE minimizes the traffic sent over the WAN and reduces the time it takes branch office users to access files and many desktop applications, allowing enterprises to consolidate their important information into data centers.

For more information, see [Chapter 11, “Configuring Wide Area File Services.”](#)



Note

WAAS version 4.1.1 supports two CIFS accelerator modes: a new transparent mode and a legacy mode. The new transparent mode requires no core, edge, or connectivity configuration. You configure the legacy mode the same as in WAAS version 4.0.x. These two modes are mutually exclusive. We recommend using the new transparent mode if you have no need to interoperate with WAAS 4.0.x devices.

File Services includes the following features:

- Prepositioning—Allows system administrators to proactively “push” frequently used files from the central file server into the cache of selected WAEs. This provides users with faster first-time file access, and makes more efficient use of available bandwidth.
- Data coherency and concurrency—Ensures data integrity across the WAAS system by managing the freshness of the data (coherency) and controlling the access to the data by multiple clients (concurrency).

- Automatic discovery—Allows you to use file services without having to register individual file servers in the WAAS Central Manager. With the automatic discovery feature, the WAAS device will automatically discover and connect to a new file server when a CIFS request is received.

WAAS Print Services

The WAAS software includes the following print services options:

- Windows print accelerator—Use this option when you have a print server in a data center and branch clients are printing to local or remote printers. This service accelerates print traffic between clients and a Windows print server located in the data center. This option requires no configuration but does require that the CIFS accelerator and Windows print acceleration be enabled. For more information, see the [“Enabling and Disabling the Global Optimization Features”](#) section on page 12-2.
- Virtual blade based print server—Use this option when you want to deploy a local print server in the branch office but without installing separate print server hardware. You can install a Windows print server in a virtual blade on the branch WAE, which allows you to manage printing by using standard Windows print server functionality. For more information, see [Chapter 14, “Configuring Virtual Blades.”](#)
- Legacy WAAS print services—This legacy service also allows you to use the branch WAE as a local print server by using Samba and Common Unix Printing System (CUPS) software that is built into WAAS. For more information, see [Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”](#)

All three of these services eliminate the need for a separate hardware print server in the branch office. WAAS print services are available for Windows clients and work with any IP-based network printer.

Virtualization

The WAAS software allows you to configure a virtual blade, which allows you to add services running in their own operating environments to your WAAS system. For example, you could configure a virtual blade in a WAE device to run Windows services such as Print Services, Active Directory Services, DNS, and DHCP services.

A WAAS virtual blade provides an emulated hardware environment within your WAE device that acts as a generic computer. You can install an operating system and applications to work with your WAAS system and provide additional services for the users on your network. For more information, see [Chapter 14, “Configuring Virtual Blades.”](#)

Overview of the WAAS Interfaces

The WAAS software provides the following interfaces to help you manage, configure, and monitor the various elements of your WAAS network:

- [WAAS Central Manager GUI, page 1-9](#)
- [WAE Device Manager GUI, page 1-14](#)
- [WAAS Print Services Administration GUI, page 1-15](#)
- [WAAS CLI, page 1-16](#)

WAAS Central Manager GUI

Every WAAS network must have one primary WAAS Central Manager device that is responsible for managing the other WAAS devices in your network. The WAAS Central Manager device hosts the WAAS Central Manager GUI, a Web-based interface that allows you to configure, manage, and monitor the WAAS devices in your network. The WAAS Central Manager resides on a dedicated WAE device.

The WAAS Central Manager GUI allows administrators to perform the following tasks:

- Configure system and network settings for an individual WAAS device or device group.
- Create and edit application policies that determine the action that a WAAS device performs when it intercepts specific types of traffic.
- Distribute print drivers from the central repository to your WAAS print servers.
- Configure file services and set up file preposition and file blocking policies.
- Create device groups that help you manage and configure multiple WAEs at the same time.
- View detailed reports about the optimized traffic in your WAAS network.

**Note**

You cannot enable file services, print services, or application acceleration on a WAE that has been configured as a WAAS Central Manager. The purpose of the WAAS Central Manager is to configure, monitor, and manage the WAEs in your network.

This section contains the following topics:

- [Accessing the WAAS Central Manager GUI, page 1-9](#)
- [Components of the WAAS Central Manager GUI, page 1-9](#)
- [WAAS Central Manager Navigation Pane, page 1-11](#)
- [WAAS Central Manager Taskbar Icons, page 1-12](#)

Accessing the WAAS Central Manager GUI

To access the WAAS Central Manager GUI, enter the following URL in your web browser:

`https://WAE_Address:8443/`

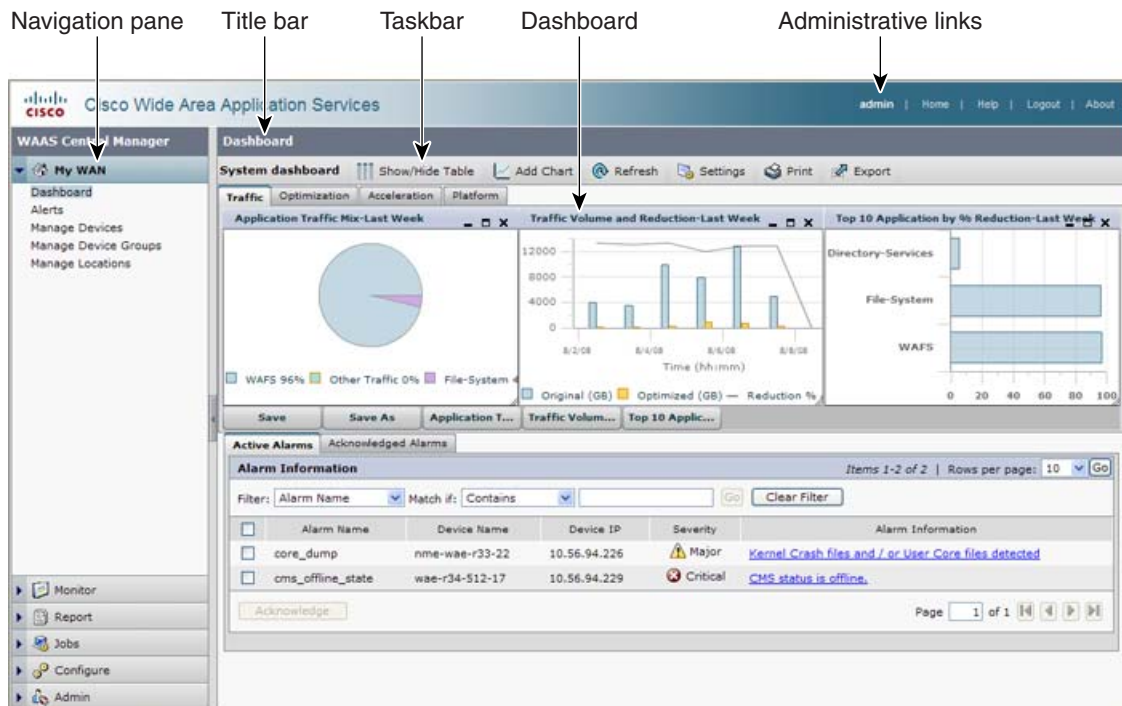
The *WAE_Address value* is the IP address or hostname of the WAAS Central Manager device.

The default administrator username is *admin* and the password is *default*. For information on creating accounts and changing passwords, see [Chapter 7, “Creating and Managing Administrator User Accounts and Groups.”](#)

Components of the WAAS Central Manager GUI

[Figure 1-2](#) shows the main components of the WAAS Central Manager GUI.

Figure 1-2 Components of the WAAS Central Manager GUI



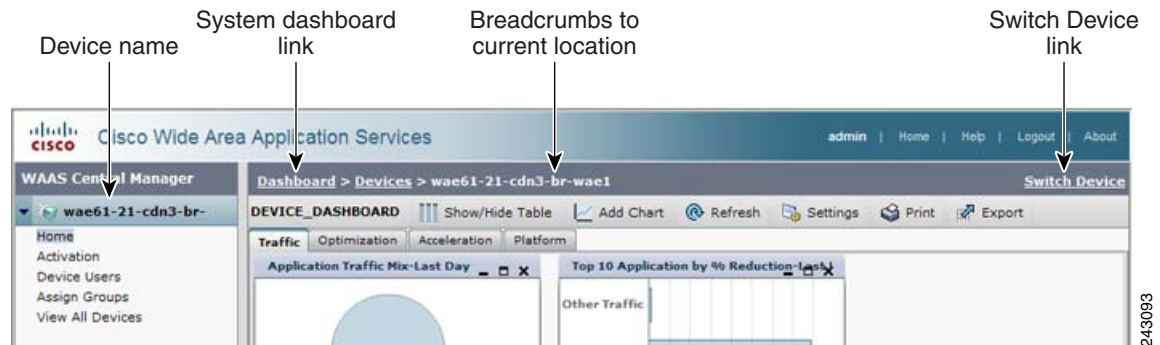
The WAAS Central Manager GUI includes the following main components:

- **Navigation pane**—Contains drawers that group the WAAS Central Manager functions. For more information, see the “[WAAS Central Manager Navigation Pane](#)” section on page 1-11.
- **Title bar**—Displays the title of the page being viewed and breadcrumb links to ease navigation back to previous levels in the hierarchy. (Breadcrumb links are shown in [Figure 1-3](#).)
- **Taskbar**—Contains icons that perform various functions depending on the content shown in the dashboard. For more information, see the “[WAAS Central Manager Taskbar Icons](#)” section on page 1-12.
- **Dashboard**—Displays the main content, which changes depending on the function that is chosen in the navigation pane.
- **Administrative links**—Includes these navigation links:
 - **Home**—Displays the System Dashboard (shown in [Figure 1-2](#)).
 - **Help**—Opens a separate window with the WAAS context sensitive help.
 - **Logout**—Logs out the current user from the WAAS Central Manager.
 - **About**—Displays the WAAS About screen that shows the version number.

There are two main contexts in the WAAS Central Manager GUI:

- **Global Context**—You are in this context initially, when no particular device or device group is chosen. The top drawer in the navigation pane reads My WAN, as shown in [Figure 1-2](#).
- **Device Context**—You are in this context after you have chosen a device or device group in the Manage Devices or Manage Device Groups pages. The top drawer in the navigation pane displays the name of the chosen device or device group, as shown in [Figure 1-3](#).

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Figure 1-3 WAAS Central Manager GUI Device Context

In the device context, the WAAS Central Manager GUI includes the following new items:

- **Device name**—The top drawer in the navigation pane shows the name of the chosen device or device group.
- **System dashboard link**—Displays the System Dashboard and returns to the global context.
- **Breadcrumbs to current location**—Displays the path to your current location in the GUI. You can click the Devices link to return to the Manage Devices page. If you are managing a device group, this link is named Device Groups and it returns you to the Manage Device Groups page.
- **Switch Device link**—Allows you to switch devices and stay on the same functional device context page in the GUI. Clicking this link opens the Switch Devices page, as shown in [Figure 1-4](#). To switch to a different device, select the radio button next to the device and click the **Switch** button.

If you are managing a device group, the name of this link is Switch DeviceGroup, and it allows you to switch to a different device group, just like for devices.

Figure 1-4 Switch Devices Page

WAAS Central Manager Navigation Pane

The WAAS Central Manager GUI navigation pane contains drawers that serve to group WAAS Central Manager functions. [Table 1-2](#) describes the drawers in the navigation pane.

Drawers may contain different functions when a particular device or device group is selected than when you are in the global context.

Table 1-2 *Drawer Descriptions*

Drawer	Description
My WAN or <i>Device name</i>	Allows you to go to the Dashboard and Alerts displays for your entire WAAS network and allows you to choose a specific device or device group for which to configure WAAS services and general settings. You can also view detailed device information and messages, and manage locations. When you have chosen a specific device or device group, this drawer is named with the device or group name and allows you to activate devices or assign groups or devices. Choose View All Devices to go back to the view of all devices.
Monitor	Allows you to see network traffic and other charts and reports to monitor the health and performance of your WAAS network. (This drawer appears only at the global level or when an individual device is chosen, not for a device group.)
Report	Allows you to manage and schedule reports for your WAAS network. (This drawer appears only at the global level when no device or device group is chosen.)
Troubleshoot	Allows you to use troubleshooting tools. (This drawer appears only when a device or device group is chosen, not at the global level.)
Jobs	Allows you to manage software update jobs.
Configure	Allows you to configure the main WAAS services (file, print, and application acceleration) and other settings.
Admin	Allows you to manage user accounts, passwords, logging, and virtual blades.

WAAS Central Manager Taskbar Icons

Table 1-3 describes the taskbar icons in the WAAS Central Manager GUI.

Table 1-3 *Taskbar Icon Descriptions*

















Taskbar Icon	Function
Common icons	
 (Refresh)	Refreshes the current page of the WAAS Central Manager GUI.
 (Delete)	Deletes a WAAS element, such as a device, device group, print driver, or file service policy.
 (Create)	Creates a new WAAS element, such as a file service policy or an acceleration policy.
 (Advanced Search)	Filters the information in a table to make it easier to locate a specific item.
 (View All)	Displays all items in a table on a single page instead of displaying those items over multiple pages.
 (Print or Print Table)	Prints the information.

Table 1-3 Taskbar Icon Descriptions (continued)

Taskbar Icon	Function
 (Assign All)	Selects all valid items in a table. For example, if you are distributing print drivers to a WAAS print server, you can click this icon to select all drivers in the list that the print server should download.
 (Remove All)	Deselects all selected items in a table.
Devices and Device Group Icons	
 (Activate All Inactive WAEs)	Activates all the inactive WAEs in your WAAS network. For more information, see the “Activating All Inactive WAAS Devices” section on page 15-29 .
 (Force Update)	<p>Reapplies the device configuration as seen in the WAAS Central Manager GUI to the device. Normally, changes made in the WAAS Central Manager GUI are applied to the device as soon as the configuration is submitted. From time to time, however, a CLI error or some other error on the device can cause the configuration on the device to differ from what is seen in the WAAS Central Manager GUI. The Force Full Database Update icon applies the full configuration that the WAAS Central Manager has for the device to be updated to the device and the configuration reapplied.</p> <p>You can view device CLI errors in the System Message window described in the “Viewing the System Message Log” section on page 16-35.</p> <p>The Force Full Database Update icon appears on the Device Dashboard window, described in the “Device Dashboard Window” section on page 16-9.</p>
 (Reload)	Reboots a WAE or device group depending on the location in the WAAS Central Manager GUI. For more information, see the “Rebooting a Device or Device Group” section on page 15-29 .
 (Force Group Settings)	Forces the device group configuration across all devices in that group. For more information, see the “Forcing Device Group Settings on All Devices in the Group” section on page 3-8 .
 (Apply Defaults)	Applies the default settings to the fields on the window.
 (Export Table)	Exports table information into a CSV file.
 (Switch Baseline Group)	<p>Allows you to select another device group to associate with the baseline group.</p> <p>For more information, see the “Switching the Baseline Group for a Service” section on page 3-13.</p>
 (Override Group Settings)	<p>Allows you to specify device-specific settings that override the group settings for the device.</p> <p>For more information, see the “Overriding the Device Group Settings on a Device” section on page 3-9.</p>
 (Deactivate Device)	Deactivates a WAE.

Table 1-3 Taskbar Icon Descriptions (continued)

Taskbar Icon	Function
 (Update Application Statistics)	Updates the application statistics.
 (Delete All)	Deletes all WAAS elements of a particular type, such as IP ACL conditions.
 (Display All Devices)	Displays all WAE devices or device groups in the navigation pane.
 (Configure Dashboard Display)	Allows you choose which charts to display in the Device Dashboard window.
Print Services Icons	
 (Retry Downloading Failed Drivers)	Attempts to download print drivers that previously failed to be distributed to the WAAS print server or device group. For more information, see Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”
 (Print Services Administration GUI)	Opens the Print Services Administration GUI for the WAAS print server. For more information about the tasks you can perform from this GUI, see the “Using the Print Services Administration GUI” section on page 13-27.
Acceleration Icons	
 (Restore Default Policies and Classifiers)	Restores the default application policies on the device or device group. For more information, see the “Restoring Application Policies and Classifiers” section on page 12-16.
 (View Topology)	Displays the topology map that shows all the TFO connections between your WAE devices. For more information, see the “Viewing Connections and Peer Devices” section on page 16-19.
 (Navigate to application configuration page)	Displays the configuration page used to create new applications. For more information, see the “Viewing a List of Applications” section on page 12-15.
System Message Log Icons	
 (Truncate Table)	For more information, see the “Viewing the System Message Log” section on page 16-35.

WAE Device Manager GUI

The WAE Device Manager is a web-based management interface that allows you to configure, manage, and monitor an individual WAE device in your network. In some cases, the same device settings exist in both the WAE Device Manager and the WAAS Central Manager GUI. For this reason, we recommend that you always configure device settings from the WAAS Central Manager GUI when possible.

In some situations, you might need to use the WAE Device Manager GUI to perform certain tasks. For example, the following tasks can only be performed from the WAE Device Manager GUI and not from the WAAS Central Manager GUI:

- Enabling print services on a WAE
- Shutting down device services

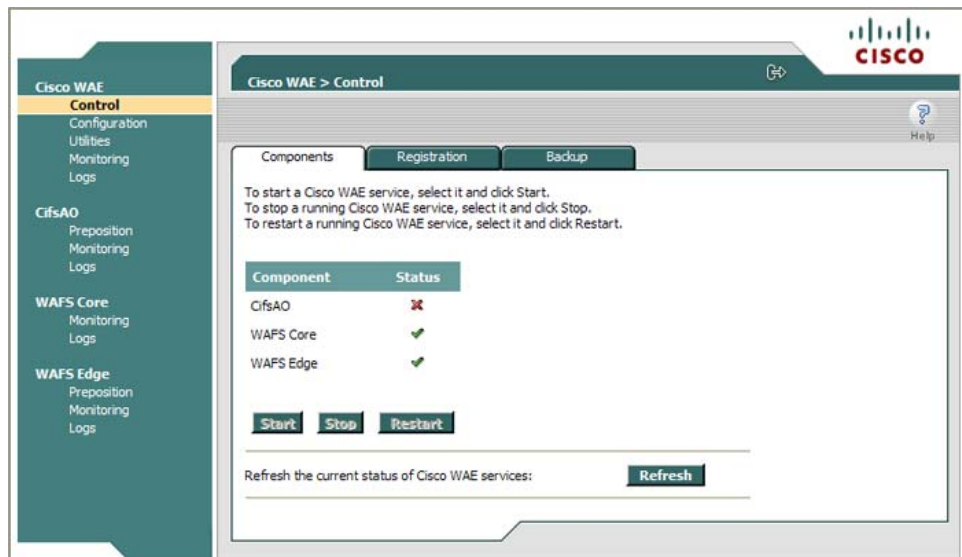
For more information about the tasks you can perform from the WAE Manager, see [Chapter 10, “Using the WAE Device Manager GUI.”](#)

To access the WAE Device Manager for a specific device, go to the following URL:

`https://Device IP Address:8443/mgr`

[Figure 1-5](#) shows an example of the WAE Device Manager window.

Figure 1-5 Example of the WAE Device Manager Window



WAAS Print Services Administration GUI

The Print Services Administration GUI is a Web-based interface that allows you to configure an individual WAAS print server and view a list of active and completed print jobs.

You can perform the following common tasks from the Print Services Administration GUI:

- Add a printer to WAAS print server
- Modify the configuration of an existing printer
- Set up print clusters
- View print jobs

You can access the Print Services Administration GUI from the WAAS Central Manager GUI or from the WAE Manager GUI. For more information, see [Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”](#)

WAAS CLI

The WAAS CLI allows you to configure, manage, and monitor WAEs on a per-device basis through a console connection or a terminal emulation program. The WAAS CLI also allows you to configure certain features that are supported only through the CLI (for example, configuring the Lightweight Directory Access Protocol [LDAP] signing on a WAE). We strongly recommend that you use the WAAS Central Manager GUI instead of the WAAS CLI, whenever possible.

The WAAS CLI is organized into four command modes. Each command mode has its own set of commands to use for the configuration, maintenance, and monitoring of a WAE. The commands that are available to you depend on the mode you are in. When you enter a question mark (?) at the system prompt, you can obtain a list of commands available for each command mode.

The four WAAS command modes are as follows:

- EXEC mode—For setting, viewing, and testing system operations. This mode is divided into two access levels: user and privileged. To use the privileged access level, enter the **enable** command at the user access level prompt, then enter the privileged EXEC password when you see the password prompt.
- Global configuration mode—For setting, viewing, and testing the configuration of WAAS software features for the entire device. To use this mode, enter the **configure** command from the privileged EXEC mode.
- Interface configuration mode—For setting, viewing, and testing the configuration of a specific interface. To use this mode, enter the **interface** command from the global configuration mode.
- Feature-specific configuration mode—Some configuration modes are available from the global or interface configuration modes for managing specific features.

For information about using the CLI to configure a WAAS device, see the *Cisco Wide Area Application Services Command Reference* and the *Cisco Wide Area Application Services Quick Configuration Guide*.

Benefits of Cisco WAAS

This section describes the benefits of Cisco WAAS and includes the following topics:

- [Preservation of Source TCP/IP Information, page 1-17](#)
- [Autodiscovery of WAAS Devices, page 1-17](#)
- [Centralized Network Monitoring and Management, page 1-17](#)
- [Optimized Read and Write Caching, page 1-18](#)
- [WCCP Support, page 1-19](#)
- [PBR Support, page 1-19](#)
- [Inline Interception Support, page 1-19](#)
- [Failure Resiliency and Protection, page 1-20](#)
- [Namespace Support, page 1-20](#)
- [RAID Compatibility, page 1-21](#)
- [Streamlined Security, page 1-21](#)
- [SNMP Support, page 1-21](#)

Preservation of Source TCP/IP Information

Many optimization products create tunnels through routers and other networking devices, which result in a loss of source TCP/IP information in the optimized data. This loss of TCP/IP information often disrupts important network services (such as QoS and NBAR), and can disrupt proper operation of traffic analysis tools such as NetFlow and security products and features such as ACLs and IP-based firewalls.

Unlike other optimization products, Cisco WAAS seamlessly integrates into your network and preserves all TCP/IP header information in the traffic that it optimizes, so that your existing analysis tools and security products are not compromised.

Autodiscovery of WAAS Devices

Cisco WAAS includes an autodiscovery feature that enables WAEs to automatically locate peer WAEs on your network. After autodiscovering a peer device, the WAEs can terminate and separate the LAN-to-WAN TCP connections and add a buffering layer to resolve the differing speeds. Once a WAE establishes a connection to a peer WAE, the two devices can establish an optimized link for TCP traffic, or pass the traffic through as unoptimized.

The autodiscovery of peer WAAS devices is achieved using proprietary TCP options. These TCP options are only recognized and understood by WAAS devices and are ignored by non-WAAS devices.

Centralized Network Monitoring and Management

Cisco WAAS Web-based management tools (WAAS Central Manager and WAE Device Manager GUIs) enable IT administrators to centrally define, monitor, and manage policies for each WAAS device, such as usage quota, backups, disaster recovery, restores, access control, and security policies. IT administrators can also perform the following tasks:

- Remotely provision, configure, and monitor each WAAS device or device group.
- Optimize system performance and utilization with comprehensive statistics, logs, and reporting.
- Perform troubleshooting tasks using tools such as SNMP-based monitoring, traps and alerts, and debug modes.

IT administrators benefit from the following features of Cisco WAAS:

- Native protocol support—Provides complete end-to-end support for the underlying file system protocol (Windows/CIFS) used by the enterprise. Security, concurrency, and coherency are preserved between each client and file server.
- Transparency—Is fully transparent to applications, file systems, and protocols, enabling seamless integration with existing network infrastructures, including mixed environments. Cisco WAAS also has no impact on any security technology currently deployed.
- Branch office data protection—Increases data protection at branch offices. Its file cache appears on the office's LAN in the same way as a local file server. End users can map their personal document folders onto the file cache using Windows or UNIX utilities. A cached copy of user data is stored locally in the branch WAE for fast access. The master copy is stored centrally in the well-protected data center.
- Centralized backup—Consolidates data across the extended enterprise into a data center, which makes it easy to apply centralized storage management procedures to branch office data. Backup and restore operations become simpler, faster, and more reliable than when the data was decentralized.

In the event of data loss, backup files exist in the data center and can be quickly accessed for recovery purposes. The amount of data loss is reduced because of the increased frequency of backups performed on the centralized storage in the data center. This centralized storage backup makes disaster recovery much more efficient and economical than working with standalone file servers or NAS appliances.

- Simplified storage management—Migrates storage from remote locations to a central data facility, which reduces costs and simplifies storage management for the extended enterprise.
- WAN adaptation—Provides remote users with near-LAN access to files located at the data center. WAAS uses a proprietary protocol that optimizes the way traffic is forwarded between the WAEs. If communication between WAEs is disrupted, the software automatically switches into Disconnected Mode, preventing operations that could jeopardize the coherency of files in the network.

Optimized Read and Write Caching

The wide area file services (WAFS) feature in Cisco WAAS maintains files locally, close to the clients. Changes made to files are immediately stored in the local branch WAE, and then streamed to the central file server. Files stored centrally appear as local files to branch users, which improves access performance. WAFS caching includes the following features:

- Local metadata handling and caching—Allows metadata such as file attributes and directory information to be cached and served locally, optimizing user access.
- Partial file caching—Propagates only the segments of the file that have been updated on write requests rather than the entire file.
- Write-back caching—Facilitates efficient write operations by allowing the data center WAE to buffer writes from the branch WAE and to stream updates asynchronously to the file server without risking data integrity.
- Advance file read—Increases performance by allowing a WAE to read the file in advance of user requests when an application is conducting a sequential file read.
- Negative caching—Allows a WAE to store information about missing files to reduce round-trips across the WAN.
- Microsoft Remote Procedure Call (MSRPC) optimization—Uses local request and response caching to reduce the round-trips across the WAN.
- Signaling messages prediction and reduction—Uses algorithms that reduce round-trips over the WAN without loss of semantics.

In WAFS legacy mode, Cisco WAAS uses its own proprietary adaptation protocol layer over the WAN between the branch WAE and data center WAE, while retaining the standard CIFS protocol at the client and server ends. This proprietary network protocol provides reliable and efficient communication over WANs, especially under high-latency, low-bandwidth conditions.

The Cisco WAAS protocol offers the following benefits:

- Reliability—Maintains its own internal message queuing and ordering, enabling it to overcome transient disconnects, network jitters, and message loss. The Cisco WAAS transport layer handles temporary network failures by reestablishing the connection, then retransmitting requests that did not receive a response on the disconnected socket.
- Efficiency—Supports compound requests, grouping multiple, dependent requests and responses into a single message. The processing of individual calls within a compound message is serialized, enabling the output of one command to be used as input for the next.

- **Link utilization optimization**—Uses multiple concurrent TCP connections for each branch WAE-to-data center WAE link. Requests and responses may be delivered across any open connection. For example, multiple requests (and responses) for data delivery can be split across multiple connections to increase the effective use of the network in cases of high-latency or high-loss WAN connections, where TCP performance degrades.
- **Command prioritization**—Assigns high priority to requests from active clients, minimizing the WAN latency experienced by users. Batch tasks (such as preposition, for example) are assigned a lower priority and are performed in the background.
- **Bandwidth conservation**—Compresses all requests and responses. Before compression, the message is encoded, allowing efficient delivery of both textual and binary data. The protocol layer applies the compression automatically, regardless of the message content.
- **Firewall-friendly**—Is layered over TCP/IP and uses TCP port 4050. You should configure firewalls to open TCP port 4050 to traffic.

WCCP Support

The Web Cache Communication Protocol (WCCP) developed by Cisco Systems specifies interactions between one or more routers (or Layer 3 switches) and one or more application appliances, web caches, and caches of other application protocols. The purpose of the interaction is to establish and maintain the transparent redirection of selected types of traffic flowing through a group of routers. The selected traffic is redirected to a group of appliances. Any type of TCP traffic can be redirected.

The WCCP v2 protocol has a built-in set of beneficial features, for example, automatic failover and load balancing. The router monitors the liveness of each WAE attached to it through the WCCP keepalive messages, and if a WAE goes down, the router stops redirecting packets to the WAE. By using WCCP, the branch WAE avoids becoming a single point of failure. The router can also load balance the traffic among a number of branch WAEs.

Cisco WAAS supports transparent interception of TCP sessions through WCCP. Once WCCP is turned on at both the router and the branch WAE, only new sessions are intercepted. Existing sessions are not affected.

PBR Support

Policy-based routing (PBR) allows IT organizations to configure their network devices (a router or a Layer 4 to Layer 6 switch) to selectively route traffic to the next hop based on the classification of the traffic. WAAS administrators can use PBR to transparently integrate a WAE into their existing branch office network and data centers. PBR can be used to establish a route that goes through a WAE for some or all packets based on the defined policies.

For more information about PBR, see [Chapter 4, “Configuring Traffic Interception.”](#)

Inline Interception Support

Direct inline traffic interception is supported on WAEs with a Cisco WAE Inline Network Adapter installed. Inline interception of traffic simplifies deployment and avoids the complexity of configuring WCCP or PBR on the routers.

The Cisco WAE Inline Network Adapter transparently intercepts traffic flowing through it or bridges traffic that does not need to be optimized. It also uses a mechanical fail-safe design that automatically bridges traffic if a power, hardware, or unrecoverable software failure occurs.

You can configure the Cisco WAE Inline Network Adapter to accept traffic only from certain VLANs; for all other VLANs, traffic is bridged and not processed.

You can serially cluster multiple WAE devices with the Cisco WAE Inline Network Adapter installed to provide spillover load balancing and active-active failover. In spillover load balancing, when the connection threshold is reached on one WAE, additional connections are optimized by another WAE.

For more information about inline mode, see the [“Using Inline Mode to Transparently Intercept TCP Traffic”](#) section on page 4-41.

Failure Resiliency and Protection

Cisco WAAS provides a high-availability failover (and load-balancing) function that minimizes the probability and duration of WAAS downtime.

If a WAE configured for WAAS fails, all peer WAEs configured to operate with it are redirected to work with an alternate WAE. This operation maintains high availability without service interruption.

This change may not be transparent to users, which means that client connections are closed and require CIFS clients to reestablish their connection. Whether such changes impact currently running applications depends on the behavior of the application being used, and on the behavior of the specific CIFS client. Typically, however, the transition is transparent to the client.

When using legacy mode and communication is interrupted between the Edge WAE and the Core Cluster or between the Core Cluster and the file server, the Cisco WAAS network switches to working in a disconnected state until full communication is restored. If the interruption is brief, the network enters a transient disconnect state, enabling a select number of services and commands for a limited time (typically lasting about one minute), such as read commands for files that are already open.

If the network outage is prolonged, Cisco WAAS switches to a full disconnect state where no services are provided to clients. In this mode, the system denies access to any file (including cached files) until reconnection occurs. From a user viewpoint, the Edge WAE responds as if the network to which it is connected is disconnected.

This approach is required to maintain the security of the data. If a no-service state was not enforced, users connected locally to the file servers can continue working on files, which creates conflicts with other users who may have been working on those files remotely when the network interruption occurred. Cisco WAAS is designed to prevent scenarios that could compromise data coherency and concurrency.

**Note**

Disconnected operation functions only with CIFS legacy mode, not with the CIFS accelerator.

Namespace Support

For legacy CIFS users, there are several ways to access the file servers cached by the Edge WAEs and integrate them within the organizational namespace. One method is to use a prefix, suffix, or alias for a specific site, which creates a unique name for each file server. (Using an alias enables the old name to be retained after replacing the local file server with the new server in the data center.) Another method is to integrate the cached file servers within the DFS namespace as DFS links. When using DFS with legacy CIFS, the DFS site name must be configured manually for each Edge WAE (or edge device

group). This information enables DFS to direct user requests correctly. Remote users are directed to file servers through the appropriate Edge WAE, while local users continue to access files directly, without making use of the Edge WAE cache.

RAID Compatibility

Cisco WAAS provides the following Redundant Array of Independent Disks (RAID) capability for increased storage capacity or increased reliability:

- Logical Disk Handling with RAID-5—Logical disk handling with Redundant Array of Independent Disks-5 (RAID-5) is implemented in WAAS as a hardware feature. RAID-5 devices can create a single logical disk drive that may contain up to six physical hard disk drives, providing increased logical disk capacity.

Systems with RAID-5 can continue operating if one of the physical drives fails or goes offline.

- Logical Disk Handling with RAID-1—Logical disk handling with RAID-1 is implemented in WAAS as a software feature. RAID-1 uses disk mirroring to write data redundantly to two or more drives, providing increased reliability.

Because the software must perform each disk write operation against two disk drives, the filesystem write performance may be affected.

- Disk Hot-Swap Support—WAAS for RAID-1 allows you to hot-swap the disk hardware. RAID-5 also allows you to hot-swap the disk hardware after the RAID array is shut down. For the disk removal and replacement procedures for RAID systems, see [Chapter 15, “Maintaining Your WAAS System.”](#)

Streamlined Security

Cisco WAAS supports disk encryption, which addresses the need to securely protect sensitive information that flows through deployed WAAS systems and that is stored in WAAS persistent storage.

Cisco WAAS does not introduce any additional maintenance overhead on already overburdened IT staffs. Cisco WAAS avoids adding its own proprietary user management layer, and instead makes use of the users, user credentials, and access control lists maintained by the file servers. All security-related protocol commands are delegated directly to the source file servers and the source domain controllers. Any user recognized on the domain and source file server are automatically recognized by Cisco WAAS with the same security level, and all without additional configuration or management.

Cisco WAAS delegates access control and authentication decisions to the origin file server.

SNMP Support

Cisco WAAS supports Simple Network Management Protocol (SNMP) including SNMPv1, SNMPv2, and SNMPv3. Cisco WAAS supports many of the most commonly used SNMP managers, such as HP OpenView and IBM Tivoli NetView.

Cisco WAAS exports parameters based on the following private, read-only MIBs:

- ACTONA-ACTASTOR-MIB.my
- CISCO-CONTENT-ENGINE-MIB

In addition, Cisco WAAS supports the full functionality of each of these standard MIBs, including the setting of traps. Most Cisco WAAS traps are also recorded in the logs displayed in the WAAS Central Manager GUI, although some (such as exceeding the maximum number of sessions) are reported only to the SNMP manager.

- MIB-2 General Network Statistics (RFC 1213 and 1157)—Contains essential parameters for the basic management of TCP/IP-based networks.
- Host Resources (RFC 1514)
- SNMPv3 MIBs (RFC 2571 through 2576)
- DISMAN-EVENT-MIB (RFC 2981)
- ENTITY-MIB (RFC 2037)

Cisco WAAS supports parameters based on SNMPv2, enabling it to integrate into a common SNMP management system. These parameters enable system administrators to monitor the current state of the Cisco WAAS network and its level of performance.

Exported parameters are divided into the following categories:

- General parameters—Includes the version and build numbers and license information.
- Management parameters—Includes the location of the Central Manager.
- Data center WAE parameters—Includes the general parameters, network connectivity parameters, and file servers being exported.
- Branch WAE parameters—Includes the general parameters, network connectivity parameters, CIFS statistics, and cache statistics.

For more information about SNMP Support, see [Chapter 17, “Configuring SNMP Monitoring.”](#)



CHAPTER 2

Planning Your WAAS Network

This chapter describes general guidelines, restrictions, and limitations that you should be aware of before you set up your Wide Area Application Services (WAAS) network.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [Checklist for Planning Your WAAS Network, page 2-1](#)
- [Site and Network Planning, page 2-4](#)
- [About Autoregistration and WAEs, page 2-8](#)
- [Identifying and Resolving Interoperability Issues, page 2-10](#)
- [WAAS Devices and Device Mode, page 2-16](#)
- [Calculating the Number of WAAS Devices Needed, page 2-17](#)
- [Supported Methods of Traffic Redirection, page 2-18](#)
- [Access Lists on Routers and WAEs, page 2-24](#)
- [WAAS Login Authentication and Authorization, page 2-25](#)
- [Logically Grouping Your WAEs, page 2-26](#)
- [Data Migration Process, page 2-28](#)

Checklist for Planning Your WAAS Network

Cisco Wide Area Application Engines (WAEs) that are running the WAAS software can be used by enterprises or service providers to optimize the application traffic flows between their branch offices and data centers. You deploy WAE nodes at the WAN endpoints near the networked application clients and their servers, where they intercept WAN-bounded application traffic and optimize it. You must insert WAE nodes into the network flow at defined processing points.

WAAS software supports the following three typical network topologies:

- Hub and spoke deployments—In a hub and spoke deployment servers are centralized and branch offices host clients and a few local services only (for example, WAAS printing services).

- Mesh deployments—In a mesh deployment, any location may host both clients and servers and the clients may access any number of local or remote servers.
- Hierarchical deployments—In a hierarchical deployment, the servers are located in multiple regional, national data centers and are accessed by the different clients. The connections between the data centers are of higher bandwidth than the connections to the branch offices.

The deployments are characterized according to the WAAS element connections, which follow the client-server access pattern and may differ from the physical network links. For more information, see [Chapter 1, “Introduction to Cisco WAAS.”](#)

Planning Checklist

When you are planning your WAAS network, use the following checklist as a guideline. As the following checklist indicates, you can break the planning phase into the following three main categories of planning activities:

- Sizing phase
- Planning for management
- Planning for application optimization



Note

Although there are some interdependencies, you do not need to complete all of the steps in a particular planning phase before you start the next step.

To plan your network, follow these guidelines:

1. Complete the sizing phase that includes the following tasks:
 - Determine which locations in your existing network require WAAS optimization (for example, which branch offices and data centers).
 - Determine the number and models of the WAAS devices that are required for each location. Some key factors in this selection process is the WAN bandwidth, the number of users, and the expected use. Various hardware configurations are possible (for example, different hard disk models and RAM size). Consider running a cluster of WAEs where additional scalability and or failover is required. For more information, see the [“Calculating the Number of WAAS Devices Needed” section on page 2-17.](#)
 - Verify that you have purchased sufficient licenses to cover your needs.
2. Plan for management as follows:
 - Complete site and network planning (for example, obtain the IP and routing information including IP addresses and subnets, routers and default gateway IP addresses, and the hostnames for the devices). See the “Checklist of WAAS Network System Parameters” table in the *Cisco Wide Area Application Services Quick Configuration Guide*.
 - Determine the login authentication and login authorization methods (for example, external RADIUS, TACACS+, Windows domain servers) and accounting policies that you want your WAAS Central Managers and WAEs to use. For more information, see [Chapter 6, “Configuring Administrative Login Authentication, Authorization, and Accounting.”](#)
 - For security purposes, plan to change the predefined password for the predefined superuser account immediately after you have completed the initial configuration of a WAE. For more information, see [“WAAS Login Authentication and Authorization” section on page 2-25.](#)

- Determine if you need to create any additional administrative accounts for a WAAS device. For more information, see [Chapter 7, “Creating and Managing Administrator User Accounts and Groups.”](#)
 - Determine if you should group your WAEs into logical groups. For more information, see the [“Logically Grouping Your WAEs” section on page 2-26.](#)
 - Determine which management access method to use. By default, Telnet is used but SSH may be the preferred method in certain deployments. For more information, see the [“Configuring Login Access Control Settings for WAAS Devices” section on page 6-7.](#)
3. Plan for application optimization as follows:
- Determine and resolve router interoperability issues (for example, the supported hardware and software versions, router performance with interception enabled). For more information, see the [“Site and Network Planning” section on page 2-4.](#)
 - Determine the appropriate interception location when the data center or branch office is complex (for example, if your existing network uses a hierarchical topology).
 - Determine which WAAS services to deploy (for example, Wide Area File Services [WAFS] services, WAAS print services, and WAAS application acceleration). For more information about the different WAAS services, see [Chapter 1, “Introduction to Cisco WAAS.”](#)
 - Determine which WAAS software licenses to install. Software licenses enable specific WAAS services. For more information about installing software licenses, see the [“Managing Software Licenses” section on page 9-3.](#)
 - Determine which traffic interception methods to use in your WAAS network (for example, inline mode; WCCP Version 2 or policy-based routing (PBR) for promiscuous mode; DFS or NetBIOS for WAFS-only traffic). For more information, see the [“Supported Methods of Traffic Redirection” section on page 2-18.](#)



Note WCCP works only with IPv4 networks.

- If you plan to use the TCP promiscuous mode service as a traffic interception method, determine whether you should use IP access control lists (ACLs) on your routers.



Note IP ACLs that are defined on a router take precedence over the IP ACLs that are defined on the WAE. For more information, see the [“Access Lists on Routers and WAEs” section on page 2-24.](#)

- Determine whether you need to define IP ACLs on the WAEs. For more information, see the [“Access Lists on Routers and WAEs” section on page 2-24.](#)



Note IP ACLs that are defined on a WAE take precedence over the WAAS application definition policies that are defined on the WAE. For more information, see the [“Precedence of IP ACLs and Application Definition Policies on WAEs” section on page 8-3.](#)

- If PBR is to be used, determine which PBR method to use to verify PBR next-hop availability for your WAEs. For more information, see the [“Methods of Verifying PBR Next-Hop Availability” section on page 4-38.](#)

- If you plan to deploy WAFS services, determine whether transparent or nontransparent interception methods (DFS or NetBIOS) should be used to intercept and redirect WAFS traffic to the local WAE. For more information, see the [“Request Redirection of CIFS Client Requests” section on page 4-48](#).
- Determine the major applications for your WAAS network. Verify whether the predefined application definition policies cover these applications and whether you should add policies if your applications are not covered by these predefined policies. For a list of the predefined application definition policies, see [Appendix A, “Default Application Policies.”](#)
- Determine the print services configuration. For more information, see [Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”](#)
- Consider day zero migration of file systems if file servers are to be centralized in the process. For more information, see the [“Data Migration Process” section on page 2-28](#).
- Identify the servers, the WAFS file servers that will be used as the target WAFS file servers, and the desired feature set (for example, disconnected mode and home directories).

After you complete the planning tasks, you are ready to perform a basic configuration of a WAAS network as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

Site and Network Planning

Before you install and deploy WAAS devices in your network, you need to collect information about your network to accommodate the integration of the WAAS devices.

In a typical distributed organizational layout, there are two types of networks where WAAS devices are installed:

- The data center (central office), where one or more colocated data center WAEs provide access to the resident file servers. In data centers, you can deploy a WAE as a single device or a pair of WAEs as a high-availability or load-sharing pairs. High-availability pairs are supported if either WCCP Version 2 or PBR is being used for traffic redirection in the data center; load-sharing pairs are only supported if WCCP Version 2 is being used for traffic redirection in the data center.
- The branch offices, where branch WAEs enable users to access the file servers over the WAN. In branch offices, you can deploy a WAE as a single device or a pair of WAEs as a high-availability or load-sharing pairs. High-availability pairs are supported if either WCCP Version 2 or PBR is being used for traffic redirection in the branch office; load-sharing pairs are only supported if WCCP Version 2 is being used for traffic redirection in the branch office.

In collaborative networks, colocated data center WAEs and branch WAEs are deployed throughout the network. These colocated WAEs are configured to share data in opposite directions (two cross-linked servers).

The WAE attaches to the LAN as an appliance. A WAE relies on packet interception and redirection to enable application acceleration and WAN optimization. Consequently, traffic interception and redirection to a WAE must occur at each site where a WAE is deployed. Traffic interception and redirection occurs in both directions of the packet flow. Because Layer 3 and Layer 4 headers are preserved, you may need to ensure that you always connect a WAE to a tertiary interface (or a subinterface) on the router to avoid routing loops between the WAE and WCCP or PBR-enabled router that is redirecting traffic to it. For more information on this topic, see the [“Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers” procedure on page 2-23](#).

**Note**

We strongly recommend that you do not use half-duplex connections on the WAE or on routers, switches, or other devices. Half duplex impedes performance and should not be used. Check each Cisco WAE interface and the port configuration on the adjacent device (router, switch, firewall, or WAE) to verify that full duplex is configured.

**Note**

The data center WAE and branch WAE communicate with each other only if the firewall is open. If you plan to deploy the Wide Area Files Services (WAFs) in legacy mode or enable directed mode, then you must configure the firewall to open port 4050 (UDP for directed mode). However, if you plan to deploy the transparent CIFS accelerator or only generic TCP optimizations and not use directed mode, you do not need to configure the firewall to open port 4050.

This section contains the following topics:

- [Windows Network Integration, page 2-5](#)
- [UNIX Network Integration, page 2-6](#)
- [WAFS-Related Ports in a WAAS Environment, page 2-7](#)
- [Firewalls and Directed Mode, page 2-8](#)

Windows Network Integration

To successfully integrate WAAS devices into the Windows environment, you might need to make certain preparations on both the data center WAE and branch WAE sides of the network. This section contains the following topics:

- [Data Center WAE Integration, page 2-5](#)
- [Branch WAE Integration, page 2-6](#)

**Note**

If the integration of WAFs is nontransparent, a WAAS device does not assume Windows server roles on its network, nor does it act as a Domain Controller or master browser in a Windows environment. Another Windows machine should fill these roles in the WAE network. This caveat is not relevant for WCCP or PBR environments because in this situation transparent integration is used.

Data Center WAE Integration

Before the initial configuration of the data center WAE, you need to know the following parameters:

- WINS server (if applicable).
- DNS server and DNS domain (if applicable).
- A browsing user with file-server directory traversal (read-only) privileges. This user, who is usually set up as a domain or service user, is required for running preposition policies.

To successfully integrate Cisco WAAS into the Windows environment on the data center WAE side of a network where DHCP is not being used, you must manually add the name and IP address of the data center WAE to the DNS server. You should take this action before installing and deploying the WAAS devices.

**Note**

User permissions are determined by the existing security infrastructure.

Branch WAE Integration

Before the initial configuration of the branch WAE, you need to know the following parameters:

- DNS server and DNS domain
- Windows Domain Name
- WINS server (if applicable)
- DFS site name (if applicable)

To successfully integrate Cisco WAAS into the Windows environment on the branch WAE side of the network, you should take the following preliminary actions before installing and deploying the WAAS devices in your network:

- To enable all branch WAEs in the specified domain to appear in the Network Neighborhood of users within the same domain, ensure that a Domain Master Browser or local Master Browser is active.
- If DHCP is not used, you must manually add the name and IP address of the branch WAE to the DNS server.
- In Active Directory (AD) environments where nontransparent integration of WAFS is being used, add the Cisco WAFS-cached file server names manually to the AD Computer Catalog. Adding these names (including the default prefix and suffix, if any) enables future integration with AD services such as DFS. If DFS is used, note the AD Site name for the current Edge WAE location and update it in the CIFS section of the Edge WAE configuration. This caveat is not applicable if transparent integration of WAFS is being used.

UNIX Network Integration

Before the initial configuration of a WAAS device, you need to know the following parameters:

- DNS server and DNS domain.
- NIS server parameters (if applicable).
- On the data center WAE side, a browsing UID or GID with file-server directory traversal (read-only) privileges. This UID or GID, which is usually set up as a domain or service user, is required for browsing when defining coherency policies.

To successfully integrate Cisco WAAS into the UNIX environment, you need to perform these actions on both the data center WAE and branch WAE sides of the network:

- You must manually add the name and IP address of both the data center WAE and the branch WAE to the DNS server.
- When separate domains are used, UNIX users may be defined at the remote (branch) offices or on the central servers. This situation may result in the same user name being defined in different domains. A user may be defined differently in the branch and center or may be defined only on one end and not on the other. You can ensure consistency in such cases by using NIS or by mapping between the different domains, either manually or automatically. That is, users can be mapped from the remote server to the central servers by translating their identities from the central office to the remote offices.

**Note**

To map users using automatic management, you must first configure the NIS server in both the data center WAE (primary) and branch WAE (secondary).

WAFS-Related Ports in a WAAS Environment

This section describes the Wide Area File Services (WAFS)-related ports used between your clients, WAEs that are functioning as file engines, and CIFS file servers. Most WAFS communication occurs between the branches and the central office. This communication is encrypted and delivered through the organization's VPN. No ports on the firewall need to be opened because all communication is tunneled internally.

You only need to change the firewall setup if administrative or other maintenance work needs to be done from a location outside the organization.

Port 4050

Communication between the Core WAE gateway and Edge WAE cache is done over TCP/IP port 4050 by the legacy WAFS feature. If you enable the transparent CIFS accelerator, port 4050 is not used for CIFS.

Ports 139 and 445

If you have only deployed WAFS services in your WAAS network, your WAAS network uses ports 139 and 445 to connect clients to a branch WAE and to connect a data center WAE to the associated file servers. The port used depends on the configuration of your WAAS network.

If WCCP is enabled or inline mode is used, the branch WAE accepts client connections on ports 139 or 445. If neither WCCP nor inline mode are enabled, the branch WAE accepts connections only over port 139.

Your WAAS network always tries to use the same port to communicate end-to-end. Consequently, if a client uses port 445 to connect to a branch WAE, the associated data center WAE will try to use the same port to connect to the file server. If port 445 is unavailable, the data center WAE will try to use port 139.

Some organizations close port 139 on their networks to minimize security risks associated with this port. If your organization has closed port 139 for security reasons, you can configure your WAAS network to bypass port 139. If this is the case in your organization, you need to perform the following tasks to bypass port 139 and use port 445 in its place if you have only deployed the WAFS services in your WAAS network:

- Enable WCCP Version 2 on your routers and branch WAE, as described in the *Cisco Wide Area Application Services Quick Configuration Guide*. Alternatively, you can use inline mode on a branch WAE with a Cisco WAE Inline Network Adapter installed.
- Enable port 445 and disable port 139 on your branch WAEs through the WAAS Central Manager GUI. Click the **Edit** icon next to the Edge WAE in the Manage Devices window and choose **Configure > Acceleration > Legacy Services > File Services > Edge Configuration** from the navigation pane.

Ports 88 and 464

If you are using Windows Domain authentication with Kerberos enabled, the WAE uses ports 88 and 464 to authenticate clients with the domain controller.

Port 50139

If you set up WAAS print services, the print server runs on port 50139. For more information about configuring WAAS print services, see [Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”](#)

Firewalls and Directed Mode

By default, WAAS transparently sets up new TCP connections to peer WAEs, which can cause firewall traversal issues when a WAAS device tries to optimize the traffic. If a WAE device is behind a firewall that prevents traffic optimization, you can use the directed mode of communicating to a peer WAE. In directed mode, all TCP traffic that is sent to a peer WAE is encapsulated in UDP, which allows a firewall to either bypass the traffic or inspect the traffic (by adding a UDP inspection rule).

Any firewall between two WAE peers must be configured to pass UDP traffic on port 4050, or whatever custom port is configured for directed mode if a port other than the default is used.

If a WAE using directed mode is behind a NAT device, you must configure the NATed IP address on the WAE.

For more information about configuring directed mode, see the [“Configuring Directed Mode” section on page 5-17.](#)

About Autoregistration and WAEs

Autoregistration automatically configures network settings and registers WAEs with the WAAS Central Manager device. On startup, devices running WAAS software (with the exception of the WAAS Central Manager device itself) automatically discover the WAAS Central Manager device and register with it. You do not need to manually configure the device. This feature is useful for large scale automated deployments of devices. Once a WAE is registered, you configure the device remotely using the WAAS Central Manager GUI.

In the example configuration provided in the *Cisco Wide Area Application Services Quick Configuration Guide*, the autoregistration feature is disabled on the WAEs when the setup utility is used to perform the initial configuration of the device.

Autoregistration uses a form of Dynamic Host Configuration Protocol (DHCP). For autoregistration to function, you must have a DHCP server that is configured with the hostname of the WAAS Central Manager and that is capable of handling vendor class option 43.



Note

The form of DHCP used for autoregistration is *not* the same as the interface-level DHCP that is configurable through the **ip address dhcp** interface configuration command. (For a description of the **ip address dhcp** interface configuration command, see the *Cisco Wide Area Application Services Command Reference*.)

The vendor class option (option 43) information needs to be sent to the WAAS device in the format for encapsulated vendor-specific options as provided in RFC 2132. The relevant section of RFC 2132, Section 8.4, is reproduced here as follows:

The encapsulated vendor-specific options field should be encoded as a sequence of code/length/value fields of syntax identical to that of the DHCP options field with the following exceptions:

- a. There should not be a “magic cookie” field in the encapsulated vendor-specific extensions field.
- b. Codes other than 0 or 255 may be redefined by the vendor within the encapsulated vendor-specific extensions field but should conform to the tag-length-value syntax defined in section 2.
- c. Code 255 (END), if present, signifies the end of the encapsulated vendor extensions, not the end of the vendor extensions field. If no code 255 is present, then the end of the enclosing vendor-specific information field is taken as the end of the encapsulated vendor-specific extensions field.

In accordance with the RFC standard, the DHCP server needs to send the WAAS Central Manager’s hostname information in code/length/value format (code and length are single octets). The code for the WAAS Central Manager’s hostname is 0x01. DHCP server management and configuration are not within the scope of the autoregistration feature.

**Note**

The WAE sends “CISCOCDN” as the vendor class identifier in option 60 to facilitate your grouping of WAEs into device groups.

Autoregistration DHCP also requires that the following options be present in the DHCP server’s offer to be considered valid:

- Subnet-mask (option 1)
- Routers (option 3)
- Domain-name (option 15)
- Domain-name-servers (option 6)
- Host-name (option 12)

In contrast, interface-level DHCP requires only subnet-mask (option 1) and routers (option 3) for an offer to be considered valid; domain-name (option 15), domain-name-servers (option 6), and host-name (option 12) are optional. All of the above options, with the exception of domain-name-servers (option 6), replace the existing configuration on the system. The domain-name-servers option is added to the existing list of name servers with the restriction of a maximum of eight name servers.

Autoregistration is enabled by default on the first interface of the device. For the FE-511, WAE-511, WAE-512, WAE-611, WAE-612, WAE-674, WAE-7326, WAE-7341, and WAE-7371 models, the first interface is GigabitEthernet 1/0. On an NME-WAE device, autoregistration is enabled on the configured interface.

**Note**

You must disable autoregistration when both device interfaces are configured as port-channel interfaces.

If you do not have a DHCP server, the device is unable to complete autoregistration and eventually times out. You can disable autoregistration at any time after the device has booted and proceed with manual setup and registration.

To disable autoregistration, or to configure autoregistration on a different interface, use the **no auto-register enable** command in global configuration mode.

**Note**

Autoregistration is automatically disabled if a static IP address is configured or if interface-level DHCP is configured on the same interface as autoregistration. (See the “[Selecting Static IP Addresses or Using Interface-Level DHCP](#)” section on page 2-10.)

The following example disables autoregistration on the interface GigabitEthernet 1/0:

```
WAE(config)# no auto-register enable GigabitEthernet 1/0
```

Autoregistration status can be obtained by using the following **show EXEC** command:

```
WAE# show status auto-register
```

Selecting Static IP Addresses or Using Interface-Level DHCP

During the initial configuration, you have the option of configuring a static IP address for the device or choosing DHCP.

DHCP is a communications protocol that allows network administrators to manage their networks centrally and automate the assignment of IP addresses in an organization’s network. When an organization sets up its computer users with a connection to the network, an IP address must be assigned to each device. Without DHCP, the IP address must be entered manually for each computer, and if computers move to another location in another part of the network, the IP address must be changed accordingly. DHCP automatically sends a new IP address when a computer is connected to a different site in the network.

If you have a DHCP server configured, autoregistration will automatically configure the network settings and register WAEs with the WAAS Central Manager device upon bootup.

If you do not have a DHCP server configured, or you have a DHCP server but do not want to use the autoregistration feature, then manually configure the following network settings with the interactive setup utility or CLI, then register the WAEs with the WAAS Central Manager device. Configure these settings:

- Ethernet interface
- IP domain name
- Hostname
- IP name server
- Default gateway
- Primary interface

When a WAAS device boots, you are prompted to run the first-time setup utility (enter basic configuration), which you use to set up the basic device network settings for the WAE.

Identifying and Resolving Interoperability Issues

This section describes how to identify and resolve interoperability issues. It contains the following topics:

- [Interoperability and Support, page 2-11](#)

- [WAAS and Cisco IOS Interoperability, page 2-12](#)
- [WAAS Compatibility with other Cisco Appliances and Software, page 2-16](#)

Interoperability and Support

Table 2-1 lists the hardware, client, and web browser support for the WAAS software.

Table 2-1 Hardware, Client, Web Browser Support

Hardware support	WAE-511, WAE-512, WAE-611, WAE-612, WAE-674, WAE-7326, WAE-7341, WAE-7371, WAVE-274, WAVE-474, WAVE-574, or an NME-WAE network module that is installed in specific Cisco routers. You must deploy the WAAS Central Manager on a dedicated device.
Client support	The WAAS software running on a branch WAE interoperates with these CIFS clients: Windows 98/NT 4.0/2000/XP/2003.
Web browser support	The WAAS GUIs require Internet Explorer 5.5 or later to run.

This section contains the following topics:

- [Unicode Support for the WAAS GUI Interfaces](#)
- [Unicode Support Limitations](#)

Unicode Support for the WAAS GUI Interfaces

The WAAS software supports Unicode in the WAAS Central Manager and the WAE Device Manager GUI interfaces.

In the WAAS Central Manager, you can create preposition policies that include Unicode characters. For example, you can define a preposition policy for a directory that contains Unicode characters in its name.

Specifically, the following fields in the WAAS Central Manager GUI support Unicode:

- The root directory and file pattern fields in the preposition policies

In the WAE Device Manager GUI, you can include Unicode characters in the name of the backup configuration file. In addition, the logs included in the WAE Device Manager GUI can display Unicode characters.

Unicode Support Limitations

The following are Unicode support limitations:

- Usernames cannot contain Unicode characters.
- When defining policies for coherency, and so on, you cannot use Unicode characters in the Description field.
- File server names cannot contain Unicode characters.

WAAS and Cisco IOS Interoperability

This section describes the interoperability of the WAAS software with the Cisco IOS features for a basic WAAS deployment that uses WCCP-based interception and transparent transport and contains the following topics:

- [WAAS Support of the Cisco IOS QoS Classification Feature, page 2-12](#)
- [WAAS Support of the Cisco IOS NBAR Feature, page 2-13](#)
- [WAAS Support of the Cisco IOS Marking, page 2-14](#)
- [WAAS Support of the Cisco IOS Queuing, page 2-14](#)
- [WAAS Support of the Cisco IOS Congestion Avoidance, page 2-14](#)
- [WAAS Support of the Cisco IOS Traffic Policing and Rate Limiting, page 2-14](#)
- [WAAS Support of the Cisco IOS Signaling, page 2-14](#)
- [WAAS Support of the Cisco IOS Link-Efficiency Operations, page 2-14](#)
- [WAAS Support of the Cisco IOS Provisioning, Monitoring, and Management, page 2-14](#)
- [WAAS and Management Instrumentation, page 2-15](#)
- [WAAS and MPLS, page 2-15](#)



Note

The WAAS software does not support Cisco IOS IPv6 and Mobile IP.

We recommend that you use Cisco IOS Software Release 12.2 or later.

WAAS Support of the Cisco IOS QoS Classification Feature

You classify packets by using a policy filter (for example, using QPM) that is defined on the packets. You may use the following policy filter properties:

- Source IP address or hostname—Supported under WAAS because the source IP address is preserved by the WAAS device.
- Source TCP/UDP port (or port range)—Supported under WAAS because the source port is preserved by the WAAS device.
- Destination IP address or hostname—Supported under WAAS because the destination IP is preserved by WAAS. WAAS relies on interception at the data center for redirecting traffic to the peer WAAS device.
- Destination TCP/UDP port (or port range)—Supported under WAAS because the destination IP is preserved by WAAS. WAAS relies on interception at the data center for redirecting traffic to the peer WAAS device.
- DSCP/IP precedence (TOS)—Supported under WAAS because WAAS copies the settings of incoming packets on to the outgoing packets from WAAS back to the router. If the packets are not colored at connection establishment time (for TCP packets), there might be a delay in propagating the settings because WAAS does not poll these settings periodically. The packets are eventually colored properly. When packets are not colored they are left uncolored by the WAAS software.

WAAS software does not support IPv6 QoS, MPLS QoS, ATM QoS, Frame Relay QoS, and Layer 2 (VLAN) QoS.

WAAS Support of the Cisco IOS NBAR Feature

Unlike a traditional type of classification that is specified through a policy filter that is listed in the [“WAAS Support of the Cisco IOS QoS Classification Feature”](#) section on page 2-12, Network-Based Application Recognition (NBAR) classification needs to consider payload. The classification keeps track of any interceptor that modifies the payload because this modification might cause NBAR to not be able to classify the packets. However, the WAAS software does support NBAR.

The following is an example flow of how the WAAS software supports NBAR:

1. A packet P1, which is part of a TCP stream S1, enters the router and is classified by NBAR on the LAN interface of the router as belonging to class C1. If the classification of P1 does not involve payload inspection (for example, only TCP/IP headers), no action needs to be taken because the WAAS software preserves this information.
2. If P1 classification requires payload inspection, P1 needs to be marked using the TOS/DSCP bits in the packet (as opposed to using other internal marking mechanisms).
3. P1 is then intercepted through WCCP Version 2 (still on the LAN interface, WCCP is processed after NBAR) and is redirected to a WAE.
4. WAAS applies any optimizations on the payload and copies the DSCP bits settings from the incoming TCP stream, S1 onto the outgoing stream, S2 (which is established between the local WAAS appliance and the remote WAAS appliance over the WAN). Because NBAR usually needs to see some payload before doing the classification, it is unlikely that WAAS will have the proper bit settings at connection-establishment time. Consequently, the WAAS software uses polling to inspect the DSCP bits on the incoming TCP stream, then copies it over to the stream from the WAAS device back to the router.
5. When S2 reenters the router, NBAR will not classify S2 as belonging to C1 because the payload has been changed or compressed. However, the DSCP settings have already marked these packets as belonging to C1. Consequently, these packets will be treated properly as if they were classified through NBAR.

As long as the flow is not identified, NBAR will continue to search for classification in the packets. Because compressed packets will not be classified, this situation can unnecessarily burden the CPU (doing packet inspection). Because of the potential degrade in performance and the slight possibility of correctness issues, we strongly recommend that you use a subinterface or a separate physical interface to connect the WAE to the router (as described in the [“Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers”](#) section on page 2-23). When you use a tertiary interface or subinterface to connect the WAE to the router, both the performance and correctness issues are addressed because each packet is processed only once.

6. For dynamic classifications, NBAR maintains a per-flow state. Once certain flows are classified, NBAR does not continue to perform deep packet inspection anymore. However, for other flows (for example, Citrix), NBAR does look at packets continuously because the classification may change dynamically in a flow. Therefore, in order to support all NBAR classifications, it is not sufficient to only poll the DSCP settings of packets incoming to WAAS once per flow; you need to poll periodically to identify flow changes. However, the WAAS system expects packets to appear in the sequence of packets belonging to class C1, followed by a sequence of C2, and so forth, so that a polling method is sufficient to track such dynamic changes.



Note This dynamic classification support requires support for marking DSCP/ToS settings, as specified in the [“WAAS Support of the Cisco IOS QoS Classification Feature”](#) section on page 2-12, as well as the tracking of dynamic changes through polling.

Several router configurations need to be followed in order to ensure NBAR-WAAS compliance, and you must ensure that the following router configurations are adhered to:

- Ensure that classification is followed by proper DSCP marking.
- Ensure that the router in general (IP access lists that are configured on the router) does not scrub DSCP/TOS settings that are already marked on the packets on entry, and that NBAR does not unmark marked packets.

WAAS Support of the Cisco IOS Marking

The Cisco IOS marking feature is supported by the WAAS software.

WAAS Support of the Cisco IOS Queuing

The Cisco IOS queuing feature for congestion management is supported by the WAAS software.

WAAS Support of the Cisco IOS Congestion Avoidance

The Cisco IOS congestion avoidance feature is supported by the WAAS software.

WAAS Support of the Cisco IOS Traffic Policing and Rate Limiting

The Cisco IOS traffic policing and rate-limiting feature is only partially supported by the WAAS software. This Cisco IOS feature will work properly when enabled on an outbound interface. However, when this feature is enabled on an inbound interface, it will see both compressed and uncompressed traffic, and will result in inaccurate rate limiting.

WAAS Support of the Cisco IOS Signaling

The Cisco IOS signaling (RSVP) feature is typically implemented in MPLS networks. Because the WAAS software does not interact with MPLS RSVP messages, the RSVP feature is supported.

WAAS Support of the Cisco IOS Link-Efficiency Operations

The Cisco IOS link-efficiency operations are supported by the WAAS software.

WAAS Support of the Cisco IOS Provisioning, Monitoring, and Management

The Cisco IOS AutoQoS feature is supported by the WAAS software but requires additional configuration. This feature is closely connected with NBAR support because the AutoQoS feature uses NBAR to discover the various flows on the network. However, because the Cisco IOS AutoQoS feature is strictly on an outbound feature (for example, it cannot be enabled on the inbound side of an interface), this situation could create a potential problem because enabling NBAR on the outbound interface is not supported.

To avoid this potential problem, enable the trust option of the AutoQoS feature on the following interfaces so that classification and queuing are performed based on the marked value (NBAR is not enabled on the outbound interface using this solution):

- On the LAN interface on which the input policy is created and on which the marking of the packets should be performed according to the AutoQoS marking (for example, interactive video mark to af41).
- On the WAN outbound interface.

WAAS and Management Instrumentation

For management instrumentation in the WAAS software, note the following:

- NetFlow is supported. However, depending on where statistics are being obtained, you may see compressed values (statistics on optimized traffic) rather than uncompressed values (statistics for unoptimized traffic).
- You may see statistics on optimized and unoptimized traffic.
- IP Service Level Agreements (SLAs) are supported.
- Full support of policies based on Layer 3 and Layer 4 is provided. Policies based on Layer 7 are partially supported because the first few messages are unoptimized.
- Intrusion Detection System (IDS) is partially supported. The first few messages are unoptimized to allow IDS to detect the intrusive strings.
- Cisco IOS security is partially supported with the exception of features that rely on Layer 5 and above visibility.
- IPsec and SSL VPN is supported.
- Access control lists (ACLs) are supported. IP ACLs on the router take precedence over IP ACLs that are defined on the WAE. For more information, see the [“Access Lists on Routers and WAEs” section on page 2-24](#).
- VPN is supported if the VPN is deployed after WCCP interception occurs.



Note A WAAS device does not encrypt WAN traffic. If you require additional security measures, you should use a VPN. However, the VPN appliances must encrypt and decrypt traffic after and before the WAAS devices so that the WAAS device only sees unencrypted traffic. The WAAS device is unable to compress encrypted traffic and provides only limited TCP optimization to it.

- Network Address Translation (NAT) is supported. However, payload-based NAT is not supported.

WAAS and MPLS

MPLS is partially supported by the WAAS software. WCCP does not know how to operate with packets that are tagged with MPLS labels. Consequently, inside the cloud, WCCP redirection will not function (for example, WCCP redirection will not work for intermediate WAEs). However, as long as the redirection occurs on interfaces that are outside the MPLS cloud, WAAS is supported.

WAAS Compatibility with other Cisco Appliances and Software

If a firewall is placed between the clients and the WAE on one side, and the router on the other side of the firewall, default WCCP redirection does not work. However, if there is a router inside the firewall and another router outside the firewall, default WCCP-based redirection does work and WAAS is supported. You can also enable directed mode to avoid firewall traversal issues. For more information, see the “[Configuring Directed Mode](#)” section on page 5-17.

Support for concatenating ACNS and WAAS devices in your network is supported. ACNS devices optimize web protocols and can be used to serve content locally. WAAS devices optimize requests from a Content Engine, which is an ACNS device that needs service from an upstream server or an upstream Content Engine. The ability to concatenate ACNS and WAAS devices in a network has the following benefits:

- If you have already deployed ACNS in your network, you can also deploy WAAS.
- If you have not already deployed ACNS in your network, but need certain ACNS features, you can purchase ACNS and deploy it with WAAS.

WAAS Devices and Device Mode

You must deploy WAAS Central Manager on a dedicated appliance. Although the WAAS Central Manager device runs the WAAS software, its only purpose is to provide management functions. WAAS Central Manager communicates with the WAEs, which are registered with it, in the network. Through the WAAS Central Manager GUI, you can centrally manage the configuration of the WAEs individually or in groups. WAAS Central Manager also gathers management statistics and logs for its registered WAEs.

A WAE also runs the WAAS software, but its role is to act as an accelerator in the WAAS network.

In a WAAS network, you must deploy a WAAS device in one of the following device modes:

- WAAS Central Manager mode—Mode that the WAAS Central Manager device needs to use.
- WAAS application accelerator mode—Mode for a WAAS Accelerator, that is data center WAEs and branch WAEs that are running WAAS software.

The default device mode for a WAAS device is WAAS accelerator mode. The **device mode** global configuration command allows you to change the device mode of a WAAS device.

```

waas-cm(config)# device mode ?
  application-accelerator  Configure device to function as a WAAS Engine.
  central-manager         Configure device to function as a WAAS Central Manager.

```

For example, after you use the WAAS CLI to specify the basic network parameters for the designated WAAS Central Manager (the WAAS device named waas-cm) and assign it a primary interface, you can use the **device mode** configuration command to specify its device mode as central-manager.

```

waas-cm# configure
waas-cm(config)#
waas-cm(config)# primary-interface gigabitEthernet 1/0
waas-cm(config)# device mode central-manager
waas-cm(config)# exit
waas-cm# copy run start
waas-cm# reload
Proceed with reload?[confirm] y
Shutting down all services, will Reload requested by CLI@ttyS0.
Restarting system.

```


For more information about how to initially configure a WAAS device, see the *Cisco Wide Area Application Services Quick Configuration Guide*.

**Note**

You cannot configure a WAE network module (in the NME-WAE family of devices) to operate in WAAS Central Manager mode.

You can configure a WAE with a Cisco WAE Inline Network Adapter to operate in WAAS Central Manager mode, but the inline interception functionality will not be available.

Calculating the Number of WAAS Devices Needed

When the threshold value of an operational system aspect is exceeded, Cisco WAAS may not meet its expected service level. This situation might result in degraded performance.

The source of the limitation might originate from a specific Cisco WAAS device (WAAS Central Manager, branch WAE, or data center WAE), the entire Cisco WAAS system, a hardware constraint, or the network connecting the distributed software entities. In some cases, the limitation might be resolved by adding more resources, or by upgrading the hardware or software.

When planning your network, consider the operational capacity, such as the number of users it should support, how many files it should support, and how much data it should cache.

When planning your WAAS network, refer to the following additional guidelines:

- Number of WAAS Central Managers— All networks must have at least one WAAS Central Manager. For larger networks, you should consider deploying two WAAS Central Managers for active and standby back up, high availability, and failover. A WAAS Central Manager is deployed on a dedicated appliance.
- Number of WAEs—A minimum of two WAEs are required for flow optimization; one WAE is required on either side of a network link (for example, one in the branch office and one in the data center). A single site can have more than one WAE for redundancy purposes.
- Number of branch WAEs—At least one branch WAE is required in each remote office. Larger offices usually have multiple departments whose users work with different servers in the central office. In this situation, you can manage your system easier by following the organizational structure with a branch WAE for each department. In certain situations, multiple branch WAEs can be clustered and configured using DFS or WCCP Version 2, providing failover capabilities. WCCP Version 2 is the recommended method for larger user populations.
- Number of data center WAEs—Each organization must have at least one data center WAE.

When determining the number of each component types required by your organization, consider the following factors:

- Number of users connecting to the system—This number depends on the static and dynamic capacities defined for the system:
 - Static capacities—Defines the number of user sessions that can connect to the system before it reaches its capacity.
 - Dynamic capacities—Defines the amount of traffic handled by the servers, which means the amount of work being performed on the network. For example, consider whether the users currently connected to the system place a heavy or light load on it.



Note You should calculate dynamic limits based on the specific load assumptions that are particular to each customer.

- Total number of users in all branches that connect to the file servers through the data center WAE—When the number of users is more than one data center WAE can support, you must add one or more additional data center WAEs to the network.

To prevent data loss due to system limitations, WAAS supports a Core WAE cluster for legacy WAFS functionality. This defined group of Core WAEs is used to do the following:

- Increase the scalability of the capacity of the system.
- Provide redundancy.

When using the transparent CIFS accelerator for WAFS, a Core WAE cluster is not needed because the WAAS system automatically routes requests through other WAEs in the event of an outage.

Supported Methods of Traffic Redirection

In a WAAS network, traffic between the clients in the branch offices and the servers in the data center can be redirected to WAEs for optimization, redundancy elimination, and compression. Traffic is intercepted and redirected to WAEs based on policies that have been configured on the routers. The network elements that transparently redirect requests to a local WAE can be a router using WCCP version 2 or PBR to transparently redirect traffic to the local WAE or a Layer 4 to Layer 7 switch (for example, the Catalyst 6500 series Content Switching Module [CSM] or Application Control Engine [ACE]).

Alternately, a WAE that has the Cisco WAE Inline Network Adapter installed can operate in inline mode and receive and optimize traffic directly before it passes through the router.

This section contains the following topics:

- [Advantages and Disadvantages of Using Inline Interception, page 2-18](#)
- [Advantages and Disadvantages of Using WCCP-Based Routing, page 2-19](#)
- [Advantages and Disadvantages of Using PBR, page 2-20](#)
- [Configuring WCCP or PBR Routing for WAAS Traffic, page 2-20](#)

For detailed information about how to configure traffic interception for your WAAS network, see [Chapter 4, “Configuring Traffic Interception.”](#)

Advantages and Disadvantages of Using Inline Interception

Inline interception requires using a WAE appliance that has the Cisco WAE Inline Network Adapter installed. In inline mode, the WAE can physically and transparently intercept traffic between the clients and the router. When using this mode, you physically position the WAE device in the path of the traffic that you want to optimize, typically between a switch and a router.

Because redirection of traffic is not necessary, inline interception simplifies deployment and avoids the complexity of configuring WCCP or PBR on the routers.

The Cisco WAE Inline Network Adapter contains one or two pairs of LAN/WAN Ethernet ports. If the adapter has two pairs of ports, it can connect to two routers if the network topology requires it.

The Cisco WAE Inline Network Adapter transparently intercepts traffic flowing through it or bridges traffic that does not need to be optimized. It also uses a mechanical fail-safe design that automatically bridges traffic if a power, hardware, or unrecoverable software failure occurs.

You can configure the Cisco WAE Inline Network Adapter to accept traffic only from certain VLANs; for all other VLANs, traffic is bridged and not processed.

You can serially cluster multiple WAE devices with the Cisco WAE Inline Network Adapter installed to provide spillover load balancing and active-active failover. In spillover load balancing, when the connection threshold is reached on one WAE, additional connections are optimized by another WAE.

Any combination of traffic interception mechanisms on peer WAEs is supported. For example, you can use inline interception on the branch WAE and WCCP on the data center WAE. For complex data center deployments we recommend using hardware accelerated WCCP interception or load balancing with the Cisco Application Control Engine (ACE).

For more information, see the [“Using Inline Mode to Transparently Intercept TCP Traffic”](#) section on page 4-41.

Advantages and Disadvantages of Using WCCP-Based Routing

WCCP specifies interactions between one or more routers (or Layer 3 switches) and one or more application appliances, web caches, and caches of other application protocols. The purpose of the interaction is to establish and maintain the transparent redirection of selected types of traffic flowing through a group of routers. The selected traffic is redirected to a group of appliances.

WCCP allows you to transparently redirect client requests to a WAE for processing. The WAAS software supports transparent intercept of all TCP traffic.

To configure basic WCCP, you must enable the WCCP Version 2 service on the router and WAE in the data center and the router and WAE in the branch office. You do not need to configure all of the available WCCP features or services in order to get a WAE up and running.



Note

You must configure the routers and WAEs to use WCCP Version 2 instead of WCCP Version 1 because WCCP Version 1 only supports web traffic (port 80).

WCCP is much simpler to configure than PBR. However, you need to have write access to the router in order to configure WCCP on the router, which typically resides in the data center and on the edge of the branch office. Another advantage of using WCCP is that you only need to perform a basic configuration of WCCP on your routers and WAEs in order to get your WAE up and running.

The WCCP Version 2 protocol also has a set of attractive features built-in, for example, automatic failover and load balancing between multiple devices. The WCCP-enabled router monitors the liveness of each WAE that is attached to it through the WCCP keepalive messages. If a WAE goes down, the router stops redirecting packets to the WAE. When you use WCCP Version 2, the branch WAE is not made a single point of failure for the WAAS services. The router can also load balance the traffic among a number of branch WAEs.

You can use CLI commands to configure basic WCCP on both the routers and the WAEs, or you can use CLI commands to configure the router for WCCP and use the WAAS Central Manager GUI to configure basic WCCP on the WAEs. In the configuration example provided in the *Cisco Wide Area Application Services Quick Configuration Guide*, the CLI is used to configure basic WCCP on the WAEs.

We recommend that you use the WAAS CLI to complete the initial basic configuration of WCCP on your first branch WAE and data center WAE, as described in *Cisco Wide Area Application Services Quick Configuration Guide*. After you have verified that WCCP transparent redirection is working properly,

you can use the WAAS Central Manager GUI to centrally modify this basic WCCP configuration or configure additional WCCP settings (for example, load balancing) for a WAE (or group of WAEs). For more information, see the [“Managing WCCP Configurations for WAEs” section on page 4-12](#). After you have configured basic WCCP on the router, you can configure advanced WCCP features on the router, as described in the [“Configuring Advanced WCCP Features on a WCCP-Enabled Router” section on page 4-7](#).

Advantages and Disadvantages of Using PBR

PBR allows IT organizations to configure their network devices (a router or a Layer 4 to Layer 6 switch) to selectively route traffic to the next hop based on the classification of the traffic. WAAS administrators can use PBR to transparently integrate a WAE into their existing branch office network and data centers. PBR can be used to establish a route that goes through a WAE for some or all packets, based on the defined policies.

To configure PBR, you must create a route map and then apply the route map to the router interface on which you want the transparent traffic redirection to occur. Route maps reference access lists that contain explicit permit or deny criteria. The access lists define the traffic that is “interesting” to the WAE (that is, traffic that the network device should transparently intercept and redirect to the local WAE). Route maps define how the network device should handle “interesting” traffic (for example, send the packet to the next hop, which is the local WAE).

The following list summarizes the main advantages of using PBR instead of WCCP Version 2 to transparently redirect IP/TCP traffic to a WAE:

- PBR provides higher performance than WCCP Version 2 because there is no GRE overhead.
- By default PBR uses CEF when CEF is enabled on the router (PBR using CEF for fast switching of packets).
- PBR can be implemented on any Cisco IOS-capable router or switch that is running an appropriate version of the Cisco IOS software. We recommend that you use Cisco IOS Software Release 12.2 or later.
- PBR provides failover if multiple next-hop addresses are defined.

The following list summarizes the main disadvantages of using PBR instead of WCCP Version 2 to transparently redirect IP/TCP traffic to a WAE:

- PBR does not support load balancing between equal cost routes. Consequently, PBR does not provide scalability for the deployment location.
- PBR is more difficult to configure than WCCP Version 2. For an example of how to configure PBR for WAAS traffic, see the [“Using Policy-Based Routing to Transparently Redirect All TCP Traffic to WAEs” section on page 4-32](#).

Configuring WCCP or PBR Routing for WAAS Traffic

The primary function of WAAS is to accelerate WAN traffic. In general, WAAS accelerates TCP traffic. WAAS uses a symmetric approach for application optimization. A WAE that has application-specific and network-specific intelligence is placed on each side of the WAN. These WAEs are deployed out of the data path in both the branch office and the data center.

Traffic between the clients in the branch offices and the servers at the data center is transparently redirected through the WAEs based on a set of configured policies with no tunneling. The routers use WCCP Version 2 or PBR to transparently intercept and redirect traffic to the local WAE for optimization,

redundancy elimination, and compression. For example, Edge-Router1 uses PBR or WCCP Version 2 to transparently redirect traffic to Edge-WAE1, the local WAE in the branch office. Core-Router1 uses PBR or WCCP Version 2 to transparently redirect traffic to the Core-WAE1, the local WAE in the data center.



Note

In this sample deployment, the Edge-Router1 and Core-Router1 could be replaced with Layer 4 to Layer 7 switches, which are capable of redirecting traffic to the local WAE.

Figure 2-1 shows that the WAEs (Edge-WAE1 and Core-WAE1) must reside in an out-of-band network that is separate from the traffic’s destination and source. For example, Edge-WAE1 is on a subnet separate from the clients (the traffic source), and Core-WAE1 is on a subnet separate from the file servers and application servers (the traffic destination). Additionally, you may need to use a tertiary interface (a separate physical interface) or a subinterface to attach a WAE to the router, which redirects traffic to it, to avoid an infinite routing loop between the WAE and the router. For more information on this topic, see the “Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers” section on page 2-23.

Figure 2-1 Example of Using PBR or WCCP Version 2 for Transparent Redirection of All TCP Traffic to WAEs

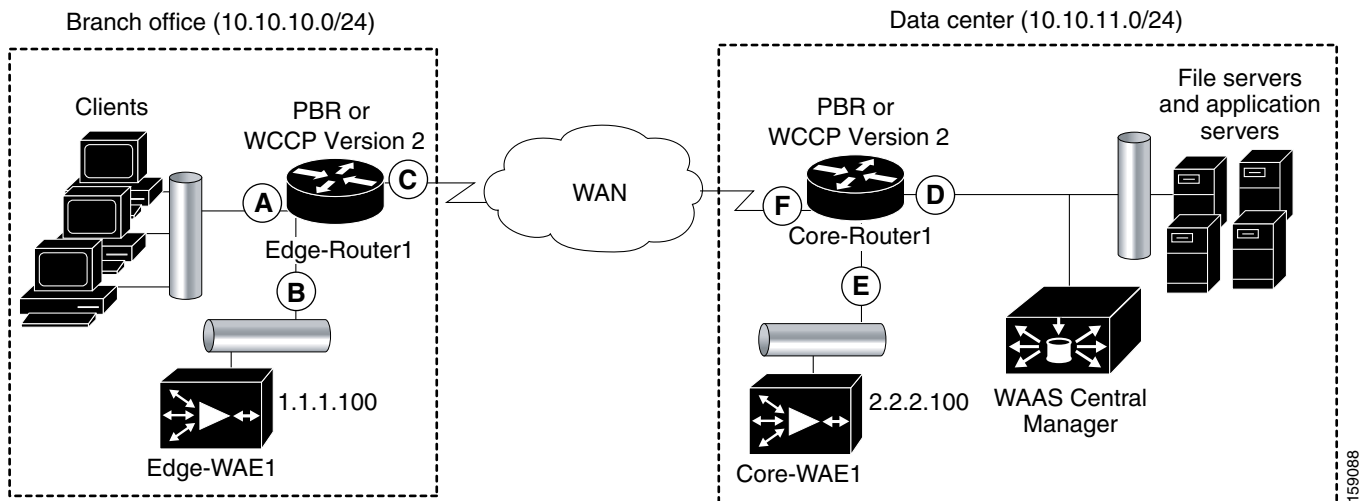


Table 2-2 provides a summary of the router interfaces that you must configure to use PBR or WCCP Version 2 to transparently redirect traffic to a WAE.

Table 2-2 Router Interfaces for WCCP or PBR Traffic Redirection to WAEs

Router interface	Description
Edge-Router1	
A	Edge LAN interface (ingress interface) that performs redirection on the outbound traffic.
B	Tertiary interface (separate physical interface) or a subinterface off of the LAN port on Edge-Router1. Used to attach Edge-WAE1 to Edge-Router1 in the branch office.
C	Edge WAN interface (egress interface) on Edge-Router1 that performs redirection on the inbound traffic.
Core-Router1	
D	Core LAN interface (ingress interface) that performs redirection on outbound traffic.

Table 2-2 Router Interfaces for WCCP or PBR Traffic Redirection to WAEs (continued)

Router interface	Description
E	Tertiary interface or subinterface off of the LAN port on Core-Router1. Used to attach Core-WAE1 to Core-Router1 in the data center.
F	Core WAN interface (egress interface) on Core-Router1 that performs redirection on the inbound traffic.

This traffic redirection does not use tunneling; the full original quadruple (source IP address, source port number, destination IP address, and destination port number) of the TCP traffic is preserved end to end. The original payload of the TCP traffic is not preserved end to end because the primary function of WAAS is to accelerate WAN traffic by reducing the data that is transferred across the WAN. This change in payload can potentially impact features on the router (which is performing the WCCP or PBR redirection) that needs to see the actual payload to perform its operation (for example, NBAR). For more information on this topic, see the [“WAAS and Cisco IOS Interoperability”](#) section on page 2-12.

Using WCCP or PBR at both ends with no tunneling requires that traffic is intercepted and redirected not only in the near-end router but also at the far-end router, which requires four interception points as opposed to two interception points in a tunnel-based mode.

You can enable packet redirection on either an outbound interface or inbound interface of a WCCP-enabled router. The terms *outbound* and *inbound* are defined from the perspective of the interface. Inbound redirection specifies that traffic should be redirected as it is being received on a given interface. Outbound redirection specifies that traffic should be redirected as it is leaving a given interface.

If you are deploying WAN optimization in your WAAS network, then you must configure the router and WAE for WCCP Version 2 and the TCP promiscuous mode service (WCCP Version 2 services 61 and 62).

**Note**

Services 61 and 62 are always enabled together when configuring TCP promiscuous on the WAE. Services 61 and 62 must be defined and configured separately when configuring TCP promiscuous on the network device (router, switch, or other). Service 61 distributes traffic by source IP address, and service 62 distributes traffic by destination IP address.

The TCP promiscuous mode service intercepts all TCP traffic that is destined for any TCP port and transparently redirects it to the WAE. The WCCP-enabled router uses service IDs 61 and 62 to access this service.

By default, the IP Protocol 6 is specified for the TCP promiscuous mode service. Consequently, the routers that have been configured to the TCP promiscuous mode service will intercept and redirect all TCP traffic destined for any TCP port to the local WAE. Because the TCP promiscuous mode service is configured on the WAE, the WAE will accept all of the TCP traffic that is transparently redirected to it by specified WCCP routers (for example, Edge-WAE1 will accept all TCP traffic that Edge-Router1 redirects to it). In the branch office, you can intercept packets at the edge LAN and WAN interfaces on the edge routers and redirect the TCP traffic to the local WAE (the branch WAE). In the data center, you can intercept packets at the core LAN and WAN interfaces on the core routers and redirect the TCP traffic to the local WAE (the data center WAE). For more information, see the [“Configuring WAEs as Promiscuous TCP Devices in a WAAS Network”](#) section on page 2-23.

Configure packet redirection on inbound interfaces of branch software routers whenever possible. Inbound traffic can be configured to use Cisco Express Forwarding (CEF), distributed Cisco Express Forwarding (dCEF), fast forwarding, or process forwarding.

**Note**

CEF is not required but is recommended for improved performance. WCCP is optimized to make use of IP CEF if CEF is enabled on the router.

To enable packet redirection on a router's outbound or inbound interface using WCCP, use the **ip wccp redirect** interface configuration command.

**Caution**

The **ip wccp redirect** interface command has the potential to affect the **ip wccp redirect exclude in** command. If you have **ip wccp redirect exclude in** set on an interface and you subsequently configure the **ip wccp redirect in** command, the **exclude in** command is overridden. If you configure the **exclude in** command, the **redirect in** command is overridden.

This section contains the following topics:

- [Configuring WAEs as Promiscuous TCP Devices in a WAAS Network, page 2-23](#)
- [Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers, page 2-23](#)

Configuring WAEs as Promiscuous TCP Devices in a WAAS Network

In order for the WAE to function as a promiscuous TCP device for the TCP traffic that is transparently redirected to it by the specified WCCP Version 2 routers, the WAE uses WCCP Version 2 services 61 and 62. The WCCP services 61 and 62 are represented by the canonical name `tcp-promiscuous` on the WAE, as shown in the following sample output of the WAAS CLI on a branch WAE:

```
Edge-WAE1(config)# wccp ?
  access-list      Configure an IP access-list for inbound WCCP encapsulated
                  traffic
  flow-redirect    Redirect moved flows
  router-list      Router List for use in WCCP services
  shutdown         Wccp Shutdown parameters
  slow-start       accept load in slow-start mode
  tcp-promiscuous  TCP promiscuous mode service
  version         WCCP Version Number
```

WCCP services 61 and 62 are represented by the name TCP Promiscuous in the WAAS Central Manager GUI. (See [Figure 4-3](#).)

Although you can also use the WAAS Central Manager GUI to configure the TCP promiscuous mode service on an individual WAE, we recommend that you use the WAAS CLI to complete the initial basic configuration of the WAE and then use the WAAS Central Manager GUI to make any subsequent configuration changes. By using the WAAS Central Manager GUI to make subsequent configuration changes, you can also apply those changes to groups of WAEs (device groups). For instructions on how to perform a basic WCCP configuration for a WAAS network, see the *Cisco Wide Area Application Services Quick Configuration Guide*. For instructions about how to use the WAAS Central Manager GUI to modify the basic WCCP configuration for a WAE or group of WAEs, see the [“Managing WCCP Configurations for WAEs” section on page 4-12](#).

Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers

If you plan to use WCCP Version 2 or PBR to transparently redirect TCP traffic to a WAE, make sure that the WAE is not attached to the same segment as the router interface on which the traffic redirection is to occur. Otherwise, an infinite routing loop between the router and the WAE will occur. These infinite

routing loops occur because there is no way to notify the router to bypass the interception and redirection after it has redirected the traffic to the WAE the first time; the router will continuously redirect the same intercepted traffic to the local WAE, creating the infinite routing loop.

**Note**

The WCCP GRE return and generic GRE egress methods allow you to place WAEs on the same VLAN or subnet as clients and servers. For information on configuring these egress methods, see the [“Configuring Egress Methods for Intercepted Connections”](#) section on page 4-29.

For example, if you attach Edge-WAE 1 to the same segment (subnet) as the LAN router interface on which the PBR or WCCP traffic redirection occurs in the branch office, there will be an infinite routing loop between Edge-Router1 and Edge-WAE1. If you attach Core-WAE1 to the same segment (subnet) as the LAN router interface on which the PBR or WCCP traffic redirection occurs in the data center, there will be an infinite routing loop between Core-Router1 and Core-WAE1.

To avoid an infinite routing loop between the router and its local WAE, connect the WAE to the router through a tertiary interface (a separate physical interface) or a subinterface (a different virtual subinterface) from the router’s LAN port. By using a tertiary interface or a subinterface to connect a WAE to the router that is performing the PBR or WCCP redirection, the WAE has its own separate processing path that has no Cisco IOS features enabled on it. In addition, this approach simplifies the process of integrating WAEs into an existing network. Because the WAEs are being connected to the routers through a tertiary interface or subinterface that has no Cisco IOS features enabled on it, the Cisco IOS features that are already enabled on your existing Cisco-enabled network elements (for example, Edge-Router1 or Core-Router1) will generally not be affected when you connect WAEs to these routers. For more information about WAAS and Cisco IOS interoperability, see the [“WAAS and Cisco IOS Interoperability”](#) section on page 2-12.

See the *Cisco Wide Area Application Services Quick Configuration Guide* for an example of how to use a subinterface to properly attach a local WAE to the router that is redirecting TCP traffic to it.

Access Lists on Routers and WAEs

You can optionally configure the router to redirect traffic from your WAE based on access lists that you define on the router. These access lists are also referred to as redirect lists. For information about how to configure access lists on routers that will be configured to transparently redirect traffic to a WAE, see the [“Configuring IP Access Lists on a Router”](#) section on page 4-10.

**Note**

IP access lists on routers have the highest priority followed by IP ACLs that are defined on the WAEs.

This section contains the following topics:

- [IP ACLs on WAEs, page 2-24](#)
- [Static Bypass Lists on WAEs, page 2-25](#)

IP ACLs on WAEs

In a centrally managed WAAS network environment, administrators need to be able to prevent unauthorized access to various devices and services. The WAAS software supports standard and extended IP access control lists (ACLs) that allow you to restrict access to or through a WAAS device.

You can use IP ACLs to reduce the infiltration of hackers, worms, and viruses that can harm the corporate network. For example, you can configure IP ACLs on a WAAS device for inbound WCCP encapsulated traffic.

The WAAS software also provides controls that allow various services to be associated with a particular interface. For example, you can use IP ACLs to define a public interface on the WAE for file serving and a private interface for management services, such as SNMP. For more information, see [Chapter 8, “Creating and Managing IP Access Control Lists for WAAS Devices.”](#)

**Note**

IP ACLs that are defined on a WAE always take precedence over any WAAS application definitions that have been defined on the WAE.

Static Bypass Lists on WAEs

In addition to defining IP ACLs, you can also configure static bypass lists on the WAEs. When you use static bypass, traffic flows between a configurable set of clients and file servers can bypass handling by the WAE. By configuring static bypass entries on the branch WAE, you can control traffic interception without modifying the router configuration. You can also configure access lists on the router to bypass traffic without first redirecting it to the branch WAE.

You can use static bypass occasionally when you want to prevent WAAS from caching a connection from a specific client to a specific file server (or from a specific client to all file servers). For information about how to centrally configure static bypass lists for a WAE or a group of WAEs, see the [“Configuring Static Bypass Lists for WAEs”](#) section on page 4-28.

**Note**

We recommend that you use access lists on the WCCP-enabled router, rather than using static bypass lists on the WAEs, because access lists are more efficient. For information about how to configure access lists on a router, see the [“Configuring IP Access Lists on a Router”](#) section on page 4-10.

WAAS Login Authentication and Authorization

In the WAAS network, administrative login authentication and authorization are used to control login requests from administrators who want to access a WAAS device for configuring, monitoring, or troubleshooting purposes.

Login authentication is the process by which WAAS devices verify whether the administrator who is attempting to log in to the device has a valid username and password. The administrator who is logging in must have a user account registered with the device. User account information serves to authorize the user for administrative login and configuration privileges. The user account information is stored in an AAA database, and the WAAS devices must be configured to access the particular authentication server (or servers) where the AAA database is located. When the user attempts to log in to a device, the device compares the person’s username, password, and privilege level to the user account information that is stored in the database.

The WAAS software provides the following authentication, authorization, and accounting (AAA) support for users who have external access servers (for example, RADIUS, TACACS+, or Windows domain servers), and for users who need a local access database with AAA features:

- *Authentication* (or *login authentication*) is the action of determining who the user is. It checks the username and password.

- *Authorization* (or *configuration*) is the action of determining what a user is allowed to do. It permits or denies privileges for authenticated users in the network. Generally, authentication precedes authorization. Both authentication and authorization are required for a user log in.
- *Accounting* is the action of keeping track of administrative user activities for system accounting purposes. In the WAAS software, AAA accounting through TACACS+ is supported.

For more information, see the [“Configuring AAA Accounting for WAAS Devices”](#) section on page 6-30.

WAAS Administrator Accounts

In a centrally managed WAAS network, administrator accounts can be created for access to the WAAS Central Manager and, independently, for access to the WAEs that are registered with the WAAS Central Manager. There are two distinct types of accounts for WAAS administrators:

- **Role-based accounts**—Allows users to access the WAAS Central Manager GUI, the WAAS Central Manager CLI, and the WAE Device Manager GUI. The WAAS software has a default WAAS system user account (username is `admin` and password is `default`) that is assigned the role of administrator.
- **Device-based CLI accounts**—Allow users to access the WAAS CLI on a WAAS device. These accounts are also referred to as local user accounts.



Note

An administrator can log in to the WAAS Central Manager device through the console port or the WAAS Central Manager GUI. An administrator can log in to a WAAS device that is functioning as a data center or branch WAE through the console port or the WAE Device Manager GUI.

A WAAS device that is running WAAS software comes with a predefined superuser account that can be used initially to access the device. When the system administrator logs in to a WAAS device before authentication and authorization have been configured, the administrator can access the WAAS device by using the predefined superuser account (the predefined username is `admin` and the predefined password is `default`). When you log in to a WAAS device using this predefined superuser account, you are granted access to all the WAAS services and entities in the WAAS system.

After you have initially configured your WAAS devices, we strongly recommend that you immediately change the password for the predefined superuser account (the predefined username is `admin`, the password is `default`, and the privilege level is superuser, privilege level 15) on each WAAS device. For instructions on how to use the WAAS Central Manager GUI to change the password, see the [“Changing the Password for Your Own Account”](#) section on page 7-7.

Logically Grouping Your WAEs

To streamline the configuration and maintenance of WAEs that are registered with a WAAS Central Manager, you can create a logical group and then assign one or more of your WAEs to the group. Groups not only save you time when configuring multiple WAEs, but they also ensure that configuration settings are applied consistently across your WAAS network. For example, you can set up a WinAuth group that defines the standard Windows authentication configuration that is wanted for all of the WAEs in that group. After you define the WinAuth settings once, you can centrally apply those values to all of the WAEs in the WinAuth group instead of defining these same settings individually on each WAE.

With the WAAS Central Manager GUI, you can easily organize your branch and data center WAEs into the following types of device groups:

- **Standard Device Group**—A collection of WAEs that share common qualities and capabilities. Setting up groups based on their authentication settings is an example of a device group. There are two types of device groups:
 - Configuration Groups
 - Wide Area File Services (WAFS) Core Clusters (only used for WAFS legacy mode)

When you create a device group, you need to identify the unique characteristics that distinguish that group of WAEs from others in your network. For example, in larger WAAS deployments one set of WAEs may need to be configured with authentication settings that are different from another set of WAEs in your WAAS network. In this case, you would create two device groups that each contain different authentication settings, and then assign your WAEs to the most appropriate group.

If you have WAEs that reside in different time zones, you can also create device groups based on geographic regions so that the WAEs in one group can have a different time zone setting from the WAEs in another group.

In smaller WAAS deployments where all WAEs can be configured with the same settings, you may only need to create one general device group, which is a configuration group. This practice allows you to configure settings for the group, then apply those settings consistently across all your WAEs.



Note The AllDevicesGroup is a default device group that automatically contains all WAEs. In the AllDevicesGroup or any other device group, you should configure only the settings that you want to be consistent across all the WAEs in the group. Settings that apply to a single WAE should be configured on that device only and not on the device group.

- **Baseline Group**—A special type of device group used to configure a WAAS service consistently across multiple WAEs. There are three types of baseline groups:
 - File
 - Acceleration
 - Platform

For example, if you want all your WAEs to contain the same set of application policies, we recommend that you create an Acceleration baseline group that contains all your custom and modified policies. When you assign WAEs to this group, the WAEs automatically inherit the application policies from the group. Anytime you need to change a policy, you make the change on the Acceleration baseline group and the change is propagated to the member devices. Setting up a baseline group is a way to apply consistent service settings across WAEs that reside in different device groups because WAEs can belong to separate device groups.



Note We recommend that you do not configure file and acceleration settings for a device group. Instead, use the File and Acceleration baseline groups for this purpose.

By default, WAAS Central Manager allows you to assign a device to multiple device groups (including baseline groups). Before you create a device group, make sure you understand the unique properties that you want the group to contain.

WAAS Central Manager allows you to create locations that you can associate with a WAAS device. You assign a device to a location when you first activate the device. The main purpose of assigning a WAAS device to a location is to help you identify a WAAS device by the physical region in which it resides. Locations are different from device groups because devices do not inherit settings from locations.

You assign a device to a location when you activate the device as described in the *Cisco Wide Area Application Services Quick Configuration Guide*. For more information about logically grouping your WAEs, see [Chapter 3, “Using Device Groups and Device Locations.”](#)

Data Migration Process

If you have an existing network, there are some steps to take before setting up your WAAS network. The first step in the data migration process is to back up the data at the branch offices and restore it to the data center.

After you back up data to the data center, you preload the cache (called *preposition*) with the files for which you want to provide the fastest access. Set up the files from your branch office file server to the WAEs that are also located in the same branch office. You can then remove the file servers from the branch offices and point to the data center file server.

The final step in the data migration process is to set the WAFS policies.

When doing the data migration process, note the following restrictions:

- Prepositioning only works in a CIFS environment.
- The topology for the file server at the data center must be identical to the topology that existed on the branch file server.
- Resource credentials (such as ACLs) are not automatically migrated. Two options are available:
 - You can use backup or restore software to restore an initial backup of the tree to the target server. This practice allows both the creation of ACLs as well as the creation of the initial file set that Rsync can take as an input for diff calculations. The replication inherits existing ACLs in that tree.
 - The other option is to perform a first run of Robocopy (including data and permissions), and then continue with sync iterations using Rsync.

After replicating, use one of Microsoft’s tools for copying only ACLs (no data) onto the replicated tree. You can use Robocopy.exe for copying directory tree or file ACLs and Permcop.exe to copy share permissions.

- The migration size must be less than the cache size of the branch WAE.



PART 2

Installing and Configuring WAAS



CHAPTER 3

Using Device Groups and Device Locations

This chapter describes the types of device groups supported by the WAAS software and how to create groups that make it easier to manage and configure multiple devices at the same time. This chapter also discusses how to use device locations.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [About Device and Baseline Groups, page 3-1](#)
- [Working with Device Groups, page 3-2](#)
- [Working with Baseline Groups, page 3-11](#)
- [Working with Device Locations, page 3-14](#)

About Device and Baseline Groups

When you create a device group, you need to identify the unique characteristics that distinguish that group of devices from others in your network. For example, in larger WAAS deployments, one set of devices may need to be configured with authentication settings that are different from another set of devices in your WAAS network. In this situation, you would create two device groups that each contain different authentication settings, and then assign your devices to the most appropriate group.

If you have devices that reside in different time zones, you can also create device groups based on geographic regions so that the devices in one group can have a different time zone setting from the devices in another group.

In smaller WAAS deployments where all devices can be configured with the same settings, you may only need to create one general device group. This setup allows you to configure settings for the group, and then apply those settings consistently across all your WAAS devices.

Groups not only save you time when configuring multiple devices, but they also ensure that configuration settings are applied consistently across your WAAS network.

When you register a WAE device with the WAAS Central Manager, that device automatically joins the AllDevicesGroup, which is the only default device group on the system. If you create additional device groups, you need to decide if you want your WAE devices to belong to more than one group (the default All Devices group and the new device group you create). If you only want a device to belong to a device group that you create, make sure that you remove the device from the default All Devices group.

You can organize your WAAS devices into the following types of device groups:

- **Standard Device Group**—A collection of devices that share common qualities and capabilities. Setting up groups based on their authentication settings as previously described is an example of a device group. There are two types of device groups: Configuration Group and WAFS Core Cluster. These are explained in more detail in the [“Creating a New Device Group” section on page 3-3](#).
- **Baseline Group**—A special type of device group used to configure a WAAS service consistently across multiple devices. There are three types of baseline groups: File, Acceleration, and Platform. By default, all devices registered with the WAAS Central Manager are assigned to all three baseline groups.

Baseline groups allow you to apply consistent service settings across devices that reside in different device groups.

For example, if you have WAAS devices that reside in different device groups and you want all the devices to share the same application policies, you should make all your policy changes to the Acceleration baseline group. Whenever you create a new policy or modify an existing policy, those changes are distributed to each device that belongs to the Acceleration baseline group. If you make the policy changes to a specific device group, the devices that belong to your other groups are not updated with the policy changes.

Working with Device Groups

This section contains the following topics:

- [Creating a Device Group, page 3-2](#)
- [Deleting a Device Group, page 3-6](#)
- [Viewing Device Group Assignments, page 3-6](#)
- [Viewing the Device Groups List, page 3-7](#)
- [Enabling or Disabling Device Group Overlap, page 3-7](#)
- [Overriding Group Configuration Settings, page 3-8](#)
- [Understanding the Impact of Assigning a Device to Multiple Device Groups, page 3-10](#)

Creating a Device Group

This section contains the following topics:

- [Creating a New Device Group, page 3-3](#)
- [Configuring the Settings for a Device Group, page 3-4](#)
- [Assigning Devices to a Configuration Device Group, page 3-5](#)

Table 3-1 describes the process for creating a new device group.

Table 3-1 Checklist for Creating a Device Group

Task	Additional Information and Instructions
1. Create a new device group.	Defines general information about the new group, such as the group name and whether all newly activated devices are assigned to this group. For more information, see the “Creating a New Device Group” section on page 3-3 .
2. Configure the settings of the new device group.	Specifies the settings that are unique to this device group. All devices that are a member of this group will automatically inherit these settings. For more information, see the “Configuring the Settings for a Device Group” section on page 3-4 .
3. Assign devices to the device group.	Assigns devices to the group so they can inherit the group settings. For more information, see the “Assigning Devices to a Configuration Device Group” section on page 3-5 .

Creating a New Device Group

Before you create a device group, make sure you understand the unique properties that you want the group to contain. For example, you may want to set up two device groups that have different authentication settings or different time zone settings.

To create a device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**. The Device Groups window appears.
- From this window you can perform the following tasks:
- Click the **Edit** icon next to the device group that you want to modify.
 - Create a new device group as described in the steps that follow.
- Step 2** Click the **Create New Device Group** icon in the taskbar. The Creating New Device Group window appears.
- Step 3** In the Name field, enter the name of the device group.
- The name must be unique and should be a name that is useful in distinguishing the device group from others on your system. The name cannot contain spaces or special characters.
- Step 4** From the Type drop-down list, choose one of the following options:
- **Configuration Group**—The standard type of device group.
 - **WAFS Core Cluster**—A special type of device group that needs to be created only when configuring wide area file services (WAFS) using the legacy mode. For more information, see the [“Configuring the Core Cluster” section on page 11-10](#).
- Step 5** Check the **Automatically assign all newly activated devices to this group** check box to set this device group as the default device group for all newly activated devices.
- Do not check any of the Baseline check boxes. If you want to create a baseline group, see the [“Customizing the Baseline Group Settings” section on page 3-12](#).



Note The system is configured with file, acceleration, and platform baseline groups by default. Only one of each of these types of baseline groups can be configured, so you won't be able to check any of the Baseline check boxes unless you have deleted one of these groups. Checking the Is Baseline check box will have no effect unless you are recreating one of these groups.

Step 6 (Optional) Enter comments about the group in the Comments field. The comments that you enter will appear in the Device Group window.

Step 7 Click **Submit**.
The page refreshes with additional options.



Note The Pages configured for this device group arrow lists the configuration windows in the WAAS Central Manager GUI that have been configured for this device group. Because this is a new device group, no pages will appear in this list.

Step 8 (Optional) Customize the navigation pane for this device group by completing the following steps. Use this feature to remove from view any configuration windows that you do not need for that particular device group:

- a. Click the **Select pages to hide from table of contents for this device group** arrow.
A list of windows in the WAAS Central Manager GUI appears.
- b. Check the windows that you want to hide for this device group. You can click the folder icon next to a window to display its child windows.
- c. Click **Submit**.

Step 9 Configure the settings for this device group as described in the “[Configuring the Settings for a Device Group](#)” section.

Configuring the Settings for a Device Group

After creating a device group, you need to configure the settings that you want to be unique to this group. If you have a general device group that contains all your WAAS devices, configure only the settings that you want to be consistent across all the devices. Settings that apply to a single device should be configured on that device only and not on the device group.



Note We recommend that you do not configure file and acceleration settings for a device group. Instead, use the File and Acceleration baseline groups for this purpose. For more information, see the “[Working with Baseline Groups](#)” section on page 3-11.

To configure settings for a device group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**.
The Device Groups window appears.

Step 2 Click the **Edit** icon next to the device group that you want to configure.
The Modifying Device Group window appears.

- Step 3** Click the **Pages configured for this device group** arrow button to view which configuration windows have already been configured for the baseline group.
- A list of pages that are configured for that device group appears. If this is a new device group or if there are no pages configured for this device group, the list displays Null.
- Step 4** Customize the navigation pane for this device group by completing the following steps:
- Click the **Select pages to hide from table of contents of this device group** arrow.

A list of windows in the WAAS Central Manager GUI appears.
 - Place a check next to the windows that you want to hide for this device group. Use this feature to remove from view any configuration windows that you do not need for this particular device group.
- Step 5** Use the navigation pane to navigate to each configuration window that you want to modify for this device group.
- If a window has not been configured for this device group, the message “There are currently no settings for this group” appears at the top of the window, as shown in [Figure 3-1](#).

Figure 3-1 Example of a Window that Has Not Been Configured for a Device Group



- Step 6** Make the necessary changes on the configuration window, and click **Submit** when finished.
- After a particular setting is configured, the configuration window is listed under Pages configured for this device group in the Modifying Device Group window.
- Step 7** Assign devices to this new group as described in the [“Assigning Devices to a Configuration Device Group”](#) section on page 3-5.

Assigning Devices to a Configuration Device Group

After you create a configuration device group, you need to assign devices to the group. The WAAS Central Manager GUI provides two methods to assign devices to a configuration group. You can either select the device first, then assign a group to the device, or you can select the device group first, then assign devices to the group.




The procedures in this section describe how to assign devices to a group. To assign a group to a device, choose **My WAN > Manage Devices**, click the **Edit** icon next to the device that you want to assign to a group, and choose **Assign Groups** from the navigation pane. You can then assign a group to the device using the same method described in steps 4 and 5 below.

You cannot assign the WAAS Central Manager to a device group. You must configure the WAAS Central Manager separately from other devices.

**Note**

By default, all devices automatically join the AllDevicesGroup when they are activated. If you do not want a device to belong to two different device groups, you should unassign the device from the AllDevicesGroup before you assign the device to another device group.

To assign a device to a device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**.
- Step 2** Click the **Edit** icon next to the device group to which you want to assign devices. The Modifying Device Group window appears.
- Step 3** In the navigation pane, choose **Assign Devices**. The WAE Assignments window appears, displaying the WAEs devices assigned to various locations.
- Step 4** Assign a device to the device group by doing either of the following:
- Click  in the taskbar to assign all available devices to the group.
 - Click  next to each device that you want to assign to the group. The icon changes to  when selected.
- Step 5** Click **Submit**. A green check mark appears next to the assigned devices.
- Step 6** Click the **Unassign** icon (green check mark) next to the name of the device that you want to remove from the device group. Alternatively, you can click the **Remove all WAEs** icon in the taskbar to remove all devices from the selected device group. Click **Submit**.
-

Deleting a Device Group

To delete a device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**. The Device Groups window appears.
- Step 2** Click the **Edit** icon next to the name of the device group that you want to delete. The Modifying Device Group window appears.
- Step 3** In the taskbar, click the **Delete Device Group** icon. You are prompted to confirm your decision to delete the device group.
- Step 4** To confirm your decision, click **OK**.
-

Viewing Device Group Assignments

The WAAS Central Manager GUI allows you to view the groups that a device belongs to, as well as the devices that belong to a specific group. This section describes both of these procedures.

To view the groups that a device belongs to, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the device for which you want to view its group assignments.
The Device Dashboard window appears.
- Step 3** In the Assignments section on the Device Dashboard window, click the link that displays the groups to which the device is assigned.
The Device Group Assignments page appears, which shows all the device groups in your WAAS network. The device is assigned to the device groups with a green check mark next to them.
You can also go to the Device Group Assignments window directly by browsing to the Assign Groups option in the navigation pane.
-

To view the devices that are assigned to a specific group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**.
- Step 2** Click the **Edit** icon next to the group for which you want to view its device members.
The Modifying Device Group window appears.
- Step 3** From the navigation pane, choose **Assign Devices**.
The WAE Assignments window appears, which shows all the devices on your WAAS network. The devices with a green check mark next to them are assigned to this group.
-

Viewing the Device Groups List

The Device Groups window lists all the device groups that have been created in your WAAS network. To view this list, choose **My WAN > Manage Device Groups** in the WAAS Central Manager GUI.

This window displays the following information about each device group:

- Type of device group (either Configuration Group or WAFS Core Cluster).
- Any comments that were entered when the device group was created.

From this window, you can perform the following tasks:

- Create a new device group. For more information, see the [“Creating a New Device Group” section on page 3-3](#).
- Modify the settings of a device group by clicking the **Edit** icon next to the group that you want to edit.

Enabling or Disabling Device Group Overlap

By default, you can assign a device to multiple device groups (including baseline groups). You can disable this functionality so a device can only belong to one device group, which eliminates the possibility of a device inheriting settings from more than one group.

To enable or disable device group overlap, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > System Properties**.
The Config Properties window appears.
- Step 2** Click the **Edit** icon next to the property name DeviceGroup.overlap.
The Modifying Config Property, DeviceGroup.overlap window appears.
- Step 3** From the Value drop-down list, choose either **true** or **false**. (The default is true.)
When you disable device group overlap (set to false), existing overlapping device groups are retained and continue to be handled as though overlap were enabled; however, any newly added groups do not allow overlapping, and new devices cannot be added to the existing overlapping groups.
- Step 4** Click **Submit**.
-

Overriding Group Configuration Settings

The WAAS Central Manager GUI provides the following methods to override the current group configuration on a device:

- [Forcing Device Group Settings on All Devices in the Group, page 3-8](#)
- [Selecting Device Group Precedence, page 3-9](#)
- [Overriding the Device Group Settings on a Device, page 3-9](#)

Forcing Device Group Settings on All Devices in the Group

To force a device group configuration across all devices in the group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**.
The Device Groups listing window appears.
- Step 2** Click the **Edit** icon next to the device group with the settings that you want to force on all devices in that group.
The Modifying Device Group window appears.
- Step 3** Click the **Force Group Settings** icon in the taskbar.
The WAAS Central Manager GUI returns the following message:

The action will apply all settings configured for this device group to all the WAES assigned to it. Do you wish to continue?
- Step 4** To force group settings across all devices in the device group, click **OK**.
- Step 5** Click **Submit**.
-

Selecting Device Group Precedence

When a device belongs to multiple device groups that have conflicting settings, the device automatically inherits the settings from the device group that was most recently changed. For a more detailed description of how a device inherits settings when it belongs to multiple device groups, see the “Understanding the Impact of Assigning a Device to Multiple Device Groups” section on page 3-10.

When a configuration conflict occurs, you can edit a device’s configuration on a page-by-page basis and select which device group’s settings should take precedence.

To select the device group precedence, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the device that you want to set the device group precedence. The Device Dashboard window appears.
- Step 3** From the navigation pane, browse to the configuration window that contains the conflicting settings. A drop-down list appears in the taskbar at the top of the window, as shown in Figure 3-2. This drop-down list allows you to select the device group that you want this configuration window to inherit settings from. The device group that is currently selected is the device group that has precedence.

Figure 3-2 Specifying the Device Group Precedence for a Configuration Window



- Step 4** From the drop-down list, choose the device group that you want this configuration page to inherit settings from, and click **Submit**. The configuration window changes to reflect the settings associated with the selected device group.

Overriding the Device Group Settings on a Device

The WAAS Central Manager GUI allows you to override the device group settings and specify new settings that are unique to that device.

To override the device group settings on a device, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the device that you want to override its group settings. The Device Dashboard window appears.

Step 3 From the navigation pane, browse to the configuration window that contains the device group settings you want to override.

Step 4 Click the Override Group Settings icon in the taskbar.

The settings in the configuration window are enabled.



Note The Override Group Settings icon only appears on configuration windows that have been modified on the associated device group.

Step 5 Make the necessary changes to the configuration window, and click **Submit**.

The device is now configured with settings that are different from the device group it belongs to.



Note The Force Settings on all Devices in Group icon appears in the device group view of an overridden configuration window. You can click this icon to reapply the device group settings to all devices in the device group.

Step 6 To reapply the device groups settings to this configuration window, choose the device group from the drop-down list in the taskbar, and click **Submit**.

Understanding the Impact of Assigning a Device to Multiple Device Groups

If a device belongs to multiple device groups, a configuration conflict might occur if the groups are not configured exactly the same. In this case, the device will inherit the settings from the device group that was most recently changed. In some cases, however, a device can retain settings from more than one device group depending on how the changes were implemented.

The following scenario describes how a device can retain settings from multiple device groups:

Action 1: Device A is assigned to Device Group 1 (DG1).

Result: Device A automatically inherits all the configuration settings of DG1.

Action 2: Device A is assigned to Device Group 2 (DG2) so it now belongs to two device groups (DG1 and DG2).

Result: Device A inherits all the settings from DG2, but it remains a member of DG1.

Action 3: The standard time zone setting on DG1 is changed to America New York.

Result: The time zone of Device A changes to America New York, but the device maintains all its other configuration settings from DG2.

In this scenario, Device A's configuration is a hybrid of DG1 and DG2. If you want to specify which device group settings a device should inherit, you can use the override features described in the [“Overriding Group Configuration Settings”](#) section on page 3-8.

Working with Baseline Groups

A baseline group is a special type of device group used to configure a WAAS service consistently across multiple devices. The WAAS Central Manager GUI provides the following three types of baseline groups:

- File—Configures file services consistently across multiple devices.
- Acceleration—Configures the application policies consistently across multiple devices.
- Platform—Configures platform settings consistently across multiple devices.

For example, if you want all your devices to have the same set of application policies, we recommend that you create an Acceleration baseline group that contains all your custom and modified policies. When you assign all your devices to this group, the devices automatically inherit the application policies from the group. Anytime you need to change a policy, you make the change to the baseline group and the change is propagated to all your devices.

A device can be a member of multiple baseline groups. However, a particular service can have only one baseline group associated with it at any given time.

A baseline group is configured in the same way and functions in the same manner as a device group. You first create the baseline group, then configure or modify service settings for that group, then finally assign devices to the group.

This section contains the following topics:

- [Configuring the Default Baseline Groups, page 3-11](#)
- [Switching the Baseline Group for a Service, page 3-13](#)

Configuring the Default Baseline Groups

[Table 3-2](#) describes the process for configuring the default baseline groups that come with your WAAS system.

Table 3-2 Checklist for Configuring the Default Baseline Groups

Task	Additional Information and Instructions
1. Customize the baseline group settings.	Changes the basic properties of the baseline group like whether newly activated devices automatically join the group. For more information, see the “Customizing the Baseline Group Settings” section on page 3-12 .
2. Configure the service settings for the baseline group.	Configures the service settings that are unique to the baseline group. All devices that are a member of this group will automatically inherit these settings. For more information, see the “Configuring the Service Settings for a Baseline Group” section on page 3-13 .
3. Assign devices to the baseline group.	Assigns devices to the group so they can inherit the group settings. For more information, see the “Assigning Devices to a Configuration Device Group” section on page 3-5 .

This section contains the following topics:

- [Customizing the Baseline Group Settings, page 3-12](#)

- [Configuring the Service Settings for a Baseline Group, page 3-13](#)

Customizing the Baseline Group Settings

The first step in configuring a baseline group is to customize the basic settings that determine the following:

- Whether all newly activated devices automatically join the baseline group.
- The configuration windows that you want to hide for the baseline group.

To customize the settings for a baseline group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose one of the three baseline groups that you want to customize, as follows:

- For the File Services baseline group, choose **Configure > File Services > Baseline Group**.
- For the Acceleration Services baseline group, choose **Configure > Acceleration > Baseline Group**.
- For the Platform Services baseline group, choose **Configure > Platform > Baseline Group**.

The Selecting the (File, Acceleration, or Platform) Baseline Group window for the chosen service appears.



Note If this baseline group does not have a device group assigned to it, the Selecting the File Baseline Group window appears. From this window, select the device group that you want to assign to this baseline group, and then proceed with the rest of the instructions in this section.

Step 2 Change the name of the baseline group by entering the new name in the provided field.

The name must be unique and should be a name that is useful in distinguishing the baseline group from others on your system. The name cannot contain spaces or special characters.

Step 3 Check the **Automatically assign all newly activated devices to this group** check box to set this baseline group as the default device group for all newly activated devices. Only check this box if you want all your devices to inherit the settings of this baseline group.

Step 4 Enter your comments in the Comments field to provide a description of this baseline group.

The comments you enter will appear in the Device Group window.

Step 5 Click the **Pages configured for this device group** arrow to view the list of the windows in the WAAS Central Manager GUI that have been configured for this baseline group.

Step 6 Customize the navigation pane for this baseline group by completing the following steps:

- Click the **Select pages to hide from table of contents of this device group** arrow.
A list of windows in the WAAS Central Manager GUI appears.
- Place a check next to the windows that you want to hide for this baseline group. Use this feature to remove from view any configuration windows that you do not need for this particular baseline group.

Step 7 Click **Submit**.

The windows that you selected to hide for this baseline group disappear from the navigation pane.

Step 8 Configure the service settings for this baseline group as described in the section that follows.

Configuring the Service Settings for a Baseline Group

Each baseline group should be configured to reflect the unique service settings that are not shared with the other baseline groups. For example, if you use the File baseline group to configure File Services on your devices and the Acceleration baseline group to configure the application policies, then these two baseline groups should be configured with different service settings. In this case, the File baseline group can be configured with Edge Server service enabled, and the Acceleration baseline group can be configured with custom or modified application policies.

To configure service settings for a baseline group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose one of the three baseline groups that you want to configure, as follows:
- For the File Services baseline group, choose **Configure > File Services > Baseline Group**.
 - For the Acceleration Services baseline group, choose **Configure > Acceleration > Baseline Group**.
 - For the Platform Services baseline group, choose **Configure > Platform > Baseline Group**.

The Modifying Device Group window for the chosen service appears.

- Step 2** Click the **Pages configured for this device group** arrow button to view the configuration windows that have already been configured for the baseline group.

A list of pages that are configured for this baseline group appears. If this is a new baseline group or if there are no pages configured for this baseline group, the list displays Null.

- Step 3** Use the navigation pane to navigate to the configuration window that you want to modify for this baseline group.

Depending on the baseline group you are configuring, you will likely want to modify the following configuration windows:

- Configure > File Services—Configures service settings for the File baseline group.
- Configure > Acceleration—Configures service settings for the Acceleration baseline group.
- Configure > General Settings—Configures service settings for the Platform baseline group.

If a configuration window has not been configured for this baseline group, the message “There are currently no settings for this group” appears at the top of the window, as shown in [Figure 3-1 on page 3-5](#).

- Step 4** After making the necessary changes to a configuration window, click **Submit**.

After you submit your changes, the modified configuration window is listed under Pages configured for this device group in the Modifying Device Group window.

- Step 5** Assign devices to this new group as described in the [“Assigning Devices to a Configuration Device Group”](#) section on page 3-5.
-

Switching the Baseline Group for a Service

The WAAS Central Manager GUI allows you to switch the device group that is associated with a baseline group. When you switch a baseline group, you must choose a regular device group to take its place. During the switch, the regular device group that you choose is converted to a baseline group, and the baseline group that you remove is converted to a regular device group.

To remove a baseline group from a service and associate another baseline group in its place, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > File or Acceleration or Platform > Baseline Group**.
- The Modify Device Group window for the chosen service appears.
- Step 2** Click the **Switch Group** icon in the taskbar. The WAAS Central Manager GUI returns the following message:
- This action will remove this device group as the Baseline Group for this service. You can then select another device group or create a new one to the Baseline Group for this service. Do you wish to Continue?
- Step 3** Click **OK** to remove the device group from the service.
- The WAAS Central Manager GUI displays the Selecting the Baseline Group window for the chosen service.
- Step 4** From the Select a Device Group to be the Baseline Group drop-down list, choose a device group, or choose the **Create New Device Group** option, as follows:
- If you choose a device group to be the baseline group for that service, the WAAS Central Manager GUI takes you to the Modify Device Group window for that device group.
 - If you choose the Create New Device Group option, the WAAS Central Manager GUI takes you to the Create New Device Group window.
-

Working with Device Locations

The WAAS Central Manager GUI allows you to create locations that you can associate with a WAAS device. You assign a device to a location when you first activate the device. The main purpose of assigning a device to a location is to help you identify a WAAS device by the physical region in which it resides. Locations are different from device groups because devices do not inherit settings from the location to which they belong.

You assign a device to a location when you activate the device as described in the [“Modifying Device Properties” section on page 9-1](#).

You can work with locations by performing these tasks:

- [Creating Locations, page 3-14](#)
- [Deleting Locations, page 3-15](#)
- [Viewing the Location Tree, page 3-15](#)

Creating Locations

To create a new location or modify an existing one, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Locations**. The Locations window appears.
- Step 2** In the taskbar, click the **Create New Location** icon.

The Creating New Location window appears.

- Step 3** In the Name field, enter a location name.
 - Step 4** From the Parent Location drop-down list, choose a parent location (or choose **None**).
A location with no parent is a level 1 location. A location with a level 1 parent becomes a level 2 location, and so forth. The location level is displayed after you choose a parent location (or choose **None**) and click **Submit** to save the configuration.
 - Step 5** (Optional) In the Comments field, enter comments about the location.
 - Step 6** Click **Submit**.
 - Step 7** Modify a location by going to the Locations window and clicking the **Edit** icon next to the name of the location that you want to modify.
 - Step 8** Assign a device to this location. For more information, see the [“Modifying Device Properties” section on page 9-1](#).
-

Deleting Locations

You can delete locations as needed, as long as they are not the root locations of activated WAAS devices.



Note If a location has a device assigned to it, you can first assign the device to another location and then delete the original location.

To delete a location, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Locations**. The Locations window appears.
 - Step 2** Click the **Edit** icon next to the location that you want to delete.
The Modifying Location window appears.
 - Step 3** In the taskbar, click the **Delete Location** icon. You are asked to confirm your decision to delete the location.
 - Step 4** To confirm the action, click **OK**. The location is deleted.
-

Viewing the Location Tree

The location tree represents the network topology you configured when you assigned a parent to each location. The WAAS Central Manager GUI graphically displays the relationships between the locations configured in your WAAS network.

To view the location tree, choose **My WAN > Manage Locations**. In the taskbar, click the **Location Trees** button. The location tree is displayed as shown in [Figure 3-3](#).

Figure 3-3 Example of the Location Tree



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CHAPTER 4

Configuring Traffic Interception

This chapter describes the WAAS software support for intercepting all TCP traffic in an IP-based network, based on the IP and TCP header information, and redirecting the traffic to wide area application engines (WAEs). This chapter describes the use of the Web Cache Communication Protocol (WCCP), policy-based routing (PBR), and inline mode for transparent redirection of traffic to WAEs.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

Before you do the procedures in this chapter, you should complete a basic initial installation and configuration of your WAAS network as described in the *Cisco Wide Area Application Services Quick Configuration Guide*. For detailed command syntax information for any of the CLI commands in this chapter, see the *Cisco Wide Area Application Services Command Reference*. For more information about WCCP, see the *Cisco IOS Configuration Fundamentals Configuration Guide* and the *Cisco IOS Configuration Fundamentals Command Reference*.

This chapter contains the following sections:

- [Request Redirection Methods, page 4-1](#)
- [Request Redirection of All TCP Traffic, page 4-3](#)
- [Request Redirection of CIFS Client Requests, page 4-48](#)

Request Redirection Methods

In a WAAS network, traffic between clients in the branch offices and the servers in the data center can be redirected to WAEs for optimization, redundancy elimination, and compression. Traffic is intercepted and redirected to WAEs based on policies that have been configured on the routers. The network elements that transparently redirect requests to a local WAE can be a router using WCCP Version 2 or PBR to transparently redirect traffic to the local WAE or a Layer 4 to Layer 7 switch (for example, the Catalyst 6500 series Content Switching Module [CSM] or Application Control Engine [ACE]). Alternately, you can intercept traffic directly by using the inline mode with a WAE that has a Cisco WAE Inline Network Adapter.

In your WAAS network, traffic can be intercepted in these modes:

- Transparent mode (WCCP or PBR)
 - For application traffic, there are no configuration changes required to the client or the client-server applications. In promiscuous WCCP mode, application traffic is transparently redirected by network elements to the local WAE.



Note The TCP promiscuous mode service (WCCP services 61 and 62) includes all protocols that use TCP as a transport, including the Common Internet File System (CIFS) protocol. When you enable the TCP promiscuous mode service on the routers and the WAEs, CIFS traffic is redirected to the WAEs because CIFS runs over TCP.

- For CIFS traffic, the branch WAEs will accelerate the traffic based on the system configuration and policy. The WAEs do not advertise the names of file servers while operating in transparent mode unless a file server is configured for the disconnected mode of operation and the network becomes disconnected. CIFS traffic between clients and file servers relies on the client's ability to reach the server natively (through directed IP traffic or name resolution). With TCP promiscuous mode, a router redirects CIFS traffic (on TCP ports 139 or 445) to a local WAE, where it is optimized based on the local policy on that WAE. The only name service provided by the branch WAE in this mode is for local print services if local print services is configured.



Note A branch WAE operates in only one of two modes: transparent (discussed above) or nontransparent (discussed below). This mode is configured on the WAE and applies to all file servers being accelerated by it. The configured mode is saved on the Central Manager and on the WAE.

- Nontransparent (explicit) mode (WCCP Version 2 disabled; applicable only to CIFS traffic when using the legacy file services mode)
 - For CIFS traffic, the Edge WAE publishes a file server name on the branch office network. This published name cannot be identical to the origin file server name due to NetBIOS name conflicts. Client computers must map drives from accelerated file servers using the published name as presented by the Edge WAE. This is the default mode.
 - For application traffic (non-CIFS), some form of interception is required in order to optimize the traffic. WCCP, PBR, inline mode, or CSM/ACE redirection must be configured; otherwise, non-CIFS traffic is unable to be optimized by WAAS.

- Inline mode

The WAE physically and transparently intercepts traffic between the clients and the router. To use this mode, you must use a WAE with the Cisco WAE Inline Network Adapter installed.

[Table 4-1](#) summarizes the transparent traffic interception methods that are supported in your WAAS network.

Table 4-1 Supported Methods of Transparent Traffic Interception

Method	Comment
WCCP Version 2	<p>Used for transparent interception of application traffic and Wide Area File Services (WAFS) traffic. Used in branch offices and data centers to transparently redirect traffic to the local WAE. The traffic is transparently intercepted and redirected to the local WAE by a WCCP-enabled router or a Layer 3 switch.</p> <p>You must configure WCCP on the router and WAE in the branch office and the router and WAE in the data center. For more information, see the following sections:</p> <ul style="list-style-type: none"> • Using WCCP to Transparently Redirect TCP Traffic to WAEs, page 4-4 • Using WCCP to Transparently Redirect CIFS Client Requests, page 4-49
Microsoft DFS	Used for either transparent or nontransparent interception of WAFS traffic for CIFS clients only. See the “Using Microsoft DFS to Intercept CIFS Client Requests” section on page 4-50.
NETBIOS	Used for nontransparent interception of WAFS traffic for CIFS clients unless the WAE is publishing the origin server name, in which case NETBIOS is used for transparent interception of WAFS traffic for CIFS clients. See the “Using Explicit Naming of Shares to Explicitly Intercept CIFS Client Requests” section on page 4-49.
PBR	<p>In branch offices, used for wide area application optimization. The branch office router is configured to use PBR to transparently intercept and route both client and server traffic to the WAE that resides in the same branch office.</p> <p>In data centers, used for data center application optimization. The data center router or L3 switch may be configured to use PBR to transparently intercept and route client and server traffic to WAE(s) within the data center. PBR, however, does not support load balancing across multiple WAEs (such as WCCP does). Neither does it support load balancing when you are using a hardware load balancer, such as the Cisco CSM or ACE. See the “Using Policy-Based Routing to Transparently Redirect All TCP Traffic to WAEs” section on page 4-32.</p>
Inline	Used for transparent interception of application traffic and WAFS traffic. See the “Using Inline Mode to Transparently Intercept TCP Traffic” section on page 4-41.
ACE or CSM	Cisco Application Control Engine (ACE) or Catalyst 6500 series Content Switching Module (CSM) installed in the data center for data center application optimization. The ACE or CSM allows for both traffic interception and load balancing across multiple WAE(s) within the data center.

If a WAE device is behind a firewall that prevents traffic optimization, you can use the directed mode of communicating between peer WAEs over the WAN. For details, see the [“Configuring Directed Mode” section on page 5-17.](#)

Request Redirection of All TCP Traffic

This section describes the methods that are supported for request redirection of TCP traffic and contains the following topics:

- [Using WCCP to Transparently Redirect TCP Traffic to WAEs, page 4-4](#)
- [Configuring Advanced WCCP Features on a WCCP-Enabled Router, page 4-7](#)

- [Managing WCCP Configurations for WAEs, page 4-12](#)
- [Configuring Egress Methods for Intercepted Connections, page 4-29](#)
- [Using Policy-Based Routing to Transparently Redirect All TCP Traffic to WAEs, page 4-32](#)
- [Using Inline Mode to Transparently Intercept TCP Traffic, page 4-41](#)

Using WCCP to Transparently Redirect TCP Traffic to WAEs

The WAAS software uses the WCCP standard, Version 2 for redirection. The main features of WCCP Version 2 include support for the following:

- Up to 32 WAEs per WCCP service
- Multiple routers
- Multicasting of protocol messages between the WAE and the WCCP-enabled router
- Authentication of protocol packets
- Redirection of non-HTTP traffic
- Packet return (including GRE, allowing a WAE to reject a redirected packet and to return it to the router to be forwarded)
- Layer 2-caching (through router versus GRE) and masking (for improved load balancing)
- Multiple forwarding methods
- Packet distribution method negotiation within a service group
- Command and status interaction between the WAE and a service group



Note

WCCP works only with IPv4 networks.

WAAS software supports the WCCP TCP promiscuous mode service (services 61 and 62). This WCCP service requires that WCCP Version 2 is running on the router and the WAE.

The TCP promiscuous mode service is a WCCP service that intercepts all TCP traffic and redirects it to the local WAE.

The WAAS software also supports service passwords, WAE failover, flow protection, and static bypass.

The Cisco 2600, Cisco 2800, Cisco 3600, Cisco 3700, Cisco 3800, and Cisco 7600 series routers are supported, and can be manually configured and enabled with WCCP Version 2 support for use with the Cisco WAEs. The Catalyst 6000 and Catalyst 6500 series switches also support WCCP Version 2.



Note

Many legacy Cisco routers, including the 2500, 2600, and 3600 routers, have far less processing power and memory than newer routing platforms such as the Integrated Services Router (ISR) models 2800 and 3800. As such, the use of WCCPv2 or PBR may cause a high level of CPU utilization on the router and cause erratic behavior. WAAS can be configured to work with these routers, but not to the same levels of performance or scalability as can be found with newer routing platforms. The Cisco ISR is the routing platform of choice for the branch office.

If you are experiencing erratic behavior, such as the WAE being ejected from the service group, enable fair-queuing, weighted fair-queuing, or rate-limiting on all physical interfaces on the router that connect to users, servers, WAEs, and the WAN. Fair-queuing cannot be configured on subinterfaces, and should

be configured on both ingress and egress physical interfaces. If another form of queuing is already configured on the LAN or WAN interfaces other than fair-queuing that provides similar fairness, it should be sufficient.

Additionally, limit the amount of bandwidth that can be received on the LAN-side interface of the router, to help the router keep its interface queues less congested and provide better performance and lower CPU utilization. Set the maximum interface bandwidth on the router to no more than 10 times the WAN bandwidth capacity. For instance, if the WAN link is a T1, the LAN interface and WAE LAN interface bandwidth should be throttled to $10 * T1 = 10 * 1.544$ Mbps, or approximately 15 Mbps. See the Cisco IOS documentation for more information.

This section contains the following topics:

- [Guidelines for Configuring WCCP, page 4-5](#)
- [Guidelines for File Server Access Methods, page 4-6](#)

Guidelines for Configuring WCCP

When you configure transparent redirection on a WAE using WCCP Version 2, follow these general guidelines:

- Intercept and redirect packets on the inbound interface whenever possible.
- Use WCCP GRE or generic GRE as the egress method if you want to place WAEs on the same VLAN or subnet as clients and servers. This topology is not allowed when using the IP forwarding egress method.
- Branch WAEs must not have their packets encrypted or compressed and should be part of the “inside” Network Address Translation (NAT) firewall if one is present.
- Use Layer 2 redirection as the packet forwarding method if you are using Catalyst 6500 series switches or Cisco 7600 series routers. Use Layer 3 GRE packet redirection if you are using any other Cisco series router.
- When you configure WCCP for use with the Hot Standby Router Protocol (HSRP), you must configure the WAE with the HSRP or the Virtual Router Redundancy Protocol (VRRP) virtual router address as its default gateway, and the WAE WCCP router-list with the primary address of the routers in the HSRP group.
- Use hardware-supported methods (CEF, dCEF) where possible. CEF is not required, but is recommended for improved performance. WCCP can use IP CEF if CEF is enabled on the router.
- Place branch WAEs on the client side of the network to minimize client-side packets through the router.
- Use WCCP passwords to avoid denial-of-service attacks. For more information, see the [“Setting a Service Group Password on a Router”](#) section on page 4-11.
- Use WCCP redirect lists for new implementations to limit client or server populations. For more information, see the [“Configuring IP Access Lists on a Router”](#) section on page 4-10.
- You must configure the WAE to accept redirected packets from one or more WCCP-enabled routers.
- You can quickly view a list of WCCP settings and services that you can configure on a WAE, from the WAAS CLI or the WAAS Central Manager GUI or the WAAS CLI. From the WAAS CLI, enter the **wccp EXEC** command followed by a question mark (?). The following sample output is from a WAE with WCCP Version 2 enabled:

```
WAE(config)# wccp ?
```

access-list	Configure an IP access-list for inbound WCCP encapsulated traffic
flow-redirect	Redirect moved flows
router-list	Router List for use in WCCP services
shutdown	Wccp Shutdown parameters
tcp-promiscuous	TCP promiscuous mode service
version	WCCP Version Number

- To configure basic WCCP, you must enable the WCCP service on at least one router in your network and on the WAE that you want the traffic redirected to. It is not necessary to configure all of the available WCCP features or services to get your WAE up and running. For an example of how to complete a basic WCCP configuration on routers and WAEs in a branch office and data center, see the *Cisco Wide Area Application Services Quick Configuration Guide*.
- You must configure the routers and WAEs to use WCCP Version 2 instead of WCCP Version 1 because WCCP Version 1 only supports web traffic (port 80).
- After enabling WCCP on the router, you must configure the TCP promiscuous mode service (WCCP services 61 and 62) on the router and the WAE, as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.
- In order for the WAE to function in TCP promiscuous mode, the WAE uses WCCP Version 2 services 61 and 62. These two WCCP services are represented by the canonical name tcp-promiscuous on the WAE.
- You can use CLI commands to configure basic WCCP on both the routers and the WAEs, or you can use CLI commands to configure the router for WCCP and use the WAAS Central Manager GUI to configure basic WCCP on the WAEs. In the configuration example provided in the *Cisco Wide Area Application Services Quick Configuration Guide*, the CLI is used to configure basic WCCP on the WAEs.

We recommend that you use the WAAS CLI to complete the initial basic configuration of WCCP on your first branch WAE and data center WAE, as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

After you have verified that WCCP transparent redirection is working properly, you can use the WAAS Central Manager GUI to centrally modify this basic WCCP configuration or configure additional WCCP settings (for example, load balancing) for a WAE (or group of WAEs). For more information, see the [“Managing WCCP Configurations for WAEs” section on page 4-12](#).

- After you have configured basic WCCP on the router, you can configure advanced WCCP features on the router, as described in the [“Configuring Advanced WCCP Features on a WCCP-Enabled Router” section on page 4-7](#).
- When you add a new router to an existing WCCP router farm or WCCP service group, the new router will reset existing connections. Until WCCP reestablishes path redirections and assignments, packets are sent directly to the client (as expected).

Guidelines for File Server Access Methods

Some file servers have several network interfaces and can be reached through multiple IP addresses. For these server types, you must add all the available IP addresses to the branch WAE’s WCCP accept list. This situation prevents a client from bypassing the branch WAE by using an unregistered IP address. The WAE Device Manager GUI displays all the IP addresses in the GUI.

Some file servers have several NetBIOS names and only one IP address. For these servers, if the client connects using the IP address in the UNC path (that is, \\IP_address\share instead of \\server\share), WAAS selects the first NetBIOS name from the server list in the WAE Device Manager GUI that matches this IP address. WAAS uses that name to perform NetBIOS negotiations between the data center WAE

and the file server, and to create resources in the cache. If a file server uses multiple NetBIOS names to represent virtual servers (possibly with different configurations) and has one NetBIOS name that is identified as the primary server name, put that name in the server list before the other names.

Configuring Advanced WCCP Features on a WCCP-Enabled Router

This section describes how to configure the advanced WCCP Version 2 features on a WCCP-enabled router that is transparently redirecting requests to WAEs in your WAAS network and contains the following topics:

- [Configuring a Router to Support WCCP Service Groups, page 4-7](#)
- [Configuring IP Access Lists on a Router, page 4-10](#)
- [Setting a Service Group Password on a Router, page 4-11](#)
- [Configuring a Loopback Interface on the Router, page 4-12](#)

**Note**

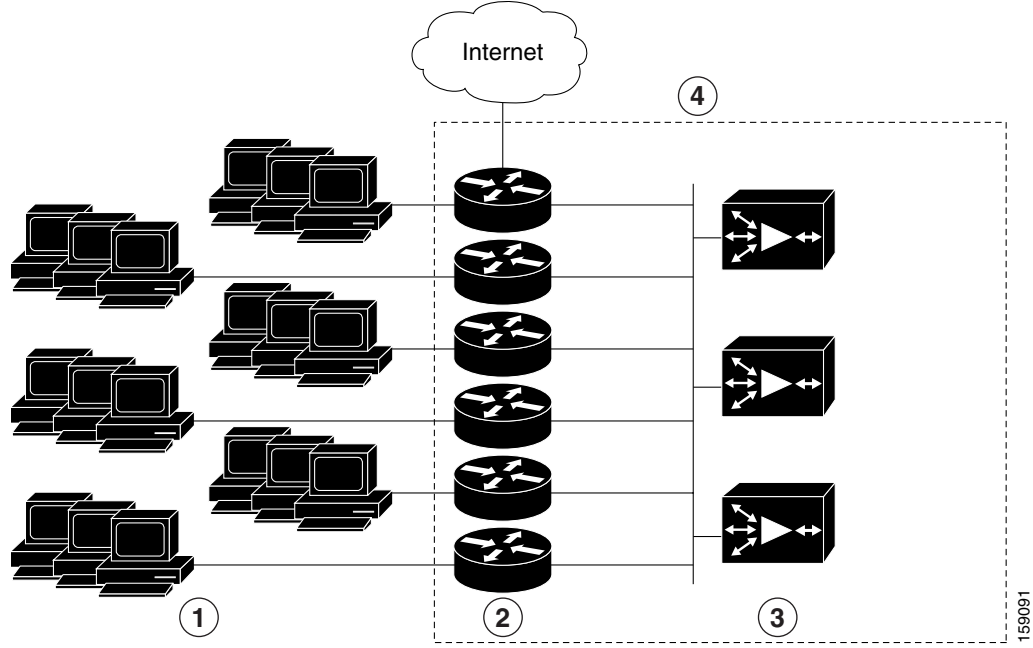
Before you do the procedures in this section, you should have already configured your router for basic WCCP as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

Configuring a Router to Support WCCP Service Groups

WCCP Version 2 enables a set of branch WAEs in a WAE group to connect to multiple routers. The WAEs in a group and the WCCP Version 2-enabled routers connected to the WAE group that are running the same WCCP service are known as a *service group*.

Through communication with the branch WAEs, the WCCP Version 2-enabled routers are aware of the available branch WAEs. Routers and branch WAEs become aware of one another and form a service group using WCCP Version 2. See [Figure 4-1](#).

Figure 4-1 Service Groups with WCCP Version 2



1	Clients requesting file services	3	Branch WAEs
2	Cisco routers	4	WAE service group

If you have a group of branch WAEs, the WAE that is seen by all the WCCP Version 2-enabled routers and that has the lowest IP address becomes the lead branch WAE.

The following procedure describes how a branch WAE in a service group is designated as the lead:

1. Each branch WAE is configured with a list of WCCP-enabled routers.
 - Multiple WCCP-enabled routers can service a group (up to 32 routers can be specified). Any of the available routers in a service group can redirect packets to each of the branch WAEs in the group.
2. Each branch WAE announces its presence to each router on the router list. The routers reply with their view of branch WAEs in the service group.
3. After the view is consistent across all of the branch WAEs in the group, one branch WAE is designated as the lead branch WAE and sets the policy that the WCCP-enabled routers need to deploy in redirecting packets.

The lead branch WAE determines how traffic should be allocated across the branch WAEs in the group. The assignment information is passed to the entire service group from the designated lead branch WAE so that the WCCP-enabled routers of the group can redirect the packets and the branch WAEs in the group can better manage their load.

WCCP uses service groups to define WAAS services for a WCCP Version 2-enabled router and branch WAEs in a group. WCCP also redirects client requests to these groups in real time.

All ports receiving redirected traffic that are configured as members of the same WCCP service group share the following characteristics:

- They have the same hash or mask parameters, as configured with the WAAS Central Manager GUI (the “[Modifying WCCP Service Masks for WAEs](#)” section on page 4-23) or the WAAS CLI (the **wccp service-number mask** global configuration command).
- The WCCP Version 2 service on individual ports cannot be stopped or started individually (a WCCP Version 2 restriction).

To direct a WCCP Version 2-enabled router to enable or disable support for a WCCP service group, use the **ip wccp** global configuration command. To remove the ability of a router to control support for a WCCP service group, use the **no** form of this command.

```
ip wccp {web-cache | service-number} [group-address groupaddress]
```

The following example shows how to enable the TCP promiscuous mode service (WCCP Version 2 services 61 and 62) on a router in a group of routers that have a group address of 224.10.10.1 in a multicast deployment:

```
Router(config)# ip wccp 61 group-address 224.10.10.1  
Router(config)# ip wccp 62 group-address 224.10.10.1
```

For a unicast deployment, enable TCP promiscuous mode service as follows:

```
Router(config)# ip wccp 61  
Router(config)# ip wccp 62
```

On each WAE in a multicast deployment, configure only the multicast address in the WCCP router list, as follows:

```
WAE(config)# wccp router-list 1 224.10.10.1
```

On each WAE in a unicast deployment, configure multiple unicast router addresses in the WCCP router list, one for each router in the service group.

Additionally, in a multicast deployment, you need to configure each router to accept multicast packets on one interface, using commands similar to the following:

```
Router(config)# interface vlan817  
Router(config-subif)# ip wccp 61 group-listen  
Router(config-subif)# ip wccp 62 group-listen  
Router(config-subif)# ip pim dense-mode
```

Finally, you need to configure each router for WCCP interception on the inbound direction of the appropriate interfaces, using commands similar to the following:

```
Router(config)# interface fa1/0.40  
Router(config-subif)# ip wccp 61 redirect in  
Router(config-subif)# exit  
Router(config)# interface serial10  
Router(config-subif)# ip wccp 62 redirect in  
Router(config-subif)# exit
```

When a new WAE is brought online, it joins the WCCP service group. With a new WAE in the service group, the hash tables responsible for distributing the load are changed, and traffic that previously went to WAE1 may now go to WAE2. Flow protection must be enabled in order for WAE2 to forward packets of already connected clients to WAE1. The end result is that all requests that belong to a single session are processed by the same WAE. Should the administrator disable flow protection, adding a WAE to the service group might disconnect some of the existing clients.

When an WAE is removed from the service group, its clients are disconnected (if they reconnect, they will reach another WAE, if one is available, or the origin file server).

WAAS supports WAE failover by reconnecting clients with other branch WAEs if a branch WAE crashed. In the event of a crash, the branch WAE stops issuing WCCP keepalives (constant high CPU load may also result in loss of keepalives and can also be considered a failover case). The router detects the lack of keepalives and removes the branch WAE from the service group. The designated branch WAE updates the WCCP configuration hash table to reflect the loss of the branch WAE and divides its buckets among the remaining branch WAEs. A new designated lead branch WAE is elected if the crashed one was the lead branch WAE. The client is disconnected, but subsequent connections are processed by another branch WAE.

Once a TCP flow has been intercepted and received by a branch WAE, the failure behavior is identical to that exhibited during nontransparent mode. For example, data center WAE and file server failure scenarios are not handled any differently as a result of using WCCP interception.

**Note**

When you add a new router to an existing WCCP router farm or WCCP service group, the new router will reset existing connections. Until WCCP reestablishes path redirections and assignments, packets are sent directly to the client (as expected).

Configuring IP Access Lists on a Router

You can optionally configure the router to redirect traffic from your WAE based on access lists that you define on the router. These access lists are also referred to as redirect lists.

**Note**

You can also configure static bypass lists on the WAE, as described in the [“Configuring Static Bypass Lists for WAEs” section on page 4-28](#). We recommend that you use IP access lists on the WCCP-enabled router, rather than using the static bypass feature, because access lists are more efficient. You can also configure IP access control lists (ACLs) on WAEs to control access to the WAE, as described in [Chapter 8, “Creating and Managing IP Access Control Lists for WAAS Devices.”](#)

IP access lists that are configured on the routers have the highest priority, followed by IP ACLs that are configured on a WAE, and followed by static bypass lists on WAEs. IP ACLs that are configured on WAEs take precedence over any application definition policies that have been defined on the WAE. For more information on this topic, see the [“Precedence of IP ACLs and Application Definition Policies on WAEs” section on page 8-3](#).

A WCCP Version 2-enabled router can be configured with access lists to permit or deny redirection of TCP traffic to a WAE. The following example shows that traffic conforming to the following criteria are not redirected by the router to the WAE:

- Originating from the host 10.1.1.1 destined for any other host
- Originating from any host destined for the host 10.255.1.1

```
Router(config)# ip wccp 61 redirect-list 120
Router(config)# ip wccp 62 redirect-list 120
Router(config)# access-list 120 deny ip host 10.1.1.1 any
Router(config)# access-list 120 deny ip any host 10.1.1.1
Router(config)# access-list 120 deny ip any host 10.255.1.1
Router(config)# access-list 120 deny ip host 10.255.1.1 any
Router(config)# access-list 120 permit ip any
```


Traffic not explicitly permitted is implicitly denied redirection. The **access-list 120 permit ip any** command explicitly permits all traffic (from any source on the way to any destination) to be redirected to the WAE. Because criteria matching occurs in the order in which the commands are entered, the global **permit** command is the last command entered.

To limit the redirection of packets to those packets matching an access list, use the **ip wccp redirect-list** global configuration command. Use this command to specify which packets should be redirected to the WAE.

When WCCP is enabled but the **ip wccp redirect-list** command is not used, all packets matching the criteria of a WCCP service are redirected to the WAE. When you specify the **ip wccp redirect-list** command, only packets that match the access list are redirected.

The **ip wccp** global configuration command and the **ip wccp redirect** interface configuration command are the only commands required to start redirecting requests to the WAE using WCCP. To instruct an interface on the WCCP-enabled router to check for appropriate outgoing packets and redirect them to a WAE, use the **ip wccp redirect** interface configuration command. If the **ip wccp** command is enabled but the **ip wccp redirect** command is disabled, the WCCP-enabled router is aware of the WAE but does not use it.

To specify the access list by name or number, use the **ip wccp group-list** global configuration command, which defines criteria for group membership. In the following example, the **access-list 1 permit 10.10.10.1** command is used to define the IP address of the WAE that is allowed to join the WCCP service group:

```
Router(config)# ip wccp 61 group-list 1
Router(config)# ip wccp 62 group-list 1
Router(config)# access-list 1 permit 10.10.10.1
```

For more information on access lists, see the Cisco IOS IP addressing and services software documentation.

Setting a Service Group Password on a Router

For security purposes, you can set a service password for your WCCP Version 2-enabled router and the WAEs that access it. Only devices configured with the correct password are allowed to participate in the WCCP service group.

From the global configuration mode of your WCCP-enabled router, enter the following commands to specify the service group password for the TCP promiscuous mode service (WCCP Version 2 services 61 and 62) on the router:

```
Router(config)# ip wccp 61 password [0-7] password
Router(config)# ip wccp 62 password [0-7] password
```

The required *password* argument is the string that directs the WCCP Version 2-enabled router to apply MD5 authentication to messages received from the specified service group. Messages that are not accepted by the authentication are discarded. *0-7* is the optional value that indicates the HMAC MD5 algorithm used to encrypt the password. This value is generated when an encrypted password is created for the WAE. *7* is the recommended value. The optional *password* argument is the optional password name that is combined with the HMAC MD5 value to create security for the connection between the router and the WAE.

For information about how to use the WAAS Central Manager GUI to specify the service group password on a WAE (or device group), see the [“Modifying the Current Settings of a WCCP Service for WAEs” section on page 4-19](#).

Configuring a Loopback Interface on the Router

The IP address of the loopback interface of the router is always used to identify the router to the WAEs. If a loopback address is not present, the highest available IP address on the router is used. If an interface changes state, and no loopback address is used, another IP address is used, which could lead to reconnection problems.

The following example configures the loopback interface, exits configuration mode, and saves the running configuration to the startup configuration:

```
Router(config)# interface Loopback0
Router(config-if)# ip address 111.111.111.111 255.255.255.0
Router(config-if)# no shutdown
Router(config-if)# end
Router# copy running-config startup-config
```

Managing WCCP Configurations for WAEs

This section contains the following topics:

- [Load Balancing and WAEs, page 4-12](#)
- [Packet-Forwarding Methods, page 4-14](#)
- [WCCP Flow Redirection on WAEs, page 4-17](#)
- [Viewing or Modifying the General WCCP Settings on WAEs, page 4-17](#)
- [Viewing a List of Currently Configured WCCP Services for WAEs, page 4-18](#)
- [Modifying the Current Settings of a WCCP Service for WAEs, page 4-19](#)
- [Creating a WCCP Service Mask for an Existing WCCP Service, page 4-23](#)
- [Modifying WCCP Service Masks for WAEs, page 4-23](#)
- [Viewing a WCCP Router List Configuration for WAEs, page 4-24](#)
- [Modifying the Configuration of WCCP Router Lists for WAEs, page 4-24](#)
- [Deleting a WCCP Router List from WAEs, page 4-25](#)
- [Defining Additional WCCP Router Lists on WAEs, page 4-25](#)
- [Configuring WAEs for a Graceful Shutdown of WCCP, page 4-27](#)
- [Configuring Static Bypass Lists for WAEs, page 4-28](#)



Note

Before you do the procedures in this section, you should have completed an initial configuration of your WAAS network, which includes the basic configuration of WCCP Version 2 and the TCP promiscuous mode service on your routers and WAEs, as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

Load Balancing and WAEs

Multiple WAEs with WCCP support can be deployed in a branch office for dynamic load balancing to enable adjustments to the loads being forwarded to the individual branch WAEs in a service group. IP packets received by a WCCP-enabled router are examined to determine if it is a request that should be

directed to a branch WAE. Packet examination involves matching the request to a defined service criteria. These packets are passed to the processing routine on the router to determine which branch WAE, if any, should receive the redirected packets.

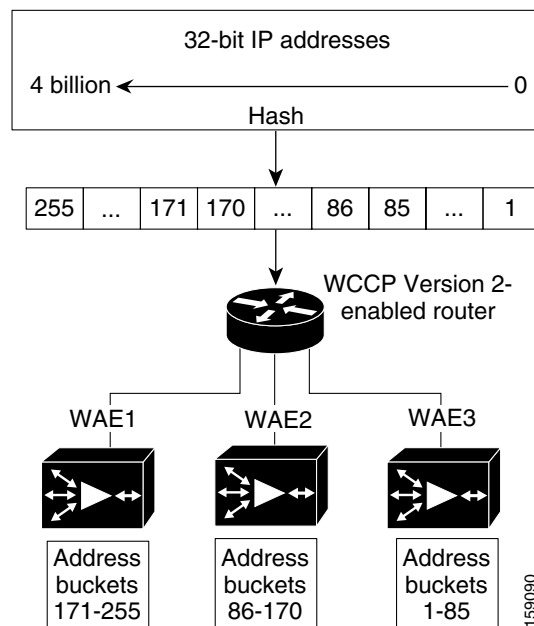
You can use load balancing to balance the traffic load across multiple branch WAEs. Load balancing allows the set of hash address buckets assigned to a branch WAE to be adjusted, shifting the load from an overwhelmed branch WAE to other branch WAEs that have available capacity. Two assignment methods are used by this technique: hashing and masking.

The term *assignment method* denotes the method used by WCCP to perform load distribution across WAEs. The two possible load-balancing assignment methods are hashing and masking. If the mask load-balancing method is not specified, then the hash load-balancing method, which is the default method, is used.

WCCP supports redirection based on a hash function. The hash key may be based on the source or destination IP address of the packet. For WAAS, load-balancing hashing is based on a source IP address (default), a destination IP address, or both.

The hash function uses the source IP address to obtain an address bucket to which the packet is assigned. These source address buckets are then mapped to a particular branch WAE depending on how many branch WAEs are present and how busy they are. (See [Figure 4-2](#).)

Figure 4-2 Load Balancing Through Hashing of IP Addresses



Note

Packets that the branch WAEs do not service are tunneled back to the same router from which they were received. When a router receives a formerly redirected packet, it knows not to redirect it again.

Destination IP address hashing guarantees that a single branch WAE caches a given file server. This method, which allows a local coherency directive to be safely applied to the file server content (provided that no other collaboration on the content occurs), improves performance and WAN link and disk utilization. This method may distribute load unevenly, however, because of uneven activity on a file server.

Source IP address hashing has better potential for session distribution between the caches on the branch WAEs. This method may impact performance and WAN link and disk utilization (see the previous description of factors to be aware of when load balancing is applied). Also, any change in the IP address of a client (which can happen when working in DHCP environments) may cause the client to switch to another branch WAE, which can cause the client to experience reduced performance until the client's working set is retrieved into the new cache.

Hashing that is based on a client IP address does not guarantee any locality of the hash key. For example, clients from the same subnet (which are likely to share and collaborate on the same content) may be assigned two different hash numbers and may be redirected to different branch WAEs, while clients from different subnets may be assigned the same hash number and may be redirected to the same branch WAE. Hashing that is based on a client IP address does guarantee consistency. For example, a client using the same IP address is redirected to the same branch WAE.

In the service farm, a lead branch WAE is chosen to build the hash table that distributes the load between the available branch WAEs. The lead branch WAE distributes the buckets evenly. The source IP address is hashed and the resulting bucket determines the branch WAE that will handle the packet (flow protection makes sure that it is the same branch WAE throughout the session).

WCCP supports redirection by mask value assignments. This method relies on masking to make redirection decisions. The decisions are made using special hardware support in the WCCP-enabled router. This method can be very efficient because packets are switched by the hardware.


Note

The masking method can only be used for load balancing with the Catalyst 6500 series switches and Cisco 7600 series routers.

You must explicitly specify masking. You can specify two mask values based on the source or destination IP address of the packet. For WAAS, the default mask value is based on the destination IP address. You can enable masks by using the default values or specifying a particular mask. The default mask values, specified in hexadecimal notation, are as follows:

- `dst-ip-mask= 0x0`
- `src-ip-mask= 0x1741`

You may specify the mask value with a maximum of seven bits. The branch WAE creates a table of the 2^7 (or 128) combinations, assigns the branch WAE IP addresses to them, and sends this table to the WCCP-enabled routers. The router uses this table to distribute the traffic among all the branch WAEs that are in the service group. Each packet that matches the WCCP service parameters is compared to this table and the packets are sent to the matching branch WAE.

Packet-Forwarding Methods

A WCCP-enabled router redirects intercepted TCP segments to a WAE using one of the following two packet-forwarding methods:

- Generic routing encapsulation (GRE)—Allows packets to reach the WAE even if there are any number of routers in the path to the WAE.
- Layer 2 redirection—Allows packets to be switched at Layer 2 (MAC layer) and reach the WAE.

Table 4-2 describes the packet-forwarding methods.

Table 4-2 Packet-Forwarding Methods

Packet-Forwarding Method	Load-Balancing Method: Hashing	Load-Balancing Method: Masking
GRE (Layer 3)	Packet redirection is completely handled by the router software.	Packet redirection is handled by the router software. We do not recommend using mask assignment when GRE is being used as the packet-forwarding method.
Layer 2 redirection	First redirected packet is handled by the router software; all subsequent redirected packets are handled by the router hardware.	All packets are handled by the router hardware (currently supported only on the Catalyst 6500 series switches or Cisco 7600 series routers because special hardware is required).

The redirection mode is controlled by the branch WAE. The first branch WAE that joins the WCCP service group decides the forwarding method (GRE or Layer 2 redirection) and the assignment method (hashing or masking). The term *mask assignment* refers to WCCP Layer 2 Policy Feature Card 2 (PFC2) input redirection.

If masking is selected with WCCP output redirection, then the branch WAE falls back to the original hardware acceleration that is used with the Multilayer Switch Feature Card (MSFC) and the Policy Feature Card (PFC).

For example, WCCP filters the packets to determine which redirected packets have been returned from the branch WAE and which ones have not. WCCP does not redirect the ones that have been returned because the branch WAE has determined that the packets should not be processed. WCCP Version 2 returns packets that the branch WAE does not service to the same router from which they were transmitted.

This section contains the following topics:

- [Reasons for Packet Rejection and Return, page 4-15](#)
- [Layer 3 GRE as a Packet-Forwarding Method, page 4-16](#)
- [Layer 2 Redirection as a Packet-Forwarding Method, page 4-16](#)

Reasons for Packet Rejection and Return

A branch WAE rejects packets and initiates packet return for the following reasons:

- The WAE is filtering out certain conditions that make processing packets unproductive, for example, when IP authentication has been turned on.
- CIFS packets are received by the branch WAE destined to a server that is not configured to be cached by the branch WAE (only in WAFS legacy mode).
- You have configured a static bypass list on the branch WAE.



Note

The packets are redirected to the source of the connection between the WCCP-enabled router and the branch WAE. Depending on the Cisco IOS software version used, this source could be either the address of the outgoing interface or the router IP address. In the latter case, it is important that the branch WAE has the IP address of the WCCP-enabled router stored in the router list. For more information on router lists, see the [“Modifying the Configuration of WCCP Router Lists for WAEs” section on page 4-24](#).

Cisco Express Forwarding (CEF) is not required but is recommended for improved performance. WCCP can use IP CEF if CEF is enabled on the router. WCCP also allows you to configure multiple routers (router lists) to support a particular WCCP service (for example, CIFS redirection).

Layer 3 GRE as a Packet-Forwarding Method

A WCCP-enabled router redirects intercepted requests to a WAE and can encapsulate the packets using generic routing encapsulation (GRE). This method for forwarding packets allows packets to reach the WAE even if there are routers in the path to the WAE. Packet redirection is handled entirely by the router software.

GRE allows datagrams to be encapsulated into IP packets at the WCCP-enabled router and then redirected to a WAE (the transparent proxy server). At this intermediate destination, the datagrams are decapsulated and then handled by the WAAS software. If the request cannot be handled locally, the origin server may be contacted by the associated WAE to complete the request. In doing so, the trip to the origin server appears to the inner datagrams as one hop. The redirected traffic using GRE usually is referred to as GRE tunnel traffic. With GRE, all redirection is handled by the router software.

With WCCP redirection, a Cisco router does not forward the TCP SYN packet to the destination because the router has WCCP enabled on the destination port of the connection. Instead, the WCCP-enabled router encapsulates the packet using GRE tunneling and sends it to the WAE that has been configured to accept redirected packets from this WCCP-enabled router.

After receiving the redirected packet, the WAE does the following:

1. Strips the GRE layer from the packet.
2. Decides whether it should accept this redirected packet and process the request for content or deny the redirected packet as follows:
 - a. If the WAE decides to accept the request, it sends a TCP SYN ACK packet to the client. In this response packet, the WAE uses the IP address of the original destination (origin server) that was specified as the source address so that the WAE can be invisible (transparent) to the client; it pretends to be the destination that the TCP SYN packet from the client was trying to reach.
 - b. If the WAE decides not to accept the request, it reencapsulates the TCP SYN packet in GRE, and sends it back to the WCCP-enabled router. The router understands that the WAE is not interested in this connection and forwards the packet to its original destination (that is, the origin server).

Layer 2 Redirection as a Packet-Forwarding Method

Layer 2 redirection is accomplished when a WCCP-enabled router or switch takes advantage of internal switching hardware that either partially or fully implements the WCCP traffic interception and redirection functions at Layer 2. This type of redirection is currently supported only with the Catalyst 6500 series switches and Cisco 7200 and 7600 series routers. With Layer 2 redirection, the first redirected traffic packet is handled by the router software. The rest of the traffic is handled by the router hardware. The branch WAE instructs the router or switch to apply a bit mask to certain packet fields, which in turn provides a mask result or index mapped to the branch WAE in the service group in the form of a mask index address table. The redirection process is accelerated in the switching hardware, making Layer 2 redirection more efficient than Layer 3 GRE.

**Note**

WCCP is licensed only on the WAE and not on the redirecting router. WCCP does not interfere with normal router or switch operations.

WCCP Flow Redirection on WAEs

Flow protection reduces the impact on existing client TCP connections when branch WAEs are added and removed from a service group. By default, WCCP flow redirection is enabled on a WAE. Flow protection reduces the impact on existing client TCP connections when branch WAEs are added and removed from a service group. The client impact is reduced because of flow protection in the following situations:

- **WAAS network expansion**—When branch WAEs are added to the service group, the newly started branch WAEs receives traffic that was previously processed by a different branch WAE. It forwards the traffic to the relevant branch WAE for continued processing. New connections are processed by the new branch WAE.
- **Branch WAE replacement following a failure**—When a branch WAE fails, another branch WAE may receive traffic that was previously processed by either that branch WAE or the origin file server. The receiving branch WAE operates according to the previous two use cases.

Without flow protection, established client connections are broken through a TCP RESET in the situations listed earlier. Flow protection applies to all supported WCCP services and cannot be configured on a per-service basis.

Viewing or Modifying the General WCCP Settings on WAEs

In a WAAS network, the following set of configuration parameters for a WAE is collectively referred to as the WCCP general settings:

- WCCP version
- Flow redirection
- Shutdown delay

Table 4-3 lists the default values for the WCCP general settings on a WAE.

Table 4-3 Default Values for the WCCP General Settings on a WAE

Feature	Default Value	Comment
WCCP Version 2	Disabled	WCCP Version 2 is the only version supported in WAAS.
Flow redirection	Enabled	Keeps the TCP flow intact and avoids overwhelming the WAE when it comes up and is assigned new traffic.
Shutdown delay	120 seconds	To prevent broken TCP connections, the WAE performs a clean shutdown of WCCP after a reload or WCCP is shut down (disabled) on the WAE.

To ensure consistency, we recommend that you change the WCCP general settings on a device group basis instead of on an individual device.



Note

Before you do the procedure in this section, you should have already completed a basic WCCP configuration for your WAAS network that includes the configuration of the TCP promiscuous mode service (WCCP Version 2 services 61 and 62) as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

To centrally view or modify the general WCCP settings for a WAE (or a group of WAEs), follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to change the values of the WCCP general settings.
- Step 3** In the navigation pane, choose **Configure > Interception > WCCP > General Settings**. The WCCP General Configuration Settings window appears.
- Step 4** Check the current settings for the chosen device (or device group):
- To keep the current settings and to close the window, click **Cancel**.
 - To modify the current settings, change the current setting as described in the rest of this procedure.

By default, WCCP is disabled on a WAE. However, as part of the initial configuration of WCCP in your WAAS network, you should have enabled WCCP Version 2 on your WAEs (the branch WAE and the data center WAE) as well as on the routers in the data center and branch office that will be transparently redirecting requests to these WAEs. For information about how to perform a basic WCCP configuration in your WAAS network, see the *Cisco Wide Area Application Services Quick Configuration Guide*.

- Step 5** Check the **Enable WCCP** check box to enable WCCP Version 2 on the chosen device (or device group), or uncheck the check box to disable WCCP on the chosen device (or device groups).



Note Ensure that the routers used in the WCCP environment are running a version of the Cisco IOS software that also supports the WCCP Version 2.

- Step 6** Check the **Enable Flow Redirection** check box to keep the TCP flow intact and to avoid overwhelming the device (or device groups) when they come up or are reassigned new traffic. For more information, see the [“WCCP Flow Redirection on WAEs” section on page 4-17](#).
- Step 7** In the Shutdown Delay field, specify the maximum amount of time (in seconds) that the chosen device (or device group) waits to perform a clean shutdown of WCCP. The default is 120 seconds.
- The WAE does not reboot until either all connections have been serviced or the maximum wait time (specified through this Shutdown Delay field) has elapsed for WCCP Version 2.
- Step 8** Click **Submit** to save the changes.
-

To configure WCCP settings from the CLI, you can use the **wccp version**, **wccp flow-redirect**, and **wccp shutdown** global configuration commands.

For more information about a graceful shut down of WCCP Version 2 on WAEs, see the [“Configuring WAEs for a Graceful Shutdown of WCCP” section on page 4-27](#).

Viewing a List of Currently Configured WCCP Services for WAEs

To centrally view a list of the WCCP services that are currently configured for a WAE (or group of WAEs), follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices window appears, listing all the device types configured in the WAAS network.
- Step 2** Click the **Edit** icon next to the device (or device group) for which you want to view a list of currently configured WCCP services.
- Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings for WAE window appears with a list of the currently configured WCCP services for the chosen device (or device group).
- Step 4** Click the **Edit WCCP Service Setting** icon next to the service that you want to modify to modify an existing WCCP service.
- For more information about modifying a service, see the [“Modifying the Current Settings of a WCCP Service for WAEs”](#) section on page 4-19.
- Step 5** Click the **Create New WCCP Service Setting** icon in the taskbar to create a new WCCP service for the chosen device (or device group).
-

To view currently configured WCCP services from the CLI, you can use the **show wccp services EXEC** command.

Modifying the Current Settings of a WCCP Service for WAEs

To modify the current settings of a WCCP service for a WAE (or group of WAEs), follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to modify the WCCP settings or services.
- Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings window appears with a list of the currently configured WCCP services for the chosen device (or device group).
- Step 4** Click the **Edit WCCP Service Setting** icon next to the service that you want to modify. The Modifying WCCP Service window appears. (See [Figure 4-3](#).)

Figure 4-3 Modifying the Settings of a WCCP Service

The screenshot shows the Cisco Wide Area Application Services (WAAS) Central Manager interface. The main content area is titled "Modifying WCCP Service, TCP Promiscuous". The "Service Type" is set to "TCP Promiscuous". The "Router List" is set to "Use Default Gateway". The "Load Balancing Hash" section has "Destination IP" unchecked and "Source IP" checked. The "Other Settings" section includes "Only Use Selected Assignment Method" (unchecked), "Forwarding Method" (GRE), "Return Method" (GRE), "Password" (empty), "Confirm Password" (empty), "Weight" (0), and "Assignment Method" (Hash).

**Note**

You can configure all settings for a WCCP service only after the service has been associated with a router list.

Step 5 Associate a router list with the TCP promiscuous mode service by choosing the appropriate number of the WCCP router list from the Router List drop-down list. Alternatively, you can choose the default, which is Use Default Gateway. This selects the default router list, which contains the single IP address of the default gateway of the WAE device.

Only configured WCCP router lists are displayed in the drop-down list. As part of the initial configuration of your WAAS network, you will have already created at least one WCCP router list for your branch WAE and a second WCCP router list for your data center WAE, as described in the *Cisco Wide Area Application Services Quick Configuration Guide*. For more information about WCCP router lists, see the following sections:

- [Modifying the Configuration of WCCP Router Lists for WAEs, page 4-24](#)
- [Deleting a WCCP Router List from WAEs, page 4-25](#)
- [Defining Additional WCCP Router Lists on WAEs, page 4-25](#)

Step 6 (Optional) Modify the current load-balancing settings for the chosen WCCP service as follows:

- To define the load-balancing hash of the destination IP address, check the **Destination IP** check box.
- To define the load-balancing hash of the source IP address, check the **Source IP** check box.

**Note**

For more information about load balancing, see the “[Load Balancing and WAEs](#)” section on [page 4-12](#).

Step 7 (Optional) Modify the other current settings for the WCCP service as follows:

- a. To force WCCP to use the configured assignment method only, check the **Only Use Selected Assignment Method** check box. When applied, use either of these two load-balancing methods:
 - Hash assignment—For the Catalyst 6500 series switches and Cisco 7600 series routers, this load-balancing method is called WCCP Layer 2 Policy Feature Card (PFC) redirection. Use this method to achieve forwarding performance of up to 3 Gbps using the Supervisor Engine 1A and the Multilayer Switch Feature Card 2 (MSFC2).
 - Mask assignment—This type of load balancing is called the WCCP Layer 2 Policy Feature Card 2 (PFC2) redirection. It uses the Supervisor Engine 2 and the MSFC2.

You can specify only one load-balancing method (hashing or masking) per WCCP service in a branch WAE group. For more information about load-balancing assignment methods, see the [“Load Balancing and WAEs”](#) section on page 4-12.

- b. From the Forwarding Method drop-down list, choose the type of packet forwarding method to use:
 - Choose GRE (the default) to use Layer 3 GRE packet redirection.
 - Choose L2 to permit the WAE (or device group) to receive transparently redirected traffic from a WCCP Version 2-enabled switch or router, if the WAE has a Layer 2 connection with the device, and the device is configured for Layer 2 redirection.

WCCP on a router or switch can take advantage of switching hardware that either partially or fully implements the traffic interception and redirection functions of WCCP in hardware at Layer 2. The WAE can then perform a Layer 2 or MAC address rewrite redirection if it is directly connected to a compatible Cisco switch. This redirection processing is accelerated in the switching hardware, which makes this method a more efficient method than Layer 3 redirection using GRE. The WAE must have a Layer 2 connection with the router or switch. Because there is no requirement for a GRE tunnel between the switch and the WAE, the switch can use a cut-through method of forwarding encapsulated packets if you choose L2. For more information, see the [“Packet-Forwarding Methods”](#) section on page 4-14.

- c. From the Return Method drop-down list, choose the type of packet return method to use:
 - Choose GRE (the default) to use GRE packet return.
 - Choose L2 to use Layer 2 rewriting for packet return.
- d. In the Password field, specify the password to be used for secure traffic between the WAEs within a cluster and the router for a specified service. Be sure to enable all other WAEs and routers within the cluster with the same password. Passwords must not exceed 8 characters in length. Reenter the password in the Confirm Password field.



Note For information about how to use the CLI to specify the service group password on a router, see the [“Setting a Service Group Password on a Router”](#) section on page 4-11.

- e. In the Weight field, specify the weight value that is used for load balancing. The weight value ranges from 0 to 10000. If the total of all the weight values of the WAEs in a service group is less than or equal to 100, then the weight value represents a literal percentage of the total load redirected to the device for load-balancing purposes. For example, a WAE with a weight of 10 receives 10 percent of the total load in a service group where the total of all weight values is 50. If a WAE in such a service group fails, the other WAEs still receive the same load percentages as before the failure; they will not receive the load allocated to the failed WAE.

If the total of all the weight values of the WAEs in a service group is between 101 and 10000, then the weight value is treated as a fraction of the total weight of all the active WAEs in the service group. For example, a WAE with a weight of 200 receives 25 percent of the total load in a service group where the total of all the weight values is 800. If a WAE in such a service group fails, the other WAEs will receive the load previously allocated to the failed WAE. The failover handling is different than if the total weights are less than or equal to 100.

By default, weights are not assigned and the traffic load is distributed evenly between the WAEs in a service group.

- f. From the Assignment Method drop-down list, choose the type of WAE load balancing assignment method to use (for more information see the [“Load Balancing and WAEs”](#) section on page 4-12):
 - Choose Hash (the default) to use the hash method.
 - Choose Mask to use the mask method.

Step 8 (Optional) Click the **Edit Mask** button to modify an existing service mask for the WCCP service. For more information about modifying service masks, see the [“Modifying WCCP Service Masks for WAEs”](#) section on page 4-23.

Step 9 (Optional) Click the **View Masks Configured for All Services** button to view a list of all configured WCCP service masks for the service. The WCCP Service Mask Settings windows appears.

Step 10 From the WCCP Service Mask Settings window, you can perform the following tasks:

- To edit a WCCP service mask, click the **Edit WCCP Service Mask** icon next to the service mask that you want to modify. The Modifying WCCP Service Mask window appears. (See [Figure 4-4](#).)

Figure 4-4 Modifying a WCCP Service Mask



Change the values of the settings that you want to modify and click **Submit**, as follows:

- In the Source IP Mask field, specify the IP address mask defined by a hexadecimal number (for example, 0xFE000000) used to match the packet source IP address. The range is 0x00000000–0xFE000000. The default is 0x00001741.
- In the Destination IP Mask field, specify the IP address mask defined by a hexadecimal number (for example, 0xFE000000) used to match the packet destination IP address. The range is 0x00000000–0xFE000000. The default is 0x00000000.



Note You can also edit a service mask by clicking the **Edit Mask** button in the Modifying WCCP Service window. (See [Figure 4-3](#).)

- To delete an existing WCCP service mask, click the **Edit WCCP Service Mask** icon next to the service mask that you want to delete. The Modifying WCCP Service Mask window appears. (See [Figure 4-4](#).) Click the **Delete WCCP Service Mask** icon in the taskbar and click **Submit**.

To configure the WCCP service from the CLI, you can use the `wccp tcp-promiscuous` global configuration command.

Creating a WCCP Service Mask for an Existing WCCP Service

To create a service mask for an existing WCCP service for a WAE (or group of WAEs), follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Devices Group**).
 - Step 2** Click the **Edit** icon next to the device (or device group) for which you want to create a WCCP service mask.
 - Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings for WAE window appears.
 - Step 4** Click the **Edit WCCP Service Setting** icon next to the service for which you want to create a mask. The Modifying WCCP Service window appears.
 - Step 5** Click the **Create Mask** button. The Creating New WCCP Service Mask window appears.

You can configure up to 16 WCCP service masks. Bit masks are specified as hexadecimal numbers. All the specified bit masks together cannot have more than 7 bits set. For example, a correct way of using three masks is 0xF (4 bits), 0x1 (1 bit), and 0x3 (2 bits) for a total of 7 bits. In this situation, you cannot configure any additional mask other than 0x0, otherwise, an error message is displayed. An example of using four masks could be 0xA (2 bits), 0x7 (3 bits), 0x8 (1 bit), 0x1 (1 bit) for a total of 7 bits.
 - Step 6** Click **Submit** to save the settings for the WCCP service mask.
-

Modifying WCCP Service Masks for WAEs

To centrally modify a service mask for a WCCP service that is configured for a WAE (or group of WAEs), follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Devices Group**).
 - Step 2** Click the **Edit** icon next to the device (or device group) for which you want to modify a WCCP service mask.
 - Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings for WAE window appears.
 - Step 4** Click the **Edit WCCP Service Setting** icon next to the service for which you want to edit a mask. The Modifying WCCP Service window appears.
 - Step 5** Click the **Edit Mask** button. The Modifying WCCP Service Mask window appears.

- Step 6** In the Source IP Mask field, specify the IP address mask defined by a hexadecimal number (for example, 0xFE000000) used to match the packet source IP address. The range is 0x00000000–0xFE000000. The default is 0x00001741.
 - Step 7** In the Destination IP Mask field, specify the IP address mask defined by a hexadecimal number (for example, 0xFE000000) used to match the packet destination IP address. The range is 0x00000000–0xFE000000. The default is 0x00000000.
 - Step 8** Click **Submit** to save the new settings for the WCCP service mask.
-

Viewing a WCCP Router List Configuration for WAEs

To centrally view the list of currently defined WCCP router list for a WAE (or group of WAEs), follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to display a WCCP router list.
- Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings window appears.
- Step 4** Click the **Edit** icon next to any of the listed WCCP services. The Modifying WCCP Service window appears.
- Step 5** Click the **View All Router List** button.

The WCCP Router List Configurations window for the chosen device (or device group) appears.

The configuration for the WCCP router lists (the number of the router list and IP addresses of each router that is included in each router list) is displayed.



Note To modify the configuration of a specific WCCP router list, click the **Edit** icon next to the router list and use the displayed Modifying Router List to modify the chosen router list. For more information about modifying router lists, see the [“Modifying the Configuration of WCCP Router Lists for WAEs” section on page 4-24](#). For information about how to delete a WCCP router list from a WAE (or group of WAEs), see the [“Deleting a WCCP Router List from WAEs” section on page 4-25](#).

To view a router list from the CLI, you can use the **show wccp routers EXEC** command.

Modifying the Configuration of WCCP Router Lists for WAEs

To centrally modify the configuration of a WCCP router list (for example, add or delete a router from a router list) for a WAE (or group of WAEs), follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).

- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to modify the router list configuration.
 - Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**.
The WCCP Service Settings window appears.
 - Step 4** Click the **Edit** icon next to a WCCP service that is currently configured to use the router list that you want to modify. The Modifying WCCP Service window appears.
 - Step 5** Click the **Edit Router List** button. The Modifying WCCP Router List window appears.
 - Step 6** Add a router to the chosen router list by entering the router IP address in the Add Router field and clicking the **Add Router** button.
 - Step 7** Remove a router from the chosen router list by checking the check box next to the IP address of the router that you want to remove and clicking the **Remove Router** button.
 - Step 8** Click **Submit** to save the settings.
-

Deleting a WCCP Router List from WAEs

When you delete a router list, the WCCP Version 2 services that have been configured to use this router list are also deleted. Ensure that the WCCP service is associated with a different router list, if required, before deleting the previously configured router list.

To centrally delete a WCCP router list (for example, add or delete an IP address from a router list) for a WAE (or group of WAEs), follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices (or Manage Device Groups)**.
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to delete a WCCP router list.
- Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings window appears.
- Step 4** Click the **Edit Router List** button. The Modifying WCCP Router List window appears.
- Step 5** Remove all of the listed routers from the chosen router list by checking the check the check box next to the IP address of the router that you want to remove and clicking the **Remove Router** button.
- Step 6** After you have removed all the routers from the chosen router list (for example, router list 2), click the **Delete Router List** icon in the taskbar.

The system displays a dialog box asking you to confirm that you want to permanently delete the router list configuration. To confirm your decision, click **OK**. The selected router list and the associated WCCP services are deleted from the chosen device (or device group).

Defining Additional WCCP Router Lists on WAEs

As part of configuring a WCCP service on a WAE, you must create a list of WCCP Version 2-enabled routers that support the TCP promiscuous service for the WAE. You can define a WCCP router list through the WAAS CLI (the **wccp router-list** global configuration command) or the WAAS Central Manager GUI.

Typically, WAAS administrators will use the WAAS CLI to define their initial set of WCCP router lists, as described in the *Cisco Wide Area Application Services Quick Configuration Guide*. After you have used the WAAS CLI to complete the initial configuration of your WCCP router lists, we recommend that you use the WAAS Central Manager GUI to centrally manage and modify your WCCP router list configurations for your WAEs.

Each WAE includes a default router list (router list 8) that is configured with the IP address of the router that is defined as the default gateway for the WAE.

**Note**

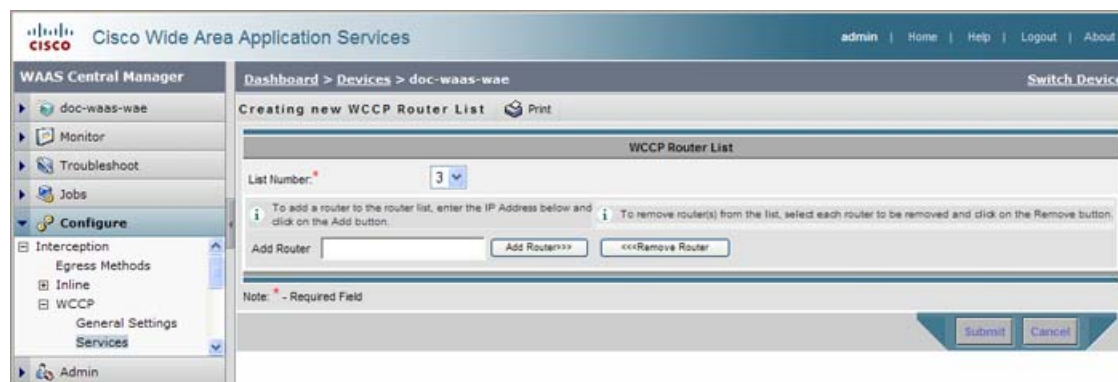
Before you do the procedure in this section, you should have already completed a basic WCCP configuration for your WAAS network that includes the configuration of the TCP promiscuous mode service (WCCP Version 2 services 61 and 62) as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

To centrally define additional WCCP router list for a WAE (or group of WAEs), follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to create a WCCP router list.
- Step 3** In the navigation pane, choose **Configure > Interception > WCCP > Services**. The WCCP Service Settings window appears.
- Step 4** Click the **Edit** icon next to any of the listed WCCP services. The Modifying WCCP Service window appears.
- Step 5** Click the **New Router List** button.

The Creating New WCCP Router List window appears. (See [Figure 4-5](#).)

Figure 4-5 Creating a New WCCP Router List Example Screen



In this example, the number 3 is preselected in the List Number drop-down list because there are already two WCCP router lists defined for the chosen device (or device group). Router list 1 has already been defined for the WCCP router in the data center that will be transparently redirecting traffic to the data center WAE, and router list 2 was defined for the WCCP router in the branch office that will be transparently redirecting traffic to the branch WAE that resides in the same branch office.

- Step 6** In the Add Router field, specify the IP address of the router to be added to router list 3.

You must enter at least one IP address. All IP addresses added must be unique within the router list. Otherwise, an error message is displayed on submit.

Step 7 Click **Add** to add an IP address to router list 3.

This list represents the IP address of every WCCP router that is to transparently redirect traffic to the chosen WAE (or group of WAEs) for the TCP promiscuous mode service.

The window refreshes and the addresses are listed in numerical order. The order might not match the order in which IP addresses were entered.

Step 8 Click **Submit** to save the router list or to save any edits you have made to the router IP addresses.

To define a router list from the CLI, you can use the **wccp router-list** global configuration command. After you create a WCCP router list on a WAE or group of WAEs, you must associate the router list with the specific WCCP service (the TCP promiscuous mode service) on the WAE or group of WAEs. For more information, see [Step 5](#) in the “[Modifying the Current Settings of a WCCP Service for WAEs](#)” section on page 4-19. In addition, ensure that WCCP Version 2 and the WCCP TCP promiscuous mode service is enabled and configured on the WCCP routers that are included in this new router list as described in the *Cisco Wide Area Application Services Quick Configuration Guide*.

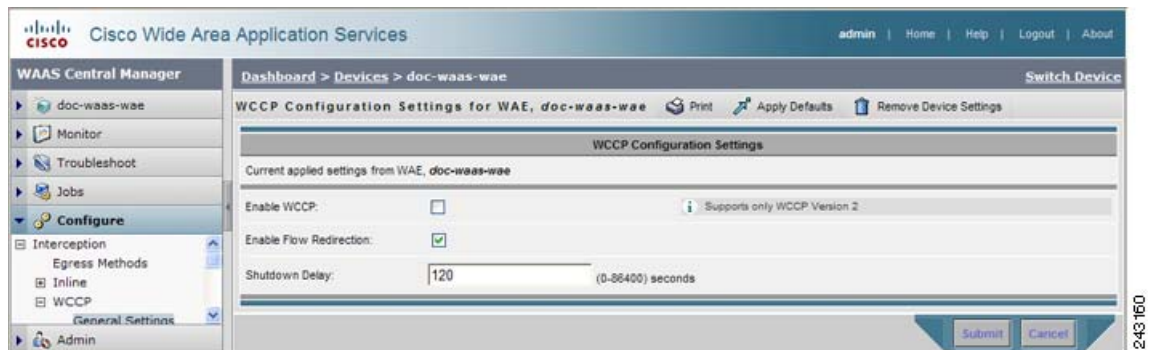
Configuring WAEs for a Graceful Shutdown of WCCP

To prevent broken TCP connections, the WAE performs a clean shutdown of WCCP after you disable WCCP Version 2 on a WAE or reload the WAE.

The WAAS Central Manager GUI allows you to disable WCCP Version 2 on a WAE. You can also perform this task locally through the CLI (by entering the **no wccp version** CLI command on the WAE).

To disable WCCP for a chosen device or device group, uncheck the **Enable WCCP** check box in the WAAS Central Manager’s WCCP Configuration Settings window. (See [Figure 4-6](#).)

Figure 4-6 WCCP Configuration Settings Window



The WAE does not reboot until one of the following occurs:

- All the connections have been serviced.
- The maximum wait time (specified through the Shutdown Delay field in the WCCP Configuration Settings window or with the **wccp shutdown max-wait** command [by default, 120 seconds]) has elapsed for WCCP Version 2.

During a clean shutdown of WCCP, the WAE continues to service the flows that it is handling, but it starts to bypass new flows. When the number of flows goes down to zero, the WAE takes itself out of the group by having its buckets reassigned to other WAEs by the lead WAE. TCP connections can still be broken if the WAE crashes or is rebooted without WCCP being cleanly shut down.

You cannot shut down an individual WCCP service on a particular port on an WAE; you must shut down WCCP on the WAE. After WCCP is shut down on the WAE, the WAE preserves its WCCP configuration settings.

Configuring Static Bypass Lists for WAEs

Using a static bypass allows traffic flows between a configurable set of clients and file servers to bypass handling by the WAE. By configuring static bypass entries on the branch WAE, you can control traffic interception without modifying the router configuration. IP access lists may be configured separately on the router to bypass traffic without first redirecting it to the branch WAE. Typically, the WCCP accept list defines the group of file servers that are cached (and the file servers that are not). Static bypass can be used occasionally when you want to prevent WAAS from caching a connection from a specific client to a specific file server (or from a specific client to all file servers).



Note

We recommend that you use IP access lists on the WCCP-enabled router, rather than using the static bypass feature, because access lists are more efficient. For information about how to configure bypass lists on a router, see the [“Configuring IP Access Lists on a Router”](#) section on page 4-10.

To centrally configure a static bypass list for a WAE (or group of WAEs), follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to create a static bypass list.
- Step 3** From the navigation pane, choose **Configure > Interception > WCCP > Bypass Lists**.
- Step 4** In the taskbar, click the **Create New WCCP Bypass List** icon. The Creating new WCCP Bypass List window appears.
- Step 5** Enter the IP address for the client in the Client Address field.
- Step 6** Enter the IP address for the server in the Server Address field.
- Step 7** Check **Submit** to save the settings.

To configure a static bypass list from the CLI, you can use the **bypass static** global configuration command.

Aggregating Static Bypass Lists

An individual WAE device can have static bypass lists defined and can belong to device groups that have other static bypass lists defined.

In the WCCP Bypass Lists window, the Aggregate Settings radio button controls how static bypass lists are aggregated for an individual device, as follows:

- Choose **Yes** if you want to configure the device with all static bypass lists that are defined for itself and for device groups to which it belongs.

- Choose **No** if you want to limit the device to just the static bypass lists that are defined for itself.

When you change the setting, you get the following confirmation message: “This option will take effect immediately and will affect the device configuration. Do you wish to continue?” Click **OK** to continue.

Configuring Egress Methods for Intercepted Connections

The WAAS software supports the following egress methods for WCCP intercepted connections:

- IP forwarding
- WCCP GRE return
- Generic GRE

The default egress method is IP forwarding. If you do not configure the egress method, then the WAE uses IP forwarding. The IP forwarding egress method does not allow you to place WAEs on the same VLAN or subnet as the clients and servers, and it does not ensure that packets are returned to the intercepting router.

The WCCP GRE return and generic GRE egress methods allow you to place WAEs on the same VLAN or subnet as clients and servers. Repeating redirection is prevented by encapsulating the outgoing frames in the GRE frames. Cisco IOS routers handle these GRE frames as bypass frames and do not apply WCCP redirection. With the WCCP GRE return method, WAAS uses the router ID address as the destination for GRE frames; with the generic GRE method, WAAS uses the address of the router configured in the WAE router list.

This technique makes it possible to support redundant routers and router load balancing; WAAS makes a best effort to return frames back to the router from which they arrived. If you want to use this functionality with multiple routers connected to the WAAS network segment, you must ensure connectivity to the router ID address, for example, by configuring static routes. The router ID is the address of the first loopback interface or highest active physical interface. This address can be found in the output of the **show wccp routers EXEC** command.

WAAS applies the following logic in its router selection for WCCP GRE and generic GRE:

- When the WAAS software applies data redundancy elimination (DRE) and compression to a TCP flow, the number of packets that are sent out may be fewer. A single packet that carries optimized data may represent original data that was received in multiple packets redirected from different routers. That optimized data-carrying packet will egress from the WAE to the router that last redirected a packet to the WAE for that flow direction.
- When the WAE receives optimized data, the data may arrive in multiple packets from different routers. The WAAS software expands the optimized data back to the original data, which will be sent out as several packets. Those original data-carrying packets will egress from the WAE to the router that last redirected a packet to the WAE for that flow direction.

The WCCP GRE return and generic GRE egress methods are similar, but the generic GRE egress method is designed specifically to be used in deployments where the router or switch does hardware accelerated processing of GRE packets, such as with the Cisco 7600 series router or the Catalyst 6500 series switch with the Supervisor Engine 32 or 720. Additionally, the generic GRE egress method returns packets to the intercepting router by using a GRE tunnel that you must configure on the router (the WAE end of the tunnel is configured automatically). The generic GRE egress method is supported only when the WCCP GRE interception method is used.

To use the generic GRE egress method, you must create an intercepting router list on the WAE (multicast addresses are not supported) and configure a GRE tunnel interface on each router. For details on configuring GRE tunnel interfaces on the routers, see the [“Configuring a GRE Tunnel Interface on a Router” section on page 4-31](#).

WCCP Version 2 is capable of negotiating the redirect method and the return method for intercepted connections. The WAAS software supports WCCP GRE and WCCP Layer 2 as WCCP negotiated return methods. If WCCP negotiates a WCCP Layer 2 return, the WAE defaults to using IP forwarding as the egress method. The WAE also defaults to IP forwarding if the interception method is set to WCCP Layer 2 and you configure generic GRE as the egress method, which are not compatible. When the WAE defaults to IP forwarding, the WAE logs a minor alarm that is cleared when you correct the configuration so that the interception and egress methods are consistent. The output of the **show egress methods EXEC** command also displays a warning if the interception and egress methods are not consistent.

The WCCP bypass traffic uses WCCP GRE as the return method, regardless of the CLI configuration.

The WCCP negotiated return and generic GRE egress methods do not apply to the inline mode of operation.

To configure the egress method for WCCP intercepted connections from the Central Manager GUI, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to configure the egress method.
 - Step 3** In the navigation pane, choose **Configure > Interception > Egress Methods**. The Egress Methods window appears.
 - Step 4** From the Egress Method Configured drop-down list, choose **IP Forwarding**, **WCCP Negotiated Return**, or **Generic GRE**.
 - Step 5** Click **Submit**.
-

To configure the interception and egress method for WCCP GRE packet return from the CLI, use the **egress-method** global configuration command:

```
WAE(config)# egress-method negotiated-return intercept-method wccp
```

To configure the interception and egress method for IP forwarding from the CLI, use the **egress-method** global configuration command:

```
WAE(config)# egress-method ip-forwarding intercept-method wccp
```

To configure the interception and egress method for the generic GRE egress method from the CLI, configure an intercepting router list and configure the generic GRE egress method, as follows:

```
WAE(config)# wccp router-list 1 192.168.68.98
WAE(config)# egress-method generic-gre intercept-method wccp
```

The router list must contain the IP address of each intercepting router. Multicast addresses are not supported. Additionally, you must configure a GRE tunnel interface on each router. For details on configuring GRE tunnel interfaces on the routers, see the [“Configuring a GRE Tunnel Interface on a Router” section on page 4-31](#).

To view the egress method that is configured and that is being used on a particular WAE, use the **show egress-methods EXEC** command. To view information about the egress method for each connection segment, use the **show tfo egress-methods connection EXEC** command.

To view the generic GRE tunnel statistics for each intercepting router, use the **show statistics generic-gre EXEC** command. To clear statistics information for the generic GRE egress method, use the **clear statistics generic-gre EXEC** command.

Configuring a GRE Tunnel Interface on a Router

If you plan to use the generic GRE egress method on the WAE, you must configure a GRE tunnel interface on each intercepting router. For ease of configuration, we recommend that you create a single multipoint tunnel on the router, instead of one point-to-point tunnel per WAE.

The tunnel interface must have a Layer 3 source interface to which it is attached and this source interface must be the interface whose IP address is configured in the WAE's intercepting router list.

The tunnel interface must be excluded from WCCP interception to avoid routing loops. Use the command **ip wccp redirect exclude in**.

This section contains the following topics:

- [Multipoint Tunnel Configuration, page 4-31](#)
- [Point-To-Point Tunnel Configuration, page 4-32](#)

Multipoint Tunnel Configuration

Consider a deployment in which there are two intercepting routers and two WAEs in the farm. Each WAE's configuration would look like the following:

```
wccp router-list 1 192.168.1.1 192.168.2.1
wccp tcp-promiscuous router-list-num-1
egress-method generic-gre intercept-method wccp
```

Each router can configure a single multipoint GRE tunnel to the WAE farm.

The router 1 configuration would look like the following:

```
interface gigabitEthernet 1/1
ip address 192.168.1.1 255.255.255.0
...
interface Tunnel1
ip address 12.12.12.1 255.255.255.0
tunnel source GigabitEthernet1/1
tunnel mode gre multipoint
ip wccp redirect exclude in
end
```

The router 2 configuration would look like the following:

```
interface Vlan815 1/0
ip address 192.168.2.1 255.255.255.0
...
interface Tunnel1
ip address 13.13.13.1 255.255.255.0
tunnel source vlan815
tunnel mode gre multipoint
ip wccp redirect exclude in
end
```



Note

Provisioning an IP address for the tunnel interface is what enables it for IP, allowing it to process and forward transit packets. If you do not want to provision an IP address, the tunnel must be IP enabled by making it an IP unnumbered interface. This restricts the tunnel to be a point-to-point tunnel.

Point-To-Point Tunnel Configuration

This section describes how to configure a point-to-point tunnel per WAE instead of a single multipoint tunnel on the router. A point-to-point tunnel is enabled for IP either by making it unnumbered or by giving it an IP address. Both methods are shown in the following example router configuration:

```
interface gigabitEthernet 1/1
ip address 192.168.1.1 255.255.255.0
...
! Tunnel1 is an unnumbered point-to-point tunnel towards WAE1
interface Tunnel1
ip unnumbered GigabitEthernet1/1
tunnel source GigabitEthernet1/1
! tunnel destination is the IP address of WAE1
tunnel destination 10.10.10.10
ip wccp redirect exclude in
end

! Tunnel2 is a point-to-point tunnel towards WAE2, with an IP address
interface Tunnel2
ip address 12.12.12.1 255.255.255.0
tunnel source GigabitEthernet1/1
! tunnel destination is the IP address of WAE2
tunnel destination 10.10.10.11
ip wccp redirect exclude in
end
```

Using Policy-Based Routing to Transparently Redirect All TCP Traffic to WAEs

Policy-based routing (PBR), introduced in the Cisco IOS Software Release 11.0, allows you to implement policies that selectively cause packets to take specific paths in the network.

PBR also provides a method to mark packets so that certain kinds of traffic receive differentiated, preferential service when used in combination with queuing techniques enabled through the Cisco IOS software. These queuing techniques provide an extremely powerful, simple, and flexible tool to network managers who implement routing policies in their networks.

PBR enables the router to put packets through a route map before routing them. When configuring PBR, you must create a route map that specifies the match criteria and the resulting action if all of the match clauses are met. You must enable PBR for that route map on a particular interface. All packets arriving on the specified interface matching the match clauses will be subject to PBR.

One interface can have only one route map tag; but you can have several route map entries, each with its own sequence number. Entries are evaluated in order of their sequence numbers until the first match occurs. If no match occurs, packets are routed as usual.

```
Router(config-if)# ip policy route--tag
```

The route map determines which packets are routed next.

You can enable PBR to establish a route that goes through WAAS for some or all packets. WAAS proxy applications receive PBR-redirection traffic in the same manner as WCCP redirection traffic, as follows:

1. In the branch office, define traffic of interest on the branch office router (Edge-Router1) as follows:
 - a. Specify which traffic is of interest to the LAN interface (ingress interface) on Edge-Router1.

Use extended IP access lists to define traffic of interest (traffic from all or filtered local source addresses to any or filtered destination address).
 - b. Specify which traffic is of interest to the WAN interface (egress interface) on Edge-Router1.

Use extended IP access lists to define traffic of interest (traffic from all or filtered local source addresses from any or filtered remote addresses).

2. In the data center, specify which traffic is of interest to the data center router (Core-Router1) as follows:
 - a. Specify which traffic is of interest to the LAN interface (ingress interface) on Core-Router1.
Use extended IP access lists to define traffic of interest (traffic from all or filtered local source addresses to any or filtered destination address).
 - b. Specify which traffic is of interest to the WAN interface (egress interface) on Core-Router1.
Use extended IP access lists to define traffic of interest (traffic from all or filtered local source addresses from any or filtered remote addresses).
3. In the branch office, create route maps on Edge-Router1, as follows:
 - a. Create a PBR route map on the LAN interface of Edge-Router1.
 - b. Create a PBR route map on the WAN interface of Edge-Router1.
4. In the data center, create route maps on Core-Router1, as follows:
 - a. Create a PBR route map on the LAN interface of Core-Router1.
 - b. Create a PBR route map on the WAN interface of Core-Router1.
5. In the branch office, apply the PBR route maps to Edge-Router1.
6. In the data center, apply the PBR route maps to Core-Router1.
7. Determine which PBR method to use to verify PBR next-hop availability of a WAE. For more information, see the [“Methods of Verifying PBR Next-Hop Availability”](#) section on page 4-38.

**Note**

For a description of the PBR commands that are referenced in this section, see the *Cisco Quality of Service Solutions Command Reference*.

[Figure 4-7](#) shows that the WAEs (Edge-WAE1 and Core-WAE1) must reside in an out-of-band network that is separate from the traffic’s destination and source. For example, Edge-WAE1 is on a subnet separate from the clients (the traffic source), and Core-WAE is on a subnet separate from the file servers and application servers (the traffic destination). Additionally, the WAE may need to be connected to the router that is redirecting traffic to it through a tertiary interface (a separate physical interface) or subinterface to avoid a routing loop. For more information on this topic, see the [“Using Tertiary Interfaces or Subinterfaces to Connect WAEs to Routers”](#) section on page 2-23.

Figure 4-7 Example of Using PBR or WCCP Version 2 for Transparent Redirection of All TCP Traffic to WAEs

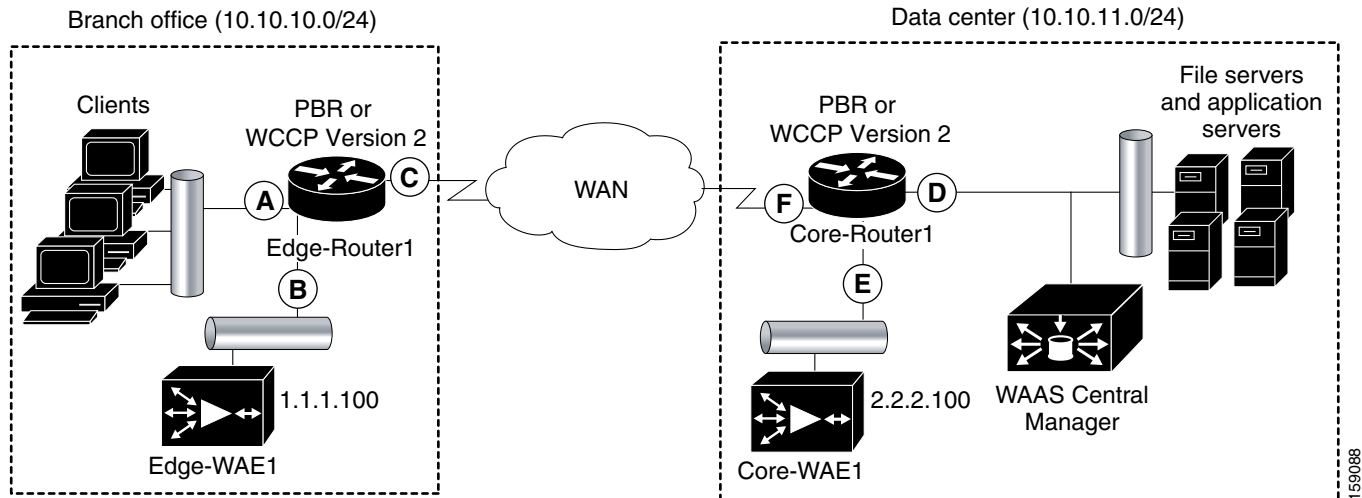


Table 4-4 provides a summary of the router interfaces that you must configure to use PBR or WCCP Version 2 to transparently redirect traffic to a WAE.

Table 4-4 Router Interfaces for WCCP or PBR Traffic Redirection to WAEs

Router interface	Comment
Edge-Router1	
A	Edge LAN interface (ingress interface) that performs redirection on outbound traffic.
B	Tertiary interface (separate physical interface) or a subinterface off of the LAN port on Edge-Router1. Used to attach Edge-WAE1 to Edge-Router1 in the branch office.
C	Edge WAN interface (egress interface) on Edge-Router1 that performs redirection on inbound traffic.
Core-Router1	
D	Core LAN interface (ingress interface) that performs redirection on outbound traffic.
E	Tertiary interface or subinterface off of the LAN port on Core-Router1. Used to attach Core-WAE1 to Core-Router1 in the data center.
F	Core WAN interface (egress interface) on Core-Router1 that performs redirection on inbound traffic.

**Note**

In Figure 4-7, redundancy (for example, redundant routers, switches, WAEs, WAAS Central Managers, and routers) is not depicted.

The following example shows how to configure PBR as the traffic redirection method in a WAAS network that has one WAE in a branch office and one WAE in the data center (as shown in Figure 4-7).

**Note**

The commands that are used to configure PBR on a router, can vary based on the Cisco IOS Release installed on the router. For information about the commands that are used to configure PBR for the Cisco IOS Release that you are running on your routers, see the appropriate Cisco IOS configuration guide.

To configure PBR to transparently redirect TCP traffic to WAEs, follow these steps:

- Step 1** In the branch office, use extended IP access lists to specify which traffic is of interest to the LAN interface (ingress interface-A) on Edge-Router:
- On Edge-Router1, define an extended IP access list within the range of 100 to 199. For example, create access list 100 on Edge-Router1:

```
Edge-Router1(config)# ip access-list extended 100
```
 - On Edge-Router1, specify which traffic is of interest to this particular interface:
 - For example, mark any IP/TCP traffic from any local source addresses (traffic for any branch office clients) on any TCP port to any destination as interesting:

```
Edge-Router1(config-ext-nacl)# permit tcp 10.10.10.0 0.0.0.255 any
```
 - Alternatively, you can selectively mark interesting traffic by defining the source IP subnet, destination IP address, and TCP port numbers. For example, mark IP/TCP traffic from any local source address on TCP ports 135 and 80 to any destination as interesting:

```
Edge-Router1(config-ext-nacl)# permit tcp 10.10.10.0 0.0.0.255 any eq 135  
Edge-Router1(config-ext-nacl)# permit tcp 10.10.10.0 0.0.0.255 any eq 80
```
- Step 2** In the branch office, use extended IP access lists to specify which traffic is of interest to the WAN interface (egress interface-C) on Edge-Router1:
- On Edge-Router1, define an extended IP access list within the range of 100 to 199. For example, create access list 101 on Edge-Router1:

```
Edge-Router1(config)# ip access-list extended 101
```
 - On Edge-Router1, specify which traffic is of interest to its WAN interface:
 - For example, mark any IP/TCP traffic to a local device as interesting:

```
Edge-Router1(config-ext-nacl)# permit tcp any 10.10.10.0 0.0.0.255
```
 - Alternatively, you can selectively mark interesting traffic by defining the source IP subnet, destination IP address, and TCP port numbers. For example, mark IP/TCP traffic to any local source addresses on TCP ports 135 and 80 to any destination as interesting:

```
Edge-Router1(config-ext-nacl)# permit tcp any 10.10.10.0 0.0.0.255 eq 135  
Edge-Router1(config-ext-nacl)# permit tcp any 10.10.10.0 0.0.0.255 eq 80
```
- Step 3** In the data center, use extended IP access lists to specify which traffic is of interest to the LAN interface (ingress interface-D) on Core-Router1:
- On Core-Router1, define an extended IP access list within the range of 100 to 199. For example, create access list 102 on Core-Router1:

```
Core-Router1(config)# ip access-list extended 102
```
 - On Core-Router1, specify which traffic is of interest to its LAN interface:
 - For example, mark any IP/TCP traffic sourced from any local device (for example, traffic sourced from any file server or application server in the data center) on any TCP port to any destination as interesting:

```
Core-Router1(config-ext-nacl)# permit tcp 10.10.11.0 0.0.0.255 any
```
 - Alternatively, you can selectively mark traffic as interesting by defining the source IP subnet, destination IP address, and TCP port numbers. For example, selectively mark IP/TCP traffic sourced from any local device on TCP ports 135 and 80 to any destination as interesting:

```
Core-Router1(config-ext-nacl)# permit tcp 10.10.11.0 0.0.0.255 any eq 135
Core-Router1(config-ext-nacl)# permit tcp 10.10.11.0 0.0.0.255 any eq 80
```

Step 4 In the data center, use extended IP access lists to mark traffic of interest for the WAN interface (egress interface-F) on Core-Router1:

- a. On Core-Router1, define an extended access list within the range of 100 to 199. For example, create access list 103 on Core-Router1:

```
Core-Router1(config)# ip access-list extended 103
```

- b. On Core-Router1, mark interesting traffic for the WAN interface:

- For example, mark any IP/TCP traffic destined to any local device (for example, traffic destined to any file server or application server in the data center) as interesting:

```
Core-Router1(config-ext-nacl)# permit tcp any 10.10.11.0 0.0.0.255
```

- Alternatively, you can selectively mark traffic as interesting by defining the source IP subnet, destination IP address, and TCP port numbers. For example, mark IP/TCP traffic on ports 135 and 80 to any local source addresses as interesting:

```
Core-Router1(config-ext-nacl)# permit tcp any 10.10.11.0 0.0.0.255 eq 135
Core-Router1(config-ext-nacl)# permit tcp any 10.10.11.0 0.0.0.255 eq 80
```

Step 5 In the branch office, define PBR route maps on Edge-Router1:

- a. Define a route map for the LAN interface (ingress interface). In the following example, the WAAS-EDGE-LAN route map is created:

```
Edge-Router1(config)# route-map WAAS-EDGE-LAN permit
```

- b. Define a route map for the WAN interface (egress interface).

In the following example, the WAAS-EDGE-WAN route map is created:

```
Edge-Router1(config)# route-map WAAS-EDGE-WAN permit
```

- c. Specify the match criteria.

Use the **match** command to specify the extended IP access list that Edge-Router1 should use to determine which traffic is of interest to its WAN interface. If you do not specify a **match** command, the route map applies to all packets.

In the following example, Edge-Router1 is configured to use the access list 101 as the criteria for determining which traffic is of interest to its WAN interface:

```
Edge-Router1(config-route-map)# match ip address 101
```



Note The **ip address** command option matches the source or destination IP address that is permitted by one or more standard or extended access lists.

- d. Specify how the matched traffic should be handled.

In the following example, Edge-Router1 is configured to send the packets that match the specified criteria to the next hop, which is Edge-WAE1 that has an IP address of 1.1.1.100:

```
Edge-Router1(config-route-map)# set ip next-hop 1.1.1.100
```



Note If you have more than one branch WAE, you can specify the IP address of a second branch WAE for failover purposes (for example, enter the **set ip next-hop 1.1.1.101** command on Edge-Router1) to specify a next-hop address of 1.1.1.101 (the IP address of Edge-WAE2) for failover purposes. The **next-hop** command is used for failover purposes and not for load-balancing purposes.

Step 6 In the data center, create route maps on Core-Router1:

- a. Define a route map on the LAN interface (ingress interface).

In the following example, the WAAS-CORE-LAN route map is created:

```
Core-Router1(config)# route-map WAAS-CORE-LAN permit
```

- b. Define a route map on the WAN interface (egress interface).

In the following example, the WAAS-CORE-WAN route map is created:

```
Core-Router1(config)# route-map WAAS-CORE-WAN permit
```

- c. Specify the match criteria.

Use the **match** command to specify the extended IP access list that Core-Router 1 should use to determine which traffic is of interest to its WAN interface. If you do not enter a **match** command, the route map applies to all packets. In the following example, Core-Router1 is configured to use the access list 103 as the criteria for determining which traffic is of interest to its WAN interface:

```
Core-Router1(config-route-map)# match ip address 103
```

- d. Specify how the matched traffic is to be handled.

In the following example, Core-Router1 is configured to send packets that match the specified criteria to the next hop, which is Core-WAE1 that has an IP address of 2.2.2.100:

```
Core-Router1(config-route-map)# set ip next-hop 2.2.2.100
```



Note If you have more than one data center WAE, you can specify the IP address of a second data center WAE for failover purposes (for example, enter the **set ip next-hop 2.2.2.101** command on Core-Router1) to specify a next-hop address of 2.2.2.101 (the IP address of Core-WAE2) for failover purposes. The **next-hop** command is used for failover purposes and not for load-balancing purposes.

Step 7 In the branch office, apply the route maps to the LAN interface (ingress interface) and the WAN interface (egress interface) on Edge-Router1:

- a. On Edge-Router1, enter interface configuration mode:

```
Edge-Router1(config)# interface FastEthernet0/0.10
```

- b. Specify that the LAN router interface should use the WAAS-EDGE-LAN route map for PBR:

```
Edge-Router1(config-if)# ip policy route-map WAAS-EDGE-LAN
```

- c. Enter interface configuration mode:

```
Edge-Router1(config-if)# interface Serial0
```

- d. Specify that the WAN router interface should use the WAAS-EDGE-WAN route map for PBR:

```
Edge-Router1(config-if)# ip policy route-map WAAS-EDGE-WAN
```

Step 8 In the data center, apply the route maps to the LAN interface (ingress interface) and the WAN interface (egress interface) on Core-Router1:

- a. On Core-Router1, enter interface configuration mode:

```
Core-Router1(config)# interface FastEthernet0/0.10
```

- b. Specify that for PBR, the LAN router interface should use the WAAS-CORE-LAN route map:

```
Core-Router1(config-if)# ip policy route-map WAAS-CORE-LAN
```

- c. Enter interface configuration mode:

```
Core-Router1(config-if)# interface Serial0
```

- d. Specify that for PBR, the WAN router interface should use the WAAS-CORE-WAN route map:

```
Core-Router1(config-if)# ip policy route-map WAAS-CORE-WAN
```

Methods of Verifying PBR Next-Hop Availability

When using PBR to transparently redirect traffic to WAEs, we recommend that you use one of the following methods to verify the PBR next-hop availability of a WAE. The method that you choose is based on the version of the Cisco IOS software that is running on the routers and the placement of your WAEs. However, method 2 is the preferred method whenever possible:

- Method 1—If the device sees the WAEs as a CDP neighbor (directly connected), it can use CDP and ICMP to verify that the WAE is operational. For more information, see the [“Method 1: Using CDP to Verify Operability of WAEs”](#) section on page 4-38.
- Method 2 (Recommended method)—If the device is running the Cisco IOS software Release 12.4 or later and the device does not see the WAE as a CDP neighbor, IP service level agreements (SLAs) can be used to verify that the WAE is operational using ICMP echoes. For more information, see the [“Method 2: Using IP SLAs to Verify WAE Operability Using ICMP Echo Verification \(Recommended Method\)”](#) section on page 4-39.
- Method 3—If the device is running the Cisco IOS software Release 12.4 or later and does not see the WAE as a CDP neighbor, IP SLAs can be used to verify that the WAE is operational using TCP connection attempts. For more information, see the [“Method 3: Using IP SLAs to Verify WAE Operability Using TCP Connection Attempts”](#) section on page 4-40.



Note

In this section, the term device is used to refer to the router or switch that has been configured to use PBR to transparently redirect traffic to a WAE.

To verify whether the WAE is CDP visible to a device that has been configured to use PBR, enter the **show cdp neighbors** command on the device. If the WAE is CDP visible to the device, the WAE will be listed in the output of the **show cdp neighbors** command.

Method 1: Using CDP to Verify Operability of WAEs

If the device that is configured to use PBR views the WAEs as a CDP neighbor (the WAE is directly connected to the device), you can configure CDP and ICMP to verify the availability of a WAE as a PBR next hop.

The following example shows how to use this method to verify PBR next-hop availability of a WAE. You must complete the following configuration process for each of the LAN and WAN route maps that are configured when CDP should be used.

To use CDP to verify operability of WAEs, follow these steps:

-
- Step 1** On the router where PBR is configured (for example, on the branch office router named Edge-Router1), enter configuration mode and enable CDP on the router:
- ```
Edge-Router1(config)# cdp run
```
- Step 2** Enable route-map configuration mode for the route map, WAAS-EGDE-LAN, which has already been created on the router:
- ```
Edge-Router1(config)# route-map WAAS-EDGE-LAN permit
```
- Step 3** Configure the router to use CDP to verify the availability of the configured next-hop addresses:
- ```
Edge-Router1(config-route-map)# set ip next-hop verify-availability
```
- Step 4** Enable CDP on the WAE (for example, on the branch office WAE named Edge-WAE1) that you want the router to redirect traffic to using PBR:
- ```
Edge-WAE1(config)# cdp enable
```
-

If you are configuring PBR and have multiple WAEs and are using Method 1 to verify the PBR next-hop availability of a WAE, no additional configuration is necessary after you have completed the preceding process.

Method 2: Using IP SLAs to Verify WAE Operability Using ICMP Echo Verification (Recommended Method)

To use IP SLAs and ICMP (the recommended method) to verify PBR next-hop availability of a WAE, follow these steps:

-
- Step 1** On the branch office router named Edge-Router1, enter the route-map configuration mode for the route map named WAAS-EDGE-LAN, which has been previously configured on this router:
- ```
Edge-Router1(config)# route-map WAAS-EDGE-LAN permit
```
- Step 2** Specify a match condition for the traffic. In the following example, the match condition specifies access list number 105:
- ```
Edge-Router1(config)# match ip address 105
```
- Step 3** Configure the route map to use IP SLA tracking instance number 1 to verify the availability of the next-hop WAE (for example, the branch WAE named Edge-WAE1 that has an IP address of 1.1.1.100):
- ```
Edge-Router1(config-route-map)# set ip next-hop verify-availability 1.1.1.100 track 1
```



**Note** Enter the **set ip next-hop verify-availability** command for each route-map that has been configured on this branch office edge router and on the data center's core router that has also been configured to use PBR to redirect traffic to WAEs.

---

- Step 4** Configure the IP SLA tracking instance 1:
- ```
Edge-Router1(config-route-map)# exit
```

```
Edge-Router1(config)# ip sla 1
Edge-Router1(config-ip-sla)#
```

- Step 5** Configure the router to echo Edge-WAE1 using the specified source interface:

```
Edge-Router1(config-ip-sla)# icmp-echo 1.1.1.100 source-interface FastEthernet 0/0.20
```

- Step 6** Configure the router to perform the echo every 20 seconds:

```
Edge-Router1(config-ip-sla)# frequency 20
Edge-Router1(config-ip-sla)# exit
```

- Step 7** Schedule the IP SLA tracking instance 1 to start immediately and to run continuously:

```
Edge-Router1(config)# ip sla schedule 1 life forever start-time now
```

- Step 8** Configure the IP SLA tracking instance 1 to track the device, which is defined in the IP SLA tracking instance 1:

```
Edge-Router1(config)# track 1 rtr 1
```

If you are configuring PBR and have multiple WAEs, and you are using Method 2 to verify PBR next-hop availability of a WAE, you must configure a separate IP SLA per WAE and then run the **track** command per IP SLA.

Method 3: Using IP SLAs to Verify WAE Operability Using TCP Connection Attempts

If the device that is configured for PBR is running the Cisco IOS software Release 12.4 or later and does not see the WAE as a CDP neighbor, IP SLAs can be used to verify that the WAE is alive using TCP connection attempts. IP SLAs can be used to monitor a WAE's availability as the PBR next hop using TCP connection attempts at a fixed interval of 60 seconds.

To verify PBR next-hop availability of a WAE, follow these steps:

- Step 1** On the branch office router named Edge-Router1, enter route-map configuration mode for the route map named WAAS-EDGE-LAN, which has been previously configured on this router:

```
Edge-Router1(config)# route-map WAAS-EDGE-LAN permit
```

- Step 2** Configure the route map to use IP SLA tracking instance number 1 to verify the availability of the next-hop WAE (the Edge WAE that has an IP address of 1.1.1.100):

```
Edge-Router1(config-route-map)# set ip next-hop verify-availability 1.1.1.100 track 1
```



Note Enter the **set ip next-hop verify-availability** command for each route map that is configured on this branch office edge router and on the data center's core router that has also been configured to use PBR to transparently redirect traffic to WAEs.

- Step 3** Configure the IP SLA tracking instance 1:

```
Edge-Router1(config-route-map)# exit
Edge-Router1(config)# ip sla 1
```

- Step 4** Configure the router to use the specified source and destination ports to use TCP connection attempts at a fixed interval of 60 seconds to monitor the WAE availability:

```
Edge-Router1(config-ip-sla)# tcp-connect 1.1.1.100 80 source-port 51883 control disable
```

```
Edge-Router1(config-ip-sla)# exit
```

Step 5 Schedule the IP SLA tracking instance 1 to start immediately and to run forever:

```
Edge-Router1(config)# ip sla schedule 1 life forever start-time now
```

Step 6 Configure the IP SLA tracking instance 1 to track the device, which is defined in the IP SLA tracking instance 1:

```
Edge-Router1(config)# track 1 rtr 1
```

If you are configuring PBR and have multiple WAEs, and you are using Method 3 to verify PBR next-hop availability of a WAE, you must configure a separate IP SLA per WAE and then run the **track** command per IP SLA.

Using Inline Mode to Transparently Intercept TCP Traffic

The WAE can physically and transparently intercept traffic between the clients and the router by using inline mode. To use inline mode, you must use a WAE with the Cisco WAE Inline Network Adapter installed. In this mode, you physically position the WAE device in the path of the traffic that you want to optimize, typically between a switch and a router, as shown in Figure 4-8. Redirection of traffic is not necessary.

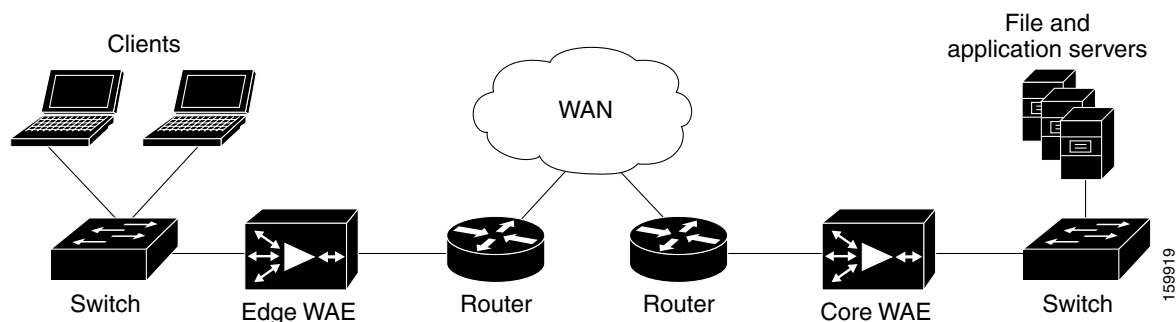


Note

When you install any inline WAE device, you must follow the cabling requirements described in the “Cabling” section of *Installing the Cisco WAE Inline Network Adapter* located on Cisco.com.

Any combination of traffic interception mechanisms on peer WAEs is supported. For example, you can use inline interception on the branch WAE and WCCP on the data center WAE. For complex data center deployments we recommend using hardware accelerated WCCP interception or load balancing with the Cisco Application Control Engine (ACE).

Figure 4-8 Inline Interception



Note

Inline mode and WCCP redirection are exclusive. You cannot configure inline mode if the WAE is configured for WCCP operation. Inline mode is the default mode when the Cisco WAE Inline Network Adapter is installed in a WAE device.

**Note**

A WAE with a Cisco WAE Inline Network Adapter can be configured as a Central Manager, but the inline interception functionality will not be available.

The Cisco WAE Inline Network Adapter contains two or four Ethernet ports. On adapters that have four Ethernet ports, the ports are grouped into two logical groups. Each group has one LAN-facing port and one WAN-facing port. Typically, you use just one group, and connect the LAN-facing port to a switch and the WAN-facing port to a router. On adapters with four ports, the second group of interfaces is provided if you are using a network topology where you need to connect the WAE to two routers. Traffic that enters on one interface in a group exits the device on the other interface in the same group.

You have the option of assigning an IP address to the inline interface, but it is not required. For more information, see the [“Configuring an IP Address on an Inline Interface”](#) section on page 4-45.

**Note**

The Cisco WAE Inline Network Adapter does not optimize the traffic from the WAN to the LAN where the destination MAC address of the next hop is a multicast MAC address. The Cisco WAE Inline Network Adapter optimizes traffic only if the next hop MAC address is a unicast address.

Traffic that flows through the Cisco WAE Inline Network Adapter is transparently intercepted for optimization. Traffic that does not need to be optimized is bridged across the LAN/WAN interfaces. If a power, hardware, or unrecoverable software failure occurs, the network adapter automatically begins operating in bypass mode, where all traffic is mechanically bridged between the LAN and WAN interfaces in each group. The Cisco WAE Inline Network Adapter also operates in bypass mode when the WAE is powered off or starting up. Additionally, you can manually put the Cisco WAE Inline Network Adapter into bypass mode.

Inline mode is configured by default to accept all TCP traffic. If the network segment in which the WAE is inserted is carrying 802.1Q tagged (VLAN) traffic, initially traffic on all VLANs is accepted. Inline interception can be enabled or disabled for each VLAN. However, optimization policies cannot be customized based on the VLAN.

You can serially cluster multiple WAE devices with the Cisco WAE Inline Network Adapter installed to provide spillover load balancing and active-active failover. For details, see the [“Clustering Inline WAEs”](#) section on page 4-48.

**Note**

When a WAE that has a Cisco WAE Inline Network Adapter installed enters bypass mode, the switch and router ports to which it is connected may have to reinitialize, and this may cause an interruption of several seconds in the traffic flow through the WAE.

If the WAE is deployed in a configuration where the creation of a loop is not possible (that is, if it is deployed in a standard fashion between a switch and a router), configure PortFast on the switch port to which the WAE is connected. PortFast allows the port to skip the first few stages of the Spanning Tree Algorithm (STA) and move more quickly into a packet forwarding mode.

This section contains the following topics:

- [Configuring Inline Interface Settings](#), page 4-43
- [Configuring an IP Address on an Inline Interface](#), page 4-45
- [Configuring VLANs for Inline Support](#), page 4-47
- [Clustering Inline WAEs](#), page 4-48

Configuring Inline Interface Settings

To configure inline interface settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. (You cannot configure inline interface settings from Device Groups.)
- The Devices window appears, listing all the devices configured in the WAAS network.
- Step 2** Click the **Edit** icon next to the device for which you want to modify the inline settings.
- The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Interception > Inline > Inline Interfaces**.
- The Inline Interfaces window appears, listing the inline interface groups available on the device. Click the **Edit Inline Interface** icon next to the inline interface group that you want to modify.
- The Modifying Inline Interface window appears, displaying the inline interface configurations for a particular slot and group. (See [Figure 4-9](#).)

Figure 4-9 Modifying Inline Interface Window

The screenshot shows the 'Modifying Inline Interface' window in the Cisco WAAS Central Manager GUI. The window title is 'Modifying Inline Interface for WAE, beante22-waas'. The main content area is titled 'Inline interface' and contains the following settings:

- Settings for inline interception card Slot: 1/ PortGroup: 0
- Shutdown:
- Intercept All VLANs:
- Exclude VLAN:
- Buttons:
- Fallover Timeout:
- AutoSense:
- Speed:
- Mode:
- Address: Netmask:
- Secondary Address 1: Secondary Netmask 1:
- Secondary Address 2: Secondary Netmask 2:
- Secondary Address 3: Secondary Netmask 3:
- Secondary Address 4: Secondary Netmask 4:

The bottom right corner of the window contains and buttons. The left navigation pane shows the path: **Configure > Interception > Inline > Inline Interfaces**.

- Step 4** Check the **Shutdown** check box to shut down the interface group. This setting bridges traffic across the LAN/WAN interfaces without any processing.
- Step 5** Check the **Intercept all VLANs** check box to enable inline interception on the interface group. Inline interception is enabled by default when the WAE contains a Cisco WAE Inline Network Adapter.



Note Inline mode and WCCP redirection are exclusive. You cannot configure inline mode if the WAE is configured for WCCP operation. Inline mode is the default mode when the Cisco WAE Inline Network Adapter is installed in a WAE device.

- Step 6** In the Exclude VLAN field, enter a list of one or more VLAN ranges to exclude from optimization. You can enter the word “native” to exclude the native VLAN. Separate each VLAN range from the next with a comma. Alternatively, you can select VLAN ranges from a list by following these steps:
- Click the **Configure Include VLANs** button when you know the list of VLANs that you want to include in inline interception. This button runs a script that prompts you for a comma-separated list of VLANs that you want to include. The script generates an inverse list of all VLANs that should be excluded and then updates the window and puts the list into the Exclude VLAN field.
 - Click the **Choose VLANs from the list** button to pick VLAN ranges. The VLAN Range Assignments window appears, displaying the VLAN ranges that are defined. Defining VLAN ranges is described in the [“Configuring VLANs for Inline Support”](#) section on page 4-47.
 - Choose the VLAN ranges to include or exclude by doing either of the following:
 - Click next to each VLAN range that you want to include for optimization on this inline interface group. The icon changes to . All VLANs that are not included for optimization are excluded.
 - Click next to each VLAN range that you want to exclude from optimization on this inline interface group. The icon changes to .
 - Click in the taskbar to select all available VLAN ranges for optimization, or click in the taskbar to exclude all VLAN ranges for optimization.
 - Click **Submit**.
- Step 7** From the Failover Timeout drop-down list, choose **1**, **3**, **5**, or **10** seconds. The default is 1 second. This value sets the number of seconds after a failure event that the WAE waits before beginning to operate in bypass mode. In bypass mode, all traffic received on either port of the interface group is forwarded out the other port in the group.
- Step 8** Configure the Speed and Mode port settings as follows:
- Uncheck the **AutoSense** check box, which is enabled by default.
 - From the Speed drop-down list, choose a transmission speed (**10**, **100**, or **1000** Mbps).
 - From the Mode drop-down list, choose a transmission mode (**full-duplex** or **half-duplex**).



Note We strongly recommend that you do not use half-duplex connections on the WAE or on routers, switches, or other devices. Half duplex impedes performance and should not be used. Check each Cisco WAE interface and the port configuration on the adjacent device (router, switch, firewall, and WAE) to verify that full duplex is configured.

- Step 9** In the Address field, enter an IP address for the inline interface, if you want to assign an IP address.
- Step 10** In the Netmask field, enter a subnet mask for the inline interface.
- Step 11** Enter up to four secondary IP addresses and corresponding subnet masks in the Secondary Address and Secondary Netmask fields.

Configuring multiple IP addresses allows the device to be present in more than one subnet and can be used to optimize response time because it allows the data to go directly from the WAAS device to the client that is requesting the information without being redirected through a router. The WAAS device becomes visible to the client because both are configured on the same subnet.

Step 12 Click **Submit**.

To configure inline interception from the CLI, use the **interface InlineGroup** global configuration command.

WAAS uses the VLAN ID to intercept or bridge VLAN traffic on the inline interface for a TCP flow. The VLAN ID of all packets sent in a particular TCP connection must match; any packets with a different VLAN ID will be bridged and not optimized. If your system has an asymmetric routing topology, in which the traffic flow in one direction uses a different VLAN ID than the traffic flow from the other direction, you may need to disable VLAN ID checking to ensure that the traffic is optimized.

To configure VLAN ID checking, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. (You cannot configure network settings from Device Groups.)
- The Devices window appears, listing all the devices configured in the WAAS network.
- Step 2** Click the **Edit** icon next to the device for which you want to modify the network settings.
- The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Interception > Inline > General Settings**.
- The General Settings window appears, listing the VLAN ID connection checking control.
- Step 4** Click the **VLAN ID Connection Check** check box to enable VLAN ID connection checking. Uncheck the box to disable it. The default setting is enabled.
- Step 5** Click **Submit**.
-

To configure VLAN ID checking from the CLI, use the **inline vlan-id-connection-check** global configuration command.

Configuring an IP Address on an Inline Interface

You can assign IP addresses to the inline group interfaces but it is not required. You can assign a primary IP address and up to four secondary IP addresses, using the procedure discussed in the [“Configuring Inline Interface Settings”](#) section on page 4-43.

You can set an inline group interface as the primary interface on the WAE by using the **Configure > Network > Network Interfaces** window, in the Primary Interface drop-down list.

In scenarios where the primary interface for a WAE is set to an inline group interface and management traffic is configured on a separate IP address (either on a secondary IP address on the same inline group interface or on a built-in interface), you must configure the WAAS Central Manager to communicate with the WAE on the IP address designated for management traffic. Configure the WAE management traffic IP address in the *Device Name* > Activation window, in the Management IP field.

If a WAE with the Cisco WAE Inline Network Adapter is present in an 802.1Q VLAN trunk line between a switch and a router, and you are configuring the inline interface with an IP address, you must set the VLAN ID that is to be assigned to traffic that leaves the WAE. The VLAN ID should be set to match the VLAN ID expected by the router.

Use the **encapsulation dot1Q** interface command to assign a VLAN ID, as follows:

```
(config)# interface inlineGroup 1/0
(config-if)# encapsulation dot1Q 100
```

This example shows how to assign VLAN ID 100 to the traffic leaving the WAE. The VLAN ID can range from 1 through 4094.


Note

You must use the **encapsulation dot1Q** interface command if you want to set the VLAN ID of the inline traffic. You cannot configure this setting through the WAAS Central Manager.

If the VLAN ID that you set with the **encapsulation dot1Q** interface command does not match the VLAN ID expected by the router subinterface, you may not be able to connect to the inline interface IP address.

The inline adapter supports only a single VLAN ID for each inline group interface. If you have configured a secondary address from a different subnet on an inline interface, you must have the same secondary address assigned on the router subinterface for the VLAN.

The following operating considerations apply to configuring IP addresses on the inline interfaces:

- This feature provides basic routable interface support and does not support the following additional features associated with the built-in interfaces: standby, port channel, and Cisco Discovery Protocol (CDP).
- If you have configured a WAE to use the inline interfaces for all traffic, inline interception must be enabled or the WAE will not receive any traffic.
- If you have configured a WAE to use the inline interfaces for all traffic and it goes into mechanical bypass mode, the WAE become inaccessible through the inline interface IP address. Console access is required for device management when an inline interface is in bypass mode.
- If you have configured a WAE with an IP address on an inline interface, the interface can accept only traffic addressed to it and ARP broadcasts, and the interface cannot accept multicast traffic.
- In a deployment using the Hot Standby Router Protocol (HSRP) where two routers that participate in an HSRP group are directly connected through two inline groups, HSRP works for all clients if the active router fails. However, this redundancy does not apply to the IP address of the WAE itself for management traffic, if management traffic is also configured to use the inline interface. If the active router fails, you will not be able to connect to the WAE inline IP address because the inline interface is physically connected to the failed router interface. You will be able to connect to the WAE through the second inline group interface that is connected to the standby router. If redundancy is needed for the IP address of the WAE itself for management traffic, we recommend that you use the IP addresses of the built-in interfaces rather than the inline interfaces.
- If you have configured a WAE to use the inline interfaces for all traffic and have not assigned IP addresses to the built-in interfaces, and then you downgrade the WAE to a version prior to 4.0.15, internal services on the WAE that are using the IP address assigned to the inline interface will lose connectivity. Before downgrading the WAE, configure the built-in interfaces with the appropriate network settings.

- Configuring IP addresses on the inline interfaces in a WAE is not supported if the WAAS Central Manager is running a software version prior to 4.0.15, even if the WAE is running version 4.0.15 or later.
- If you downgrade the WAAS Central Manager to a version prior to 4.0.15, in a deployment where a WAE is configured to use the inline interfaces for all traffic, the WAAS Central Manager will lose communication with the WAE because it cannot recognize the inline interface as the primary interface. To avoid losing communication, either configure the WAE to accept management traffic on one of the built-in interfaces, or set the inline interface IP address as the alternate management address in the Device Name > Activation window, in the Management IP field.

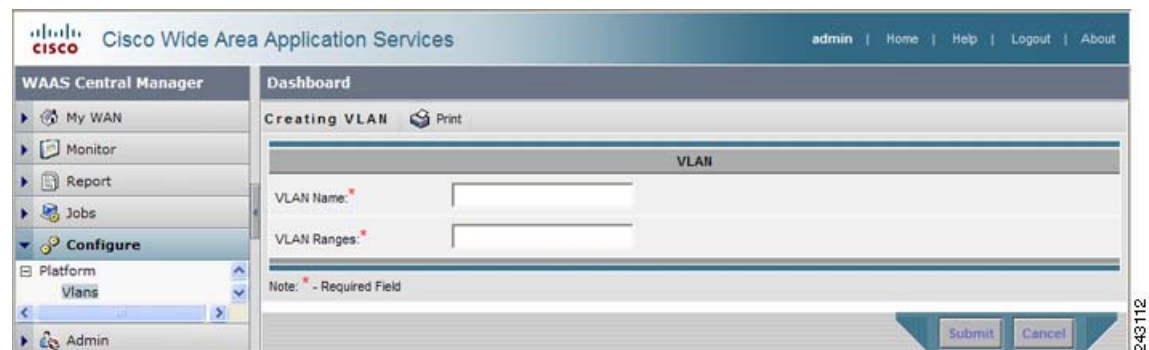
Configuring VLANs for Inline Support

Initially, the WAE accepts traffic from all VLANs. You can configure the WAE to include or exclude traffic from certain VLANs; for excluded VLANs, traffic is bridged across the LAN/WAN interfaces in a group and is not processed.

To configure a VLAN for inline support, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Platform > Vlans**. The Vlans window appears, listing the VLANs that are defined. You can click the **Edit Vlan** icon next to an existing VLAN that you want to modify.
- Step 2** In the taskbar, click the **Create New Vlan** icon. The Creating Vlan window appears. (See [Figure 4-10](#).)

Figure 4-10 Creating New Vlan Window Example



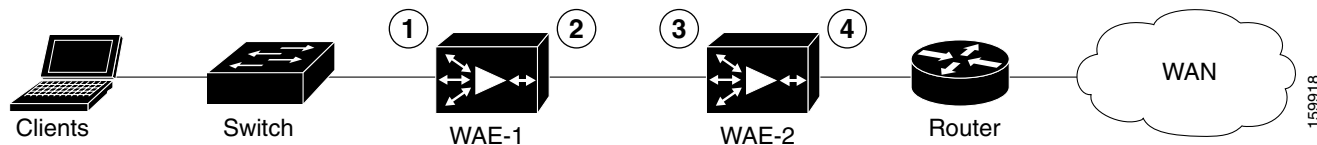
- Step 3** In the VLAN Name field, enter a name for the VLAN list.
- Step 4** In the VLAN Ranges field, enter a list of one or more VLAN ranges. Separate each VLAN range from the next with a comma (but no space). This list of VLAN ranges can be included or excluded from optimization when you configure the inline interface group, as described in the [“Configuring Inline Interface Settings”](#) section on page 4-43. You cannot specify the term “native” in this field.
- Step 5** Click **Submit**.

This facility for creating VLAN lists is provided so that you can configure VLAN lists globally. You do not need to use this facility to configure VLANs for an inline interface. You can configure VLANs directly in the inline interface settings window, as described in the [“Configuring Inline Interface Settings”](#) section on page 4-43.

Clustering Inline WAEs

You can serially cluster multiple WAE devices with the Cisco WAE Inline Network Adapter installed to provide spillover load balancing and active-active failover. A serial cluster consists of two or more WAE devices connected together sequentially in the traffic path. The WAN port of one Cisco WAE Inline Network Adapter is connected to the LAN port of the next Cisco WAE Inline Network Adapter, and so on, as shown in [Figure 4-11](#).

Figure 4-11 Inline Cluster



1	Inline LAN port on WAE-1	3	Inline LAN port on WAE-2
2	Inline WAN port on WAE-1	4	Inline WAN port on WAE-2

In a serial cluster, all traffic between the switch and router passes through all inline WAEs. In [Figure 4-11](#), TCP connections are optimized by WAE-1 until its connection threshold is reached. Additional connections are optimized by WAE-2. This arrangement is referred to as spillover load sharing.

If a WAE fails, it automatically bypasses the traffic, which is handled by the other WAEs in the cluster. The policy configuration of serially clustered WAEs should be the same. If they differ, then the spillover load balancing and failover functionality apply only to the classes of traffic where the policies agree.

Request Redirection of CIFS Client Requests

In an IP-based branch office network, clients use the Common Internet File System (CIFS) protocol to request file and print services from networked servers.

The WAAS software supports several methods to redirect CIFS requests from clients to a WAE acting as a branch WAE. This section contains the following topics:

- [Using Inline Mode to Transparently Redirect CIFS Client Requests, page 4-48](#)
- [Using WCCP to Transparently Redirect CIFS Client Requests, page 4-49](#)
- [Using Explicit Naming of Shares to Explicitly Intercept CIFS Client Requests, page 4-49](#)
- [Using Microsoft DFS to Intercept CIFS Client Requests, page 4-50](#)

Using Inline Mode to Transparently Redirect CIFS Client Requests

In an IP-based branch office network, clients use the CIFS protocol to request file and print services from networked servers. WAAS supports the use of inline mode with the Cisco WAE Inline Network Adapter for the transparent interception of CIFS requests.

Because this interception and redirection process is completely invisible or transparent to the client who is requesting the content, no desktop changes are required. The branch WAE operation is transparent to the network.

When a branch WAE operates in transparent inline mode, it does not publish the server name. CIFS clients use the branch office IT infrastructure to resolve a CIFS server name to an IP address (DNS, WINS). When a client connects to the file server, the inline WAE intercepts the TCP packets, extracts the original target server IP address, and handles the request.

Client connections to CIFS servers that are not cached by the branch WAE are supported. The inline WAE does not intercept these requests but instead passes them through to their destinations.

Using WCCP to Transparently Redirect CIFS Client Requests

In an IP-based branch office network, clients use the CIFS protocol to request file and print services from networked servers. WAAS supports the use of WCCP Version 2 for the transparent interception of CIFS requests. This transparent interception of CIFS requests is based on the IP and TCP header information, and redirects them to branch WAEs.

The WAAS software supports the WCCP Version 2 service named the TCP promiscuous mode service (WCCP Version 2 services 61 and 62). The TCP promiscuous mode service allows you to use WCCP Version 2 to transparently intercept and redirect all TCP traffic to a branch WAE.

Because this interception and redirection process is completely invisible or transparent to the client who is requesting the content, no desktop changes are required. The branch WAE operation is transparent to the network; the WCCP-enabled router operates entirely in its normal role for nonredirected traffic.

When a branch WAE operates in transparent mode, it does not publish the server name. CIFS clients use the branch office IT infrastructure to resolve a CIFS server name to an IP address (DNS, WINS). When a client connects to the file server, the router intercepts the TCP packets and redirects them to the WAE. The WAE extracts the original target server IP address and handles the request.

Client connections to CIFS servers that are not cached by the branch WAE are supported. You can configure an accept or reject target IP list on the WCCP-enabled router. In this configuration, the router does not redirect packets to the branch WAE but immediately forwards the packets to their destination.

If a WAE receives TCP packets destined to target servers that are not cached, it uses the WCCP packet return method to return the packets to the router for handling.



Note

We recommend that you configure accept or reject target IP lists on routers in the branch offices where considerable CIFS traffic for noncached servers (either local servers residing on a different subnet or remote servers) is expected to be routed through the router. If you configure accept or reject target IP lists on routers in the central office, performance can be compromised when the WCCP packet return method is used because of excessive processing both at the router and in the cache.

Using Explicit Naming of Shares to Explicitly Intercept CIFS Client Requests

The distributed file system (DFS) from Microsoft provides an infrastructure to connect multiple file servers into one name space. Specifically, a file server can act as a DFS root, and other file servers can register as subdirectories in that root directory. For example, the main file server \\main-fs can have a root directory \\main-fs\engineering. Under that directory, a particular engineering group's file server \\eng1\ can be linked as \\main-fs\engineering\eng1.

If a client attempts to access a file in a subdirectory of \\main-fs\engineering\eng1 when request interception is being handled by Microsoft DFS, the following occurs:

1. The main file server (the DFS root server) sends a response to the client saying “this directory is not hosted here.”
2. The client then sends a “Referrer-Request” message to the main file server asking “from where can I find this directory.”
3. The main file server replies with \\eng1\.
4. The client connects to \\eng1\ and asks for the specified file.

The WAAS software supports the DFS infrastructure feature that allows multiple servers to be registered as the servers (also called replicas) for a directory, enabling load balancing and failover among the replica servers. When a client sends a “Referrer-Request” message for a directory that has multiple servers, the DFS root server gives the client a list of servers. The client typically chooses the first server on the list to contact. However, if the first server is not reachable, the client tries the second server and so on. By creating a number of lists where the first server on each list is a different replica server, and then providing those lists to clients, the DFS root server can load balance the replica servers.

The contents of the file servers in the network data center that need to be cached at branch offices are registered as subdirectories in a DFS root server. All branch office WAEs are configured as replica servers for those subdirectories at the DFS root server. When a client attempts access to a file in a subdirectory, the DFS root server (using the Active-Directory configuration) directs the client to the WAE at the same branch as the client. This redirection method is transparent to the client.

Using Microsoft DFS to Intercept CIFS Client Requests

Microsoft DFS allows you to intercept CIFS client requests in either Wide Area File Services (WAFS) transparent or non-transparent scenarios. The WAE can use name publishing or can rely on WCCP Version 2 to receive CIFS client requests.

When you use explicit naming of shares on your WAE, it is not transparent to the client. The client is explicitly told to access the branch WAE to access a file. Specifically, clients at branch A are told to mount a share from \\default-prefix-identifying-exported-file-server\file-server-name to access the file data. The WAAS software allows an administrator to define any name (not only a prefix) to represent the original file server. For example, users accessed their local file server, LFS1, before the file servers were grouped into the data center. After centralization, users can continue to use LFS1 even though the data has migrated to the central file server.

The branch office WAE uses DNS, WINS, and NetBIOS protocols to resolve \\WAE-at-the-branch to the IP address of the WAE. The resolution order depends on the client type. Windows 2000 and XP clients try first to resolve the address using DNS, then WINS, and then broadcast. Windows 98 resolves the address in the opposite order. To resolve the address using DNS, the WAE must be registered as \\WAE-at-the-branch in the DNS server at the enterprise. WAAS software supports only static DNS. To resolve the address using WINS and NetBIOS, during startup the WAE registers itself as \\WAE-at-the-branch with the WINS server (which is preconfigured at the WAE). If the WINS server is absent and DNS is not available, or the WAE is not registered in the DNS, the WAE answers the broadcast queries from the client. The broadcast method works only when the WAE is connected with an additional interface to the CIFS client subnet, or if non-transparent mode is used. A WAE failure requires clients to change their configuration to continue accessing the file data. Use the startup script for reconfiguration.



CHAPTER 5

Configuring Network Settings

This chapter describes how to configure basic network settings such as creating additional network interfaces to support network traffic, specifying a DNS server, enabling Cisco Discovery Protocol (CDP), and configuring the directed mode of operation where peer WAEs exchange traffic using UDP encapsulation to avoid firewall traversal issues.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [Configuring Network Interfaces, page 5-1](#)
- [Configuring a Load-Balancing Method for Interfaces, page 5-10](#)
- [Configuring TCP Settings, page 5-10](#)
- [Enabling the MTU Discovery Utility, page 5-14](#)
- [Configuring Static IP Routes, page 5-15](#)
- [Configuring CDP Settings, page 5-15](#)
- [Configuring the DNS Server, page 5-16](#)
- [Configuring Windows Name Services, page 5-17](#)
- [Configuring Directed Mode, page 5-17](#)

Configuring Network Interfaces

During initial setup, you chose an initial interface and either configured it for DHCP or gave it a static IP address. This section describes how to configure additional interfaces using options for redundancy, load balancing, and performance optimization.

This section contains the following topics:

- [Configuring a Standby Interface, page 5-2](#)
- [Configuring the Interface Priority Setting, page 5-4](#)
- [Configuring Multiple IP Addresses on a Single Interface, page 5-6](#)
- [Modifying Gigabit Ethernet Interface Settings, page 5-6](#)

- [Configuring Port-Channel Settings, page 5-8](#)
- [Configuring Interfaces for DHCP, page 5-9](#)

We recommend that you use the WAAS Central Manager GUI instead of the WAAS CLI to configure network settings, but if you want to use the CLI, see the following commands in the *Cisco Wide Area Application Services Command Reference*: **interface**, **ip address**, **port-channel**, and **primary-interface**.

**Note**

We strongly recommend that you do not use half-duplex connections on the WAE or on routers, switches, or other devices. Half duplex impedes performance and should not be used. Check each Cisco WAE interface and the port configuration on the adjacent device (router, switch, firewall, and WAE) to verify that full duplex is configured.

Configuring a Standby Interface

In this procedure, you configure a logical interface called a standby interface. After you set up the parameters for this logical interface, you must associate physical interfaces with the standby interface to create the standby group. (A standby group consists of two or more physical interfaces.) In the WAAS Central Manager GUI, you create the standby group by assigning a standby group priority to the physical interface. (See the [“Configuring the Interface Priority Setting” section on page 5-4.](#))

Standby interfaces remain inactive unless an active interface fails. When an active network interface fails (because of cable trouble, Layer 2 switch failure, high error count, or other failure), and that interface is part of a standby group, a standby interface can become active and take the load off the failed interface. With standby interface configuration, only one interface is active at a given time.

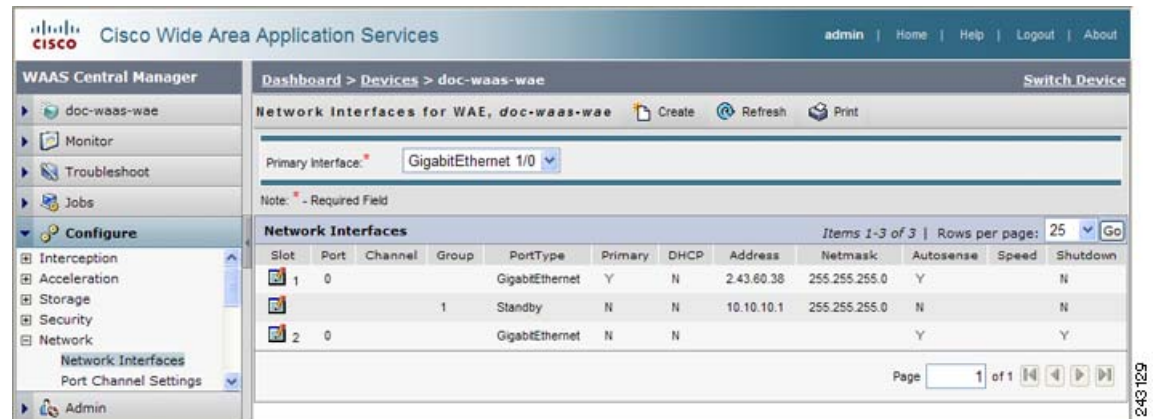
To configure standby interfaces, you must assign each physical interface to a standby group. The following rules define standby group relationships:

- A standby group consists of two or more physical interfaces.
- The maximum number of standby groups on a WAAS device is four.
- Each standby group is assigned a unique standby IP address, shared by all members of the group.
- Configuring the duplex and speed settings of the standby group member interfaces provides better reliability.
- IP ACLs can be configured on physical interfaces that are members of a standby group.
- Each interface in a standby group is assigned a priority. The operational interface with the highest priority in a standby group is the active interface. Only the active interface uses the group IP address.
- If the active interface fails, the operational interface in its standby group that is assigned the next highest priority becomes active.
- If all the members of a standby group fail, then one recovers, the WAAS software brings up the standby group on the operational interface.
- The priority of an interface in a standby group can be changed at runtime. The interface that has the highest priority after this change becomes the new active interface. (The default action is to preempt the currently active interface if an interface with higher priority exists.)
- The **errors** option, which is disabled by default, defines the maximum number of errors allowed on the active interface before the interface is shut down and before the standby is brought up.

To configure a standby interface, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
- Step 2** Click the **Edit** icon next to the device for which you want to configure a standby interface. The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Network > Network Interfaces**. The Network Interfaces window for the device appears. (See [Figure 5-1](#).)

Figure 5-1 Network Interfaces for Device Window



- Step 4** In the taskbar, click the **Create New Interface** icon. The Creating New Network Interface window appears.
- Step 5** From the Port Type drop-down list, choose **Standby**. The window refreshes with fields for configuring the standby group settings.
- Step 6** From the Standby Group Number drop-down list, choose a group number (1–4) for the interface.
- Step 7** In the Address field, specify the IP address of the standby group.
- Step 8** In the Netmask field, specify the netmask of the standby group.
- Step 9** In the Number of Errors field, enter the maximum number of errors allowed on this interface. The range is 0 to 4294967295.
- Step 10** Check the **Shutdown** check box to shut down the hardware interface. By default, this option is disabled.
- Step 11** In the Gateway field enter the default gateway IP address. If an interface is configured for DHCP, then this field is read only.
- Step 12** Click **Submit**.
- Step 13** Configure the interface priority setting as described in the [“Configuring the Interface Priority Setting”](#) section on page 5-4.”

Configuring the Interface Priority Setting

After you have configured a logical standby interface using the WAAS Central Manager GUI, you configure the standby group by setting a priority for each physical interface that you want to be associated with that standby group. The interface priority setting defines the active interface in a particular standby group and the order in which other interfaces in the standby group will become active if the active interface fails. The operational interface with the highest priority in a standby group is the active interface. Only the active interface uses the standby group IP address. You must have a standby interface configured before you can enter the priority settings in the WAAS Central Manager GUI. (See the [“Configuring a Standby Interface”](#) section on page 5-2.)

To configure the priority of the interface and associate it with a particular standby group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI, choose **My WAN > Manage Devices**. The Devices window appears.
 - Step 2** Click the **Edit** icon next to the device for which you want to configure a standby interface. The Device Dashboard window appears.
 - Step 3** In the navigation pane, choose **Configure > Network > Network Interfaces**. The Network Interfaces window for the device appears.
 - Step 4** Click the **Edit** icon next to the physical interface to which you want to assign a standby priority. The Modifying Network Interface window appears. (See [Figure 5-2](#).)

Do not choose a logical interface (standby or portchannel) in this step. You cannot assign a standby priority to a logical interface.

Figure 5-2 Modifying Network Interface Window—Standby Group Priority Settings

The screenshot displays the 'Modifying Network Interface' configuration window for GigabitEthernet 1/0. The left sidebar shows the navigation menu with 'Configure' selected. The main configuration area includes the following fields and options:

- Network Interface:** Slot: 1, Port: 0
- Port Type:** GigabitEthernet
- Description:** WAE-611 Edge for docs
- Use CDP:**
- AutoSense:**
- Speed:** 10
- Mode:** half-duplex
- MTU:** 1500 bytes
- Address:** 2.43.60.38
- Netmask:** 255.255.255.0
- Secondary Address 1-4:** (Empty)
- Secondary Netmask 1-4:** (Empty)
- Use DHCP:**
- Gateway:** 2.43.60.1
- Join Standby Group 1-4:** (All)
- Priority:** (Empty)
- Inbound ACL:** Do Not Set
- Outbound ACL:** Do Not Set

Buttons for 'Submit' and 'Cancel' are located at the bottom right. A note at the bottom left states: 'Note: * - Required Field'.

- Step 5** Complete the following steps to specify the group and priority level number for this interface:
- Scroll down the window until you see the Join Standby Group check boxes.
 - Check the **Join Standby Group** check box that you want this interface to join.
 - Enter a priority level number (0–4294967295) to set the priority of the interface in the standby group.

A Standby Group Priority field becomes available only when you have previously configured that standby group. (See the “[Configuring a Standby Interface](#)” section on page 5-2.) You can configure up to four standby groups for each WAAS device.



Note

If an interface belongs to more than one standby group, you can configure the interface with a different priority in each standby group for better load balancing. For example, interfaces GE 0/0 and GE 0/1 are both in standby group 1 and in standby group 2. If you configure GE 0/0 with the highest priority in standby group 1 and configure GE 0/1 with the highest priority in standby group 2, standby group 1 will use GE 0/0 as the active interface, while standby group 2 will use GE 0/1 as the active interface. This configuration allows each interface to back up the other, if one of them fails.

- Step 6** Click **Submit**. The interface joins the specified standby group.
-

Configuring Multiple IP Addresses on a Single Interface

You can configure up to four secondary IP addresses on a single interface. This configuration allows the device to be present in more than one subnet and can be used to optimize response time because it allows the data to go directly from the WAAS device to the client that is requesting the information without being redirected through a router. The WAAS device becomes visible to the client because both are configured on the same subnet.

To configure multiple IP addresses on a single interface, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
- Step 2** Click the **Edit** icon next to the device for which you want to configure interface settings. The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Network > Network Interfaces**. The Network Interfaces listing window appears.
- Step 4** Click the **Edit** icon for the GigabitEthernet physical interface that you want to modify. The Modifying Network Interface window appears.



Note Do not choose a logical interface (standby or port channel) in this step. You cannot configure multiple interfaces on a logical interface.

- Step 5** In the Secondary Address and Secondary Netmask fields 1 through 4, enter up to four different IP addresses and secondary netmasks for the interface.
- Step 6** Click **Submit**.
-

Modifying Gigabit Ethernet Interface Settings

To modify the settings of an existing Gigabit Ethernet interface, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears, listing all the device types configured in the WAAS network.
- Step 2** Click the **Edit** icon next to the device for which you want to modify the interface settings. The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Network > Network Interfaces**. The Network Interfaces window appears, listing the network interfaces configured on particular slots and ports.

**Note**

On an NME-WAE device, the internal interface to the router is designated slot 1, port 0 and the external interface is designated slot 2, port 0. For NME-WAE configuration details, see the document *Configuring Cisco WAAS Network Modules for Cisco Access Routers*.

- Step 4** Click the **Edit Network Interface** icon next to the Gigabit Ethernet interface that you want to modify. The Modifying Network Interface window appears, displaying the interface configurations on a particular slot and port.

**Note**

Some of the fields in the window are not available. Interface configurations for slot, port, and port type are set for physical interfaces during initial startup or by using the WAAS CLI. The port channel number can be configured for a port channel interface when you create this type of interface in the WAAS Central Manager GUI; however, this field is not available when you modify a physical interface. (See the “[Configuring Port-Channel Settings](#)” section on page 5-8.)

**Note**

When configuring the internal interface (GigabitEthernet 1/0) on an NME-WAE device, you cannot change the following fields or check boxes: AutoSense, Speed, Mode, Address, Netmask, and Use DHCP. If you attempt to change these values, the Central Manager displays an error when you click Submit. These settings for the internal interface can be configured only through the host router CLI. For details, see the document *Configuring Cisco WAAS Network Modules for Cisco Access Routers*.

- Step 5** Check the **Use CDP** check box to enable Cisco Discovery Protocol (CDP) on an interface. When enabled, CDP obtains protocol addresses of neighboring devices and discovers the platform of those devices. It also shows information about the interfaces used by your router. Configuring CDP from the CDP Settings window enables CDP globally on all the interfaces. For information on configuring CDP settings, see the “[Configuring CDP Settings](#)” section on page 5-15.

- Step 6** Check the **Shutdown** check box to shut down the hardware interface.

- Step 7** Check the **AutoSense** check box to set the interface to autonegotiate the speed and mode. Checking this check box disables the manual Speed and Mode drop-down list settings.

**Note**

When autosense is on, manual configurations are overridden. You must reboot the WAAS device to start autosensing.

- Step 8** Manually configure the interface transmission speed and mode settings as follows:

- a. Uncheck the **AutoSense** check box.
- b. From the Speed drop-down list, choose a transmission speed (**10**, **100**, or **1000** Mbps).
- c. From the Mode drop-down list, choose a transmission mode (**full-duplex** or **half-duplex**).

Full-duplex transmission allows data to travel in both directions at the same time through an interface or a cable. A half-duplex setting ensures that data only travels in one direction at any given time. Although full duplex is faster, the interfaces sometimes cannot operate effectively in this mode. If you encounter excessive collisions or network errors, you may configure the interface for half-duplex rather than full duplex.

**Note**

We strongly recommend that you do not use half-duplex connections on the WAE or on routers, switches, or other devices. Half duplex impedes performance and should not be used. Check each Cisco WAE interface and the port configuration on the adjacent device (router, switch, firewall, and WAE) to verify that full duplex is configured.

- Step 9** Specify a value (in bytes) in the MTU field to set the interface Maximum Transmission Unit (MTU) size. The range is 88–1500 bytes. The MTU is the largest size of IP datagram that can be transferred using a specific data link connection.
- Step 10** Enter a new IP address in the Address field to change the interface IP address.
- Step 11** Enter a new netmask in the Netmask field to change the interface netmask.
- Step 12** Click **Submit**.

Configuring Port-Channel Settings

WAAS software supports the grouping of up to four same-speed network interfaces into one virtual interface. This grouping capability allows you to set or remove a virtual interface that consists of two Gigabit Ethernet interfaces. This capability also provides interoperability with Cisco routers, switches, and other networking devices or hosts supporting EtherChannel, load balancing, and automatic failure detection and recovery based on each interface's current link status. EtherChannel is also referred to as a port channel.

To configure port-channel settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
- Step 2** Click the **Edit** icon next to the name of the device for which you want to configure interfaces. The Device Dashboard window appears.
- Step 3** In the navigation Pane, choose **Configure > Network > Network Interfaces**. The Network Interfaces window appears, listing all the interfaces for the chosen device.
- Step 4** In the taskbar, click the **Create New Interface** icon. The Creating New Network Interface window appears.
- Step 5** From the Port Type drop-down list, choose **Port Channel**.
The window refreshes and provides fields for configuring the network interface settings.
- Step 6** In the Port Channel Number field, enter either **1** or **2** for the port-channel interface number.
- Step 7** Check the **Shutdown** check box to shut down this interface. By default, this option is disabled.
- Step 8** In the Gateway field, enter the default gateway IP address.
- Step 9** In the Address field, specify the IP address of the interface.
- Step 10** In the Netmask field, specify the netmask of the interface.
- Step 11** (Optional) From the Inbound ACL drop-down list, choose an IP ACL to apply to inbound packets. The drop-down list contains all the IP ACLs that you configured in the system.
- Step 12** (Optional) From the Outbound ACL drop-down list, choose an IP ACL to apply to outbound packets.

Step 13 Click **Submit**.



Note

You must disable autoregistration when both device interfaces are configured as port-channel interfaces.

Configuring Interfaces for DHCP



Note

You must disable autoregistration before you can manually configure an interface for DHCP.

A WAAS device sends its configured client identifier and hostname to the DHCP server when requesting network information. You can configure DHCP servers to identify the client identifier information and the hostname information that the WAAS device is sending and then to send back the specific network settings that are assigned to the WAAS device.

To enable an interface for DHCP, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
- Step 2** Click the **Edit** icon next to the name of the device for which you want to configure interface settings. The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Network > Network Interfaces**. The Network Interfaces listing window appears.
- Step 4** Click the **Edit** icon for the GigabitEthernet physical interface that you want to modify. The Modifying Network Interface window appears.



Note

Do not choose a logical interface (standby or port channel) in this step, because you cannot configure DHCP on a logical interface. In addition, do not choose the internal interface (GigabitEthernet 1/0) on an NME-WAE device, because this interface can be configured only through the host router CLI. For details, see the document *Configuring Cisco WAAS Network Modules for Cisco Access Routers*.

- Step 5** Scroll down the window and check the **Use DHCP** check box.
When this check box is checked, the secondary IP address and netmask fields are disabled.
 - Step 6** In the Hostname field, specify the hostname for the WAAS device or other device.
 - Step 7** In the Client Id field, specify the configured client identifier for the device.
The DHCP server uses that identifier when the WAAS device requests the network information for the device.
 - Step 8** Click **Submit**.
-

Configuring a Load-Balancing Method for Interfaces

Before you configure load balancing, ensure that you have configured the port-channel settings described in the “[Configuring Port-Channel Settings](#)” section on page 5-8.

To configure load balancing, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group with the port channel that you want to configure for load balancing.
 - Step 3** In the navigation Pane, choose **Configure > Network > Port Channel Settings**.
 - Step 4** From the Load Balancing Method drop-down list, choose a load-balancing method:
 - **dst-ip**—Destination IP address. .
 - **round robin**—Each interface in the channel group. Round robin allows traffic to be distributed evenly among all interfaces in the channel group. The other balancing option gives you the flexibility to choose specific interfaces (by IP address) when sending an Ethernet frame. This option is selected by default.
 - Step 5** Click **Submit**.
-

To configure a load-balancing method from the CLI, you can use the **port-channel** global configuration command.

Configuring TCP Settings

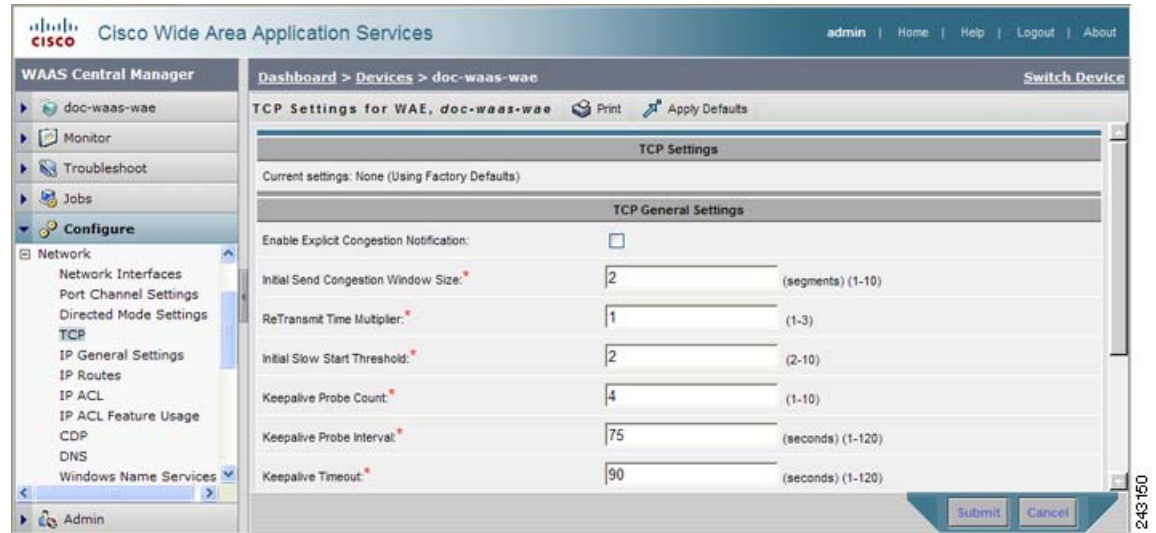
For data transactions and queries between client and servers, the size of windows and buffers is important, so fine-tuning the TCP stack parameters becomes the key to maximizing cache performance.

Because of the complexities involved in TCP parameters, be careful in tuning these parameters. In nearly all environments, the default TCP settings are adequate. Fine tuning of TCP settings is for network administrators with adequate experience and full understanding of TCP operation details.

To configure TCP settings, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the WAAS device or device group for which you want to configure TCP settings. The Device Dashboard window appears.
 - Step 3** In the navigation pane, choose **Configure > Network > TCP**. The TCP Settings window appears. (See [Figure 5-3](#).)

Figure 5-3 TCP Settings Window



Step 4 Make the necessary changes to the TCP settings.

See [Table 5-1](#) for a description of each TCP field in this window.

Step 5 Click **Submit**.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking **Reset**. The Reset button is visible only when you have applied default or group settings to change the current device settings but have not yet submitted the changes.

Table 5-1 TCP Settings

TCP Setting	Description
TCP General Settings	
Enable Explicit Congestion Notification	Enables reduction of delay and packet loss in data transmissions. It provides TCP support for RFC 2581. By default, this option is disabled. For more information, see the “Explicit Congestion Notification” section on page 5-12.
Initial Send Congestion Window Size	Initial congestion window size value in segments. The range is 1 to 10 segments. The default is 2 segments. For more information, see the “Congestion Windows” section on page 5-12.

Table 5-1 TCP Settings (continued)

TCP Setting	Description
ReTransmit Time Multiplier	Factor used to modify the length of the retransmit timer by 1 to 3 times the base value determined by the TCP algorithm. The default is 1, which leaves the times unchanged. The range is 1 to 3. For more information, see the “Retransmit Time Multiplier” section on page 5-13. Note Modify this factor with caution. It can improve throughput when TCP is used over slow reliable connections but should never be changed in an unreliable packet delivery environment.
Initial Slow Start Threshold	Threshold for slow start in segments. The range is 2 to 10 segments. The default is 2 segments. For more information, see the “TCP Slow Start” section on page 5-13.
Keepalive Probe Count	Number of times that the WAAS device can retry a connection before the connection is considered unsuccessful. The range is 1 to 120 attempts. The default is 4 attempts.
Keepalive Probe Interval	Length of time that the WAAS device keeps an idle connection open. The default is 75 seconds.
Keepalive Timeout	Length of time that the WAAS device keeps a connection open before disconnecting. The range is 1 to 120 seconds. The default is 90 seconds.

To configure TCP settings from the CLI, you can use the **tcp** global configuration command.

This section contains the following topics:

- [Explicit Congestion Notification, page 5-12](#)
- [Congestion Windows, page 5-12](#)
- [Retransmit Time Multiplier, page 5-13](#)
- [TCP Slow Start, page 5-13](#)

Explicit Congestion Notification

The TCP Explicit Congestion Notification (ECN) feature allows an intermediate router to notify the end hosts of impending network congestion. It also provides enhanced support for TCP sessions associated with applications that are sensitive to delay or packet loss. The major issue with ECN is that the operation of both the routers and the TCP software stacks needs to be changed to accommodate the operation of ECN.

Congestion Windows

The congestion window (*cwnd*) is a TCP state variable that limits the amount of data that a TCP sender can transmit onto the network before receiving an acknowledgment (ACK) from the receiving side of the TCP transmission. The TCP *cwnd* variable is implemented by the TCP congestion avoidance algorithm. The goal of the congestion avoidance algorithm is to continually modify the sending rate so that the

sender automatically senses any increase or decrease in available network capacity during the entire data flow. When congestion occurs (manifested as packet loss), the sending rate is first lowered then gradually increased as the sender continues to probe the network for additional capacity.

Retransmit Time Multiplier

The TCP sender uses a timer to measure the time that has elapsed between sending a data segment and receiving the corresponding ACK from the receiving side of the TCP transmission. When this retransmit timer expires, the sender (according to the RFC standards for TCP congestion control) must reduce its sending rate. However, because the sender is not reducing its sending rate in response to network congestion, the sender is not able to make any valid assumptions about the current state of the network. Therefore, in order to avoid congesting the network with an inappropriately large burst of data, the sender implements the slow start algorithm, which reduces the sending rate to one segment per transmission. (See the [“TCP Slow Start” section on page 5-13.](#))

You can modify the sender's retransmit timer by using the Retransmit Time Multiplier field in the WAAS Central Manager GUI. The retransmit time multiplier modifies the length of the retransmit timer by one to three times the base value, as determined by the TCP algorithm that is being used for congestion control.

When making adjustments to the retransmit timer, be aware that they affect performance and efficiency. If the retransmit timer is triggered too early, the sender pushes duplicate data onto the network unnecessarily; if the timer is triggered too slowly, the sender remains idle for too long, unnecessarily slowing data flow.

TCP Slow Start

Slow start is one of four congestion control algorithms used by TCP. The slow start algorithm controls the amount of data being inserted into the network at the beginning of a TCP session when the capacity of the network is not known.

For example, if a TCP session began by inserting a large amount of data into the network, much of the initial burst of data would likely be lost. Instead, TCP initially transmits a modest amount of data that has a high probability of successful transmission. Next, TCP probes the network by sending increasing amounts of data as long as the network does not show signs of congestion.

The slow start algorithm begins by sending packets at a rate that is determined by the congestion window, or *cwnd* variable. (See the [“Congestion Windows” section on page 5-12.](#)) The algorithm continues to increase the sending rate until it reaches the limit set by the slow start threshold (*ssthresh*) variable. Initially, the value of the *ssthresh* variable is adjusted to the receiver's maximum segment size (RMSS). However, when congestion occurs, the *ssthresh* variable is set to half the current value of the *cwnd* variable, marking the point of the onset of network congestion for future reference.

The starting value of the *cwnd* variable is set to that of the sender maximum segment size (SMSS), which is the size of the largest segment that the sender can transmit. The sender sends a single data segment, and because the congestion window is equal to the size of one segment, the congestion window is now full. The sender then waits for the corresponding ACK from the receiving side of the transmission. When the ACK is received, the sender increases its congestion window size by increasing the value of the *cwnd* variable by the value of one SMSS. Now the sender can transmit two segments before the congestion window is again full and the sender is once more required to wait for the corresponding ACKs for these segments. The slow start algorithm continues to increase the value of the *cwnd* variable and therefore

increase the size of the congestion window by one SMSS for every ACK received. If the value of the *cwnd* variable increases beyond the value of the *ssthresh* variable, then the TCP flow control algorithm changes from the slow start algorithm to the congestion avoidance algorithm.

Enabling the MTU Discovery Utility

The WAAS software supports the IP Path Maximum Transmission Unit (MTU) Discovery method, as defined in RFC 1191. When enabled, the Path MTU Discovery feature discovers the largest IP packet size allowable between the various links along the forwarding path and automatically sets the correct value for the packet size. By using the largest MTU that the links can handle, the sending device can minimize the number of packets it must send.

IP Path MTU Discovery is useful when a link in a network goes down, which forces the use of another, different MTU-sized link. IP Path MTU Discovery is also useful when a connection is first being established, and the sender has no information about the intervening links.



Note

IP Path MTU Discovery is a process initiated by the sending device. If a server does not support IP Path MTU Discovery, the receiving device will have no available means to avoid fragmenting datagrams generated by the server.

By default, this feature is disabled. With the feature disabled, the sending device uses a packet size that is the lesser of 576 bytes and the next hop MTU. Existing connections are not affected when this feature is turned on or off.

To enable the MTU Discovery feature, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group that you want to configure.
 - Step 3** In the navigation pane, choose **Configure > Network > IP General Settings**. The IP General Settings window appears.
 - Step 4** Under the IP General Settings heading, enable the MTU discovery feature by checking the **Enable Path MTU Discovery** check box. By default, this option is disabled.
 - Step 5** Click **Submit** to save your settings.
-

To enable the MTU discovery utility from the CLI, you can use the **ip path-mtu-discovery enable** global configuration command.

Configuring Static IP Routes

The WAAS software allows you to configure a static route for a network or host. Any IP packet designated for the specified destination uses the configured route.

To configure a static IP route, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Devices Group**).
 - Step 2** Click the **Edit** icon next to the device or device group that you want to configure.
 - Step 3** In the navigation pane, choose **Configure > Network > IP Routes**. The IP Route Entries window appears.
 - Step 4** In the taskbar, click the **Create New IP Route Entry** icon. The Creating New IP Route window appears.
 - Step 5** In the Destination Network Address field, enter the destination network IP address.
 - Step 6** In the Netmask field, enter the destination host netmask.
 - Step 7** In the Gateway's IP Address field, enter the IP address of the gateway interface.
The gateway interface IP address should be in the same network as that of one of the device's network interfaces.
 - Step 8** Click **Submit**.
-

To configure a static route from the CLI, you can use the **ip route** global configuration command.

Aggregating IP Routes

An individual WAE device can have IP routes defined and can belong to device groups that have other IP routes defined.

In the IP Route Entries window, the Aggregate Settings radio button controls how IP routes are aggregated for an individual device, as follows:

- Choose **Yes** if you want to configure the device with all IP routes that are defined for itself and for device groups to which it belongs.
- Choose **No** if you want to limit the device to just the IP routes that are defined for itself.

When you change the setting, you get the following confirmation message: "This option will take effect immediately and will affect the device configuration. Do you wish to continue?" Click **OK** to continue.

Configuring CDP Settings

Cisco Discovery Protocol (CDP) is a device discovery protocol that runs on all Cisco-manufactured devices. With CDP, each device in a network sends periodic messages to all other devices in the network. All devices listen to periodic messages that are sent by others to learn about neighboring devices and determine the status of their interfaces.

With CDP, network management applications can learn the device type and the Simple Network Management Protocol (SNMP) agent address of neighboring devices. Applications are able to send SNMP queries within the network. CiscoWorks2000 also discovers the WAAS devices by using the CDP packets that are sent by the WAAS device after booting.

To perform device-related tasks, the WAAS device platform must support CDP to be able to notify the system manager of the existence, type, and version of the WAAS device platform.

To configure CDP settings, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group that you want to configure.
 - Step 3** From the navigation pane, choose **Configure > Network > CDP**. The CDP Settings window appears.
 - Step 4** Check the **Enable** check box to enable CDP support. By default, this option is enabled.
 - Step 5** In the Hold Time field, enter the time (in seconds) to specify the length of time that a receiver is to keep the CDP packets.
The range is 10 to 255 seconds. The default is 180 seconds.
 - Step 6** In the Packet Send Rate field, enter a value (in seconds) for the interval between CDP advertisements.
The range is 5 to 254 seconds. The default is 60 seconds.
 - Step 7** Click **Submit**.
-

To configure CDP settings from the CLI, you can use the **cdp** global configuration command.

Configuring the DNS Server

DNS allows the network to translate domain names entered in requests into their associated IP addresses. To configure DNS on a WAAS device, you must complete the following tasks:

- Specify the list of DNS servers, which are used by the network to translate requested domain names into IP addresses that the WAAS device should use for domain name resolution.
- Enable DNS on the WAAS device.

To configure DNS server settings for a WAAS device, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group that you want to configure.
 - Step 3** From the navigation pane, choose **Configure > Network > DNS**. The DNS Settings window appears.
 - Step 4** In the Local Domain Name field, enter the name of the local domain. You can configure up to three local domain names. Separate items in the list with a space.
 - Step 5** In the List of DNS Servers field, enter a list of DNS servers used by the network to resolve hostnames to IP addresses.
You can configure up to three DNS servers. Separate items in the list with a space.
 - Step 6** Click **Submit**.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default and device group settings. To revert to the previously configured window settings, click **Reset**. The Reset button appears only when you have applied default or group settings to change the current device settings but the settings have not yet been submitted.

To configure DNS name servers from the CLI, you can use the **ip name-server** global configuration command.

Configuring Windows Name Services

To configure Windows name services for a device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group for which you want to configure Windows name services.
 - Step 3** From the navigation pane, choose **Configure > Network > Windows Name Services**. The Windows Name Services Settings window appears.
 - Step 4** In the Workgroup or Domain Name field, enter the name of the workgroup (or domain) in which the chosen device or device group resides.

This name must be entered in shortname format and cannot exceed 127 characters. Valid characters include alphanumeric characters, a forward slash (/), an underscore (_), and a dash (-).

For example, if your domain name is cisco.com, the short name format is cisco.
 - Step 5** Check the **NT** check box if the workgroup or domain is a Windows NT 4 domain. For example, if your domain name is cisco.com, the short name format is cisco. If your workgroup or domain is a Windows 2000 or Windows 2003 domain, do not check the NT check box. By default, this option is disabled.
 - Step 6** In the WINS server field, enter the hostname or IP address of the Windows Internet Naming Service (WINS) server.
 - Step 7** Click **Submit**.
-

To configure Windows name services from the CLI, you can use the **windows-domain** global configuration command.

Configuring Directed Mode

By default, WAAS transparently sets up new TCP connections to peer WAEs, which can cause firewall traversal issues when a WAAS device tries to optimize the traffic. If a WAE device is behind a firewall that prevents traffic optimization, you can use the directed mode of communicating to a peer WAE. In directed mode, all TCP traffic that is sent to a peer WAE is encapsulated in UDP, which allows a firewall to either bypass the traffic or inspect the traffic (by adding a UDP inspection rule).

Any firewall between two WAE peers must be configured to pass UDP traffic on port 4050, or whatever custom port is configured for directed mode if a port other than the default is used. Additionally, because the WAAS automatic discovery process uses TCP options before directed mode begins sending UDP traffic, the firewall must be configured to pass the TCP options. Cisco firewalls can be configured to allow TCP options by using the **ip inspect waas** command (for IOS 12.4(11)T2 and later) or the **inspect waas** command (for FWSM 3.2(1) and later and PIX 7.2(3) and later).

After directed mode is activated, the WAE transparently intercepts only packets coming from the LAN, while WAN packets are directly routed between the WAEs using UDP.

Directed mode operates with all configurable methods of traffic interception. Directed mode requires that you configure the WAAS devices (or Cisco WAE Inline Network Adapters) with routable, non-NATed IP addresses. When using directed mode with inline mode, you must configure the Cisco WAE Inline Network Adapter with routable IP addresses on its interfaces or traffic is black holed.

If a WAE at either end of a peer WAE connection specifies directed mode, and both WAEs support directed mode, then both WAEs use directed mode, even if one is not explicitly configured for directed mode. If a peer WAE does not support directed mode, then the peers pass through traffic unoptimized and each WAE creates a transaction log entry that notes the failed directed mode attempt.

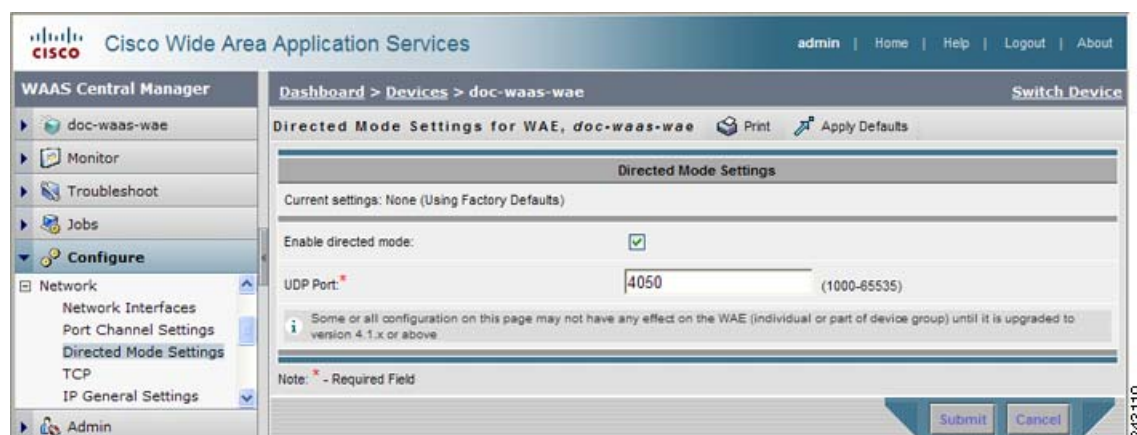
You can invoke directed mode operation in the following ways:

- Directed mode can be explicitly activated in the WAAS Central Manager GUI or CLI.
- Directed mode can be automatically invoked when a peer WAE requests that directed mode be used.

To activate directed mode, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to configure directed mode.
- Step 3** In the navigation pane, choose **Configure > Network > Directed Mode Settings**. The Directed Mode Settings window appears. (See [Figure 5-4](#).)

Figure 5-4 Directed Mode Settings Window



- Step 4** Check the **Enable** check box to activate directed mode.
- Step 5** Enter a port number in the UDP Port field to configure a custom UDP port for directed mode. The default is port 4050.

Step 6 Click **Submit** to save the settings.

To configure directed mode from the CLI, use the **directed-mode** global configuration command.



CHAPTER 6

Configuring Administrative Login Authentication, Authorization, and Accounting

This chapter describes how to configure administrative login authentication, authorization, and accounting for Wide Area Application Services (WAAS) devices.

This chapter contains the following sections:

- [About Administrative Login Authentication and Authorization, page 6-1](#)
- [Configuring Administrative Login Authentication and Authorization, page 6-6](#)
- [Configuring AAA Accounting for WAAS Devices, page 6-30](#)
- [Viewing Audit Trail Logs, page 6-32](#)

You use the WAAS Central Manager GUI to centrally create and manage two different types of administrator user accounts (device-based CLI accounts and roles-based accounts) for your WAAS devices. For more information, see [Chapter 7, “Creating and Managing Administrator User Accounts and Groups.”](#)



Note

Throughout this chapter, the term WAAS device is used to refer collectively to WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

About Administrative Login Authentication and Authorization

In the WAAS network, administrative login authentication and authorization are used to control login requests from administrators who want to access a WAAS device for configuring, monitoring, or troubleshooting purposes.

Login authentication is the process by which WAAS devices verify whether the administrator who is attempting to log in to the device has a valid username and password. The administrator who is logging in must have a user account registered with the device. User account information serves to authorize the user for administrative login and configuration privileges. The user account information is stored in an AAA database, and the WAAS devices must be configured to access the particular authentication server (or servers) where the AAA database is located. When the user attempts to login to a device, the device compares the person’s username, password, and privilege level to the user account information that is stored in the database.

The WAAS software provides the following authentication, authorization, and accounting (AAA) support for users who have external access servers (for example, RADIUS or TACACS+ servers), and for users who need a local access database with AAA features:

- Authentication (or login authentication) is the action of determining who the user is. It checks the username and password.
- Authorization (or configuration) is the action of determining what a user is allowed to do. It permits or denies privileges for authenticated users in the network. Generally, authentication precedes authorization. Both authentication and authorization are required for a user log in.
- Accounting is the action of keeping track of administrative user activities for system accounting purposes. In the WAAS software, AAA accounting through TACACS+ is supported. For more information, see the [“Configuring AAA Accounting for WAAS Devices”](#) section on page 6-30.

**Note**

An administrator can log in to the WAAS Central Manager device through the console port or the WAAS Central Manager GUI. An administrator can log in to a WAAS device that is functioning as a data center or branch WAE through the console port or the WAE Device Manager GUI.

When the system administrator logs in to a WAAS device before authentication and authorization have been configured, the administrator can access the WAAS device by using the predefined superuser account (the predefined username is admin and the predefined password is default). When you log in to a WAAS device using this predefined superuser account, you are granted access to all the WAAS services and entities in the WAAS system.

**Note**

Each WAAS device must have one administrator account with the username admin. You cannot change the username of the predefined superuser account. The predefined superuser account must have the username admin.

After you have initially configured your WAAS devices, we strongly recommend that you immediately change the password for the predefined superuser account (the predefined username is admin, the password is default, and the privilege level is superuser, privilege level 15) on each WAAS device.

If the predefined password for this superuser account has not been changed on a WAAS Central Manager device, the following dialog box is displayed each time you use the account to log in to the WAAS Central Manager GUI. (See [Figure 6-1](#).)

Figure 6-1 *Message Indicating the Predefined Password for the Superuser Account Should Be Changed*



If you have not changed the predefined password for this superuser account, the console will also display the following message each time you use the account to log in to the WAAS CLI on a WAAS device:

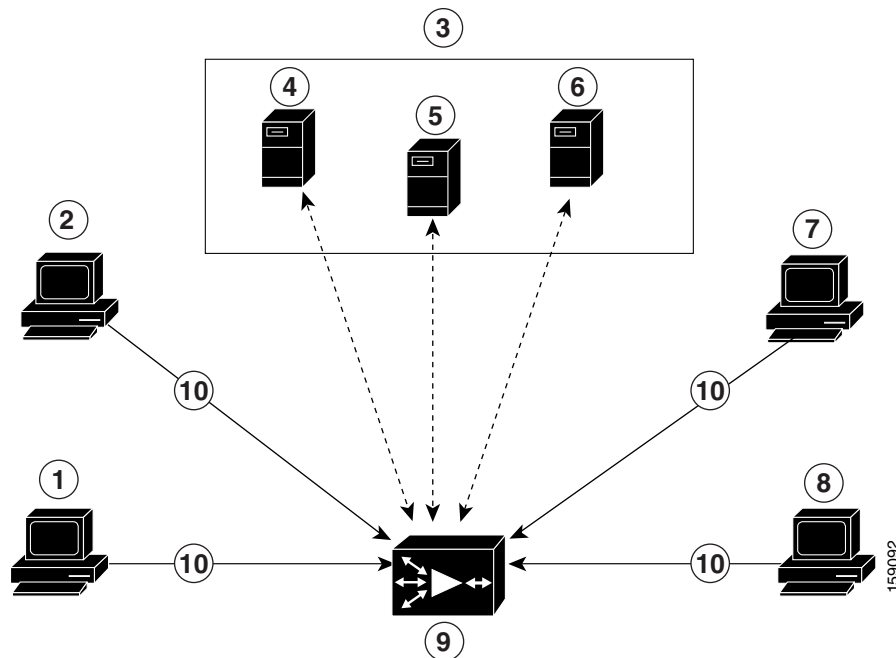
```
Device is configured with a (well known) default username/password
for ease of initial configuration. This default username/password
should be changed in order to avoid unwanted access to the device.
```

```
System Initialization Finished.
waas-cm#
```

For instructions on using the WAAS Central Manager GUI to change the password for the predefined superuser account, see the “[Changing the Password for Your Own Account](#)” section on page 7-7.

Figure 6-2 shows how an administrator can log in to a WAE through the console port or the WAAS GUIs (the WAAS Central Manager GUI or the WAE Device Manager GUI). When the WAAS device receives an administrative login request, the WAE can check its local database or a remote third-party database (TACACS+, RADIUS, or Windows domain database) to verify the username with the password and to determine the access privileges of the administrator.

Figure 6-2 Authentication Databases and a WAE



1	FTP/SFTP client	6	Windows domain server
2	WAAS Central Manager GUI or WAE Device Manager GUI	7	Console or Telnet clients
3	Third-party AAA servers	8	SSH client
4	RADIUS server	9	WAE that contains a local database and the default primary authentication database
5	TACACS+ server	10	Administrative login requests

The user account information is stored in an AAA database, and the WAAS devices must be configured to access the particular authentication server (or servers) that contains the AAA database. You can configure any combination of these authentication and authorization methods to control administrative login access to a WAAS device:

- Local authentication and authorization
- RADIUS

- TACACS+
- Windows domain authentication

**Note**

If you configure authentication using an external authentication server, you still must create a user account in the WAAS Central Manager as described in [Chapter 7, “Creating and Managing Administrator User Accounts and Groups.”](#) The user account must not be a local one; that is, do not check the Local User check box when you create the account.

For more information on the default AAA configuration, see the [“Default Administrative Login Authentication and Authorization Configuration”](#) section on page 6-4. For more information on configuring AAA, see the [“Configuring Administrative Login Authentication and Authorization”](#) section on page 6-6.

Default Administrative Login Authentication and Authorization Configuration

By default, a WAAS device uses the local database to obtain login authentication and authorization privileges for administrative users.

[Table 6-1](#) lists the default configuration for administrative login authentication and authorization.

Table 6-1 *Default Configuration for Administrative Login Authentication and Authorization*

Feature	Default Value
Administrative login authentication	Enabled
Administrative configuration authorization	Enabled
Authentication server failover because the authentication server is unreachable	Disabled
TACACS+ login authentication (console and Telnet)	Disabled
TACACS+ login authorization (console and Telnet)	Disabled
TACACS+ key	None specified
TACACS+ server timeout	5 seconds
TACACS+ retransmit attempts	2 times
RADIUS login authentication (console and Telnet)	Disabled
RADIUS login authorization (console and Telnet)	Disabled
RADIUS server IP address	None specified
RADIUS server UDP authorization port	Port 1645
RADIUS key	None specified
RADIUS server timeout	5 seconds
RADIUS retransmit attempts	2 times
Windows domain login authentication	Disabled
Windows domain login authorization	Disabled
Windows domain password server	None specified

Table 6-1 Default Configuration for Administrative Login Authentication and Authorization

Feature	Default Value
Windows domain realm (Kerberos realm used for authentication when Kerberos authentication is used). Note When Kerberos authentication is enabled, the default realm is DOMAIN.COM and security is the Active Directory Service (ADS).	Null string
Hostname or IP address of the Windows Internet Naming Service (WIN) server for Windows domain	None specified
Window domain administrative group	There are no predefined administrative groups.
Windows domain NETBIOS name	None specified
Kerberos authentication	Disabled
Kerberos server hostname or IP address (host that is running the Key Distribution Center (KDC) for the given Kerberos realm)	None specified
Kerberos server port number (port number on the KDC server)	Port 88
Kerberos local realm (default realm for WAAS)	kerberos-realm: null string
Kerberos realm (maps a hostname or DNS domain name to a Kerberos realm)	Null string

**Note**

If you configure a RADIUS or TACACS+ key on the WAAS device (the RADIUS and the TACACS+ client), make sure that you configure an identical key on the external RADIUS or TACACS+ server.

You change these defaults through the WAAS Central Manager GUI, as described in the [“Configuring Administrative Login Authentication and Authorization”](#) section on page 6-6.

Multiple Windows domain utilities are included in the WAAS software to assist with Windows domain authentication configuration. You can access these utilities through the WAAS CLI by using the **windows-domain diagnostics EXEC** command.

To invoke these utilities from the WAAS Central Manager GUI, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
 - Step 2** Click the **Edit** icon next to the device for which you want to run the utilities in a predefined order.
 - Step 3** In the navigation pane, choose **Admin > Authentication > Windows Domain**.
 - Step 4** In the displayed window, click the **Show Authentication Status** button at the bottom of the window.
-

Configuring Administrative Login Authentication and Authorization

To centrally configure administrative login authentication and authorization for a WAAS device or a device group (a group of WAEs), follow these steps:

-
- Step 1** Determine the login authentication scheme that you want to configure the WAAS device to use when authenticating administrative login requests (for example, use the local database as the primary login database and your RADIUS server as the secondary authentication database).
- Step 2** Configure the login access control settings for the WAAS device, as described in the [“Configuring Login Access Control Settings for WAAS Devices”](#) section on page 6-7.
- Step 3** Configure the administrative login authentication server settings on the WAAS device (if a remote authentication database is to be used). For example, specify the IP address of the remote RADIUS servers, TACACS+ servers, or Windows domain server that the WAAS device should use to authenticate administrative login requests, as described in the following sections:
- [Configuring RADIUS Server Authentication Settings, page 6-13](#)
 - [Configuring TACACS+ Server Authentication Settings, page 6-15](#)
 - [Configuring Windows Domain Server Authentication Settings, page 6-17](#)
- Step 4** Specify one or all of the following login authentication configuration schemes that the WAAS device should use to process administrative login requests:
- Specify the administrative login authentication scheme.
 - Specify the administrative login authorization scheme.
 - Specify the failover scheme for the administrative login authentication server (optional).

For example, specify which authentication database the WAAS device should check to process an administrative login request. See the [“Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices”](#) section on page 6-26.

**Caution**

Make sure that RADIUS, TACACS+, or Windows domain authentication is configured and operating correctly before disabling local authentication and authorization. If you disable local authentication and RADIUS, TACACS+, or Windows domain settings are not configured correctly, or if the RADIUS, TACACS+, or Windows domain server is not online, you may be unable to log in to the WAAS device.

You can enable or disable the local and the remote databases (TACACS+, RADIUS, and Windows domain) through the WAAS Central Manager GUI or the WAAS CLI. The WAAS device verifies whether all databases are disabled and, if so, sets the system to the default state (see [Table 6-1](#)). If you have configured the WAAS device to use one or more of the external third-party databases (TACACS+, RADIUS, or Windows domain authentication) for administrative authentication and authorization, make sure that you have also enabled the local authentication and authorization method on the WAAS device, and that the local method is specified as the last option; otherwise, the WAAS device will not go to the local authentication and authorization method by default if the specified external third-party databases are not reachable.

By default, local login authentication is enabled first. Local authentication and authorization uses locally configured login and passwords to authenticate administrative login attempts. The login and passwords are local to each WAAS device and are not mapped to individual usernames. When local authentication is disabled, if you disable all other authentication methods, local authentication is reenabled automatically.

You can disable local login authentication only after enabling one or more of the other administrative login authentication methods. However, when local login authentication is disabled, if you disable all other administrative login authentication methods, local login authentication is reenabled automatically. You cannot specify different administrative login authentication methods for console and Telnet connections.

We strongly recommend that you set the administrative login authentication and authorization methods in the same order. For example, configure the WAAS device to use RADIUS as the primary login method, TACACS+ as the secondary login method, Windows as the tertiary method, and the local method as the quaternary method for both administrative login authentication and authorization.

**Note**

A TACACS+ server will not authorize a user who is authenticated by a different method. For example, if you configure Windows as the primary authentication method, but TACACS+ as the primary authorization method, TACACS+ authorization will fail.

We strongly recommend that you specify the local method as the last method in your prioritized list of login authentication and authorization methods. By adhering to this practice, if the specified external third-party servers (TACACS+, RADIUS, or Windows domain servers) are not reachable, a WAAS administrator can still log in to a WAAS device through the local authentication and authorization method.

This section describes how to centrally configure administrative login authentication and contains the following topics:

- [Configuring Login Access Control Settings for WAAS Devices, page 6-7](#)
- [Configuring Remote Authentication Server Settings for WAAS Devices, page 6-12](#)
- [Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices, page 6-26](#)

Configuring Login Access Control Settings for WAAS Devices

This section describes how to centrally configure remote login and access control settings for a WAAS device or device group and contains the following topics:

- [Configuring Secure Shell Settings for WAAS Devices, page 6-8](#)
- [Disabling and Reenabling the Telnet Service for WAAS Devices, page 6-10](#)
- [Configuring Message of the Day Settings for WAAS Devices, page 6-10](#)
- [Configuring Exec Timeout Settings for WAAS Devices, page 6-11](#)
- [Configuring Line Console Carrier Detection for WAAS Devices, page 6-12](#)

Configuring Secure Shell Settings for WAAS Devices

Secure Shell (SSH) consists of a server and a client program. Like Telnet, you can use the client program to remotely log in to a machine that is running the SSH server, but unlike Telnet, messages transported between the client and the server are encrypted. The functionality of SSH includes user authentication, message encryption, and message authentication.



Note

By default, the SSH feature is disabled on a WAAS device.

The SSH management window in the WAAS Central Manager GUI allows you to specify the key length, login grace time, and maximum number of password guesses allowed when logging in to a specific WAAS device or device group for configuration, monitoring, or troubleshooting purposes.

To centrally enable the SSH feature on a WAAS device or a device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device (or device group) for which you want to enable SSH.
- Step 3** In the navigation pane, choose **Admin > Login Access Control > SSH**.

The SSH Configuration window appears. (See [Figure 6-3](#).)

Figure 6-3 SSH Configuration Window

SSH Configuration	
Current applied settings from WAE, doc-waas-wae	
Enable:	<input checked="" type="checkbox"/>
Allow non-admin users:	<input type="checkbox"/>
Length of key:	1024 bits (512-2048)
Login grace time:	300 seconds (1-9999)
Maximum number of password guesses:	3 (1-99)
Enable SSHv1 configuration:	<input checked="" type="checkbox"/>
Enable SSHv2 configuration:	<input checked="" type="checkbox"/>

Note: * - Required Field

- Step 4** Check the **Enable** check box to enable the SSH feature. SSH enables login access to the chosen WAAS device (or the device group) through a secure and encrypted channel.
- Step 5** Check the **Allow non-admin users** check box to allow non-administrative users to gain SSH access to the chosen device (or device group). By default, this option is disabled.



Note

Nonadministrative users are non-superuser administrators. All non-superuser administrators only have restricted access to a WAAS device because their login accounts have a privilege level of 0. Superuser administrators have full access to a WAAS device because their login accounts have the highest level of privileges, a privilege level of 15.

- Step 6** In the Length of key field, specify the number of bits needed to create an SSH key. The default is 1024. When you enable SSH, be sure to generate both a private and a public host key, which client programs use to verify the server's identity. When you use an SSH client and log in to a WAAS device, the public key for the SSH daemon running on the device is recorded in the client machine known_hosts file in your home directory. If the WAAS administrator subsequently regenerates the host key by specifying the number of bits in the Length of key field, you must delete the old public key entry associated with the WAAS device in the known_hosts file before running the SSH client program to log in to the WAAS device. When you use the SSH client program after deleting the old entry, the known_hosts file is updated with the new SSH public key for the WAAS device.
- Step 7** In the Login grace time field, specify the number of seconds for which an SSH session will be active during the negotiation (authentication) phase between client and server before it times out. The default is 300 seconds.
- Step 8** In the Maximum number of password guesses field, specify the maximum number of incorrect password guesses allowed per connection. The default is 3.
- Although the value in the Maximum number of password guesses field specifies the number of allowed password guesses from the SSH server side, the actual number of password guesses for an SSH login session is determined by the combined number of allowed password guesses of the SSH server and the SSH client. Some SSH clients limit the maximum number of allowed password guesses to three (or to one in some cases), even though the SSH server allows more than this number of guesses. When you specify n allowed password guesses, certain SSH clients interpret this number as $n + 1$. For example, when configuring the number of guesses to two for a particular device, SSH sessions from some SSH clients will allow three password guesses.
- Step 9** Specify whether the clients should be allowed to connect using the SSH protocol Version 1 or Version 2:
- To specify Version 1, check the **Enable SSHv1** check box.
 - To specify Version 2, check the **Enable SSHv2** check box.



Note You can enable both SSH Version 1 and Version 2, or you can enable one version and not the other. You cannot disable both versions of SSH unless you disable the SSH feature by unchecking the **Enable** check box. (See [Step 4](#).)

- Step 10** Click **Submit** to save the settings.
- A “Click Submit to Save” message appears in red in the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking the **Reset** button. The Reset button is visible only when you have applied default or group settings to change the current device settings but have not yet submitted the changes.
- If you try to exit this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

To configure SSH settings from the CLI, you can use the **sshd** and **ssh-key-generate** global configuration commands.

Disabling and Reenabling the Telnet Service for WAAS Devices

By default, the Telnet service is enabled on a WAAS device. You must use a console connection instead of a Telnet session to define device network settings on a WAAS device. However, after you have used a console connection to define the device network settings, you can use a Telnet session to perform subsequent configuration tasks.

You must enable the Telnet service before you can use the Telnet button in the Device Dashboard window to Telnet to a device.

To centrally disable the Telnet service on a WAAS device or a device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device (or device group) for which you want to disable Telnet.
 - Step 3** In the navigation pane, choose **Admin > Login Access Control > Telnet**. The Telnet Settings window appears.
 - Step 4** Uncheck the **Telnet Enable** check box to disable the terminal emulation protocol for remote terminal connection for the chosen device (or device group).
 - Step 5** Click **Submit** to save the settings.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking the **Reset** button. The **Reset** button is visible only when you have applied default or group settings to change the current device settings but have not yet submitted the changes.

If you try to exit this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

To centrally reenable the Telnet service on the device (or device group) at a later time, check the **Telnet Enable** check box in the Telnet Settings window and click **Submit**.

From the CLI, you can use the **no telnet enable** global configuration command to disable Telnet or the **telnet enable** global configuration command to enable it.

Configuring Message of the Day Settings for WAAS Devices

The Message of the Day (MOTD) feature enables you to provide information bits to the users when they log in to a device that is part of your WAAS network. There are three types of messages that you can set up:

- MOTD banner
- EXEC process creation banner
- Login banner



Note

When you run an SSH version 1 client and log in to the device, the MOTD and login banners are not displayed. You need to use SSH version 2 to display the banners when you log in to the device.

To configure the MOTD settings, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
 - Step 2** Click the **Edit** icon next to the WAAS device for which you want to set up the message of the day. The Device Dashboard window for the chosen device appears.
 - Step 3** In the navigation pane, choose **Admin > Login Access Control > Message of the day**. The MOTD Configuration window for the chosen device appears.
 - Step 4** To enable the MOTD settings, check the **Enable** check box. The Message of the Day (MOTD) banner, EXEC process creation banner, and Login banner fields become enabled.
 - Step 5** In the Message of the Day (MOTD) Banner field, enter a string that you want to display as the MOTD banner after a user logs in to the device.



Note In the Message of the Day (MOTD) Banner, EXEC Process Creation Banner, and Login Banner fields, you can enter a maximum of 1024 characters. A new line character (or Enter) is counted as two characters, as it is interpreted as `\n` by the system. You cannot use special characters such as ```, `%`, `^`, and `"` in the MOTD text. If your text contains any of these special characters, WAAS software removes it from the MOTD output.

-
- Step 6** In the EXEC Process Creation Banner field, enter a string to be displayed as the EXEC process creation banner when a user enters into the EXEC shell of the device.
 - Step 7** In the Login Banner field, enter a string to be displayed after the MOTD banner, when a user attempts to login to the device.
 - Step 8** To save the configuration, click **Submit**.
-

Configuring Exec Timeout Settings for WAAS Devices

To centrally configure the length of time that an inactive Telnet session remains open on a WAAS device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device (or device group) for which you want to configure the EXEC timeout.
 - Step 3** In the navigation pane, choose **Admin > Login Access Control > Exec Timeout**.
 - Step 4** In the Exec Timeout field, specify the number of minutes after which an active session times out. The default is 15 minutes.

A Telnet session with a WAAS device can remain open and inactive for the period specified in this field. When the EXEC timeout period elapses, the WAAS device automatically closes the Telnet session.
 - Step 5** Click **Submit** to save the settings.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking the **Reset** button. The **Reset** button is visible only when you have applied default or group settings to change the current device settings but have not yet submitted the changes.

If you try to exit this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

To configure the Telnet session timeout from the CLI, you can use the **exec-timeout** global configuration command.

Configuring Line Console Carrier Detection for WAAS Devices

You need to enable carrier detection if you plan to connect the WAAS device to a modem for receiving calls.



Note

By default, this feature is disabled on a WAAS device.

To centrally enable console line carrier detection for a WAAS device or device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device (or device group) that you want to configure.
- Step 3** In the navigation pane, choose **Admin > Login Access Control > Console Carrier Detect**. The Console Carrier Detect Settings window appears.
- Step 4** Check the **Enable console line carrier detection before writing to the console** check box to enable the window for configuration.
- Step 5** Click **Submit** to save the settings.
A message appears that explains that if a null-modem cable that has no carrier detect pin wired is being used, the WAE may appear unresponsive on the console until the carrier detect signal is asserted. To recover from a misconfiguration, the WAE should be rebooted and the 0x2000 bootflag should be set to ignore the carrier detect setting.
- Step 6** Click **OK** to continue.

To configure console line carrier detection from the CLI, you can use the **line console carrier-detect** global configuration command.

Configuring Remote Authentication Server Settings for WAAS Devices

If you have determined that your login authentication scheme is to include one or more external authentication servers, you must configure these server settings before you can configure the authentication scheme in the WAAS Central Manager GUI. The section contains the following topics:

- [Configuring RADIUS Server Authentication Settings, page 6-13](#)

- [Configuring TACACS+ Server Authentication Settings, page 6-15](#)
- [Configuring the TACACS+ Enable Password Attribute, page 6-16](#)
- [Configuring Windows Domain Server Authentication Settings, page 6-17](#)
- [LDAP Server Signing, page 6-23](#)

Configuring RADIUS Server Authentication Settings

RADIUS is a client/server authentication and authorization access protocol used by a network access server (NAS) to authenticate users attempting to connect to a network device. The NAS functions as a client, passing user information to one or more RADIUS servers. The NAS permits or denies network access to a user based on the response that it receives from one or more RADIUS servers. RADIUS uses the User Datagram Protocol (UDP) for transport between the RADIUS client and server.

RADIUS authentication clients reside on devices that are running WAAS software. When enabled, these clients send authentication requests to a central RADIUS server, which contains user authentication and network service access information.

You can configure a RADIUS key on the client and server. If you configure a key on the client, it must be the same as the one configured on the RADIUS servers. The RADIUS clients and servers use the key to encrypt all RADIUS packets transmitted. If you do not configure a RADIUS key, packets are not encrypted. The key itself is never transmitted over the network.



Note

For more information about how the RADIUS protocol operates, see RFC 2138, *Remote Authentication Dial In User Service (RADIUS)*.

RADIUS authentication usually occurs when an administrator first logs in to the WAAS device to configure the device for monitoring, configuration, or troubleshooting purposes. RADIUS authentication is disabled by default. You can enable RADIUS authentication and other authentication methods at the same time. You can also specify which method to use first.



Tip

The WAAS Central Manager does not cache user authentication information. Therefore, the user is reauthenticated against the RADIUS server for every request. To prevent performance degradation caused by many authentication requests, install the WAAS Central Manager device in the same location as the RADIUS server, or as close as possible to it, to ensure that authentication requests can occur as quickly as possible.

To centrally configure RADIUS server settings for a WAAS device or device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) that you want to configure.
- Step 3** From the navigation pane, choose **Admin > Authentication > RADIUS**. The RADIUS Server Settings window appears. (See [Figure 6-4](#).)

Figure 6-4 RADIUS Server Settings Window

The screenshot shows the 'RADIUS Server Settings' window in the Cisco WAAS Central Manager. The window title is 'RADIUS Server Settings for WAE, doc-waas-wae'. The current settings are 'None (Using Factory Defaults)'. The fields are as follows:

Field	Value	Unit/Notes
Time to Wait *	5	(seconds) (1-20)
Number of Retransmits *	2	
Shared Encryption Key *		
Server 1 Name *		
Server 1 Port *	1645	
Server 2 Name		
Server 2 Port		
Server 3 Name		
Server 3 Port		
Server 4 Name		
Server 4 Port		
Server 5 Name		
Server 5 Port		

* To use RADIUS for Login or Configuration Authentication, please go to the Authentication Methods page.

Note: * - Required Field

Buttons: Submit, Cancel

- Step 4** In the Time to Wait field, specify how long the device or device group should wait for a response from the RADIUS server before timing out. The range is from 1 to 20 seconds. The default value is 5 seconds.
- Step 5** In the Number of Retransmits field, specify the number of attempts allowed to connect to a RADIUS server. The default value is 2 times.
- Step 6** In the Shared Encryption Key field, enter the secret key that is used to communicate with the RADIUS server.



Note If you configure a RADIUS key on the WAAS device (the RADIUS client), make sure that you configure an identical key on the external RADIUS server.

- Step 7** In the Server Name field, enter an IP address or hostname of the RADIUS server. Five different hosts are allowed.
- Step 8** In the Server Port field, enter a UDP port number on which the RADIUS server is listening. You must specify at least one port. Five different ports are allowed.
- Step 9** Click **Submit** to save the settings.

You can now enable RADIUS as an administrative login authentication and authorization method for this WAAS device or device group, as described in the [“Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices”](#) section on page 6-26.

To configure RADIUS settings from the CLI, you can use the **radius-server** global configuration command.

Configuring TACACS+ Server Authentication Settings

TACACS+ controls access to network devices by exchanging network access server (NAS) information between a network device and a centralized database to determine the identity of a user or an entity. TACACS+ is an enhanced version of TACACS, a UDP-based access-control protocol specified by RFC 1492. TACACS+ uses TCP to ensure reliable delivery and encrypt all traffic between the TACACS+ server and the TACACS+ daemon on a network device.

TACACS+ works with many authentication types, including fixed password, one-time password, and challenge-response authentication. TACACS+ authentication usually occurs when an administrator first logs in to the WAAS device to configure the WAE for monitoring, configuring, or troubleshooting.

When a user requests restricted services, TACACS+ encrypts the user password information using the MD5 encryption algorithm and adds a TACACS+ packet header. This header information identifies the packet type being sent (for example, an authentication packet), the packet sequence number, the encryption type used, and the total packet length. The TACACS+ protocol then forwards the packet to the TACACS+ server.

A TACACS+ server can provide authentication, authorization, and accounting functions. These services, while all part of TACACS+, are independent of one another, so a given TACACS+ configuration can use any or all of the three services.

When the TACACS+ server receives a packet, it does the following:

- Authenticates the user information and notifies the client that the login authentication has either succeeded or failed.
- Notifies the client that authentication will continue and that the client must provide additional information. This challenge-response process can continue through multiple iterations until login authentication either succeeds or fails.

You can configure a TACACS+ key on the client and server. If you configure a key on a WAAS device, it must be the same as the one configured on the TACACS+ servers. The TACACS+ clients and servers use the key to encrypt all TACACS+ packets transmitted. If you do not configure a TACACS+ key, packets are not encrypted.

TACACS+ authentication is disabled by default. You can enable TACACS+ authentication and local authentication at the same time.

The TACACS+ database validates users before they gain access to a WAAS device. TACACS+ is derived from the United States Department of Defense (RFC 1492) and is used by Cisco Systems as an additional control of nonprivileged and privileged mode access. The WAAS software supports TACACS+ only and not TACACS or Extended TACACS.

If you are using TACACS+ for user authentication, you can create WAAS user group names that match the user groups that you have defined on the TACACS+ server. WAAS can then dynamically assign roles and domains to users based on their membership in the groups defined on the TACACS+ server. (See the [“Working with Accounts” section on page 7-3.](#)) You must specify associated group names for each user in the TACACS+ configuration file, as follows:

```
user = tacusr1 {
  default service = permit
  service = exec
  {
    waas_rbac_groups = admin,groupname1,groupname2
    priv-lvl = 15
  }
  global = cleartext "tac"
}
```

For each user, list the groups they belong to in the `waas_rbac_groups` attribute, separating each group from the next with a comma.

**Tip**

The WAAS Central Manager does not cache user authentication information, so the user is reauthenticated against the TACACS+ server for every request. To prevent performance degradation caused by many authentication requests, install the WAAS Central Manager device in the same location as the TACACS+ server, or as close as possible to it, to ensure that authentication requests can occur as quickly as possible.

Configuring the TACACS+ Enable Password Attribute

The WAAS software CLI EXEC mode allows you to set, view, and test system operations. The mode is divided into two access levels: user and privileged. To access privileged-level EXEC mode, enter the **enable** EXEC command at the user access level prompt and specify a privileged EXEC password (superuser or admin-equivalent password) when prompted for a password.

In TACACS+, the enable password feature allows an administrator to define a different enable password per administrative-level user. If an administrative-level user logs in to the WAAS device with a normal-level user account (privilege level of 0) instead of an admin or admin-equivalent user account (privilege level of 15), that user must enter the admin password to access privileged-level EXEC mode.

```
WAE> enable
Password:
```

**Note**

This caveat applies even if the WAAS users are using TACACS+ for login authentication.

To centrally configure TACACS+ server settings on a WAAS device or device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) that you want to configure.
- Step 3** From the navigation pane, choose **Admin > Authentication > TACACS+**. The TACACS+ Server Settings window appears.
- Step 4** Check the **Use ASCII Password Authentication** check box to use the ASCII password type for authentication.

The default password type is PAP (Password Authentication Protocol). However, you can change the password type to ASCII when the authentication packets are to be sent in ASCII cleartext format.
- Step 5** In the Time to Wait field, specify how long the device should wait before timing out. The range is from 1 to 20 seconds. The default value is 5 seconds.
- Step 6** In the Number of Retransmits field, specify the number of attempts allowed to connect to a TACACS+ server. The range is 1 to 3 times. The default value is 2 times.
- Step 7** In the Security Word field, enter the secret key that is used to communicate with the TACACS+ server.

**Note**

If you configure a TACACS+ key on the WAAS device (the TACACS+ client), make sure that you configure an identical key on the external TACACS+ server.

- Step 8** In the Primary Server field, enter an IP address or hostname for the primary TACACS+ server.

Step 9 In the Secondary Server field, enter an IP address or hostname for a secondary TACACS+ server.

Step 10 In the Tertiary Server field, enter an IP address or hostname for a tertiary TACACS+ server.



Note You can specify up to two backup TACACS+ servers.

Step 11 Click **Submit** to save the settings.

You can now enable TACACS+ as an administrative login authentication and authorization method for this WAAS device or device group, as described in the [“Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices”](#) section on page 6-26.

To configure TACACS+ settings from the CLI, you can use the **tacacs** global configuration command.

Configuring Windows Domain Server Authentication Settings

A Windows domain controller can be configured to control access to the WAAS software services using either a challenge/response or shared secret authentication method. The system administrator can log in to the WAAS device by using an FTP, SSH, or Telnet session, the console, or the WAAS Central Manager GUI with a single user account (username/password/privilege). RADIUS and TACACS+ authentication schemes can be configured simultaneously with Windows domain authentication. Logging of a variety of authentication login statistics can be configured when Windows domain authentication is enabled. The log files and the statistical counters and related information can be cleared at any time.

In a WAAS network, Windows domain authentication is used in the following cases:

- Log in to the WAAS Central Manager GUI
- Log in to the WAE Device Manager GUI
- CLI configuration on any WAAS device
- Disconnected mode operation

You can configure Windows authentication for the WAAS Central Manager device, a single WAAS device, or a group of devices. To configure Windows domain authentication on a WAAS device, you must configure a set of Windows domain authentication settings.



Note

Windows domain authentication is not performed unless a Windows domain server is configured on the WAAS device. If the device is not successfully registered, authentication and authorization do not occur. WAAS supports authentication by a Windows domain controller running only on Windows Server 2000 or Windows Server 2003.

This section contains the following topics:

- [Configuring Windows Domain Server Settings on a WAAS Device, page 6-17](#)
- [Unregistering a WAE from a Windows Domain Controller, page 6-21](#)
- [Disabling the Automatic Machine Account Password Changes for the Edge WAE, page 6-22](#)

Configuring Windows Domain Server Settings on a WAAS Device

You will need to know the name and IP address, or hostname, of the Windows domain controller that will be used for authentication.

To configure Windows Domain server settings on a WAAS device or device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) that you want to configure.
- Step 3** From the navigation pane, choose **Admin > Authentication > Windows Domain**. The Windows Domain Server Settings window appears. (See [Figure 6-5](#).)

Figure 6-5 Windows Domain Server Settings Window



Note If the related WINS server and the workgroup or domain name have not been defined for the chosen device (or device group), an informational message is displayed at the top of this window to inform you that these related settings are currently not defined, as shown in [Figure 6-5](#). To define these settings, choose **Configure > Network > Windows Name Services**.

- Step 4** Specify an administrative group for normal users (non-superuser administrators), who only have restricted access to the chosen device (or device group) because their administrator user account only has a privilege level of 0, by entering the name of the group in the Administrative group for normal users field.



Note By default, there are not predefined user groups for Windows domain authorization configured on a WAE.

- Step 5** Specify an administrative group for superusers (superuser administrators), who have unrestricted access to the chosen device (or device group) because their administrator user account has a privilege level of 15, by entering the name of the group in the Administrative group for superusers field.



Note In addition to configuring Windows domain administrative group on a WAE, you must configure the Windows domain administrative group on your Microsoft Windows 2000 or 2003 server. You must create a Windows Domain administrative superuser group and a normal user group. Make sure that the group scope for the superuser group is set to global, assign user member to newly created administrative group, and add the user account (for example, the winsuper user) to the Windows domain superuser group. For more information about how to configure the Windows domain administrative group on your Windows server, see your Microsoft documentation.

When a user attempts to access this WAE through a Telnet session, FTP, or SSH session, the WAE is now configured to use the Active Directory user database to authenticate a request for administrative access.

- Step 6** Select NTLM or Kerberos as a shared secure authentication method for administrative logins to the chosen device (or device group) as follows:



Note Kerberos version 5 is used for Windows systems running Windows 2000 or higher with users logging in to domain accounts.

- To enable NTLM, check the **NTLM enabled** check box.
- To select NTLM version 1, check the **NTLM enabled** check box. NTLM version 1 is selected by default.

NTLM version 1 is used for all Windows systems, including legacy systems such as Windows 98 with Active Directory, Windows NT, and more recent Windows systems, such as Windows 2000, Windows XP, and Windows 2003. We recommend the use of Kerberos if you are using a Windows 2000 SP4 or Windows 2003 domain controller.

- To select NTLM version 2, choose **V2** from the drop-down list.

NTLM version 2 is used for Windows systems running Windows 98 with Active Directory, Windows NT 4.0 (Service Pack 4 or higher), Windows XP, Windows 2000, and Windows 2003. Enabling NTLM version 2 support on the WAAS print server will not allow access to clients who use NTLM or LM.



Caution Enable NTLM version 2 support in the print server only if all the clients' security policy has been set to Send NTLMv2 responses only/Refuse LM and NTLM.

- To select Kerberos, check the **Kerberos enabled** check box. In the Realm field, enter the fully qualified name of the realm in which the WAAS device resides. In the Key Distribution center, enter the fully qualified name or the IP address of the distribution center for the Kerberos key. If desired, enter the name of the organizational unit in the Organizational Unit field.

All Windows 2000 domains are also Kerberos realms. Because the Windows 2000 domain name is also a DNS domain name, the Kerberos realm name for the Windows 2000 domain name is always in uppercase letters. This capitalization follows the recommendation for using DNS names as realm names in the Kerberos Version 5 protocol document (RFC-4120) and affects only interoperability with other Kerberos-based environments.

Step 7 In the Domain Controller field, enter the name of the Windows Domain Controller.

The domain registration will be successful even if the domain controller name is invalid or if the domain controller is not available. This behavior is possible because the registration process makes use of the domain controller name from the password server field of the smb.conf file. The prioritization list in the smb.conf file commonly uses the format, “*DomainControllerName, **” or simply, “***” (asterisk). Samba looks for domain controllers first by name, and if these are unavailable, Samba proceeds to the * and looks for available Domain Controllers in the workgroup. This behavior is an intentional facet of the design, and it allows domain registration even when a domain controller is not available.

Step 8 Click **Submit**.



Note Make sure that you click **Submit** now so that the specified changes are committed to the WAAS Central Manager database. The Domain Administrator’s username and password, which you will enter next in [Step 9](#), is not stored in the WAAS Central Manager’s database.

Step 9 Register the chosen device (or device group) with the Windows Domain Controller as follows:

- a. In the Domain Administrator username field, enter the administrative username (the domain\username or the domain name plus the username) of the specified Windows Domain Controller.
- b. In the Domain Administrator password field, enter the administrative password of the specified Windows Domain Controller.
- c. In the Confirm password field, reenter the administrative password of the specified Windows Domain Controller.
- d. Click the **Register** button.

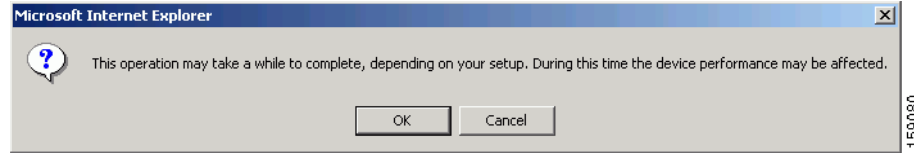


Note When you click the Register button, the WAAS Central Manager immediately sends a registration request to the WAAS device (or device group) using SSH (the specified domain administrator password is encrypted by SSH). The registration request instructs the device to perform domain registration with the specified Windows Domain Controller using the specified domain administrator’s username and password. If the device is accessible (if it is behind a NAT and has an external IP address), the registration request is performed by the device (or device group).

- e. To check the status of the registration request, you must set Windows as the authentication and authorization method for the device, as described in the “[Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices](#)” section on page 6-26, then wait a few minutes and click the **Show Authentication Status** button.

You may choose to check the **Refresh Authentication Status** check box before you click the **Show Authentication Status** button. When this box is checked, the WAAS Central Manager queries the device for an updated domain registration status. When this box is unchecked, the status is retrieved from the Central Manager local cache.

After you click the **Show Authentication Status** button, a dialog box appears prompting if you want to continue with this request to view the status of the authentication request. (See [Figure 6-6](#).)

Figure 6-6 Confirmation Dialog Box

- f. Click **OK** to continue or click **Cancel** to cancel the request.

If the request fails, you will receive an error dialog. Wait a few more minutes and try again to see the updated authentication status.

If the request succeeds, the domain registration status will be shown immediately below the Windows Authentication and Domain Registration heading, in the lower part of [Figure 6-5](#). In addition, the status of windows authentication and disconnected mode is shown in this area.

After configuring the Windows domain settings, to complete the process of enabling Windows authentication, you must set Windows as the authentication and authorization method for the device by using the Authentication Methods window, as described in the “[Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices](#)” section on page 6-26.

We recommend that you use the WAAS Central Manager GUI instead of the WAAS CLI to configure Windows Domain server settings, but if you want to use the CLI, see the following commands in the *Cisco Wide Area Application Services Command Reference*: **windows-domain** and **kerberos** (if you are using Kerberos as a shared secure authentication method)

Next, register the WAAS device with the Windows domain server that you configured, and then verify it, by using the following commands (for Kerberos authentication):

```
WAE# windows-domain diagnostics net "ads join -U AdminUsername%AdminPassword"
WAE# windows-domain diagnostics net "ads testjoin -U AdminUsername%AdminPassword"
```

For NTLM authentication, use the following commands instead:

```
WAE# windows-domain diagnostics net "rpc join -U AdminUsername%AdminPassword"
WAE# windows-domain diagnostics net "rpc testjoin -U AdminUsername%AdminPassword"
```

Finally, enable Windows Domain as the administrative login authentication and authorization configuration by using the following commands:

```
WAE(config)# authentication login windows-domain enable primary
WAE(config)# authentication configuration windows-domain enable primary
```

To enable content request authentication in disconnected mode, use the **authentication content-request windows-domain disconnected-mode enable** configuration command.

Unregistering a WAE from a Windows Domain Controller

If you want to unregister a WAE device from a Windows domain controller, you can do that directly from the WAAS Central Manager, as long as you have used the Kerberos shared secure authentication method. If you have used the NTLM method, you cannot unregister the WAE by using the WAAS Central Manager; you must log into the domain controller and remove the device registration manually.

Before you can unregister a device, you must disable windows authentication for the device.

To unregister a WAE device, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the name of the device (or the device group) that you want to unregister.
 - Step 3** From the navigation pane, choose **Admin > Authentication > Authentication Methods**. The Authentication and Authorization Methods window appears. (See [Figure 6-7](#) on page 6-28.)
 - Step 4** Under both the Authentication Login Methods and the Authorization Methods sections, change each of the drop-down lists that are set to WINDOWS so that they are set to something different. For more information about changing these settings, see the “[Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices](#)” section on page 6-26.
 - Step 5** Click **Submit** to save the settings.
 - Step 6** From the navigation pane, choose **Admin > Authentication > Windows Domain**. The Windows Domain Server Settings window appears. (See [Figure 6-5](#).)
 - Step 7** (Optional) Enter the administrative username and password in the Domain administrator username, Domain administrator password, and Confirm password fields. It is not mandatory to enter the username and password, but in some cases, the domain controller requires them to perform the unregistration.
 - Step 8** Scroll down and click the **Unregister** button.



Note

When you click the Unregister button, the WAAS Central Manager immediately sends an unregistration request to the WAAS device (or device group) using SSH. The unregistration request instructs the device to unregister from the specified Windows Domain Controller.

- a. Check the status of the unregistration request by waiting a few minutes and clicking the **Show Authentication Status** button. A dialog box appears prompting if you want to continue with this request to view the status of the authentication request. (See [Figure 6-6](#).)
 - b. Click **OK** to continue or click **Cancel** to cancel the request.
-

If you want to use the CLI to unregister a WAE device, you must first use the following commands to disable windows authentication:

```
WAE(config)# no authentication login windows-domain enable
WAE(config)# no authentication configuration windows-domain enable
```

Next, unregister the WAAS device from the Windows domain server by using the following command (for Kerberos authentication):

```
WAE# windows-domain diagnostics net "ads leave -U AdminUsername%AdminPassword"
```

There is no CLI command to unregister the WAAS device if it is using NTLM authentication.

Disabling the Automatic Machine Account Password Changes for the Edge WAE

In a WAAS network where a Windows domain controller is configured for authentication and Disconnected Mode is enabled on an Edge WAE operating in WAFS legacy mode, the domain controller authenticates content requests in the event of a WAN failure. By default, Windows domain controllers enforce automatic machine account password changes as part of the authentication process. The machine

account password for the Edge WAE is automatically negotiated and changed between the Edge WAE and the domain controller every seven days. However, if the authentication service is down, this process may not occur, and the machine account password for the Edge WAE may expire.

To prevent this situation, we recommend that you disable automatic machine account password changes for the Edge WAE. The procedure that follows describes how to disable automatic machine account password changes for Windows XP and Windows Server 2003 using Group Policy Editor. Refer to Microsoft's Help and Support page for details on how to disable automatic machine account password changes for the other Windows operating systems.

To disable the automatic machine account password changes for the Edge WAE using Group Policy Editor, follow these steps:

-
- Step 1** On the Windows domain controller, click **Start** and then choose **Run**.
 - Step 2** Enter **Gpedit** at the prompt, and then click **OK**.
 - Step 3** Expand the Local Computer Policy, Windows Settings, Security Settings, Local Policies, Security Settings, Local Policies, Security Options.
 - Step 4** Configure the following setting: Domain Member: Disable machine account password changes (DisablePasswordChange).
-

LDAP Server Signing

LDAP server signing is a configuration option of the Microsoft Windows Server's Network security settings. This option controls the signing requirements for Lightweight Directory Access Protocol (LDAP) clients. LDAP signing is used to verify that an intermediate party did not tamper with the LDAP packets on the network and to guarantee that the packaged data comes from a known source. Windows Server 2003 administration tools use LDAP signing to secure communications between running instances of these tools and the servers that they administer.

By using the Transport Layer Security (TLS, RFC 2830) protocol to provide communications privacy over the Internet, client/server applications can communicate in a way that prevents eavesdropping, tampering, or message forging. TLS v1 is similar to Secure Sockets Layer (SSL). TLS offers the same encryption on regular LDAP connections (ldap://:389) as SSL, while operating on a secure connection (ldaps://:636). A server certificate is used by the TLS protocol to provide a secure, encrypted connection to the LDAP server. A client certificate and key pair are required for client authentication.

In the WAAS software, login authentication with Windows 2003 domains is supported when the *LDAP server signing requirements* option for the Domain Security Policy is set to "Require signing." The LDAP server signing feature allows the WAE to join the domain and authenticate users securely.



Note

When you configure your Windows domain controller to require an LDAP signature, you must also configure LDAP signing on the client WAE. By not configuring the client to use LDAP signatures, communication with the server is affected, and user authentication, group policy settings, and logon scripts might fail. Install the Certification Authority service on the Microsoft server with the server's certificate (**Programs > Administrative Tools > Certification Authority**). Enable the LDAP server signing requirements property on the Microsoft server (**Start > Programs > Administrative Tools > Domain Controller Security Policy**). In the displayed window, choose **Require signing** from the drop-down list, and click **OK**.

For information about how to configure your Windows domain controller to require an LDAP signature, see your Microsoft documentation.

This section contains the following topics:

- [Configuring LDAP Signing on the Client WAEs, page 6-24](#)
- [Disabling LDAP Server Signing on a Client WAE, page 6-25](#)

Configuring LDAP Signing on the Client WAEs

You can configure a security setting on Windows 2003 domain controllers to require clients (such as WAEs) to sign LDAP requests. Because unsigned network traffic can be intercepted and manipulated by outside parties, some organizations require LDAP server signing to prevent man-in-the-middle attacks on their LDAP servers. You can only configure LDAP signing on a single WAE; it cannot be configured at a system level. In addition, you must configure LDAP signing on a WAE through the WAAS CLI; you cannot configure LDAP signing through any of the WAAS GUIs (either the WAAS Central Manager GUI or the WAE Device Manager GUI).

By default, LDAP server signing is disabled on a WAE. To enable this feature on a WAE, follow these steps:

Step 1 Enable LDAP server signing on the WAE:

```
WAE# configure terminal
WAE(config)# smb-conf section "global" name "ldap ssl" value "start_tls"
```

Step 2 Save the configuration on the WAE:

```
WAE(config)# exit
WAE# copy run start
```

Step 3 Check the current running LDAP client configuration on the WAE:

```
WAE# show smb-conf
```

Step 4 Register the WAE with the Windows domain:

```
WAE# windows-domain diagnostics net "ads join -U Administrator%password"
```

Step 5 Enable user login authentication on the WAE:

```
WAE# configure
WAE(config)# authentication login windows-domain enable primary
```

Step 6 Enable user login authorization on the WAE:

```
WAE(config)# authentication configuration windows-domain enable primary
```

Step 7 Check the current configuration for login authentication and authorization on the WAE:

```
WAE# show authentication user
Login Authentication: Console/Telnet/Ftp/SSH Session
-----
local                enabled (secondary)
Windows domain      enabled (primary)
Radius              disabled
Tacacs+             disabled

Configuration Authentication: Console/Telnet/Ftp/SSH Session
-----
```

```

local                               enabled (primary)
Windows domain                       enabled (primary)
Radius                               disabled
Tacacs+                              disabled

```

The WAE is now configured to authenticate Active Directory users. Active Directory users can use Telnet, FTP, or SSH to connect to the WAE or they can access the WAE through the WAAS GUIs (WAAS Central Manager GUI or the WAE Device Manager GUI).

- Step 8** View statistics that are related to Windows domain user authentication. Statistics increment after each user authentication attempt:

```

WAE# show statistics windows-domain
Windows Domain Statistics
-----
Authentication:
  Number of access requests:           9
  Number of access deny responses:     3
  Number of access allow responses:    6
Authorization:
  Number of authorization requests:     9
  Number of authorization failure responses: 3
  Number of authorization success responses: 6
Accounting:
  Number of accounting requests:        0
  Number of accounting failure responses: 0
  Number of accounting success responses: 0

```

```

WAE# show statistics authentication
Authentication Statistics
-----
Number of access requests:           9
Number of access deny responses:     3
Number of access allow responses:    6

```

- Step 9** Use the **clear statistics EXEC** command to clear the statistics on the WAE:
- To clear all of the login authentication statistics, enter the **clear statistics authentication EXEC** command.
 - To clear only the statistics that are related to Windows domain authentication, enter the **clear statistics windows-domain EXEC** command.
 - To clear all of the statistics, enter the **clear statistics all EXEC** command.

Disabling LDAP Server Signing on a Client WAE

To disable LDAP server signing on a WAE, follow these steps:

- Step 1** Unregister the WAE from the Windows domain:

```
WAE# windows-domain diagnostics net "ads leave -U Administrator"
```

- Step 2** Disable user login authentication:

```
WAE# configure
WAE(config)# no authentication login windows-domain enable primary
```

- Step 3** Disable LDAP signing on the WAE:

```
WAE(config)# no smb-conf section "global" name "ldap ssl" value "start_tls"
```

Enabling Administrative Login Authentication and Authorization Schemes for WAAS Devices

This section describes how to centrally enable the various administrative login authentication and authorization schemes (the authentication configuration) for a WAAS device or device group.



Caution

Make sure that RADIUS, TACACS+, or Windows domain authentication is configured and operating correctly before disabling local authentication and authorization. If you disable local authentication and if RADIUS, TACACS+, or Windows domain authentication is not configured correctly, or if the RADIUS, TACACS+, or Windows domain server is not online, you may be unable to log in to the WAAS device.

By default, a WAAS device uses the local database to authenticate and authorize administrative login requests. The WAAS device verifies whether all authentication databases are disabled and if so, sets the system to the default state. For information on this default state, see the [“Default Administrative Login Authentication and Authorization Configuration”](#) section on page 6-4.



Note

You must configure the TACACS+, or RADIUS, or Windows server settings for the WAAS device (or device group) before you configure and submit these settings. See the [“Configuring TACACS+ Server Authentication Settings”](#) section on page 6-15, the [“Configuring RADIUS Server Authentication Settings”](#) section on page 6-13, and the [“Configuring Windows Domain Server Authentication Settings”](#) section on page 6-17 for information on how to configure these server settings on a WAAS device or device group.

By default, WAAS devices fail over to the secondary method of administrative login authentication whenever the primary administrative login authentication method fails. You change this default login authentication failover method through the WAAS Central Manager GUI, as follows:

- To change the default for a WAAS device, choose **My WAN > Manage Devices**. Click the **Edit** icon next to the name of the WAAS device for which you want to change the default login authentication failover method, and then choose **Admin > Authentication > Authentication Methods** from the navigation pane. Check the **Failover to next available authentication method** box in the displayed window and click **Submit**.
- To change the default for a device group, choose **My WAN > Manage Device Groups**. Click the **Edit** icon next to the name of the device group for which you want to change the default login authentication failover method, and then choose **Admin > Authentication > Authentication Methods** from the navigation pane. Check the **Failover to next available authentication method** box in the displayed window and click **Submit**.

After you enable the failover to next available authentication method option, the WAAS device (or the devices in the device group) queries the next authentication method only if the administrative login authentication server is unreachable, not if authentication fails for some other reason.



Note To use the login authentication failover feature, you must set TACACS+, RADIUS, or Windows domain as the primary login authentication method, and local as the secondary login authentication method.

If the failover to next available authentication method option is *enabled*, follow these guidelines:

- You can configure only two login authentication schemes (a primary and secondary scheme) on the WAAS device.
- Note that the WAAS device (or the devices in the device group) fails over from the primary authentication scheme to the secondary authentication scheme only if the specified authentication server is unreachable.
- Configure the local database scheme as the secondary scheme for both authentication and authorization (configuration).

For example, if the failover to next available authentication method option is *enabled* and RADIUS is set as the primary login authentication scheme and local is set as the secondary login authentication scheme, the following events occur:

1. When the WAAS device (or the devices in the device group) receives an administrative login request, it queries the external RADIUS authentication server.
2. One of the following occurs:
 - a. If the RADIUS server is reachable, the WAAS device (or the devices in the device group) uses this RADIUS database to authenticate the administrator.
 - b. If the RADIUS server is not reachable, the WAAS device (or the devices in the device group) tries the secondary authentication scheme (that is, it queries its local authentication database) to authenticate the administrator.



Note The local database is contacted for authentication only if this RADIUS server is not available. In any other situation (for example, if the authentication fails in the RADIUS server), the local database is not contacted for authentication.

Conversely, if the failover to next available authentication method option is *disabled*, then the WAAS device (or the devices in the device group) contacts the secondary authentication database regardless of the reason why the authentication failed with the primary authentication database.

If all the authentication databases are enabled for use, then all the databases are queried in the order of priority selected and based on the failover reason. If no failover reason is specified, then all the databases are queried in the order of their priority. For example, first the primary authentication database is queried, then the secondary authentication database is queried, then the tertiary database is queried, and finally the quaternary authentication database is queried.

To specify the login authentication and authorization scheme for a WAAS device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the name of the device (or the device group) that you want to configure.
 - Step 3** From the navigation pane, choose **Admin > Authentication > Authentication Methods**. The Authentication and Authorization Methods window appears. (See [Figure 6-7](#).)

Figure 6-7 Authentication and Authorization Methods Window

The screenshot shows the 'Authentication and Authorization Methods' configuration window in the Cisco WAAS Central Manager. The interface includes a navigation menu on the left with options like 'Admin', 'Authentication', and 'Authorization'. The main content area shows the configuration for device 'doc-waas-wae'. It features a 'Failover to next available authentication method' checkbox, an 'Authentication Login Methods' section with a 'Primary Login Method' dropdown set to 'local', and an 'Authorization Methods' section with a 'Primary Configuration Method' dropdown also set to 'local'. A note at the bottom states 'Note: * - Required Field'. The 'Submit' button is located at the bottom right of the configuration area.

Step 4 Check the **Failover to next available authentication method** check box to query the secondary authentication database only if the primary authentication server is unreachable.

To use this feature, you must set TACACS+, RADIUS, or Windows domain as the primary authentication method and local as a secondary authentication method. Make sure that you configure the local method as a secondary scheme for both authentication and authorization (configuration).

Step 5 Check the **Authentication Login Methods** check box to enable authentication privileges using the local, TACACS+, RADIUS, or WINDOWS databases.

Step 6 Specify the order of the login authentication methods that the chosen device or device group are to use:

- a. From the Primary Login Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the first method that the chosen device (or the device group) should use for administrative login authentication.
- b. From the Secondary Login Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the method that the chosen device (or the device group) should use for administrative login authentication if the primary method fails.
- c. From the Tertiary Login Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the method that the chosen device (or the device group) should use for administrative login authentication if both the primary and the secondary methods fail.
- d. From the Quaternary Login Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the method that the chosen device (or device group) should use for administrative login authentication if the primary, secondary, and tertiary methods all fail.

**Note**

We strongly recommend that you specify the local method as the last method in your prioritized list of login authentication and authorization methods. By adhering to this practice, the WAAS administrator will be able to still log in to a WAAS device (or the devices in the device groups) through the local authentication and authorization method if the specified external third-party servers (TACACS+, RADIUS, or Windows domain servers) are not reachable.

- Step 7** Check the **Authorization Methods** check box to enable authorization privileges using the local, TACACS+, RADIUS, or WINDOWS databases.

**Note**

Authorization privileges apply to console and Telnet connection attempts, secure FTP (SFTP) sessions, and Secure Shell (SSH, Version 1 and Version 2) sessions.

- Step 8** Specify the order of the login authorization (configuration) methods that the chosen device (or the device group) should use:

**Note**

We strongly recommend that you set the administrative login authentication and authorization methods in the same order. For example, configure the WAAS device (or device group) to use RADIUS as the primary login method, TACACS+ as the secondary login method, Windows as the tertiary method, and the local method as the quaternary method for both administrative login authentication and authorization.

- a. From the Primary Configuration Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the first method that the chosen device (or the device group) should use to determine authorization privileges.

**Note**

If you have checked the **Failover to next available authentication method** check box (Step 4), make sure that you choose **TACACS+ or RADIUS** from the Primary Configuration Method drop-down list to configure either the TACACS+ or RADIUS method as the primary scheme for authorization (configuration).

- b. From the Secondary Configuration Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the method that the chosen device (or the device group) should use to determine authorization privileges if the primary method fails.

**Note**

If you have checked the **Failover to next available authentication method** check box (Step 4), make sure that you choose **local** from the Secondary Configuration Method drop-down list to configure the local method as the secondary scheme for authorization (configuration).

- c. From the Tertiary Configuration Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the method that the chosen device (or the device group) should use to determine authorization privileges if both the primary and secondary methods fail.
- d. From the Quaternary Configuration Method drop-down list, choose **local**, **TACACS+**, **RADIUS**, or **WINDOWS**. This option specifies the method that the chosen device (or device group) should use to determine authorization privileges if the primary, secondary, and tertiary methods all fail.

- Step 9** Check the **Windows authentication for WAN Failure (Disconnected Mode)** check box to enable content request authentication in disconnected mode. Disconnected mode is available only if you are using WAFS legacy mode.

When this feature is enabled, the Windows domain server authenticates the content request in disconnected mode. By default, this feature is disabled on a WAE.

If you enable this feature, we recommend that you also disable automatic account password changes for the WAE. For more information, see the [“Disabling the Automatic Machine Account Password Changes for the Edge WAE”](#) section on page 6-22.



Note Windows authentication for disconnected mode operates only if you select NTLM as the shared secure authentication method in the Windows Domain settings window, as described in the [“Configuring Windows Domain Server Authentication Settings”](#) section on page 6-17.

- Step 10** Click **Submit** to save the settings.



Note If you have enabled the Windows authentication method, it takes about 15 seconds to activate it. Wait at least 15 seconds before checking Windows authentication status or performing any operation that requires Windows authentication.

To configure the login authentication and authorization scheme from the CLI, you can use the **authentication** global configuration command. Before you can enable Windows domain authentication or authorization for a device, the device must be registered with the Windows domain controller.

Configuring AAA Accounting for WAAS Devices

Accounting tracks all user actions and when the actions occurred. It can be used for an audit trail or for billing for connection time or resources used (bytes transferred). Accounting is disabled by default.

The WAAS accounting feature uses TACACS+ server logging. Accounting information is sent to the TACACS+ server only, not to the console or any other device. The syslog file on the WAAS device logs accounting events locally. The format of events stored in the syslog is different from the format of accounting messages.

The TACACS+ protocol allows effective communication of AAA information between WAAS devices and a central server. It uses TCP for reliable connections between clients and servers. WAAS devices send authentication and authorization requests, as well as accounting information to the TACACS+ server.



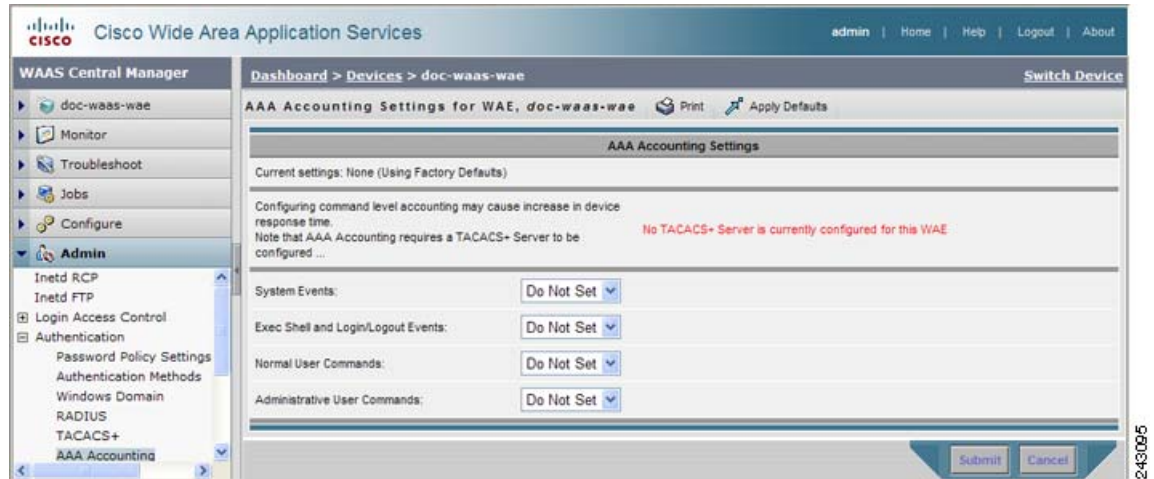
Note Before you can configure the AAA accounting settings for a WAAS device, you must first configure the TACACS+ server settings for the WAAS device. (See the [“Configuring TACACS+ Server Authentication Settings”](#) section on page 6-15.)

To centrally configure AAA accounting settings for a WAAS device or device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).

- Step 2** Click the **Edit** icon next to the name of the device (or the device group) that you want to configure.
- Step 3** In the navigation pane, choose **Admin > Authentication > AAA Accounting**. The AAA Accounting Settings window appears. (See [Figure 6-8](#).)

Figure 6-8 AAA Accounting Settings Window



- Step 4** From the System Events drop-down list, choose a keyword to specify when the chosen device (or the device group) should track system-level events that are not associated with users, such as reloads, and to activate accounting for system events.
- Step 5** From the Exec Shell and Login/Logout Events drop-down list, choose a keyword to specify when the chosen device (or the device group) should track EXEC shell and user login and logout events and to activate accounting for EXEC mode processes. Reports include username, date, start and stop times, and the WAAS device IP address.
- Step 6** From the Normal User Commands drop-down list, choose a keyword to specify when the chosen device (or the device group) should track all the commands at the normal user privilege level (privilege level 0) and to activate accounting for all commands at the non-superuser administrative (normal user) level.
- Step 7** From the Administrative User Commands drop-down list, choose a keyword to specify when the chosen device (or the device group) should track all commands at the superuser privilege level (privilege level 15) and to activate accounting for all commands at the superuser administrative user level.



Caution

Before using the **wait-start** option, ensure that the WAAS device is configured with the TACACS+ server and is able to successfully contact the server. If the WAAS device cannot contact a configured TACACS+ server, it might become unresponsive.

[Table 6-2](#) describes the event type options.

Table 6-2 Event Types for AAA Accounting

GUI Parameter	Function
Event Type Options	
stop-only	The WAAS device sends a stop record accounting notice at the end of the specified activity or event to the TACACS+ accounting server.

Table 6-2 *Event Types for AAA Accounting (continued)*

GUI Parameter	Function
start-stop	The WAAS device sends a start record accounting notice at the beginning of an event and a stop record at the end of the event to the TACACS+ accounting server. The start accounting record is sent in the background. The requested user service begins regardless of whether or not the start accounting record was acknowledged by the TACACS+ accounting server.
wait-start	The WAAS device sends both a start and a stop accounting record to the TACACS+ accounting server. However, the requested user service does not begin until the start accounting record is acknowledged. A stop accounting record is also sent.
Do Not Set	Accounting is disabled for the specified event.

Step 8 Click **Submit** to save the settings.

To configure AAA accounting settings from the CLI, you can use the **aaa accounting** global configuration command.

Viewing Audit Trail Logs

The WAAS Central Manager device logs user activity in the system. The only activities that are logged are those activities that change the WAAS network. For more information on viewing a record of user activity on your WAAS system, see the [“Viewing the Audit Trail Log”](#) section on page 16-36.



CHAPTER 7

Creating and Managing Administrator User Accounts and Groups

This chapter describes how to create user accounts and groups from the WAAS Central Manager GUI.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [Overview of Administrator User Accounts, page 7-1](#)
- [Creating and Managing User Accounts, page 7-2](#)

Overview of Administrator User Accounts

Your WAAS system comes with an administrator account already created that you can use to access the WAAS Central Manager GUI as well as the WAAS CLI. This account has a username of *admin* and a password of *default*. You can use the WAAS Central Manager GUI to change the password of this account.

If you want to create additional administrator user accounts, see [Table 7-1](#) for a description of the two types of accounts you can create from the WAAS Central Manager GUI.

Table 7-1 Account Type Descriptions

Account Type	Description
Roles-based account	<p>Allows you to create accounts that manage and configure specific WAAS services. For example, you may want to delegate the configuration of application acceleration to a specific administrator. In this case, you could create a roles-based account that only has access to the Acceleration pages in the WAAS Central Manager GUI.</p> <p>You can also create a roles-based account that only has access to the WAE Device Manager instead of the WAAS Central Manager GUI. And you can create a role-based account that also is a local user account.</p> <p>You create roles-based accounts from the Admin drawer in the WAAS Central Manager GUI.</p>
Local account	<p>Provides CLI access to WAE devices and optionally allows users to access the Print Services Administration GUI and the WAE Device Manager GUI. A user with this account type can log into the WAAS Central Manager but they have the access rights assigned to the default account, which initially has access to no GUI functionality.</p> <p>We recommend that you create a local account if there is an administrator that only needs CLI access to WAE devices or to the WAE Device Manager GUI.</p> <p>You create local accounts in the same way as roles-based accounts, but you check the Local User check box when creating the account.</p>

Creating and Managing User Accounts

This section contains the following topics:

- [Overview for Creating an Account, page 7-2](#)
- [Working with Accounts, page 7-3](#)
- [Working with Passwords, page 7-9](#)
- [Working with Roles, page 7-10](#)
- [Working with Domains, page 7-14](#)
- [Working with User Groups, page 7-17](#)

Overview for Creating an Account

[Table 7-2](#) provides an overview of the steps you must complete to create a new roles-based administrator account.

Table 7-2 Checklist for Creating a Roles-based Administrator Account

Task	Additional Information and Instructions
1. Create a new account.	Creates an account on the system with a specific username, password, and privilege level. For more information, see the “Creating a New Account” section on page 7-4 .

Table 7-2 Checklist for Creating a Roles-based Administrator Account (continued)

Task	Additional Information and Instructions
2. Create a role for the new account.	Creates a role that specifies the services that an account can configure in your WAAS network. For more information, see the “Creating a New Role” section on page 7-10 . If you are using an external authentication server, you can define matching user groups that automatically assign roles to users.
3. Assign the role to the new account.	Assigns the new role to the new account. For more information, see the “Assigning a Role to a User Account” section on page 7-12 . If you are using an external authentication server, you can define matching user groups that automatically assign roles to users.
4. Create a domain.	Creates a domain that will specify the WAEs or device groups that the new account can manage. For more information, see the “Creating a New Domain” section on page 7-14 .
5. Add an entity to the domain.	Adds one or more WAEs or device groups to the domain. For more information, see the “Adding an Entity to a Domain” section on page 7-15 .
6. Assign a domain to a user account.	Assigns the domain to the new user account. For more information, see the “Assigning a Domain to a User Account” section on page 7-15 . If you are using an external authentication server, you can define matching user groups that automatically assign domains to users.

Working with Accounts

When you create a user account, you enter information about the user such as the username, the name of the individual who owns the account, contact information, job title, and department. All user account information is stored in an internal database on the WAAS Central Manager.

Each user account can then be assigned to a role. A *role* defines which WAAS Central Manager GUI configuration pages the user can access and which services the user has authority to configure or modify. The WAAS Central Manager provides two predefined roles, known as the admin and print roles. The admin role has access to all services. The print role has access to all print related pages. A *domain* defines which entities in the network that the user can access and configure or modify. You can assign a user account to zero or more roles and to zero or more domains.

In addition to user accounts, you can create user groups if you are using external authentication of users on a TACACS+ or Windows domain server (not a RADIUS server). By creating user group names that match the user groups that you have defined on the external authentication server, WAAS can dynamically assign roles and domains to users based on their membership in a group as defined on the external authentication server. You do not need to define a role or domain for each user individually.

Two default user accounts are preconfigured in the WAAS Central Manager. The first account, called *admin*, is assigned the administrator role that allows access to all services and access to all entities in the system. This account cannot be deleted from the system, but it can be modified. Only the username and the role for this account are unchangeable. Only an account that has been assigned the admin role can create other admin-level accounts.

The second preconfigured user account is called *default*. Any user account that is authenticated but has not been registered in the WAAS Central Manager obtains the access rights (role) assigned to the default account. This account is configurable by an administrator, but it cannot be deleted nor its username changed. Initially, the default account has no access to GUI functionality because it has no roles defined, though it can log into the WAAS Central Manager GUI.

This section contains the following topics:

- [Creating a New Account, page 7-4](#)
- [Modifying and Deleting User Accounts, page 7-6](#)
- [Changing the Password for Your Own Account, page 7-7](#)
- [Changing the Password for Another Account, page 7-8](#)
- [Viewing User Accounts, page 7-8](#)
- [Unlocking User Accounts, page 7-8](#)

Creating a New Account

The first step in setting up an account is to create the account by specifying a username and selecting whether a local CLI account is created at the same time. After the account is created, you can assign roles to the account that determine the WAAS services and devices that the account can manage and configure.

[Table 7-3](#) describes the results of creating a local CLI user when setting up an account.

Table 7-3 Results of Creating a Local User

Action	Result
Creating a Local User	<ul style="list-style-type: none"> • The account can be used to access the WAAS CLI, WAAS Central Manager GUI (with the default role), and WAE Device Manager (if that option is selected). • Users can change their own passwords, and the password change will propagate to standby WAAS Central Managers. • The account is stored in the WAAS Central Manager database and is also propagated to the standby WAAS Central Managers.
Not Creating a Local User	<ul style="list-style-type: none"> • The user account is created in the primary and standby WAAS Central Manager management databases. • No user account is created in the CLI. Users will have to use another account to access the CLI. • The new account can be used to log in to the WAAS Central Manager GUI if an external authentication server is set. The user is assigned the roles defined for the default user (initially none). • Local users can change their passwords using the WAAS Central Manager GUI only if they have roles that allow access to the Admin > AAA section.



Note

If a user account has been created from the CLI only, when you log in to the WAAS Central Manager GUI for the first time, the Centralized Management System (CMS) automatically creates a user account (with the same username as configured in the CLI) with default authorization and access control. An account created from the CLI initially will be unable to access any configuration pages in the WAAS Central Manager GUI. You must use an admin account to give the account created from the CLI the roles that it needs to perform configuration tasks from the WAAS Central Manager GUI.

To create a new account, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users**.
The User Accounts window displays all the user accounts on the system.

Step 2 Click the **Create New User Accounts** icon.
The Creating New User Account window appears.



Note This window can be accessed only by users with administrator-level privileges.

Step 3 In the Username field, enter the user account name.
Usernames are case sensitive and support special characters.

Step 4 Complete the following steps to allow the user to access the WAE Device Manager GUI:

- a. Check the **WAE Device Manager User** check box.
- b. From the Device Manager Access drop-down list, choose one of the following options for Device Manager GUI access for this account:
 - **Read Only**—Limits this user to read only access to the Device Manager GUI.
 - **Read Write**—Allows this user to have read and write access to the Device Manager GUI.

Step 5 Complete the following steps to create a local CLI user account:

a. Check the **Local User** check box. See [Table 7-3 on page 7-4](#) for information about the benefits of creating a local CLI user. A local user is created on all WAE devices.



Note Do not create a local user that has a username identical to a username defined in an external authentication server that is authorizing access to the WAAS device.

b. In the Password field, enter a password for the local user account, and reenter the same password in the Confirm Password field. Passwords are case-sensitive, must be 1 to 34 characters in length, and cannot contain the characters ` ` ` | (apostrophe, double quote, or pipe) or any control characters.

c. From the CLI Privilege Level drop-down list, select one of the following options for the local user account:

- **0 (normal user)**—Limits the CLI commands this user can use to only user-level EXEC commands. This is the default value.
- **15 (super user)**—Allows this user to use privileged EXEC-level CLI commands.



Note The WAAS CLI EXEC mode is used for setting, viewing, and testing system operations. It is divided into two access levels: user and privileged. A local user who has “normal” privileges can only access the user-level EXEC CLI mode. A local user who has “superuser” privileges can access the privileged EXEC mode as well as all other modes (for example, configuration mode and interface mode) to perform any administrative task. For more information about the user-level and privileged EXEC modes and CLI commands, see the *Cisco Wide Area Application Services Command Reference*.

Step 6 Check the **Print Admin** check box to use this account to upload drivers to the central repository on the WAAS Central Manager and to access the Print Services Administration GUI.

For more information, see the “[Setting Up the WAAS Central Manager as the Driver Repository](#)” section on page 13-16 and the “[Using the Print Services Administration GUI](#)” section on page 13-27.

Note the following about the print admin account:

- This Print Admin checkbox is enabled only after you check the **Local User** check box.
- The print admin account must have a privilege level of 15 (super user) in order to use the account to upload drivers to the repository. If the print admin account has a privilege level of 0, it can be used only to access the Print Services Administration GUI.
- The print admin account does not have access to print related pages in the WAAS Central Manager unless it also has the print or admin roles assigned.
- You must assign a domain to the print admin account. All WAEs to which the user needs access should be members in the assigned domain.
- You cannot assign the print role to an externally authenticated user.

Step 7 (Optional) In the User Information fields, enter the following information about the user in the appropriate fields: first name, last name, phone number, e-mail address, job title, and department.

Step 8 (Optional) In the Comments field, enter any additional information about this account.

Step 9 Click **Submit**.

A Changes Submitted message appears at the bottom of the window.

Step 10 Assign roles to this new account as described in the [“Working with Roles”](#) section on page 7-10 and assign domains as described in the [“Working with Domains”](#) section on page 7-14.

Modifying and Deleting User Accounts



Note Modifying a user account from the CLI does not update the Centralized Management System (CMS) database.

To modify an existing user account, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users**.

The User Accounts window appears.

Step 2 Click the **Edit** icon next to the user account that you want to modify.

The Modifying User Account window appears. You can delete or edit user accounts as follows:



Note This window can only be accessed by users with administrator-level privileges.

- To delete the user account, click the **Delete** icon in the taskbar, and then click **OK** to confirm the deletion.

If the local user account was created using the WAAS Central Manager GUI, the corresponding user account is removed from the CLI and is also deleted from all standby WAAS Central Managers.



Note Deleting a user account from the CLI does *not* disable the corresponding user account in the CMS database. Consequently, the user account remains active in the CMS database. User accounts created in the WAAS Central Manager GUI should always be deleted from the WAAS Central Manager GUI.

- To edit the user account, make the necessary changes to the username and account information, and click **Submit**.

Changing the Password for Your Own Account

If you are logged in to the WAAS Central Manager GUI, you can change your own account password if you meet the following requirements:

- Your account and password were created in the WAAS Central Manager GUI and not in the CLI.
- You are authorized to access the password window.



Note We do not recommend changing the local CLI user password from the CLI. Any changes to local CLI user passwords from the CLI are not updated in the management database and are not propagated to the standby WAAS Central Manager. Therefore, passwords in the management database will not match a new password configured in the CLI.



Note The advantage of initially setting passwords from the WAAS Central Manager GUI is that both the primary and the standby WAAS Central Managers will be synchronized, and GUI users will not have to access the CLI to change their password.

To change the password for your own account, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > Password**.
The Changing Password for User Account window appears.
- Step 2** In the New Password field, enter the changed password. Passwords are case sensitive, must be 1 to 34 characters in length, and cannot contain the characters ` ` | (apostrophe, double quote, or pipe) or any control characters.
- Step 3** In the Confirm New Password field, reenter the password for confirmation.
- Step 4** Click **Submit**.
The message “Changes Submitted” appears at the bottom of the window confirming that your password has been changed.

When you change the password of an account by using the WAAS Central Manager GUI, it changes the password for all WAE devices managed by the Central Manager.

Changing the Password for Another Account

If you log into the WAAS Central Manager GUI using an account with admin privileges, you can change the password of any other account.

To change the password for another account, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users**.
A list of roles-based user accounts appears.
 - Step 2** Click the **Edit** icon next to the account that needs a new password. The Modifying User Account window appears.
 - Step 3** In the Password field, enter the changed password. Passwords are case-sensitive, must be 1 to 34 characters in length, and cannot contain the characters ` ` | (apostrophe, double quote, or pipe) or any control characters.
 - Step 4** In the Confirm Password field, reenter the password for confirmation.
 - Step 5** Click **Submit**.
The message “Changes Submitted” appears at the bottom of the window confirming that your password has been changed.
-

Viewing User Accounts

To view all user accounts, choose **Admin > AAA > Users** from the WAAS Central Manager GUI. The User Accounts window displays all the user accounts in the management database. From this window, you can also create new accounts as described in the [“Creating a New Account” section on page 7-4](#).

Unlocking User Accounts

When a user account is locked out, the user cannot log in to the WAAS device until an administrator unlocks the account. A user account will be locked out if the user unsuccessfully tries to log in three consecutive times

To unlock an account, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI, choose **System > AAA > Users**.
The User Accounts listing window appears and displays the status of each user account.



Note This window can only be accessed by users with administrator-level privileges.

- Step 2** Click the **Edit** icon next to the user account that you want to modify.
The Modifying User Account window appears and displays a list of devices on which this account is locked out.
- Step 3** Choose the device on which you want to unlock the account.
The list of device users appears.

Step 4 Choose the user or users to unlock, and click the **unlock** button.

Working with Passwords

The WAAS system features two levels of password policy: *standard* and *strong*. By default, the standard password policy is enabled.

To change the password policy, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group on which you want to change the password policy.
- Step 3** From the WAAS Central Manager GUI navigation pane, choose **Admin > Authentication > Password Policy Settings**.
- Step 4** Check the **Enforce stringent password** check box to enable the strong password policy.
- Step 5** Click **Submit** to save your changes.
-

To configure password policy from the CLI, use the **authentication strict-password-policy** global configuration command.

When the standard password policy is enabled, user passwords must meet the following requirements:

- The password must be 1 to 34 characters long.
- The password can include both uppercase and lowercase letters (A–Z and a–z) and numbers (0–9).
- The password cannot contain the characters ` ` | (apostrophe, double quote, or pipe) or any control characters.

When the strong password policy is enabled, user passwords must meet the following requirements:

- The password must be at least 11 characters long.
- The password can include both uppercase and lowercase letters (A–Z and a–z), numbers (0–9), and special characters including ~`!@#%\$%^&*()_+=[\] ; : , < / > .
- The password cannot contain the characters ` ` | (apostrophe, double quote, or pipe) or any control characters.
- The password cannot contain all the same characters (for example, **99999**).
- The password cannot contain consecutive characters (for example, **12345**).
- The password cannot be the same as the username.

User passwords expire within 90 days. Each new password must be different from the previous 12 passwords.

A user account will be locked out after three failed login attempts. The user remains locked-out until cleared by the administrator. To clear a locked-out account, see the [“Unlocking User Accounts” section on page 7-8](#).

Working with Roles

The WAAS Central Manager GUI allows you to create roles for your WAAS system administrators so that each administrator can focus on configuring and managing a specific WAAS service. For example, you can set up a role that allows an administrator to create and modify application policies but does not allow the administrator to make any other changes to the system.

You can think of a role as a set of enabled services. Make sure you have a clear idea of the services that you want the role to be responsible for because you will select these services when you create the role. Once you create the role, you can assign the role to existing accounts as described later in this chapter.

A role can give read and write or read-only access to each enabled service.

Each user account or group can be assigned to zero or more roles. Roles are not inherited or embedded. The WAAS Central Manager provides two predefined roles, known as the admin and print roles. The admin role has access to all services. The print role has access to all print related pages in the WAAS Central Manager.

WAAS can dynamically assign a role to users based on their membership in a group as defined on an external TACACS+ or Windows domain authentication server. To take advantage of this feature, you must define user group names on the WAAS Central Manager that match the user groups defined on the external authentication server and you must assign a role to the user groups on the WAAS Central Manager. For more information on user groups, see the “Working with User Groups” section on page 7-17.

This section contains the following topics:

- [Creating a New Role, page 7-10](#)
- [Assigning a Role to a User Account, page 7-12](#)
- [Modifying and Deleting Roles, page 7-13](#)
- [Viewing Role Settings, page 7-13](#)

Creating a New Role

To create a new role, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Roles**.

The Roles listing window appears.

Step 2 Click the **Create New Role** icon from the taskbar.

The Creating New Role window appears.

Step 3 In the Name field, enter the name of the role.

Step 4 Check the check box next to the services that you want this role to manage.

The check boxes in this window are tri-state check boxes. When there is a check in the box, it means that the user will have read and write access to the listed service. Click the check box again to change the indicator to a square partially filling the check box. This indicator means that the user will have read-only access to the service.

To expand the listing of services under a category, click the folder, and then check the check box next to the services that you want to enable for this role. To choose all the services under one category simultaneously, check the check box next to the top-level folder for those services.

[Table 7-4](#) lists the services that you can enable for a role.

Table 7-4 Description of the WAAS Services

Service	Description
Devices	Allows this role to configure and manage the settings in the My WAN drawer of the WAAS Central Manager GUI. If you do not want to enable the entire My WAN drawer, select the subpages that you want this role to manage.
Monitor	Allows this role to configure and manage the settings in the Monitor drawer of the WAAS Central Manager GUI. If you do not want to enable the entire Monitor drawer, select the subpages that you want this role to manage.
Report	Allows this role to configure and manage the settings in the Report drawer of the WAAS Central Manager GUI. If you do not want to enable the entire Report drawer, select the subpages that you want this role to manage.
Jobs	Allows this role to configure and manage the settings in the Jobs drawer of the WAAS Central Manager GUI. If you do not want to enable the entire Jobs drawer, select the subpages that you want this role to manage.
Configure	Allows this role to configure and manage the settings in the Configure drawer of the WAAS Central Manager GUI. If you do not want to enable the entire Configure drawer, select the subpages that you want this role to manage.
Admin	Allows this role to access the items in the Admin drawer of the WAAS Central Manager GUI. If you do not want to enable the entire Admin drawer, select the subpages that you want this role to manage.
All WAEs	<p>Allows this role to access all the WAEs in your WAAS network. If this service is not enabled, the user account will only have access to the WAEs associated with the domain that you assign to the account.</p> <p>Selecting this service allows you to skip the following tasks when setting up a roles-based account:</p> <ul style="list-style-type: none"> • Creating and maintaining a domain that contains all the WAEs in your network. • Assigning to the account the domain that contains all the WAEs.
All Device Groups	<p>Allows this role to access all the device groups in your WAAS network. If this service is not enabled, then the user account will only have access to the device groups associated with the domain that you assigned to the account.</p> <p>Selecting this service allows you to skip the following tasks when setting up a roles-based account:</p> <ul style="list-style-type: none"> • Creating and maintaining a domain that contains all the device groups in your network. • Assigning to the account the domain that contains all the device groups.

Table 7-4 Description of the WAAS Services (continued)

Service	Description
Monitoring API	Allows this role to access monitoring APIs through HTTPS requests. For more information, see the <i>Cisco Wide Area Application Services API Reference</i> .
System Status	Allows this role to access the device alarms window, My WAN > Alerts. For more information about device alarms, see Chapter 16, “Monitoring and Troubleshooting Your WAAS Network.”

Step 5 (Optional) Enter any comments about this role in the Comments field.

Step 6 Click **Submit** to save your settings.

Assigning a Role to a User Account

After you create a role, you need to assign the role to an account (or a user group). If you create an account but do not assign a role to the account, that account can log into the WAAS Central Manager GUI but no data will be displayed and the configuration pages will not be available.



Note

The admin user account, by default, is assigned to the role that allows access to all entities in the system. It is not possible to change the role for this user account.

To assign one or more roles to a user account group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users** (or **Admin > AAA > User Groups**).

The User Accounts (or User Groups) window appears with all configured user accounts listed.

Step 2 Click the **Edit** icon next to the user account or group for which you want to assign roles.

The Modifying User Account (or Modifying User Group) window appears.

Step 3 Click the **Role Management** tab.

The Role Management window appears with all configured role names listed.

Step 4 Click the **Assign** icon (blue cross mark) that appears next to the role name that you want to assign to the selected user account or group.

Step 5 Click the **Unassign** (green tick mark) next to the role name to unassign a previously assigned role.



Note

Click the **Assign all Roles** icon in the taskbar to assign all roles in the current window to a user account or group. Alternatively, click the **Remove all Roles** icon to unassign all roles associated with a user account or group.

Step 6 Click **Submit**.

A green tick mark appears next to the assigned roles and a blue cross mark appears next to the unassigned roles. The roles assigned to this user account or group will be listed in the Roles section in the Modifying User Account (or Modifying User Group) window.

Modifying and Deleting Roles



Note The admin user account, by default, is allowed access to all services and cannot be modified.

To modify or delete a role, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Roles**.
The Roles window appears.
- Step 2** Click the **Edit** icon next to the name of the role you want to change or delete.
The Modifying Role window appears. You can modify the role as follows:
- To delete this role, click the **Delete** icon in the taskbar.
 - To edit this role, make the necessary changes to the fields, and click **Submit**.
 - To enable a service for this role, check the check box next to the services that you want. To disable a previously selected service, uncheck the check box next to the service you want to disable. To choose all the services under one category simultaneously, check the check box next to the top-level service.
-

Viewing Role Settings

You might want to view role settings before assigning a role to a particular user account or group.

To view role settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users** (or **Admin > AAA > User Groups**).
The User Accounts (or User Groups) window appears with all configured user accounts or groups listed.
- Step 2** Click the **Edit** icon next to the user account or group that you want to view.
The Modifying User Account (or Modifying User Group) window appears.
- Step 3** Click the **Role Management** tab.
The Role Management window appears.
- Step 4** Click the **View** icon next to the role that you want to view.
The Viewing Role window appears, which displays the role name, comments about this role, and the services that are enabled for this role.
- Step 5** After you have finished viewing the settings, click **Close**.
-

Working with Domains

A *domain* is a collection of device groups or WAEs that make up the WAAS network. A role defines which services a user can manage in the WAAS network, but a domain defines the device groups, WAEs, or file server dynamic shares that are accessible by the user.

When you create a domain, you choose the type of entities that can be associated with the domain. Entity types include WAEs, device groups, or none (for file server dynamic shares). For file server dynamic shares, the dynamic shares are assigned in the dynamic shares configuration, as described in the [“Creating Dynamic Shares” section on page 11-20](#).

WAAS can dynamically assign a domain to a user based on their membership in a group as defined on an external TACACS+ or Windows domain authentication server. To take advantage of this feature, you must define user group names on the WAAS Central Manager that match the user groups defined on the external authentication server and you must assign a domain to the user groups on the WAAS Central Manager. For more information on user groups, see the [“Working with User Groups” section on page 7-17](#).

This section contains the following topics:

- [Creating a New Domain, page 7-14](#)
- [Adding an Entity to a Domain, page 7-15](#)
- [Assigning a Domain to a User Account, page 7-15](#)
- [Modifying and Deleting Domains, page 7-16](#)
- [Viewing Domains, page 7-16](#)

Creating a New Domain

To create a new domain, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Domains**.
The Domains listing window appears.
 - Step 2** Click the **Create New Domain** icon in the taskbar.
The Creating New Domain window appears.
 - Step 3** In the Name field, enter the name of the domain.
 - Step 4** From the Entity Type drop-down list, choose the entity type that you want to assign to the domain. Entity choices include WAEs, Device Groups, and None. Choose **None** if this domain is used for a file server dynamic share.
 - Step 5** (Optional) In the Comments field, enter any comments about this domain.
 - Step 6** Click **Submit**.
If the entity type you chose has not already been assigned to the domain, then a message indicating that the entity type has not been assigned appears.
 - Step 7** Assign an entity to this domain as described in the section that follows, [“Adding an Entity to a Domain”](#). If you chose None for the Entity Type, do not assign an entity to the domain, instead, the entity is used in a dynamic share configuration, as described in the [“Creating Dynamic Shares” section on page 11-20](#).
-

Adding an Entity to a Domain

Once you have created a domain, you can assign an entity to the domain. An entity is either a collection of WAEs or a collection of device groups. You do not need to assign an entity to a domain that is used for a file server dynamic share, where the entity type is None.

To add an entity to a domain, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Domains**.

Step 2 Click the **Edit** icon next to the domain that you want to modify.

Step 3 Click the **Entity Management** tab.

The *Entity_name* Assignments for Domain window for the current domain appears.

You can add or remove entities from the domain as follows:

- To add an entity to the current domain, click the **Assign** icon (blue cross mark) next to the entity that you want to add. A green tick mark appears next to the selected entity when you submit the settings. Alternatively, to add all entities to the selected domain, click the **Assign all** icon in the taskbar.
- To remove an entity from the current domain, click the **Unassign** icon (green tick mark) next to the name of the entity that you want to remove from the domain. A blue cross mark appears next to the unassigned entity after you submit the settings.

Alternatively, to remove all entities from the domain, click the **Remove all** icon in the taskbar.

Step 4 Click **Submit**.

Green check marks appear next to the entities that you assigned to the domain.

Step 5 Assign the domain to an account as described in the section that follows.

Assigning a Domain to a User Account

Assigning a domain to an account or group specifies the entities (devices or device groups) or file server dynamic shares that the account or group can manage.



Note

If the role that you assigned to an account or group has the All WAEs or All Device Groups service enabled, you do not need to assign a domain to the account or group. The account or group can automatically access all the WAEs and/or device groups in the WAAS system. For more information, see [Table 7-4 on page 7-11](#).

To assign a domain to a user account or group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users** (or **Admin > AAA > User Groups**).

The User Accounts (or User Groups) window appears with all configured user accounts or groups listed.

Step 2 Click the **Edit** icon next to the user account or group for which you want to assign domains.

The Modifying User Account (or Modifying User Group) window appears.

Step 3 Click the **Domain Management** tab.

The Domain Management window appears with all configured domains and their entity types listed.

Step 4 Click the **Assign** icon (blue cross mark) that appears next to the domain name that you want to assign to the selected user account or group.

To dissociate an already associated domain from the user account or group, click the **Unassign** (green tick mark) next to the domain name.



Note To assign all domains in the current window to a user account or group, click the **Assign all Domains** icon in the taskbar. Alternatively, to unassign all domains associated with a user account or group, click the **Remove all Domains** icon.

Step 5 Click **Submit**.

A green check mark appears next to the assigned domains, and a blue cross mark appears next to the unassigned domains. The domains assigned to a user account or group are listed in the Domains section in the Modifying User Account (or Modifying User Group) window.

Modifying and Deleting Domains

To modify or delete an existing domain, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Domains**.

The Domains window appears.

Step 2 Click the **Edit** icon next to the domain that you want to modify.

The Modifying Domain window appears. You can modify the domain as follows:

- To delete the domain, click the **Delete** icon in the taskbar and then click **OK** to confirm the deletion.
- To modify a domain, make the necessary changes to the fields and click **Submit**.

Viewing Domains

To view the domain configuration for a particular user account or group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users** (or **Admin > AAA > User Groups**).

The User Accounts (or User Groups) window appears with all configured user accounts or groups listed.

Step 2 Click the **Edit** icon next to the user account or group for which you want to view the domain configuration.

The Modifying User Account (or Modifying User Group) window appears.

Step 3 Click the **Domain Management** tab.

The Domain Management window appears.

Step 4 Click the **View** (eyeglass) icon next to the domain name to view details about the domain.

The Viewing Domain window appears and displays the domain name, entity type, comments about this domain, and entities assigned to this domain.

Step 5 After you have finished viewing the settings, click **Close**.

Working with User Groups

If you are using external authentication of users on TACACS+ or Windows domain servers (not RADIUS servers), you may want to create user groups. By creating user group names that match the user groups that you have defined on the external authentication server, WAAS can dynamically assign roles and domains to users based on their membership in a group as defined on the external authentication server. You do not need to define a role or domain for each user individually; instead, you define roles and domains for the user groups, and the user is assigned the roles and domains that are defined for the groups to which they belong.

WAAS reads group membership information for each user from the external authentication server.

This section contains the following topics:

- [Creating a New User Group, page 7-17](#)
- [Assigning Roles to a User Group, page 7-18](#)
- [Assigning Domains to a User Group, page 7-18](#)
- [Modifying and Deleting a User Group, page 7-19](#)
- [Viewing User Groups, page 7-19](#)

Creating a New User Group

To create a new user group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > User Groups**.

The User Groups listing window appears.

Step 2 Click the **Create New User Groups** icon in the taskbar.

The Creating New User Group window appears.

Step 3 In the Name field, enter the name of the user group.

Ensure that the name matches the name of a user group defined on the external authentication server that you are using. Name matching is case sensitive.



Note A user group name cannot consist solely of numbers, periods (.), or spaces. Any leading periods, asterisks (*), or spaces are cropped.

Step 4 (Optional) In the Comments field, enter any comments about this user group.

Step 5 Click **Submit**.

Step 6 Assign a role or domain to this user group as described in the sections that follow.

Assigning Roles to a User Group

After you create a user group, you need to assign a role to the group. If you create a user group but do not assign a role to the group, the users in that group can log into the WAAS Central Manager GUI but no data will be displayed and the configuration pages will not be available.

To assign one or more roles to a user group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > User Groups**.
The User Groups window appears with all configured user groups listed.
- Step 2** Click the **Edit** icon next to the user group for which you want to assign roles.
The Modifying User Group window appears.
- Step 3** Click the **Role Management** tab.
The Role Management for User Group window appears with all configured role names listed.
- Step 4** Click the **Assign** icon (blue cross mark) that appears next to the role name that you want to assign to the selected user group.
- Step 5** Click the **Unassign** (green tick mark) next to the role name to unassign a previously assigned user group role.



Note Click the **Assign all Roles** icon in the taskbar to assign all roles in the current window to a user group. Alternatively, click the **Remove all Roles** icon to unassign all roles associated with a user group.

- Step 6** Click **Submit**.
A green tick mark appears next to the assigned roles and a blue cross mark appears next to the unassigned roles. The roles assigned to this user group will be listed in the Roles section in the Modifying User Group window.
-

Assigning Domains to a User Group

Assigning a domain to a user group specifies the entities (devices or device groups) that the users who are members of the user group can manage.



Note If the role that you assigned to a user group has the All WAEs or All Device Groups service enabled, you do not need to assign a domain to the user group. The users in that group can automatically access all the WAEs and/or device groups in the WAAS system. For more information, see [Table 7-4 on page 7-11](#).

To assign a domain to a user group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > User Groups**.
The User Groups window appears with all configured user groups listed.
- Step 2** Click the **Edit** icon next to the user group for which you want to assign domains.
The Modifying User Group window appears.

Step 3 Choose the **Domain Management** tab.

The Domain Management for User Group window appears with all configured domains and their entity types listed.

Step 4 Click the **Assign** icon (blue cross mark) that appears next to the domain name that you want to assign to the selected user group.

To dissociate an already associated domain from the user group, click the **Unassign** (green tick mark) next to the domain name.



Note To assign all domains in the current window to a user group, click the **Assign all Domains** icon in the taskbar. Alternatively, to unassign all domains associated with a user group, click the **Remove all Domains** icon.

Step 5 Click **Submit**.

A green check mark appears next to the assigned domains, and a blue cross mark appears next to the unassigned domains. The domains assigned to a user group are listed in the Domains section in the Modifying User Group window.

Modifying and Deleting a User Group

To modify an existing user group, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > User Groups**.

The User Groups window appears.

Step 2 Click the **Edit** icon next to the user group that you want to modify.

The Modifying User Group window appears. You can delete or edit user groups as follows:



Note This window can be accessed only by users with administrator-level privileges.

- To delete the user group, click the **Delete** icon in the taskbar, and then click **OK** to confirm the deletion.
- To edit the user group, make the necessary changes to the name and comment information, and click **Submit**.
- To change the Roles assigned to the user group, click the **Role Management** tab, make the necessary changes to the roles, and click **Submit**.
- To change the Domains assigned to the user group, click the **Domain Management** tab, make the necessary changes to the domains, and click **Submit**.

Viewing User Groups

To view all user groups, choose **Admin > AAA > User Groups** from the WAAS Central Manager GUI. The User Groups window displays all the user groups in the management database. From this window, you can also create new groups as described in the [“Creating a New User Group”](#) section on page 7-17.



CHAPTER 8

Creating and Managing IP Access Control Lists for WAAS Devices

This chapter describes how to use the Wide Area Application Services (WAAS) Central Manager GUI to centrally create and manage Internet Protocol (IP) access control lists (ACLs) for your WAAS devices.

This chapter contains the following sections:

- [About IP ACLs for WAAS Devices, page 8-1](#)
- [Creating and Managing IP ACLs for WAAS Devices, page 8-3](#)
- [List of Extended IP ACL Conditions, page 8-8](#)



Note

Throughout this chapter, the term WAAS device is used to refer collectively to WAAS Central Managers and Wide Area Application Engine (WAEs) in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).



Note

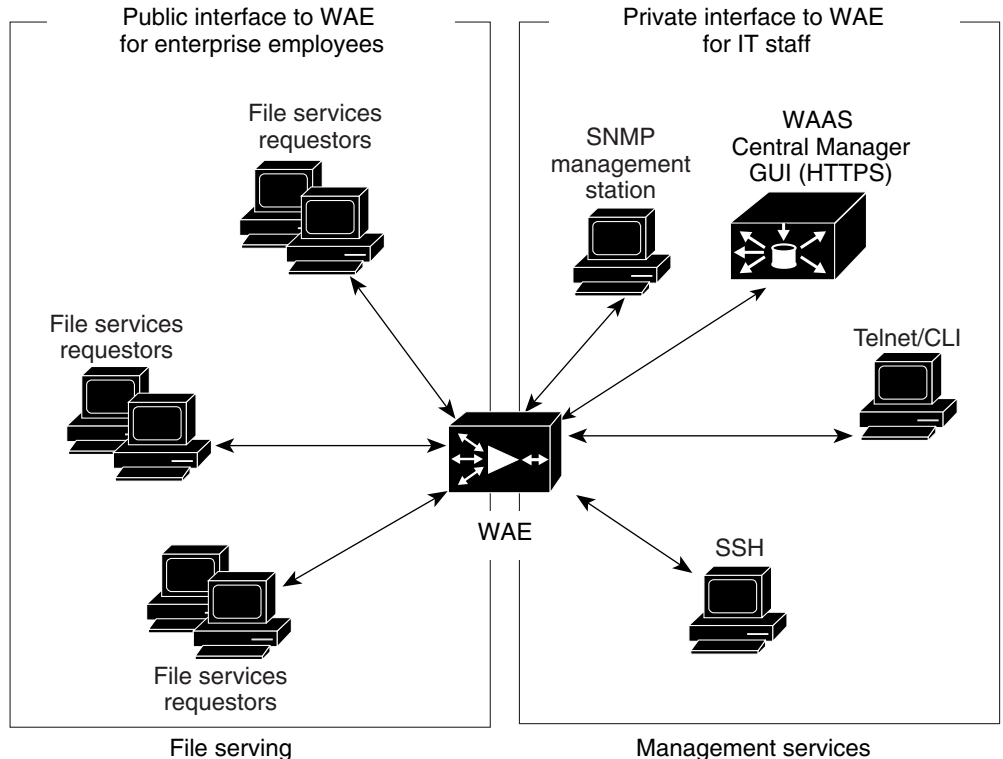
ACLs do not apply to the inline interfaces on a Cisco WAE Inline Network Adapter installed in a WAE.

About IP ACLs for WAAS Devices

In a centrally managed WAAS network environment, administrators need to be able to prevent unauthorized access to various devices and services. IP ACLs can filter packets by allowing you to permit or deny IP packets from crossing specified interfaces on a WAAS device. Packet filtering helps to control packet movement through the network. This control can help limit network traffic and restrict network use by specific users or devices.

The WAAS software also provides controls that allow various services to be tied to a particular interface. For example, you can use IP ACLs to define a public interface on the WAE for file serving and a private interface for management services, such as Telnet, Secure Shell (SSH), SNMP, HTTP, and software upgrades. (See [Figure 8-1](#).)

Figure 8-1 Example of How IP ACLs Are Used to Control Access to Specific Interfaces on a WAE



The WAAS software supports standard and extended ACLs that allow you to restrict access to or through a WAAS device. You can use IP ACLs to reduce the infiltration of hackers, worms, and viruses that can harm the corporate network.

The following examples illustrate how IP ACLs can be used in environments that have WAAS devices:

- A WAAS device resides on the customer premises and is managed by a service provider, and the service provider wants to secure the device for its management only.
- A WAAS device is deployed anywhere within the enterprise. As with routers and switches, the administrator wants to limit access to Telnet, SSH, and the WAAS Central Manager GUI to the IT source subnets.

To use ACLs, you must first configure ACLs and then apply them to specific services or interfaces on the WAAS device. The following are some examples of how IP ACLs can be used in various enterprise deployments:

- An application layer proxy firewall with a hardened outside interface has no ports exposed. (“Hardened” means that the interface carefully restricts which ports are available for access primarily for security reasons. Because the interface is outside, many types of attacks are possible.) The WAAS device’s outside address is globally accessible from the Internet, while its inside address is private. The inside interface has an ACL to limit Telnet, SSH, and GUI access.
- A WAE that is using WCCP is positioned on a subnet off the Internet router. Both the WAE and the router must have IP ACLs. IP access lists on routers have the highest priority followed by IP ACLs that are defined on the WAEs.

Precedence of IP ACLs and Application Definition Policies on WAEs

When the WAE is operating in pass-through mode, all traffic is still subject to IP ACLs that are configured on a WAE because these IP packets are processed by the WAE. The IP ACLs that are configured on the WAE should be used to define the policies that you want to be applied to a WAE's incoming traffic and that are addressed at the IP level.

IP ACLs that are configured on a WAE always take precedence over any WAAS application definition policies that are defined on a WAE. For example, you might define an extended IP ACL that has the following conditions on the WAE in the branch office:

- ip access-list extended DENY_10.56.65.21
- deny ip any host 10.56.65.21
- permit ip any

This extended IP ACL will be applied to the interface on the branch WAE as follows:

- Interface GigabitEthernet 1/0
- IP address 10.56.64.166 255.255.255.240
- IP access-group DENY_10.56.65.21 out

This interface is the only interface that is up and running on the branch WAE. In this case, it does not matter what application definition policies have been configured on this branch WAE because the branch WAE will drop all the TCP traffic from 10.56.65.21 at IP layer only and will not send the traffic any further (for example, the branch WAE will drop the traffic and not send the traffic to the WAE in the data center).

**Note**

We strongly recommend that you use the WAAS Central Manager GUI instead of the WAAS CLI to centrally configure and apply IP ACLs to your WAAS devices. For more information, see the [“Creating and Managing IP ACLs for WAAS Devices”](#) section on page 8-3.

Creating and Managing IP ACLs for WAAS Devices

This section provides guidelines and an example of how to use the WAAS Central Manager GUI to create and manage IP ACLs for your WAAS devices.

When you create an IP ACL, you should note the following important points:

- IP ACL names must be unique within the device.
- IP ACL names must be limited to 30 characters and contain no white space or special characters.
- Each WAAS Central Manager device can manage up to 50 IP ACLs and a total of 500 conditions per device.
- When the IP ACL name is numeric, numbers 1 through 99 denote standard IP ACLs and numbers 100 through 199 denote extended IP ACLs. IP ACL names that begin with a number cannot contain nonnumeric characters.
- The WAAS Central Manager GUI allows the association of standard IP ACLs with SNMP and WCCP. Any device that attempts to access one of these applications associated with an ACL must be on the list of trusted devices to be allowed access.
- You can associate any previously configured standard IP ACL with SNMP and WCCP; however, you can associate an extended IP ACL only with the WCCP application.

- You can delete an IP ACL, including all conditions and associations with network interfaces and applications, or you can delete only the IP ACL conditions. Deleting all conditions allows you to change the IP ACL type if you choose to do so. The IP ACL entry continues to appear in the IP ACL listing; however, it is in effect nonexistent.

To use the WAAS Central Manager GUI to create and modify an IP ACL for a single WAE, associate an IP ACL with an application, and then apply it to an interface on the WAE, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the name of the device (for example, a data center WAE named bd-s14) for which you want to create an IP ACL.
- Step 3** In the navigation pane, choose **Configure > Network > IP ACL**.
The IP ACL window appears. By default, there are no IP ACLs defined for a WAE. The IP ACL window indicates if there are currently no IP ACLs configured for the WAE.
- Step 4** In the taskbar, click the **Create a new IP ACL** icon.
The Creating New IP ACL window appears. Fill in the fields as follows:
- In the Name field, enter a name (for example, test1), observing the naming rules for IP ACLs. By default, this new IP ACL is created as a standard ACL.
- Note** IP ACL names must be unique within the device, must be limited to 30 characters, and cannot contain any white spaces or special characters.
- If you want to change this default setting and create this new ACL as an extended ACL, choose **Extended** from the ACL Type drop-down list.
- Step 5** Click **Submit** to save the IP ACL named test1. IP ACLs without any conditions defined do not appear on the individual devices.
- Step 6** Add conditions to the standard IP ACL named test1 that you just created:
- In the taskbar, click the **Create New Condition** icon.
The Creating New Condition window appears. (See [Figure 8-2](#).)



Note The number of available fields for creating IP ACL conditions depends on the type of IP ACL that you have created, either standard or extended.

Figure 8-2 Creating a New Condition for an Extended IP ACL Window

The screenshot shows the Cisco Wide Area Application Services (WAAS) Central Manager GUI. The main window is titled "Creating New Condition, of Standard IP ACL for WAE, doc-waas...". The "Condition" section contains the following fields:

- Purpose:** Permit (dropdown)
- Extended Type:** Generic (dropdown)
- Protocol:** IP (text input)
- Established:**
- Source IP:** 0.0.0.0 (text input)
- Source IP Wildcard:** 255.255.255.255 (text input)
- Source Port 1:** 0 (text input)
- Source Operator:** range (dropdown)
- Source Port 2:** 65535 (text input)
- Destination IP:** 0.0.0.0 (text input)
- Destination IP Wildcard:** 255.255.255.255 (text input)
- Destination Port 1:** 0 (text input)
- Destination Operator:** range (dropdown)
- Destination Port 2:** 65535 (text input)
- ICMP Param Type:** None (dropdown)
- ICMP Message:** administratively-prohibited (dropdown)
- ICMP Type:** 0 (text input)
- Use ICMP Code:**
- ICMP Code:** 0 (text input)

A note at the bottom states: "Note: * - Required Field". The "Submit" and "Cancel" buttons are located at the bottom right of the window.

- b. Enter values for the properties that are enabled for the type of IP ACL that you are creating, as follows:
 - To set up conditions for a standard IP ACL, go to [Step 7](#).
 - To set up conditions for an extended IP ACL, go to [Step 8](#).

Step 7 Set up conditions for a standard IP ACL:

- a. From the drop-down list, choose a purpose (**Permit** or **Deny**).
- b. In the Source IP field, enter the source IP address.
- c. In the Source IP Wildcard field, enter a source IP wildcard address.
- d. Click **Submit** to save the condition.

The Modifying IP ACL window reappears, displaying the condition and its configured parameters in tabular format.

- e. To add another condition to the IP ACL, repeat the steps.
- f. To reorder your list of conditions from the Modifying IP ACL window, use the Up or Down Arrows in the Move column, or click a column heading to sort by any configured parameter.



Note The order of the conditions listed in the WAAS Central Manager GUI becomes the order in which IP ACLs are applied to the device.

- g. When you have finished adding conditions to the IP ACL, and you are satisfied with all your entries and the order in which the conditions are listed, click **Submit** in the Modifying IP ACL window to commit the IP ACL to the device database.

A green “Change submitted” indicator appears in the lower right corner of the Modifying IP ACL window to indicate that the IP ACL is being submitted to the device database. [Table 8-1](#) describes the fields in a standard IP ACL.

Table 8-1 Standard IP ACL Conditions

Field	Default Value	Description
Purpose* ¹	Permit	Specifies whether a packet is to be passed (Permit) or dropped (Deny).
Source IP*	0.0.0.0	Number of the network or host from which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Source IP Wildcard*	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.

1. * = required field.

Step 8 Set up conditions for an extended IP ACL:

- a. From the drop-down list, choose a purpose (**Permit** or **Deny**).
- b. From the Extended Type drop-down list, choose **Generic**, **TCP**, **UDP**, or **ICMP**. (See [Table 8-2](#).)

Table 8-2 Extended IP ACL Conditions

Field	Default Value	Description
Purpose* ¹	Permit	Specifies whether a packet is to be passed or dropped. Choices are Permit or Deny.
Extended Type*	Generic	Specifies the Internet protocol to be applied to the condition. When selected, the GUI window refreshes with applicable field options enabled. The options are generic, TCP, UDP, or ICMP.

1. * = required field.

After you choose a type of extended IP ACL, various options become available in the GUI, depending on what type you choose.

- c. In the fields that are enabled for the chosen type, enter the data. (For more information, see [Table 8-4](#) through [Table 8-7](#).)
- d. Click **Submit** to save the condition.
The Modifying IP ACL window reappears, displaying the condition and its configured parameters in tabular format.
- e. To add another condition to the IP ACL, repeat the steps.
- f. To reorder your list of conditions from the Modifying IP ACL window, use the Up or Down Arrows in the Move column, or click a column heading to sort by any configured parameter.



Note The order of the conditions listed in the WAAS Central Manager GUI becomes the order in which IP ACLs are applied to the device.

- g. When you have finished adding conditions to the IP ACL, and you are satisfied with all your entries and the order in which the conditions are listed, click **Submit** in the Modifying IP ACL window to commit the IP ACL to the device database.

A green “Change submitted” indicator appears in the lower right corner of the Modifying IP ACL window to indicate that the IP ACL is being submitted to the device database.

- Step 9** Modify or delete an individual condition from an IP ACL:
- Click the **Edit** icon next to the name of the IP ACL that you want to modify. The Modifying IP ACL window appears, listing all the conditions that are currently applied to the IP ACL.
 - Click the **Edit Condition** icon next to the condition that you want to modify or delete. The Modifying Condition window appears.
 - To modify the condition, change any allowable field as necessary.
 - To delete the condition, click the **Trash (Delete IP ACL Condition)** icon in the taskbar.
 - To reorder your list of conditions, use the Up or Down arrows in the Move column, and click **Submit**.
- Step 10** Associate a standard IP ACL with SNMP or WCCP:
- Click the **Edit** icon next to the name of the device for which you want to associate a standard IP ACL with SNMP or WCCP.
 - In the navigation pane, choose **Configure > Network > IP ACL Feature Usage**. The IP ACL Feature Settings window appears.
 - From the drop-down lists, choose the name of an IP ACL for SNMP or WCCP. (For more details, see [Table 8-3](#).) If you do not want to associate an IP ACL with one of the applications, choose **Do Not Set**.

Table 8-3 IP ACL Feature Settings

WAAS Central Manager GUI Parameter	Function
SNMP	Associates a standard IP ACL with SNMP. This option is supported for WAAS devices that are operating as a WAE or a WAAS Central Manager device.
WCCP	Associates any IP ACL with WCCP Version 2. This option is only supported for WAAS devices that are operating as a WAE and not as a WAAS Central Manager device. WCCP is only supported on WAEs; it is not supported on a WAAS Central Manager device.

- Click **Submit** to save the settings.

- Step 11** Apply an IP ACL to an interface:
- Click the **Edit** icon next to the name of the device for which you want to apply an IP ACL to an interface on the WAE.
 - In the navigation pane, choose **Configure > Network > Network Interfaces**.
The Network Interfaces window for the device appears. This window displays all the interfaces available on that device.



Note The Port Type column may contain a port-channel interface indicating an EtherChannel configuration. EtherChannel for the WAAS software supports the grouping of up to four same-speed network interfaces into one virtual interface.

- c. Click the **Edit** icon next to the name of the interface to which you want to apply an IP ACL. The Modifying Network Interface window appears.
- d. Scroll to the bottom of the window. From the Inbound ACL drop-down list, choose the name of an IP ACL.
- e. From the Outbound ACL drop-down list, choose the name of an ACL.

The only network interface properties that can be altered from the WAAS Central Manager GUI are the inbound and outbound IP ACLs. All other property values are populated from the device database and are read-only in the WAAS Central Manager GUI.

Step 12 Click **Submit** to save the settings.

Step 13 (Optional) Delete an IP ACL:

- a. Click the **Edit** icon next to the name of the device that has the IP ACL that you want to delete.
- b. In the navigation pane, choose **Configure > Network > IP ACL**.
- c. Click the **Edit** icon next to the name of the IP ACL that you want to delete (for example, test1).
The Modifying IP ACL window appears. If you created conditions for the IP ACL, you have two options for deletion:
 - **Delete ACL**—Removes the IP ACL, including all conditions and associations with network interfaces and applications.
 - **Delete All Conditions**—Removes all the conditions, while preserving the IP ACL name.
- d. To delete the entire IP ACL, click the large **Trash (Delete ACL)** icon in the taskbar. You are prompted to confirm your action. Click **OK**. The record is deleted.
- e. To delete only the conditions, click the small **Delete All Conditions** Trash/List icon in the taskbar. When you are prompted to confirm your action, click **OK**. The window refreshes, conditions are deleted, and the ACL Type field becomes available.

To define an IP ACL from the CLI, you can use the **ip access-list** global configuration command, and to apply the IP ACL to an interface on the WAAS device, you can use the **ip access-group** interface configuration command. To configure the use of an IP ACL for SNMP, you can use the **snmp-server access-list** global configuration command. To specify an IP ACL that the WAE applies to the inbound WCCP GRE encapsulated traffic that it receives, you can use the **wccp access-list** global configuration command.

List of Extended IP ACL Conditions

When you define a condition for an extended IP ACL, you can specify the Internet protocol to be applied to the condition (as described in [Step 8](#) in the “[Creating and Managing IP ACLs for WAAS Devices](#)” section on page 8-3).

The list of extended IP ACL conditions are as follows:

- Generic (See [Table 8-4](#).)
- TCP (See [Table 8-5](#).)
- UDP (See [Table 8-6](#).)
- ICMP (See [Table 8-7](#).)

Table 8-4 *Extended IP ACL Generic Condition*

Field	Default Value	Description
Purpose* ¹	Permit	Specifies whether a packet is to be passed (Permit) or dropped (Deny).
Extended Type*	Generic	Matches any Internet protocol.
Protocol	ip	Internet protocol (gre , icmp , ip , tcp , or udp). To match any Internet protocol, use the keyword ip .
Source IP*	0.0.0.0	Number of the network or host from which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Source IP Wildcard*	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.
Destination IP	0.0.0.0	Number of the network or host to which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Destination IP Wildcard	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.

1. * = required field.

Table 8-5 *Extended IP ACL TCP Condition*

Field	Default Value	Description
Purpose* ¹	Permit	Specifies whether a packet is to be passed (Permit) or dropped (Deny).
Extended Type*	TCP	Matches the TCP Internet protocol.
Established	Unchecked (false)	When checked, a match with the ACL condition occurs if the TCP datagram has the ACK or RST bits set, indicating an established connection. Initial TCP datagrams used to form a connection are not matched.
Source IP*	0.0.0.0	Number of the network or host from which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Source IP Wildcard*	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.
Source Port 1	0	Decimal number or name of a TCP port. Valid port numbers are 0 to 65535. Valid TCP port names are as follows: ftp, ftp-data, https, mms, netbios-dgm, netbios-ns, netbios-ss, nfs, rtsp, ssh, telnet, and www.

Table 8-5 *Extended IP ACL TCP Condition (continued)*

Field	Default Value	Description
Source Operator	range	Specifies how to compare the source ports against incoming packets. Choices are <, >, ==, !=, or range.
Source Port 2	65535	Decimal number or name of a TCP port. See Source Port 1.
Destination IP	0.0.0.0	Number of the network or host to which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Destination IP Wildcard	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.
Destination Port 1	0	Decimal number or name of a TCP port. Valid port numbers are 0 to 65535. Valid TCP port names are as follows: ftp, ftp-data, https, mms, netbios-dgm, netbios-ns, netbios-ss, nfs, rtsp, ssh, telnet, and www.
Destination Operator	range	Specifies how to compare the destination ports against incoming packets. Choices are <, >, ==, !=, or range.
Destination Port 2	65535	Decimal number or name of a TCP port. See Destination Port 1.

1. * = required field.

Table 8-6 *Extended IP ACL UDP Condition*

Field	Default Value	Description
Purpose* ¹	Permit	Specifies whether a packet is to be passed (Permit) or dropped (Deny).
Extended Type*	UDP	Matches the UDP Internet protocol.
Established	—	Not available for UDP.
Source IP*	0.0.0.0	Number of the network or host from which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Source IP Wildcard*	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.
Source Port 1	0	Decimal number or name of a UDP port. Valid port numbers are 0 to 65535. Valid UDP port names are as follows: bootpc, bootps, domain, mms, netbios-dgm, netbios-ns, netbios-ss, nfs, ntp, snmp, snmptrap, tacacs, tftp, and wccp.
Source Operator	range	Specifies how to compare the source ports against incoming packets. Choices are <, >, ==, !=, or range.

Table 8-6 *Extended IP ACL UDP Condition (continued)*

Field	Default Value	Description
Source Port 2	65535	Decimal number or name of a UDP port. See Source Port 1.
Destination IP	0.0.0.0	Number of the network or host to which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Destination IP Wildcard	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.
Destination Port 1	0	Decimal number or name of a UDP port. Valid port numbers are 0 to 65535. Valid UDP port names are as follows: bootpc, bootps, domain, mms, netbios-dgm, netbios-ns, netbios-ss, nfs, ntp, snmp, snmptrap, tacacs, tftp, and wccp.
Destination Operator	range	Specifies how to compare the destination ports against incoming packets. Choices are <, >, ==, !=, or range.
Destination Port 2	65535	Decimal number or name of a UDP port. See Destination Port 1.

1. * = required field.

Table 8-7 *Extended IP ACL ICMP Condition*

Field	Default Value	Description
Purpose* ¹	Permit	Specifies whether a packet is to be passed (Permit) or dropped (Deny).
Extended Type*	ICMP	Matches the ICMP Internet protocol.
Source IP*	0.0.0.0	Number of the network or host from which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Source IP Wildcard*	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.
Destination IP	0.0.0.0	Number of the network or host to which the packet is being sent, specified as a 32-bit quantity in 4-part dotted decimal format.
Destination IP Wildcard	255.255.255.255	Wildcard bits to be applied to the source, specified as a 32-bit quantity in 4-part dotted decimal format. Place a 1 in the bit positions that you want to ignore and identify bits of interest with a 0.

Table 8-7 Extended IP ACL ICMP Condition (continued)

Field	Default Value	Description
ICMP Param Type*	None	Choices are None , Type/Code , or Msg . None —Disables the ICMP Type, Code, and Message fields. Type/Code —Allows ICMP messages to be filtered by ICMP message type and code. Also enables the ability to set an ICMP message code number. Msg —Allows a combination of type and code to be specified using a keyword. Activates the ICMP message drop-down list. Disables the ICMP Type field.
ICMP Message*	administratively-prohibited	Allows a combination of ICMP type and code to be specified using a keyword chosen from the drop-down list.
ICMP Type*	0	Number from 0 to 255. This field is enabled when you choose Type/Code .
Use ICMP Code*	Unchecked	When checked, enables the ICMP Code field.
ICMP Code*	0	Number from 0 to 255. Message code option that allows ICMP messages of a particular type to be further filtered by an ICMP message code.

1. * = required field.



CHAPTER 9

Configuring Other System Settings

This chapter describes how to perform other system tasks such as setting the system clock, modifying the default system configuration settings, and enabling alarm overload detection, after you have done a basic configuration of your WAAS device.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [Modifying Device Properties, page 9-1](#)
- [Managing Software Licenses, page 9-3](#)
- [Enabling the Inetd RCP Services, page 9-4](#)
- [Enabling the Inetd FTP Service, page 9-4](#)
- [Configuring Date and Time Settings, page 9-5](#)
- [Configuring Secure Store Settings, page 9-10](#)
- [Modifying the Default System Configuration Properties, page 9-16](#)
- [Configuring Faster Detection of Offline WAAS Devices, page 9-18](#)
- [Configuring Alarm Overload Detection, page 9-19](#)
- [Configuring the E-mail Notification Server, page 9-20](#)

Modifying Device Properties

The WAAS Central Manager GUI allows you to make the following changes to the properties of a WAE device:

- Rename the device
- Assign a new location to the device
- Assign an IP address to be used for management traffic to the device
- Deactivate or activate the device

You can also use the WAAS Central Manager GUI to check the status of a device to determine if it is online, pending, or inactive.

You can only rename a WAAS Central Manager device from the GUI.

To modify a device's properties, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.

Step 2 Click the **Edit** icon next to the device that you want to modify.

The Device Dashboard window appears.

Step 3 In the navigation pane, choose *Device Name* > **Activation**.

The Device Activation window appears with fields for editing the properties of the selected device.

For a WAAS Central Manager device, the only fields that you can change in this window are the name and NetBIOS name of the device. In addition, the device IP address and role are displayed.

Step 4 Under the General Configuration heading, set or modify the following device properties:

- To change the hostname of the device, enter a new name in the Name field. This name must conform to the following rules:
 - The name must use only alphanumeric characters and hyphens (-).
 - The first and last character must be a letter or a digit.
 - Maximum length is 30 characters.
 - Names are case insensitive.
 - The following characters are considered illegal and cannot be used when naming a device: @, #, \$, %, ^, &, *, (), |, \, /, <, >.

- To activate or deactivate the device, check or uncheck the **Activate** check box. When this box is checked, the device is activated for centralized management through the WAAS Central Manager GUI.

You can also click the **Deactivate** icon in the task bar to deactivate the device. Deactivating a device allows you to replace the device in the event of a hardware failure without losing all of its configuration settings.

- To change the NetBIOS name of the device, enter the new NetBIOS name for the device in the provided field.



Note If the WAE is operating in nontransparent mode and print services is enabled, you must configure identical names for the NetBIOS name and the hostname of the device that you enter in the Name field.

Step 5 Under the Locality heading, set or change the location by choosing a new location from the **Location** drop-down list. To create a new location for this device, see the [“Creating Locations” section on page 3-14](#).

Step 6 Under the NAT Configuration heading, configure the NAT settings using the following fields:

- Check the **Use WAE's primary IP Address** check box to enable the WAAS Central Manager to use the IP address configured on the primary interface of the device to communicate with devices in the WAAS network that are behind a NAT firewall.
- Allow the WAAS Central Manager to communicate with devices in the WAAS network that are behind the NAT firewall using an explicitly configured IP address, by entering the IP address of the device in the Management IP field. You also need to enter this address in scenarios where the

primary interface for a WAE is set to an inline group interface and management traffic is configured on a separate IP address (either on a secondary IP address on the same inline group interface or on a built-in interface).

- In the Port field, enter the port number for the management IP address.



Note If the WAAS Central Manager cannot contact a device using the primary IP address, it attempts to communicate using the Management IP address.

Step 7 In the Comments field, enter any comments that you want to appear for this device.

Step 8 Click **Submit**.

Managing Software Licenses

WAAS software version 4.1.1 introduces software licenses that enable specific WAAS optimization and acceleration features. A software license must be installed and configured before the features that it enables will operate.

[Table 9-1](#) lists the software licenses that may be purchased and the features that each license enables.

Table 9-1 WAAS Software Licenses

License	Description
Transport	Enables basic DRE, TFO, and LZ optimization. Cannot be configured if the Enterprise license is configured.
Enterprise	Enables the EPM, HTTP, MAPI, NFS, CIFS (WAFS), and Windows Print application accelerators, the WAAS Central Manager, and basic DRE, TFO, and LZ optimization. Cannot be configured if the Transport license is configured.
Video	Enables the video application accelerator. Requires the Enterprise license to be configured first.
Virtual-Blade	Enables the virtualization feature. Requires the Enterprise license to be configured first.

Licenses are installed and managed only on individual WAE devices, not device groups. Not all licenses are supported on all devices.

To add a license from the WAAS Central Manager, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.

Step 2 Click the **Edit** icon next to the device that you want to modify.

Step 3 In the navigation pane, choose **Admin > License Management**.

Step 4 Check the check box next to each license that you want to add.

Step 5 Click **Submit**.

To add licenses from the CLI, you can use the **license add EXEC** command.

To remove licenses from the CLI, you can use the **clear license EXEC** command.

To display the status of all licenses from the CLI, you can use the **show license EXEC** command.

The setup utility also configures licenses when you first set up a new WAAS device.

Enabling the Inetd RCP Services

Remote Copy Protocol (RCP) lets you download, upload, and copy configuration files between remote hosts and a switch. Unlike TFTP, which uses User Datagram Protocol (UDP), a connectionless protocol, RCP uses TCP, which is connection oriented. Inetd (an Internet daemon) is a program that listens for connection requests or messages for certain ports and starts server programs to perform the services associated with those ports. RCP copies files between devices.

RCP is a subset of the UNIX rshell service, which allows UNIX users to execute shell commands on remote UNIX systems. It is a UNIX built-in service. This service uses TCP as the transport protocol and listens for requests on TCP port 514. RCP service can be enabled on WAAS devices that use WAAS software.

To enable RCP services on a WAAS device, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group for which you want to enable RCP services.
 - Step 3** In the navigation pane, choose **Admin > Inetd RCP**. The Inetd RCP Settings window appears.
 - Step 4** Check the **Inetd Rcp Enable** check box. By default, this option is disabled.



Note The Inetd daemon listens for FTP, RCP, and TFTP services. For Inetd to listen to RCP requests, it must be explicitly enabled for RCP service.

- Step 5** Click **Submit** to save your changes.
A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking the Reset button. The Reset button is visible only when you have applied default or group settings to change the current device settings but you have not yet submitted the changes.

If you try to leave this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

Enabling the Inetd FTP Service

To enable the Inetd FTP service, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).

- Step 2** Click the **Edit** icon next to the device or device group on which you want to enable the Inetd FTP service.
- Step 3** From the navigation pane, choose **Admin > Inetd FTP**. The Inetd FTP Settings window appears.
- Step 4** Check the **Inetd Enable FTP Service** check box to enable Inetd FTP service on the device or device group. By default, this option is disabled.
- Step 5** Click **Submit** to save your changes.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking the Reset button. The Reset button is visible only when you have applied default or group settings to change the current device settings but you have not yet submitted the changes.

If you try to leave this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

Configuring Date and Time Settings

This section explains how to configure date and time settings for your WAAS network devices and contains the following topics:

- [Configuring NTP Settings, page 9-5](#)
- [Configuring Time Zone Settings, page 9-5](#)

Configuring NTP Settings

The WAAS Central Manager GUI allows you to configure the time and date settings using a Network Time Protocol (NTP) host on your network. NTP allows the synchronization of time and date settings for the different geographical locations of the devices in your WAAS network.

To configure NTP settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group that you want to configure.
- Step 3** From the navigation pane, choose **Configure > Date/Time > NTP**. The NTP Settings window appears.
- Step 4** Check the **Enable** check box to enable NTP settings. By default, this option is disabled.
- Step 5** In the NTP Server field, enter a hostname or IP address.
- Step 6** Click **Submit**.
-

Configuring Time Zone Settings

If you have an outside source on your network that provides time services (such as a Network Time Protocol [NTP] server), you do not need to set the system clock manually. When manually setting the clock, enter the local time.

**Note**

Two clocks exist in the system: the software clock and the hardware clock. The software uses the software clock. The hardware clock is used only at startup to initialize the software clock.

To configure the time zone on a device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group for which you want to configure the time zone.
- Step 3** In the navigation pane, choose **Configure > Date/Time > Time Zone**. The Time Zone Settings window appears.
- Step 4** To configure a standard time zone, follow these steps:
- Under the Time Zone Settings section, click the **Standard Time Zone** radio button. The default is UTC (offset = 0) with no summer time configured. When you configure a standard time zone, the system is automatically adjusted for the UTC offset, and the UTC offset need not be specified.
The standard convention for time zones uses a *Location/Area* format in which *Location* is a continent or a geographic region of the world and *Area* is a time zone region within that location.
 - From the drop-down list, choose a location for the time zone. (For an explanation of the abbreviations in this list, see [Table 9-2](#)).
The window refreshes, displaying all area time zones for the chosen location in the second drop-down list.
 - Choose an area for the time zone. The UTC offset is automatically set for standard time zones.
Summer time is built-in for some standard time zones (mostly time zones within the United States), and will result an automatic change in the UTC offset during summer time. For a list of standard time zones that can be configured and their UTC offsets, see [Table 9-3](#).
- Step 5** To configure a customized time zone on the device, follow these steps:
- Under the Time Zone Settings section, click the **Customized Time Zone** radio button.
 - In the Customized Time Zone field, specify the name of the time zone. The time zone entry is case-sensitive and can contain up to 40 characters including spaces. If you specify any of the standard time zone names, an error message is displayed when you click **Submit**.
 - For UTC Offset, choose the + or – sign from the first drop-down list to specify whether the configured time zone is ahead or behind UTC. Also, choose the number of hours (0–23) and minutes (0–59) offset from UTC for the customized time zone. The range for the UTC offset is from –23:59 to 23:59, and the default is 0:0.
- Step 6** To configure customized summer time, follow these steps under the Customized Summer Time Savings section.

**Note**

You can specify a customized summer time for both standard and customized time zones.

- To configure absolute summer time, click the **Absolute Dates** radio button.
You can configure a start date and end date for summer time in absolute dates or recurring dates. Absolute date settings apply only once and must be set every year. Recurring dates apply repeatedly for many years.

- b. In the Start Date and End Date fields, specify the month (January through December), day (1–31), and year (1993–2032) on which summer time must start and end in mm/dd/yyyy format. Make sure that the end date is always later than the start date.

Alternatively, click the **Calendar** icon next to the Start Date and End Date fields to display the Date Time Picker popup window. By default the current date is highlighted in yellow. In the Date Time Picker popup window, use the left or right arrow icons to choose the previous or following years, if required. Choose a month from the drop-down list. Click a day of the month. The chosen date is highlighted in blue. Click **Apply**. Alternatively, click **Set Today** to revert to the current day. The chosen date will be displayed in the Start Date and End Date fields.

- c. To configure recurring summer time, click the **Recurring Dates** radio button.
- d. From the Start Day drop-down list, choose a day of the week (**Monday–Sunday**) to start.
- e. From the Start Week drop-down list, choose an option (**first, 2nd, 3rd, or last**) to set the starting week. For example, choose **first** to configure summer time to recur beginning the first week of the month or **last** to configure summer time to recur beginning the last week of the month.
- f. From the Start Month drop-down list, choose a month (**January–December**) to start.
- g. From the End Day drop-down list, choose a day of the week (**Monday–Sunday**) to end.
- h. From the End Week drop-down list, choose an option (**first, 2nd, 3rd, or last**) to set the ending week. For example, choose **first** to configure summer time to end beginning the first week of the month or **last** to configure summer time to stop beginning the last week of the month.
- i. From the End Month drop-down list, choose a month (**January–December**) to end.

- Step 7** From the Start Time drop-down lists, choose the hour (0–23) and minute (0–59) at which daylight saving time should start. From the End Time drop-down lists, choose the hour (0–23) and minute (0–59) at which daylight saving time should end.

Start Time and End Time fields for summer time are the times of the day when the clock is changed to reflect summer time. By default, both start and end times are set at 00:00.

- Step 8** In the Offset field, specify the minutes offset from UTC (0–1439). (See [Table 9-3](#).)

The summer time offset specifies that the number of minutes that the system clock moves forward at the specified start time and backward at the end time.

- Step 9** Click the **No Customized Summer Time Configured** radio button to not specify a summer or daylight saving time for the corresponding time zone.

- Step 10** Click **Submit** to save the settings.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking the Reset button. The Reset button is visible only when you have applied default or group settings to change the current device settings but have not yet submitted the changes.

If you attempt to leave this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

Table 9-2 Timezone Location Abbreviations

Time Zone	Expansion
CET	Central European Time
CST6CDT	Central Standard/Daylight Time
EET	Eastern European Time

Table 9-2 *Timezone Location Abbreviations (continued)*

Time Zone	Expansion
EST	Eastern Standard Time
EST5EDT	Eastern Standard/Daylight Time
GB	Great Britain
GB-Eire	Great Britain/Ireland
GMT	Greenwich Mean Time
HST	Hawaiian Standard Time
MET	Middle European Time
MST	Mountain Standard Time
MST7MDT	Mountain Standard/Daylight Time
NZ	New Zealand
NZ-CHAT	New Zealand, Chatham Islands
PRC	People's Republic of China
PST8PDT	Pacific Standard/Daylight Time
ROC	Republic of China
ROK	Republic of Korea
UCT	Coordinated Universal Time
UTC	Coordinated Universal Time
WET	Western European Time
W-SU	Middle European Time

Table 9-3 *Timezone—Offset from UTC*

Time Zone	Offset from UTC (in hours)
Africa/Algiers	+1
Africa/Cairo	+2
Africa/Casablanca	0
Africa/Harare	+2
Africa/Johannesburg	+2
Africa/Nairobi	+3
America/Buenos_Aires	-3
America/Caracas	-4
America/Mexico_City	-6
America/Lima	-5
America/Santiago	-4
Atlantic/Azores	-1
Atlantic/Cape_Verde	-1
Asia/Almaty	+6
Asia/Baghdad	+3
Asia/Baku	+4
Asia/Bangkok	+7

Table 9-3 *Timezone—Offset from UTC (continued)*

Time Zone	Offset from UTC (in hours)
Asia/Colombo	+6
Asia/Dacca	+6
Asia/Hong_Kong	+8
Asia/Irkutsk	+8
Asia/Jerusalem	+2
Asia/Kabul	+4.30
Asia/Karachi	+5
Asia/Katmandu	+5.45
Asia/Krasnoyarsk	+7
Asia/Magadan	+11
Asia/Muscat	+4
Asia/New Delhi	+5.30
Asia/Rangoon	+6.30
Asia/Riyadh	+3
Asia/Seoul	+9
Asia/Singapore	+8
Asia/Taipei	+8
Asia/Tehran	+3.30
Asia/Vladivostok	+10
Asia/Yekaterinburg	+5
Asia/Yakutsk	+9
Australia/Adelaide	+9.30
Australia/Brisbane	+10
Australia/Darwin	+9.30
Australia/Hobart	+10
Australia/Perth	+8
Australia/Sydney	+10
Canada/Atlantic	-4
Canada/Newfoundland	-3.30
Canada/Saskatchewan	-6
Europe/Athens	+2
Europe/Berlin	+1
Europe/Bucharest	+2
Europe/Helsinki	+2
Europe/London	0
Europe/Moscow	+3
Europe/Paris	+1
Europe/Prague	+1
Europe/Warsaw	+1
Japan	+9

Table 9-3 *Timezone—Offset from UTC (continued)*

Time Zone	Offset from UTC (in hours)
Pacific/Auckland	+12
Pacific/Fiji	+12
Pacific/Guam	+10
Pacific/Kwajalein	-12
Pacific/Samoa	-11
US/Alaska	-9
US/Central	-6
US/Eastern	-5
US/East-Indiana	-5
US/Hawaii	-10
US/Mountain	-7
US/Pacific	-8

UTC was formerly known as Greenwich Mean Time (GMT). The offset time (number of hours ahead or behind UTC) as displayed in the table is in effect during winter time. During summer time or daylight saving time, the offset may be different from the values in the table and is calculated and displayed accordingly by the system clock.

Configuring Secure Store Settings

Secure store encryption provides stronger encryption and key management for your WAAS system. The WAAS Central Manager and WAE devices use secure store encryption for handling passwords, managing encryption keys, and for data encryption.

This section contains the following topics:

- [Secure Store Overview](#)
- [Enabling Secure Store Encryption on the Central Manager](#)
- [Enabling Secure Store Encryption on a Standby Central Manager](#)
- [Enabling Secure Store Encryption on a WAE Device](#)
- [Changing the Secure Store Encryption Key and Password](#)
- [Disabling Secure Store Encryption on a Central Manager or WAE Device](#)

Secure Store Overview

When you enable secure store encryption on the Central Manager or a WAE device, the WAAS system uses strong encryption algorithms and key management policies to protect certain data on the system. This data includes encryption keys used by applications in the WAAS system, CIFS passwords, and user login passwords.

To enable secure store encryption you must enter a password on the Central Manager. This password is used to generate the *key encryption key* according to secure standards. The WAAS system uses the key encryption key to encrypt and store other keys generated on the Central Manager or WAE devices. These other keys are used for WAAS functions including disk encryption or to encrypt and store WAFS user credentials.

When secure store is enabled on the Central Manager, the data is encrypted using a 256-bit key encryption key generated from the password you enter and using SHA1 hashing and an AES 256-bit algorithm. When secure store is enabled on a WAE device the data is encrypted using a 256-bit key encryption key generated using SecureRandom, a cryptographically strong pseudorandom number generator.

To implement secure store your system must meet the following requirements:

- You must have a Central Manager configured for use in your network.
- Your WAE devices must be registered with the Central Manager.
- Your WAE devices must be online (have an active connection) with the Central Manager. This requirement applies only if you are enabling secure store on WAE devices.
- All Central Managers and WAE devices must be running WAAS software version 4.0.19 or higher.

To implement strong store encryption, perform the following procedures:

-
- Step 1** Enable strong storage encryption on your primary Central Manager. See [Enabling Secure Store Encryption on the Central Manager](#).
- Step 2** Enable strong storage encryption on any standby Central Managers. See [Enabling Secure Store Encryption on a Standby Central Manager](#).
- Step 3** Enable strong storage encryption on WAE devices or WAE device groups. See [Enabling Secure Store Encryption on a WAE Device](#). (Secure store must be enabled on the Central Manager before you enable it on the WAE devices.)

You can enable secure store independently on the Central Manager and on the WAE devices. To ensure full protection of your encrypted data, enable secure store on both the Central Manager and the WAE devices. You must enable secure store on the Central Manager first.

**Note**

When you reboot the Central Manager, you must re-enable secure store encryption manually. Disk encryption and CIFS preposition features on the remote WAE devices will not operate properly until you enter the secure store password on the Central Manager to re-enable secure store encryption.

When secure store is enabled, the following system characteristics are affected:

- Passwords stored in the Central Manager database are encrypted using strong encryption techniques.
- If a primary Central Manager fails, secure store key management will be handled by the standby Central Manager. (Secure store mode must be enabled manually on the standby Central Manager.)
- CIFS prepositioning credentials are encrypted using the strong encryption key on the Central Manager and the WAE devices.
- Backup scripts will backup the secure store mode status of the device at the time of backup. Backup is supported only on the Central Manager.

- Restore scripts will verify if the backup file has secure store mode enabled. If the backup file is in secure store mode, you must enter the pass phrase to verify and restore the device. Restore is supported only on the Central Manager.
- When you enable secure store on a WAE device, the system initializes and retrieves a new encryption key from the Central Manager. The WAE uses this key to encrypt data such as CIFS prepositioning credentials and information on the disk (if disk encryption is also enabled).
- When you reboot the WAE after enabling secure store, the WAE retrieves the key from the Central Manager automatically, allowing normal access to the data that is stored in WAAS persistent storage.
- If secure store is active, you cannot downgrade to an earlier version of WAAS software that does not support secure store mode. You must disable secure store mode before installing the previous version of WAAS software.
- While secure store encrypts certain system information, it does not encrypt the data on the hard drives. To protect the data disks, you must enable disk encryption separately. See [Enabling Disk Encryption, page 15-26](#).

Enabling Secure Store Encryption on the Central Manager

To enable secure store encryption on the Central Manager, use the CLI to execute the **cms secure-store init** and **cms secure-store open EXEC** mode commands:

-
- Step 1** Enter the **cms secure-store init** command.
- The Central Manager responds with the “please enter pass phrase” message.
- Step 2** Type a password and press Enter. At the prompt, retype the password to confirm it.
- Secure store is initialized. However, data on the Central Manager is not yet encrypted with the secure store encryption. The system continues to use the previous encryption mode.
- Step 3** Enter the **cms secure-store open** command to activate secure store encryption.
- The Central Manager responds with the “please enter pass phrase” message.
- Step 4** Type the password and press Enter.
- The Central Manager encrypts the data using secure store encryption.
-



Note

Whenever you reboot the Central Manager, you must re-enable secure store encryption manually. Disk encryption and CIFS preposition features on the remote WAE devices will not operate properly until you enter the secure store password on the Central Manager to re-enable secure store encryption.



Note

When you enable secure store on the primary Central Manager, you should enable secure store on the standby Central Manager as well. See [Enabling Secure Store Encryption on a Standby Central Manager, page 9-13](#).

You can check the status of secure store encryption by entering the **show cms secure-store** command.

Enabling Secure Store Encryption on a Standby Central Manager

**Note**

A standby Central Manager provides limited encryption key management support. If the primary Central Manager fails the standby Central Manager provides only encryption key retrieval to the WAE devices, but does not provide new encryption key initialization. Do not enable disk encryption or secure store on WAE devices when the primary Central Manager is not available.

To enable secure store encryption on a standby Central Manager, first enable secure store on the primary Central Manager and then use the CLI to execute the **cms secure-store open** EXEC mode command on the standby Central Manager:

- Step 1** Enable secure store encryption on the primary Central Manager. See [Enabling Secure Store Encryption on the Central Manager, page 9-12](#).
- Step 2** Wait until the standby Central Manager replicates the data from the primary Central Manager. The replication should occur in 60 seconds (default) or as configured for your system.
- Step 3** Enter the **cms secure-store open** command on the standby Central Manager to activate secure store encryption. The standby Central Manager responds with the “please enter pass phrase” message.
- Step 4** Type the password and press Enter. The standby Central Manager encrypts the data using secure store encryption.

**Note**

Repeat steps 3 and 4 for each standby Central Manager on your system.

You can check the status of secure store encryption by entering the **show cms secure-store** command.

Enabling Secure Store Encryption on a WAE Device

To enable secure store encryption on a WAE device, follow these steps:

- Step 1** From the WAAS Central Manager GUI, choose **Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the Edit icon next to the device or device group for which you want to enable secure store.

**Note**

The secure store status must be the same for all WAE devices in a device group. Either all WAE devices in the group must have secure store enabled, or all must have secure store disabled. Before you add a WAE device to a device group, set its secure store status to match the others. See [Working with Device Groups, page 3-2](#).

- Step 3** From the navigation pane, choose **Configure > Security > Secure Store**. The Secure Store Settings window appears, as shown in [Figure 9-1](#).

Figure 9-1 Example of Secure Store Settings Window



Step 4 Check the **Initialize CMS Secure Store** box and the **Open CMS Secure Store** box.

Step 5 Click **Submit** to activate secure store encryption.

A new encryption key is initialized on the Central Manager, and the WAE encrypts the data using secure store encryption.

To enable secure store from the CLI, use the **cms secure-store init** EXEC command followed by the **cms secure-store open** command.

**Note**

If you have made any other CLI configuration changes on a WAE within the datafeed poll rate time interval (5 minutes by default) before executing the **cms secure-store** command, those prior configuration changes will be lost and you will need to redo them.

**Note**

When you enable or disable secure store on a device group, the changes do not take effect on all WAE devices simultaneously. When you view the WAE devices be sure to give the Central Manager enough time to update the status of each WAE device.

Changing the Secure Store Encryption Key and Password

The secure store encryption password is used by the Central Manager to generate the encryption key for the encrypted data. You can change the secure store encryption password and the encryption key using the CLI EXEC mode command **cms secure-store change**.

To change the password and generate a new encryption key on the Central Manager, do the following:

Step 1 Enter the **cms secure-store change** command.

The Central Manager responds with the “please enter pass phrase” message.

- Step 2** Type the new password and press Enter. At the prompt, retype the password to confirm it. The WAAS device re-encrypts the stored data using a new encryption key derived from the new password.
-

To generate a new encryption key for a WAE device use the WAAS Central Manager GUI and do the following:

- Step 1** From the WAAS Central Manager GUI, choose **Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the Edit icon next to the device or device group for which you want to generate a new encryption key.
- Step 3** From the navigation pane, choose **Configure > Security > Secure Store**.
- Step 4** Check the **Change CMS Secure Store** box and then click Submit.
- A new encryption key is generated in the Central Manager. The Central Manager replaces the encryption key in the WAE with the new key. The WAE re-encrypts the stored data using the new encryption key.
-

To configure the secure store encryption key from the CLI, use the **cms secure-store change** EXEC command.

Disabling Secure Store Encryption on a Central Manager or WAE Device

To disable secure store encryption on a Central Manager or WAE device, follow these steps:

- Step 1** From the WAAS Central Manager GUI, choose **Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the Edit icon next to the device or device group for which you want to disable secure store.
- Step 3** From the navigation pane, choose **Configure > Security > Secure Store**. The Secure Store Settings window appears, as shown in [Figure 9-1](#).
- Step 4** Check the **Clear CMS Secure Store** box and then click Submit to disable secure store encryption and return to standard encryption.

You can also enter the **cms secure-store clear** command to disable secure store encryption and return to standard encryption.

To disable secure store from the CLI, use the **cms secure-store clear** EXEC command.



Note When you disable secure store on the primary Central Manager, you should disable secure store on the standby Central manager as well.

Modifying the Default System Configuration Properties

The WAAS software comes with preconfigured system properties that you can modify to alter the default behavior of the system. To modify these properties, choose **Configure > System Properties** from the WAAS Central Manager GUI navigation pane.

Table 9-4 describes the system configuration properties that you can modify.

Table 9-4 Descriptions for System Configuration Properties

System Property	Description
cdm.remoteuser.deletionDaysLimit	Maximum number of days since their last login after which a remote user will be deleted from the WAAS Central Manager database. For example, if cdm.remoteuser.deletionDaysLimit is set to 5, a remote user will be deleted from the database if the difference between their last login time and the current time is more than 5 days. The default is 1 day. A remote user is a user that is defined in an external AAA server and not in the WAAS Central Manager.
cdm.session.timeout	Timeout in minutes of a WAAS Central Manager GUI session. The default is 10 minutes. If the session is idle for this length of time, the user is automatically logged out.
DeviceGroup.overlap	Status of whether a device can belong to more than one device group. The default is true (devices can belong to more than one device group).
System.datafeed.pollRate	Poll rate between a WAAS device and the WAAS Central Manager (in seconds). The default is 300 seconds.
System.device.recovery.key	Device identity recovery key. This property enables a device to be replaced by another node in the WAAS network.
System.guiServer.fqdn	Scheme to use (IP address or FQDN) to launch the Device Manager GUI.
System.healthmonitor.collectRate	Collect and send rate in seconds for the CMS device health (or status) monitor. If the rate is set to 0, the health monitor is disabled. The default is 120 seconds.
System.lcm.enable	Local and central management feature (enable or disable). This property allows settings that are configured using the local device CLI or the WAAS Central Manager GUI to be stored as part of the WAAS network configuration data. The default is true. If this property is set to false (disabled), configuration changes made on a local device will not be communicated to the Central Manager and configurations done in the Central Manager will overwrite local device configurations.
System.monitoring.collectRate	Rate at which a WAE collects and sends the monitoring report to the WAAS Central Manager (in seconds). The default is 300 seconds (5 minutes). Reducing this interval impacts the performance of the WAAS Central Manager device.
System.monitoring.dailyConsolidationHour	Hour at which the WAAS Central Manager consolidates hourly and daily monitoring records. The default is 1 (1:00 a.m.).
System.monitoring.enable	WAE statistics monitoring (enable or disable). The default is true.

Table 9-4 Descriptions for System Configuration Properties (continued)

System Property	Description
System.monitoring.maxReports	Maximum number of completed or failed report instances to store for each custom report. The default is 10 report instances.
System.monitoring.monthlyConsolidationFrequency	<p>How often (in days) the WAAS Central Manager consolidates daily monitoring records into monthly records. If this setting is set to 1, the WAAS Central Manager checks if consolidation needs to occur every day, but only performs consolidation if there is enough data for consolidation to occur. The default is 14 days.</p> <p>When a monthly data record is created, the corresponding daily records are removed from the database. Consolidation occurs only if there is at least two calendar months of data plus the consolidation frequency days of data. This ensures that the WAAS Central Manager always maintains daily data records for the past month and can display data on a day level granularity for the last week.</p> <p>For example, if data collection starts on February 2nd, 2006 and System.monitoring.monthlyConsolidationFrequency is set to 14, then the WAAS Central Manager checks if there is data for the past two calendar months on the following days: Feb 16th, March 2nd, March 16th, and March 30th. No consolidation will occur because there is not enough data on these days.</p> <p>On April 13th, however, two calendar months of data exists. The WAAS Central Manager then consolidates data for the month of February and deletes the daily data records for that month.</p>
System.monitoring.recordLimitDays	Maximum number of days of monitoring data to maintain in the system. The default is 1825 days.
System.print.driverFtpTimeout	Maximum number of seconds to wait for printer driver files to transfer by FTP. The range is 10 to 1800 seconds. The default is 600 seconds.
System.registration.autoActivation	Status of the automatic activation feature, which automatically activates WAE devices that are registered to the Central Manager. The default is true (devices are automatically registered).
System.rpc.timeout.syncGuiOperation	Timeout in seconds for the GUI synchronization operations for the Central Manager to WAE connection. The default is 50 seconds.

To view or modify the value of a system property, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > System Properties**. The Config Properties window appears.
 - Step 2** Click the **Edit** icon next to the system property that you want to change. The Modifying Config Property window appears.
 - Step 3** From a drop-down list, enter a new value or choose a new parameter, depending on the system property that you want to change.
 - Step 4** Click **Submit** to save the settings
-

Configuring Faster Detection of Offline WAAS Devices

You can detect offline WAAS devices more quickly if you enable the fast detection of offline devices. A WAAS device is declared as offline when it has failed to contact the WAAS Central Manager for a getUpdate (get configuration poll) request for at least two polling periods. (See the [“About Faster Detection of Offline Devices”](#) section on page 9-18 for more information about this feature.)

To configure fast detection of offline WAAS devices, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Fast Device Offline Detection**. The Configure Fast Offline Detection window appears.



Note The fast detection of offline devices feature is in effect only when the WAAS Central Manager receives the first UDP heartbeat packet and a getUpdate request from a device.

- Step 2** Check the **Enable** check box to enable the WAAS Central Manager to detect the offline status of devices quickly.
- Step 3** In the Heartbeat Rate (Seconds) field, specify how often devices should transmit a UDP heartbeat packet to the WAAS Central Manager. The default is 30 seconds.
- Step 4** In the Heartbeat Fail Count field, specify the number of UDP heartbeat packets that can be dropped during transmission from devices to the WAAS Central Manager before a device is declared offline. The default is 1.
- Step 5** In the Heartbeat UDP Port field, specify the port number using which devices will send UDP heartbeat packets to the primary WAAS Central Manager. The default is port 2000.

The Maximum Offline Detection Time field displays the product of the failed heartbeat count and heartbeat rate.

Maximum Offline Detection Time = Failed heartbeat count * Heartbeat rate

If you have not enabled the fast detection of offline devices feature, then the WAAS Central Manager waits for at least two polling periods to be contacted by the device for a getUpdate request before declaring the device to be offline. However, if you enable the fast detection of offline devices feature, then the WAAS Central Manager waits until the value displayed in the Maximum Offline Detection Time field is exceeded.

If the WAAS Central Manager receives the Cisco Discovery Protocol (CDP) from a device, then the WAAS Central Manager GUI displays the device as offline after a time period of 2* (heartbeat rate) * (failed heartbeat count).

- Step 6** Click **Submit**.
-

About Faster Detection of Offline Devices

Communication between the WAAS device and WAAS Central Manager using User Datagram Protocol (UDP) allows faster detection of devices that have gone offline. UDP heartbeat packets are sent at a specified interval from each device to the primary WAAS Central Manager in a WAAS network. The primary WAAS Central Manager tracks the last time that it received a UDP heartbeat packet from each device. If the WAAS Central Manager has not received the specified number of UDP packets, it displays

the status of the nonresponsive devices as offline. Because UDP heartbeats require less processing than a `getUpdate` request, they can be transmitted more frequently, and the WAAS Central Manager can detect offline devices much faster.

You can enable or disable this feature, specify the interval between two UDP packets, and configure the failed heartbeat count. Heartbeat packet rate is defined as the interval between two UDP packets. Using the specified heartbeat packet rate and failed heartbeat count values, the WAAS Central Manager GUI displays the resulting offline detection time as a product of heartbeat rate and failed heartbeat count. If the fast detection of offline devices is enabled, the WAAS Central Manager detects devices that are in network segments that do not support UDP and uses `getUpdate` (`get configuration poll`) request to detect offline devices.

By default, the feature to detect offline devices more quickly is not enabled.

Configuring Alarm Overload Detection

WAAS devices can track the rate of incoming alarms from the Node Health Manager. If the rate of incoming alarms exceeds the high-water mark (HWM), then the WAAS device enters an alarm overload state. This situation occurs when multiple applications raise alarms at the same time to report error conditions. When a WAAS device is in an alarm overload state, the following occurs:

- SNMP traps for subsequent alarm raise and clear operations are suspended. The trap for the raise alarm-overload alarm and the clear alarm-overload alarm are sent; however, traps related to alarm operations between the raise alarm-overload alarm and the clear alarm-overload alarm operations are suspended.
- Alarm overload raise and clear notifications are not blocked. The alarm overload state is communicated to SNMP and the Configuration Management System (CMS). However, in the alarm overload state, SNMP and the CMS are not notified of individual alarms. The information is only available by using the CLI.
- The WAAS device remains in an alarm overload state until the rate of incoming alarms decreases to the point that the alarm rate is less than the low-water mark (LWM).
- If the incoming alarm rate falls below the LWM, the WAAS device comes out of the alarm overload state and begins to report the alarm counts to SNMP and the CMS.

When the WAAS device is in an alarm overload state, the Node Health Manager continues to record the alarms being raised on the WAAS device and keeps a track of the incoming alarm rate. Alarms that have been raised on a WAAS device can be listed using the **show alarm** CLI commands that are described in the *Cisco Wide Area Application Services Command Reference*.

To configure alarm overload detection for a WAAS device (or device group), follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices (or Device Groups) window appears.
 - Step 2** Click the **Edit** icon next to the device (or device group) for which you want to configure the alarm overload state.
 - Step 3** In the navigation pane, choose **Configure > Network Monitoring > Alarm Overload Detection**. The Alarm Overload Detection Settings window appears.
 - Step 4** Uncheck the **Enable Alarm Overload Detection** check box if you do not want to configure the WAAS device (or device group) to suspend alarm raise and clear operations when multiple applications report error conditions. This check box is checked by default.

- Step 5** In the Alarm Overload Low Water Mark (Clear) field, enter the number of incoming alarms per second below which the WAAS device comes out of the alarm overload state.
- The low-water mark is the level up to which the number of alarms must drop before alarms can be restarted. The default value is 1. The low-water mark value should be less than the high-water mark value.
- Step 6** In the Alarm Overload High Water Mark (Raise) field, enter the number of incoming alarms per second above which the WAAS device enters the alarm overload state. The default value is 10.
- Step 7** Click **Submit** to save the settings.
-

To configure alarm overload detection from the CLI, you can use the **alarm overload-detect** global configuration command.

Configuring the E-mail Notification Server

You can schedule reports to be generated periodically, and when they are generated, a link to the report can be e-mailed to one or more recipients. (For details, see the [“Managing Reports” section on page 16-25.](#))

To enable email notification, you must configure email server settings for the WAAS Central Manager by following these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
- Step 2** Click the **Edit** icon next to the WAAS Central Manager device for which you want to configure the email server settings.
- Step 3** In the navigation pane, choose **Configure > Notifier > Email Notification Server**. The Configure Email Server Details window appears.
- Step 4** In the Mail Server Hostname field, enter the hostname of the email server that is to be used to send email.
- Step 5** In the Mail Server Port field, enter the port number. The default is port 25.
- Step 6** In the Server Username field, enter a valid email account username.
- Step 7** In the Server Password field, enter the password for the email account.
- Step 8** Click **Submit**.
-



CHAPTER 10

Using the WAE Device Manager GUI

This chapter describes how to use the WAE Device Manager GUI, which is a separate interface from the WAAS Central Manager GUI. The WAE Device Manager is a web-based management interface that allows you to control and monitor an individual WAE device in your network. The WAAS Central Manager device does not have a WAE Device Manager interface. In many cases, the same device settings are found in both the WAE Device Manager and the WAAS Central Manager GUI. For this reason, we recommend that you always configure device settings from the WAAS Central Manager GUI if possible.

When you change device settings in the WAE Device Manager, the changes are propagated to the WAAS Central Manager and override the group settings for that device. If you later decide that you want the group settings to override the settings that you configured from the WAE Device Manager, you can use the group override features in the WAAS Central Manager GUI. For more information, see the [“Overriding Group Configuration Settings”](#) section on page 3-8.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [Launching the WAE Device Manager, page 10-1](#)
- [A Quick Tour of the WAE Device Manager, page 10-2](#)
- [WAE Management Workflow, page 10-3](#)
- [Managing a Cisco WAE, page 10-4](#)
- [Managing a CIFS Accelerator Device, page 10-19](#)
- [Managing a WAFS Core Device, page 10-22](#)
- [Managing a WAFS Edge Device, page 10-22](#)
- [Monitoring the WAE, page 10-23](#)
- [Viewing WAE Logs, page 10-31](#)

Launching the WAE Device Manager

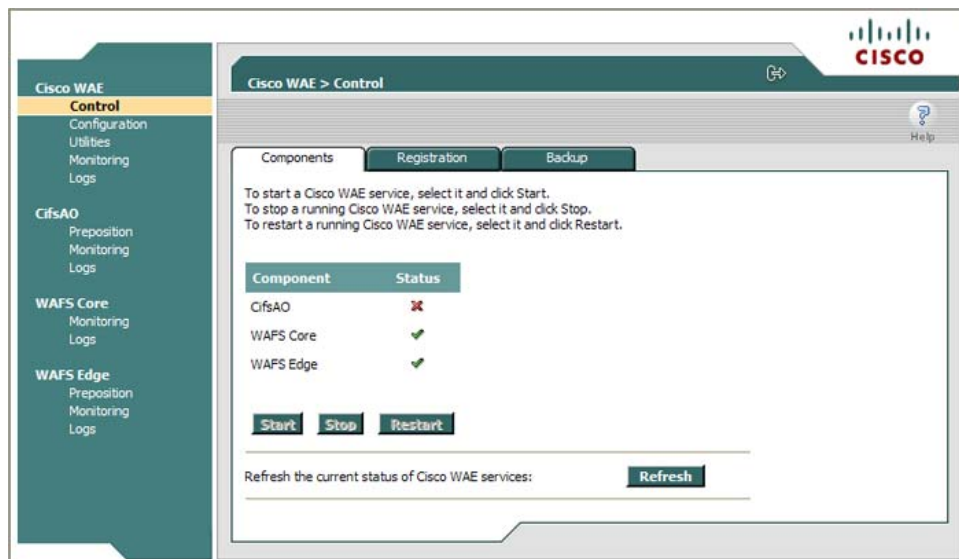
Each WAAS device is managed separately using the WAE Device Manager web-based interface. You can launch the WAE Device Manager remotely from any location on the WAAS network using Internet Explorer.

To launch the WAE Device Manager, use one of the following methods:

- Go to `https://Device_IP_Address:8443/mgr`
The Login window of the WAE Device Manager appears. Enter your username and password in the fields provided and click **Login**. The default username is admin and the default password is default.
- From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**, click the **Edit** icon next to the device that you want to manage, and click the **Device GUI** button at the bottom of the window.

The WAE Device Manager interface appears. (See [Figure 10-1](#).)

Figure 10-1 WAE Device Manager Interface



A Quick Tour of the WAE Device Manager

The WAE Device Manager is divided into two sections. The area on the left displays the navigation area. The area on the right displays information about the options that you have selected from the navigation area.

The navigation area allows you to navigate the management screens for different WAE components. The navigation area includes the following options:

- **Cisco WAE**—Allows you to start and stop the WAE components, register and unregister the WAE, back up and restore configuration files, and use various WAE utilities. For more information, see the [“Managing a Cisco WAE”](#) section on page 10-4.
- **CifsAO**—Allows you to monitor preposition tasks, view WAFS device statistics, and view the log. For more information, see the [“Managing a CIFS Accelerator Device”](#) section on page 10-19.

The CifsAO option only appears if you have enabled the transparent CIFS accelerator on this WAAS device. For more information, see the [“Enabling and Disabling the Global Optimization Features”](#) section on page 12-2.

- **WAFS Core**—Allows you to monitor WAFS Core statistics and view log information. For more information, see the [“Managing a WAFS Core Device”](#) section on page 10-22.

The WAFS Core option only appears if you have configured this WAAS device as a core device in legacy WAFS mode. For more information, see [Chapter 11, “Configuring Wide Area File Services.”](#)

- WAFS Edge—Allows you to monitor preposition tasks, monitor WAFS Edge statistics, and view log information. For more information, see the [“Managing a WAFS Edge Device” section on page 10-22.](#)

The WAFS Edge option appears only if you have configured this WAAS device as an edge device in legacy WAFS mode. For more information, see [Chapter 11, “Configuring Wide Area File Services.”](#)

The options in the navigation area include suboptions, which when selected, display additional tabs in the display area. Mandatory fields in the display area are indicated with an asterisk. If you click **Save** without entering a value in a mandatory field, an error message is displayed. Click the **Back** link to return to the window where the error occurred.

Information displayed in tables can be sorted by clicking the column headers. Clicking the header a second time sorts the information in reverse order.

As you navigate in the WAE Device Manager, your current location is always displayed across the top of the display area.

To log out of the WAE Device Manager, click the  icon on the upper-right side of the display area.

**Note**

JavaScripts, cookies, and popup windows must be enabled in the web browser to use the WAE Device Manager.

WAE Management Workflow

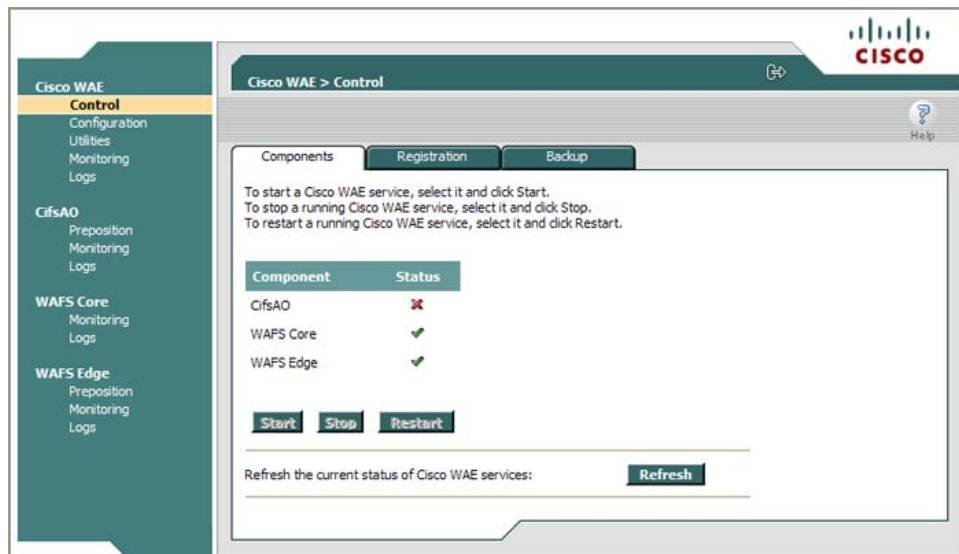
After WAEs have been deployed and registered (as described in the *Cisco Wide Area Application Services Quick Configuration Guide*), use the WAE Device Manager to perform the following actions:

- Start and stop components as described in the [“Starting and Stopping Components” section on page 10-5.](#)
- Register and unregister the WAE as described in the [“Registering and Unregistering a WAE” section on page 10-6.](#)
- Back up and restore configuration files as described in the [“Backing Up the Configuration Files” section on page 10-7.](#)
- Configure Windows authentication as described in the [“Configuring Windows Authentication” section on page 10-10.](#)
- Define component-specific notification recipients as described in the [“Defining Notification Settings” section on page 10-15.](#)
- Run WAE maintenance utilities as described in the [“Utilities Option” section on page 10-17.](#)
- View the details, current status, and history of preposition tasks performed on WAFS devices as described in the [“Preposition Option” section on page 10-19.](#)
- View SNMP-generated information and graphs about each WAE component as described in the [“Monitoring the WAE” section on page 10-23.](#)
- View the logs for each WAE component as described in the [“Viewing WAE Logs” section on page 10-31.](#)

Managing a Cisco WAE

You use the Cisco WAE menu item in the navigation area to perform basic operations such as viewing the status of WAE components and stop or start components on the WAE. Figure 10-2 shows the Cisco WAE Control window.

Figure 10-2 Cisco WAE Control Window



The Cisco WAE menu item includes the following options:

- **Control**—Enables you to control the WAE and its components as described in the “[Control Option](#)” section on page 10-4.
- **Configuration**—Enables you to perform basic configuration tasks as described in the “[Configuration Option](#)” section on page 10-8.
- **Utilities**—Enables you to run various maintenance utilities on the WAE as described in the “[Utilities Option](#)” section on page 10-17.
- **Monitoring**—Enables you to view tables and graphs about the CPU and disk utilization in the WAE as described in the “[Monitoring the WAE](#)” section on page 10-23.
- **Logs**—Enables you to view event logs for various WAE subsystems as described in the “[Viewing WAE Logs](#)” section on page 10-31.

Control Option

The Control option displays the following tabs:

- **Components**—Enables you to view the working status of each WAE component. You can start, stop, and restart any component. For more information, see the “[Starting and Stopping Components](#)” section on page 10-5.
- **Registration**—Enables you to register or unregister the WAE with the WAAS Central Manager. For more information, see the “[Registering and Unregistering a WAE](#)” section on page 10-6.

- Backup—Enables you to download and save WAE configuration files and to restore these files back to the WAE, if required. For more information, see the “[Backing Up the Configuration Files](#)” section on page 10-7 and the “[Restoring the Configuration Files](#)” section on page 10-7.

Starting and Stopping Components

The Components tab enables you to view which components are running and which components are not, and allows you to start, stop, and restart components.

From this tab you can click **Refresh** to update the status of each component and update the WAE Device Manager interface to reflect recent changes made to the device from the WAAS Central Manager GUI. For example, if the device is configured to be a transparent CIFS accelerator device while you are logged into the WAE Device Manager, that change is not reflected until you either click **Refresh** or log in again to the WAE Device Manager.



Note

If a component is not running, most of its configuration can be performed offline. However, any configuration changes made to the component will take effect only after it is restarted.



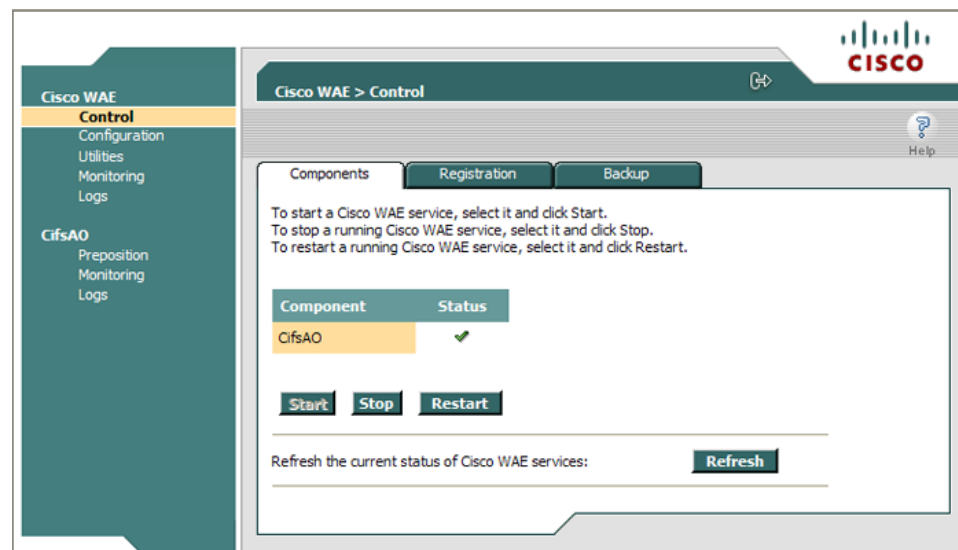
Note

Do not stop or start a component if the device is not registered to a WAAS Central Manager.

To start and stop components, follow these steps:

- Step 1** In the Components tab of the Cisco WAE Control window, choose the component that you want to activate and click **Start**.
- After a few seconds, a green checkmark ✓ appears next to the selected component, indicating its status is running, as shown in [Figure 10-3](#).

Figure 10-3 Components Tab—Starting Components



- To stop a component, choose the component from the list and click **Stop**.

After a few seconds, a red **X** appears next to the selected component, indicating that it is no longer running.

- To restart a WAE component, choose the component from the list and click **Restart**.
- To display the current status of the WAE components, click **Refresh**.

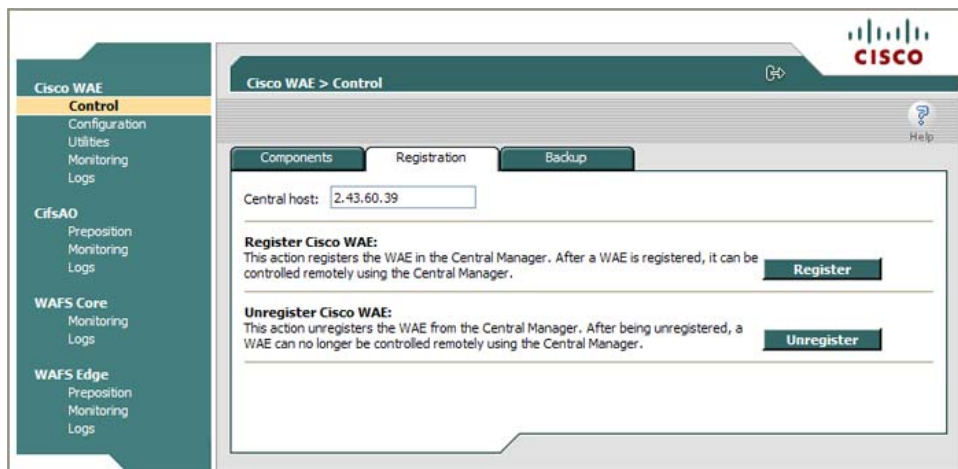
Registering and Unregistering a WAE

The Registration tab enables you to register the WAE with the specified WAAS Central Manager or unregister the WAE. After the WAE is registered, you can view and manage it from the WAAS Central Manager GUI.

To register the WAE, follow these steps:

- Step 1** In the Cisco WAE Control window, click the **Registration** tab. (See [Figure 10-4](#).)

Figure 10-4 Cisco WAE Control — Registration Tab



- Step 2** In the Central Host field, verify that the address of the WAAS Central Manager is displayed. If no address appears in this field, then the WAE is not registered with a Central Manager.

- Step 3** Click **Register** to register the WAE.

The “Registration will update the WAE properties in the WAAS Central Manager. Are you sure?” message is displayed. Click **OK**. If successful, the “Appliance registered successfully” message is displayed.

- Step 4** Click **Unregister** to unregister the Cisco WAE.

If successful, the “Appliance unregistered successfully” message is displayed.



Note When you unregister a WAE, any policies defined for it in the WAAS Central Manager GUI are removed.

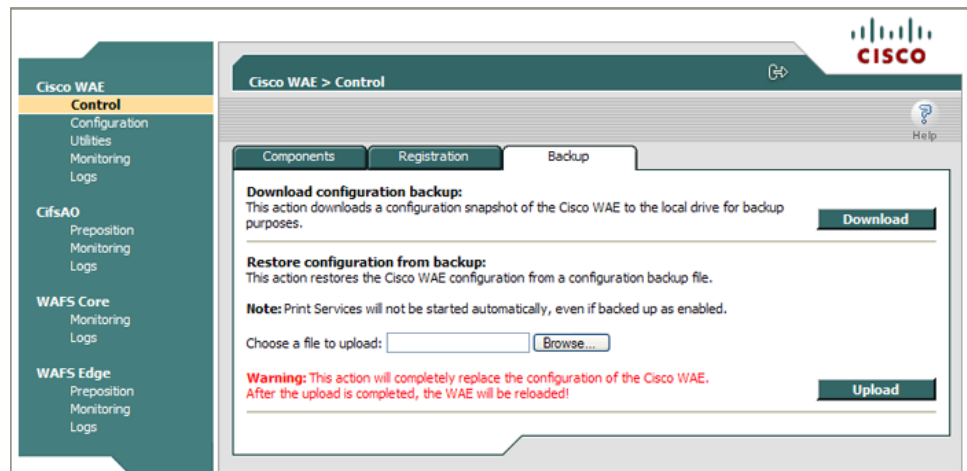
Backing Up the Configuration Files

The Backup tab enables you to back up and restore the configuration files of the WAE.

To back up the WAE configuration, follow these steps:

- Step 1** In the Cisco WAE Control window, click the **Backup** tab. (See [Figure 10-5](#).)

Figure 10-5 Cisco WAE Control —Backup Tab



- Step 2** In the Download configuration backup area, click **Download**.
- Step 3** In the File Download window, click **Save**.
- Step 4** In the Save As window, browse to where you want to save the file. You can also change the filename.
- Step 5** Click **Save**.

The WAE configuration files are downloaded to the selected destination folder and stored in a single, compressed file.

For information about restoring files from a backup, see the [“Restoring the Configuration Files”](#) section on page 10-7.

Restoring the Configuration Files

The Backup tab enables you to restore the configuration files of the WAE. Restoring the configuration returns the WAE to its previous state when the backup was performed.

To restore the configuration files, follow these steps:

- Step 1** In the Restore configuration from backup area, click **Browse** to navigate to the location of the backup file that you want to restore.
- Step 2** Click **Upload** to restore the selected configuration files.



Note After the upload is completed, the WAE will be reloaded.

Configuration Option

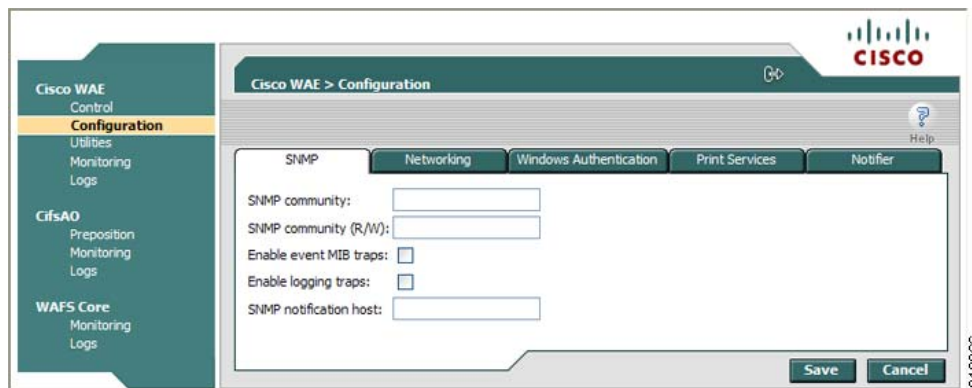
The Configuration option for the Cisco WAE menu item displays the following tabs:

- **SNMP**—Allows you to enable event MIB and logging traps on the WAE. For more information, see the “[Configuring SNMP Settings](#)” section on page 10-8.
- **Networking**—Allows you to view WAE settings defined during initial device setup described in the *Cisco Wide Area Application Services Quick Configuration Guide*. For more information, see the “[Viewing Network Settings](#)” section on page 10-9.
- **Windows Authentication**—Allows you to define the settings required by the WAE for Windows authentication to enable device login, disconnected mode, and CLI configuration. For more information, see the “[Configuring Windows Authentication](#)” section on page 10-10.
- **Print Services**—Allows you to configure print services. For more information on configuring print services, see [Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”](#)
- **Notifier**—Allows you to define the e-mail address to which notifications are sent when alerts are generated by the WAE. For more information, see the “[Defining Notification Settings](#)” section on page 10-15.

Configuring SNMP Settings

The SNMP tab allows you to configure the SNMP settings on the Cisco WAE. To configure the SNMP settings, click the **SNMP** tab in the Configuration window. The SNMP tab appears. (See [Figure 10-6](#).)

Figure 10-6 WAE Configuration—SNMP Tab



This tab allows you to configure the following settings:

- **SNMP community**—Sets the SNMP community string for read access, which is used as a password for authentication when accessing the SNMP agent of the WAE.

- SNMP community (R/W)—Sets the SNMP community string for read/write access, which is used as a password for authentication when accessing the SNMP agent of the WAE.
- Enable event MIB traps—Allows the WAE to send event MIB traps to the SNMP host specified in the SNMP notification host field.
- Enable logging traps—Enables logging traps on the device.
- SNMP notification host—Enter the IP address or hostname of your SNMP host so that the WAE can send MIB and logging traps to the host.

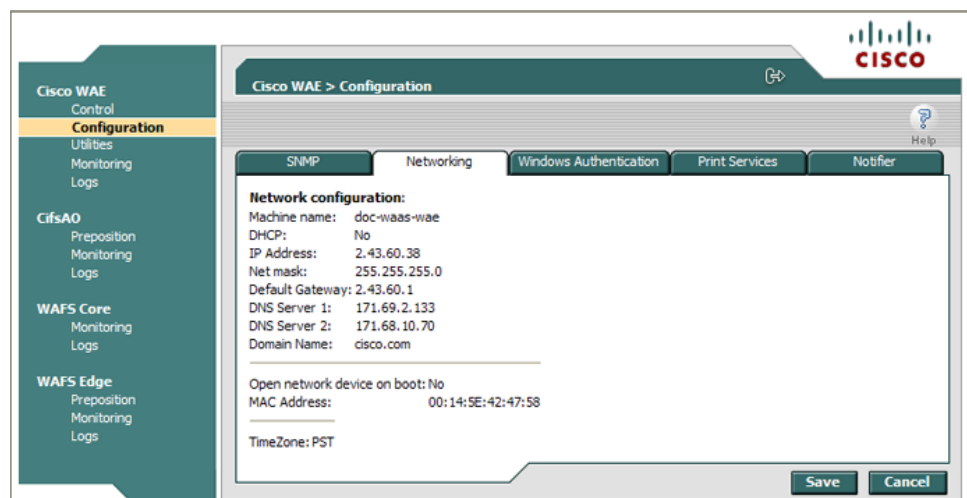
Click **Save** after making any changes to this page, or click **Cancel** to disregard your changes so that they do not take effect.

Viewing Network Settings

The Networking tab (see [Figure 10-7](#)) enables you to view the connection parameters between the WAE and the LAN.

To view the WAE connection settings, click the **Networking** tab in the Configuration window.

Figure 10-7 Cisco WAE Configuration—Networking Tab



The Networking tab contains the following information:

- Machine name—The hostname of the WAE.
- DHCP—Whether a DHCP server is available on the network.
- IP Address
- Net mask
- Default Gateway
- DNS Server 1
- DNS Server 2
- Domain Name
- MAC Address
- Time Zone

Configuring Windows Authentication

The WAAS Central Manager GUI and the WAE Device Manager use Pluggable Authentication Modules (PAM) for user login authentication. Administrative users defined in the WAAS Central Manager GUI are distributed to the WAE Device Managers. Administrative user authentication is performed only upon login to the WAAS Central Manager GUI or the WAE Device Manager. Each WAE has a default GUI and CLI user with the username admin and password default. This user account cannot be deleted, but the password can be changed.

**Note**

In situations where the CLI user account information conflicts with the management GUI configuration, the management GUI configuration will overwrite any conflicting CLI user account information at the time of configuration distribution. A warning is displayed to CLI users after configuring CLI user account settings to inform users of this behavior.

This section contains the following topics:

- [Understanding Login Authentication and Authorization Through the Local Database, page 10-10](#)
- [Supported Authentication Methods, page 10-10](#)
- [LDAP Server Signing, page 10-11](#)
- [Setting Up Windows Authentication, page 10-11](#)
- [Checking the Status of Windows Authentication, page 10-14](#)

Understanding Login Authentication and Authorization Through the Local Database

Local user authentication and authorization use locally configured usernames and passwords to authenticate administrative user login attempts. The login and passwords are local to each WAE.

By default, local user login authentication is enabled as the primary authentication method. You can disable local user login authentication only after enabling one or more of the other administrative login authentication methods. However, when local user login authentication is disabled, and you disable all other administrative login authentication methods, local user login authentication is reenabled automatically.

Windows Domain authentication is another user login authentication method. You can use the console, Telnet, FTP, SSH, or HTTP (WAFS Central Manager and WAE Device Manager interfaces) to authenticate Windows Domain users.

Supported Authentication Methods

When you enable Windows authentication on your WAE, you can configure additional settings that make the authentication process of your users, WAE, and print services more secure when they register with the domain controller.

WAFS supports the following Windows authentication methods on the WAE:

- NTLMv2 authentication—A Windows authentication protocol that is built into most Windows operating systems.
- Kerberos—A Windows authentication protocol that uses secret-key cryptography and is built into Windows 2003 Server.

LDAP Server Signing

Lightweight Directory Access Protocol (LDAP) server signing is a configuration option of the Microsoft Windows Server's Network security settings. This option controls the signing requirements for LDAP clients such as the WAE. LDAP signing is used to verify that an intermediate party did not tamper with the LDAP packets on the network and to guarantee that the packaged data comes from a known source.

The WAAS software supports both print services' and login authentication with Windows 2003 domains when the LDAP server signing requirements option for the Domain Security Policy has been set to "Require signing." LDAP server signing allows the WAE to join the domain and authenticate users securely.

**Note**

When you configure your Windows domain controller to require an LDAP signature, you must also configure LDAP server signing on the WAE from the CLI by using the **smb-conf** section **"global" name "ldap ssl" value "start_tls"** global configuration command. You cannot enable this option using the WAE Device Manager interface. For information on using the **smb-conf** command, see the *Cisco Wide Area Application Services Command Reference*.

Setting Up Windows Authentication

The Windows Authentication tab allows you to configure the security settings on the WAE.

To configure Windows Authentication, follow these steps:

-
- Step 1** Log into the WAE Device Manager.
 - Step 2** In the Configuration window, click the **Windows Authentication** tab.
The Window Authentication window appears. (See [Figure 10-8](#).)

Figure 10-8 Cisco WAE Configuration—Windows Authentication Tab

Step 3 Enter the NetBIOS name.

The NetBIOS name cannot exceed 15 characters nor contain special characters.



Note By default, the NetBIOS name field is automatically populated with the hostname of the file engine. If this hostname changes, the NetBIOS field is not automatically updated with the new name.

Step 4 Enter the workgroup or domain name in the short name format, and check the **NT Domain** check box if the workgroup/domain is a Windows NT 4 domain.

For example, if your domain name is cisco.com, the short name format is cisco. If your workgroup or domain is a Windows 2000 or Windows 2003 domain, do *not* check the **NT Domain** check box.

If the NT Domain check box is checked, the domain name and short name format can contain a period (.), but be careful not to enter the fully qualified name for the NT domain.

Step 5 Enter the IP address or hostname for the WINS server that you are using.

Step 6 Check the **Use NTLMv2 authentication** check box to enable NTLMv2 authentication.



Note Enable NTLMv2 support *only* if all clients have their security policy set to “Send NTLMv2 responses only/Refuse LM and NTLM.” Using NTLM v2 when the clients do not require it could cause authentication to fail.

Step 7 Check the **Windows authentication for WAFS Management login** check box to use Windows Domain to authenticate Telnet, FTP, console, SSH, and user interface (WAAS Central Manager GUI and WAE Device Manager) logins to WAFS.

When you add users through the WAAS Central Manager GUI, you are given the option to configure users as local users who have their login password stored on the WAE. Local users are authenticated by the WAE, but nonlocal users are commonly verified using Windows Domain authentication.

- **Windows authentication for file server failover**—Enables disconnected mode for this device. (This option appears only for Edge WAEs.) For more information, see the [“Preparing Your WAAS Network for WAN Failures”](#) section on page 11-33.

Step 8 If you are using Kerberos authentication, check the **Kerberos enabled** check box and then specify the following information:

- The fully qualified name of the Kerberos realm. All Windows 2000 domains are also Kerberos realms, but the realm name is always the all uppercase version of the domain name.
- The fully qualified name or IP address of the Key Distribution Center. You can also specify a port using the following format: *ip address* or *name:port number*. For example, 10.10.10.2:88.
- The organizational unit.

You can only enable Kerberos authentication if at least one of the boxes described in [Step 7](#) is checked. After you enable Kerberos, make sure that the clock on your WAE is within 5 minutes of the clock on your domain controller. Otherwise, your domain controller will refuse to use Kerberos for authentication.

If you are using a Windows 2000 (with SP4) or Windows 2003 (with SP1) domain controller, you should enable Kerberos authentication.

Step 9 If your domain controller has been configured to require LDAP server signing, you need to use the WAAS CLI to enable LDAP server signing on the WAE by using the **smb-conf section global name "ldap ssl" value "start_tls"** global configuration command. For information on using the **smb-conf** command, see the *Cisco Wide Area Application Services Command Reference*.

Step 10 Check the **Register WAE with Domain Controller** check box.



Note You need to register the WAE with the domain controller whenever you enable or disable Kerberos, enable Windows authentication, or change the NetBios name, workgroup, or Kerberos realm.

A series of fields display under the check box. Enter the following information in these fields:

- Domain controller (enter the name, not the IP address).
You can only enter the NetBios name of the domain controller when Kerberos is disabled. If Kerberos is enabled, you can enter the fully qualified domain name of the domain controller.
- Domain administrator username (enter the username, domain\username, or domain+username).
- Domain administrator password.

Step 11 Click **Save**.

The Windows Authentication settings are saved, and the WAE is registered with the domain controller.

Step 12 Verify if Windows Authentication is working correctly. See the [“Checking the Status of Windows Authentication”](#) section on page 10-14.

Checking the Status of Windows Authentication

After you enable Windows Authentication, you can check the status of Windows Authentication and view the results of built-in tests that can help you resolve authentication issues.

A Windows Authentication problem can occur if you incorrectly configure the settings described in the [“Setting Up Windows Authentication”](#) section on page 10-11. Problems can also occur if the configuration of your domain controller changes.

The Authentication Details window shows the following information:

- A list of winbind Authentication tests
- The results of each test
- A pass or fail indicator
- Troubleshooting tips to help you resolve why a test failed

To check the status of Windows Authentication, follow these steps:

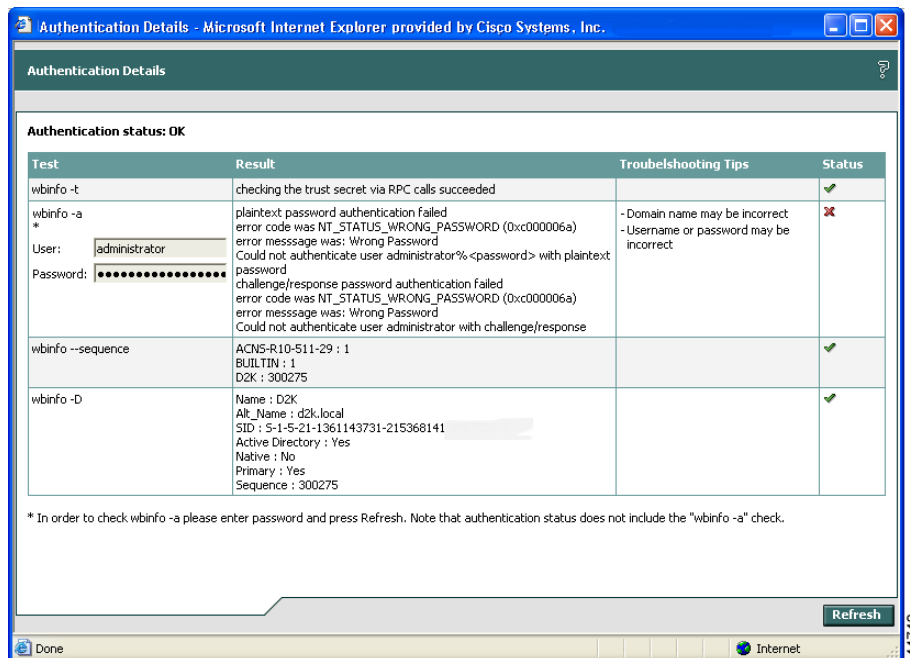
Step 1 On the Windows Authentication tab, click **Show authentication status**.

A message appears that explains the authentication status could take a while to display and that the WAE’s performance could be impacted while the authentication status is being obtained.

Step 2 In the message dialog box, click **OK** to proceed or click **Cancel** to not display the authentication details.

If you clicked OK, the Authentication Details window appears. (See [Figure 10-9](#).)

Figure 10-9 Authentication Details Window



Step 3 Check the Authentication status field at the top of the window.

If the status field displays “OK,” then Windows Authentication is functioning correctly. If this field displays “Not OK,” then proceed to the next step.

- Step 4** View the status of each test, and resolve any failures using the provided troubleshooting tips. [Table 10-1](#) describes these tests.

Table 10-1 Authentication Test Descriptions

Test	Description
wbinfo -t	Verifies that the workstation trust account created when the Samba server is added to the Windows domain is working.
wbinfo -a	Tests the domain credentials based on the specified username and password. To run this test, enter the appropriate username and password, and then click Refresh . Wait for the test results to be displayed.
wbinfo -D	Shows information from Samba about the domain.
wbinfo --sequence	Shows the sequence numbers of all known domains.
Time skew	Shows the time offset between the WAE and the KDC server. The time offset must be within 5 minutes; otherwise, the Windows KDC server refuses to use Kerberos for authentication. You can use the WAAS CLI to configure the time on the WAE. This test is performed only when Kerberos authentication is enabled.

- Step 5** Click **Refresh** to ensure that all the tests complete successfully.

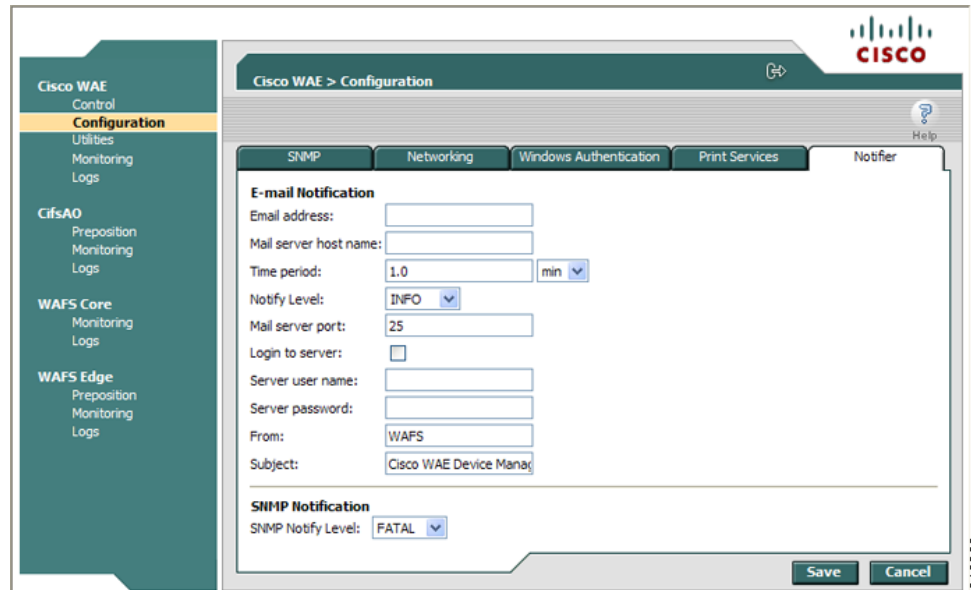
Defining Notification Settings

The Notifier tab allows you to define the e-mail address to which notifications are sent when alerts are generated by the WAE.

To define notification settings, follow these steps:

- Step 1** In the Configuration window, click the **Notifier** tab. (See [Figure 10-10](#).)

Figure 10-10 Notifier Tab



- Step 2** In the Email address field, enter the address to which notifications about this WAE are sent.
- Step 3** In the Mail server host name field, enter the name of the mail server host.
- Step 4** In the Time period field, enter the time interval for notifications to accumulate until they are sent through e-mail and choose the relevant time unit from the drop-down list (min or sec).
- Step 5** From the Notify Level drop-down list, choose the minimum event severity level for generating notifications.
- Step 6** In the Mail server port field, enter the port number for connecting with the mail server.
- Step 7** Check the **Login to server** check box if the WAE must log in to the mail server to send notifications. If this option is selected, additional fields are enabled.
- Step 8** In the Server username field, enter the username for accessing the mail server.
- Step 9** In the Server password field, enter the password for accessing the mail server.
- Step 10** In the From field, enter the text that should appear in the From field of each e-mail notification.
- Step 11** In the Subject field, enter the text that should appear as the subject of each notification.
- Step 12** From the SNMP Notify Level drop-down list, choose the minimum event severity level for generating SNMP notifications.
- Step 13** Click **Save**.

Utilities Option

The Utilities option displays the following tabs:

- Support—Allows you to dump WAE data to an external location for support purposes. For more information, see the “Running Support Utilities” section on page 10-17.
- WAFS Cache Cleanup—Allows you to remove all files from the WAFS cache. For more information, see the “Running the Cache Cleanup Utility” section on page 10-18.
- File Server Rename—Allows you to rename a file server in the WAFS cache. For more information, see the “Running the File Server Rename Utility” section on page 10-18.

Running Support Utilities

The Support tab displays product information about the WAE, including the WAAS software version and build number running on the device.

The Support tab also allows you to download a system report that provides a snapshot of the current state of the WAE and its operation, including the configuration log files of various components. You can send this report to Cisco Technical Support (TAC) if you need assistance.



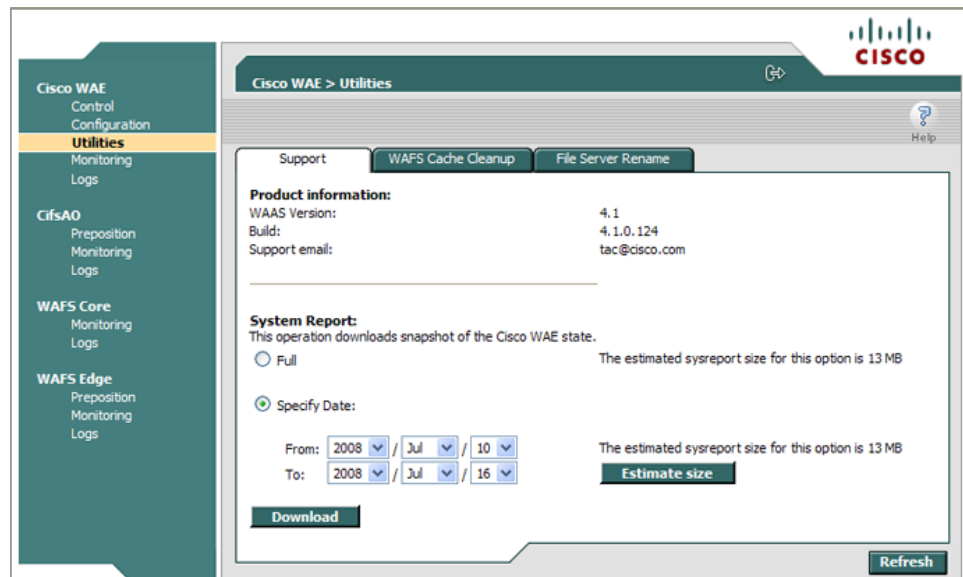
Note

Downloading a full system report can impact the performance of the WAE. For this reason, we recommend downloading the system report during nonpeak hours or limiting the date range of the report.

To download the system report, follow these steps:

- Step 1** In the Utilities window, click the **Support** tab.
The Support window appears. (See Figure 10-11.)

Figure 10-11 Utilities—Support Tab



- Step 2** In the System Report area, choose one of the following radio buttons:

- **Full** to download a full system report.
- **Specify Date:** to download a report for the time range that you specify (default is the past 7 days).

Step 3 Click **Estimate size** to view the size of the report.

The actual size of the report may vary from the estimate. If the estimated size is large, you may want to specify a smaller time frame and download multiple smaller reports to minimize the stress on the WAE.

Step 4 Click **Download**.

A message informs you that downloading the report can affect the performance of all services on the device.

Step 5 Click **OK** to start the collection process.

Step 6 In the File Download window, click **Save**.

Step 7 In the Save As window, browse to where you want to save the file. (You can also change the filename.) Click **Save**. The file is saved in tar gzip format.

Running the Cache Cleanup Utility

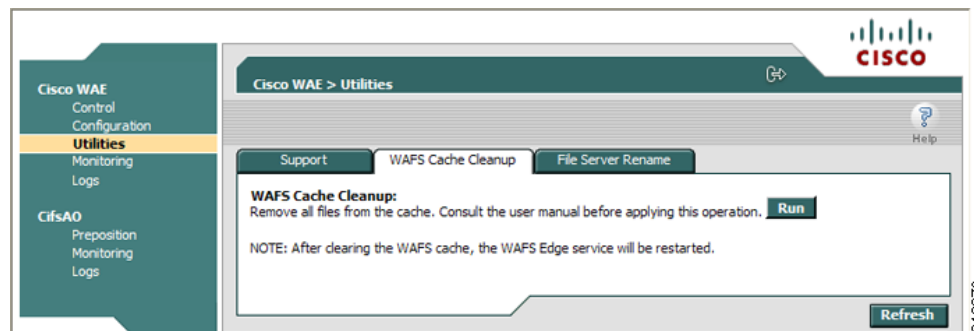
The WAFS Cache Cleanup tab enables you to remove all files from the WAFS device cache.

To run the cache cleanup utility, follow these steps:

Step 1 In the Utilities window, click the **WAFS Cache Cleanup** tab.

The WAFS Cache Cleanup window appears. (See [Figure 10-12](#).)

Figure 10-12 Utilities—WAFS Cache Cleanup Tab



Step 2 Click **Run** to erase the contents of the cache.

Running the File Server Rename Utility

The File Server Rename tab enables you to change the resource location for all resources of a given file server name on the WAAS device.

To run the file server rename utility, follow these steps:

-
- Step 1** If the WAFS Edge component is running, stop it as described in the [“Starting and Stopping Components” section on page 10-5](#).
- Step 2** In the Utilities window, click the **File Server Rename** tab.
- Step 3** In the Current File Server name field, enter the current name.
- Step 4** In the New File Server name field, enter the new name and click **Run** for the new name to take effect.
-

Managing a CIFS Accelerator Device

The CifsAO option in the navigation area allows you to monitor preposition tasks, view WAFS device statistics, and view the log. The CifsAO option appears only if you are using transparent CIFS accelerator mode.

The CifsAO option includes the following menu items:

- **Preposition**—Allows you to monitor the progress of preposition policies created in the WAAS Central Manager GUI. In addition, you can optionally terminate preposition tasks. For more information, see the [“Preposition Option” section on page 10-19](#).
- **Monitoring**—Allows you to view WAFS device statistics in tables and graphs as described in the [“Monitoring the Cisco WAE Component” section on page 10-25](#).
- **Logs**—Allows you to view the event log related to the CIFS accelerator. For more information, see the [“Viewing Cisco WAE Logs” section on page 10-33](#).

Preposition Option

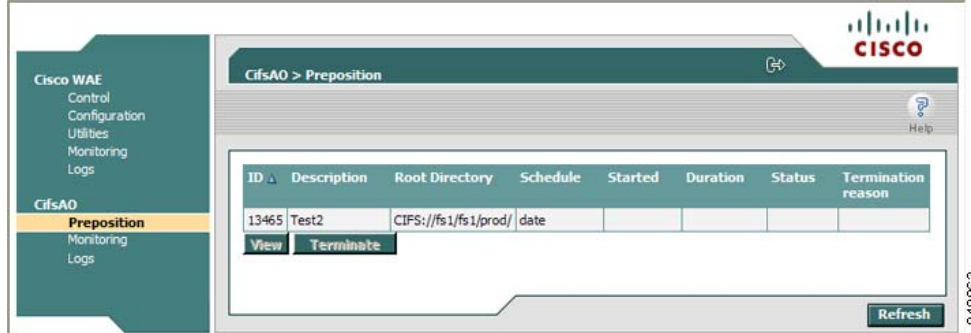
The Preposition option allows you to view the details and current status of preposition policies created in the WAAS Central Manager GUI. These policies define which files are proactively placed in the WAAS device cache according to a prearranged schedule. Prepositioning enables system administrators to strategically place large, frequently accessed files at the network edge during off-peak hours, increasing efficiency and providing end users with quick first-time access of those files.

You can view information such as the root directory containing the files being prepositioned, the schedule for each policy, and the status of the most recent task for each policy. You can also view a detailed task history for each policy, and manually terminate any tasks in progress.

To view preposition policies for this device, follow these steps:

-
- Step 1** In the navigation area, click **Preposition**.
- The CifsAO > Preposition window appears. (See [Figure 10-13](#).)

Figure 10-13 CifsAO > Preposition Window



The Preposition window contains a table that displays all the preposition policies assigned to this WAFS Edge device. For each policy, the following information is displayed:

- ID—ID number of the selected policy.
- Description—Descriptive name assigned to the policy.
- Root Directory—Source directory for the content being prepositioned.
- Schedule—Defined schedule for the policy.
- Started—When this policy was last invoked by the system.
- Duration—Elapsed time of the latest task.
- Status—Current status of the policy, updated every time the refresh button is clicked. If the task defined by the policy is currently being run, its status is In Progress. A preposition task in progress can be terminated.
- Termination reason—Reason the policy was terminated.

Step 2 Choose a policy in the table and click **View** to view a detailed task history (iterations of a selected policy).

The Preposition Task Details window appears. (See [Figure 10-14](#).)

Figure 10-14 Preposition Task Details

Preposition Policy 1 - asas

Create Date: 2005-10-18 8:50:42 PM Status: enabled
 Last Modified: 2005-10-18 8:50:42 PM
 * Root Dir: cifs://sj_central
 [Include sub directories]
 Schedule: now
 Total size: 5.0 % of cache size Duration:
 Min file size: 20.0 KB Perform on: Files changed since last pre-position
 Max file size:

Started	Duration	Total data	# matching files	Amount copied	# files copied	Throughput [KB/sec]	Status	Termination reason
2005-10-18 8:50:50 PM	2.5800166 [min]	0.0 [bytes]	0	0.0 [bytes]	0	0.0	Terminated	File server disconnection

Refresh Close

http://10.56.41.66/mgr/execute/showDirectiveDetails?directiveType=preposition&id=1&formMode=popup&formRe

The top half of the Preposition Policy window displays the following details about the selected policy:

- Create Date—When the policy was created.
- Last Modified—When the policy was last modified.
- Total size—Limit placed on the total size of the files being prepositioned, if any.
- Min file size—Minimum size of files in the root directory (and subdirectories if they are part of the preposition policy) that are affected by the policy.
- Max file size—Maximum size of files in the root directory (and subdirectories if they are part of the preposition policy) that are affected by the policy.
- Perform on—Which files to preposition from the selected location—those files that have changed since the last preposition, those files changed during a defined interval, or all files.

The lower half of the Preposition Policy window contains a table that displays the most recent tasks performed by the selected policy (up to the last 10 iterations), including the following information:

- Total data—Total amount of data to be transferred by the policy.
- # matching files—Number of files matching the defined filter of the policy.
- Amount copied—Total amount of data copied by the policy during its most recent run. (This amount may be less than the amount in the Total data field if the policy is currently in progress, or if the policy did not complete its run, for example, due to time constraints placed on its operation.)
- # files copied—Number of files copied by the policy during its most recent run.
- Throughput—Throughput achieved by the policy in kilobits per second (Kbps).
- Termination reason—Reason that the policy was terminated, if relevant. Policies can be terminated due to time or space constraints placed on the policy or to a decision by the administrator to manually terminate its operation.

Step 3 Click **Close** to return to the Policies window.



Note To update the information displayed in the Policies window, click **Refresh**.

Terminating a Preposition Task

You can terminate a preposition task that is in progress at any time. This action does not delete the preposition policy that generated the task; the system will still perform the task described by the policy when the next scheduled time arrives.



Note Do not terminate a preposition task if the device is not registered to a WAAS Central Manager.

To terminate a preposition task, follow these steps:

-
- Step 1** In the Policies window, select a preposition policy with a status of In Progress and click **Terminate**. A confirmation message is displayed.
- Step 2** Click **Yes** to terminate the task. If you click **View** to display the Preposition Policy window, the table that displays the task history contains a message indicating that the latest task was terminated by the administrator.
-

Managing a WAFS Core Device

The WAFS Core option in the navigation area allows you to monitor WAFS Core statistics and view log information. The WAFS Core option appears only if you are using WAFS legacy mode.

The WAFS Core option includes the following menu items:

- **Monitoring**—Allows you to view WAFS Core statistics in tables and graphs as described in the [“Monitoring the Cisco WAE Component”](#) section on page 10-25.
- **Logs**—Allows you to view the event log related to the WAFS Core. For more information, see the [“Viewing Cisco WAE Logs”](#) section on page 10-33.

Managing a WAFS Edge Device

The WAFS Edge menu item in the navigation area allows you to monitor preposition tasks, monitor WAFS Edge statistics, and view log information. The WAFS Edge option appears only if you are using WAFS legacy mode.

The WAFS Edge option includes the following menu items:

- **Preposition**—Allows you to monitor the progress of preposition policies created in the WAAS Central Manager GUI. In addition, you can optionally terminate preposition tasks. For more information, see the [“Preposition Option”](#) section on page 10-19. Preposition works the same for WAFS legacy mode and transparent CIFS accelerator mode.

- **Monitoring**—Allows you to view WAFS Edge device statistics in tables and graphs as described in the “[Monitoring the Cisco WAE Component](#)” section on page 10-25.
- **Logs**—Allows you to view the event log related to the WAFS Edge device. For more information, see the “[Viewing Cisco WAE Logs](#)” section on page 10-33.

Monitoring the WAE

The Monitoring option available for the Cisco WAE, WAFS Core, WAFS Edge, and transparent CIFS accelerator components enables you to view detailed tables that describe the current state of the WAE. It also provides graphs that display historical data about the selected components. These graphs enable you to track WAE statistics for a day, week, month, or an entire year.



Note

WAE statistics and graphs are generated by the freeware MRTG utility. For details, go to <http://people.ee.ethz.ch/~oetiker/webtools/mrtg/>.

The monitoring options differ for each WAE component as described in [Table 10-2](#).

Table 10-2 *Monitoring Options by Component*

Component	Monitored Statistics
Cisco WAE	CPU and disk drive utilization
Transparent CIFS accelerator	CIFS traffic and cache
WAFS Core	Connectivity
WAFS Edge	Connectivity, CIFS traffic, and cache

This section contains the following topics:

- [Monitoring Graphs](#), page 10-23
- [Monitoring the Cisco WAE Component](#), page 10-25
- [Monitoring a WAFS Core](#), page 10-26
- [Monitoring a Transparent CIFS Accelerator or a WAFS Edge Device](#), page 10-28

Monitoring Graphs

The WAAS software generates four historical graphs for each monitored statistic. Each graph presents a different range of time for the selected data as follows:

- **Daily**—Displays data for the past 24 hours. Each data point represents a 5-minute average.
- **Weekly**—Displays data for the past seven days. Each data point represents a 30-minute average.
- **Monthly**—Displays data for the past five weeks. Each data point represents a 2-hour average.
- **Yearly**—Displays data for the past 12 months. Each data point represents a one-day average.

The maximum value over the given time period and the current value for the statistic being monitored is also displayed below each of these graphs.

Viewing Options

You can view all four historical graphs for a particular statistic (for example, connected sessions) at once or view an index window of only the daily graphs for all monitored statistics available for that component.

Figure 10-15 shows a sample screen when a user chooses to view the historical graphs for a particular statistic.

Figure 10-15 Sample Graph Window

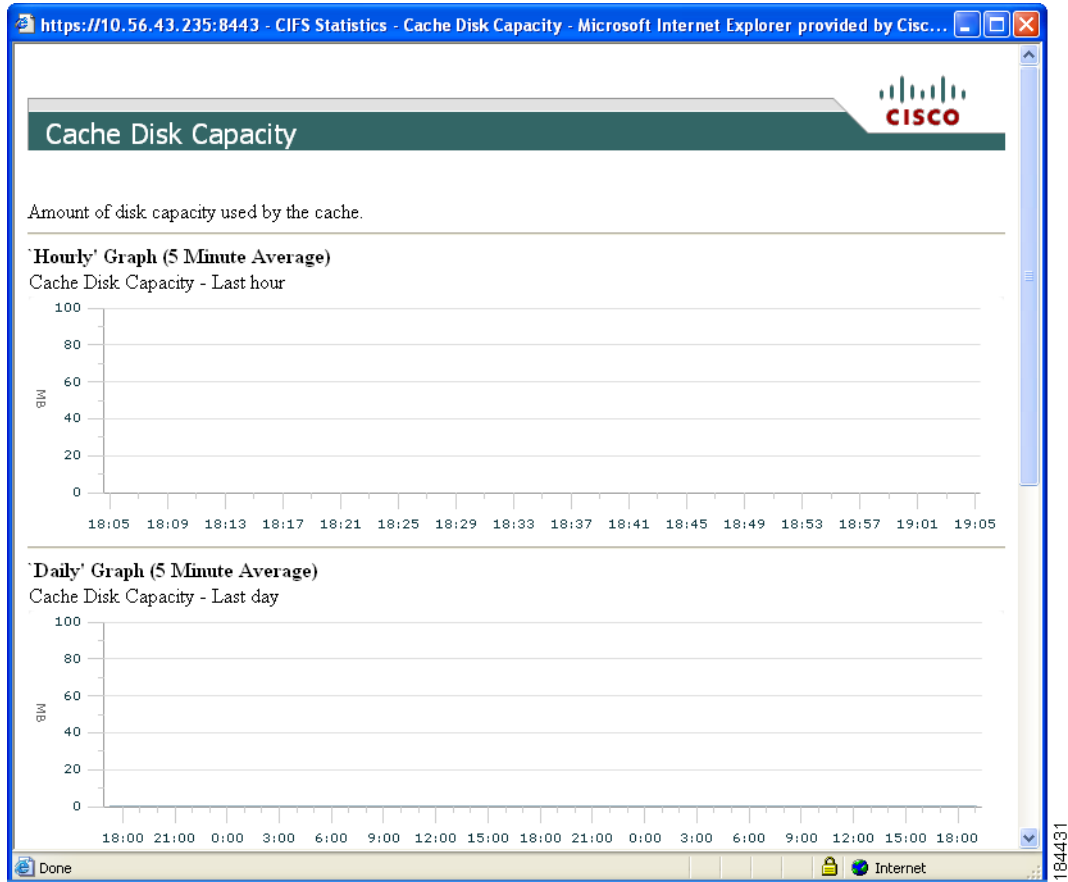
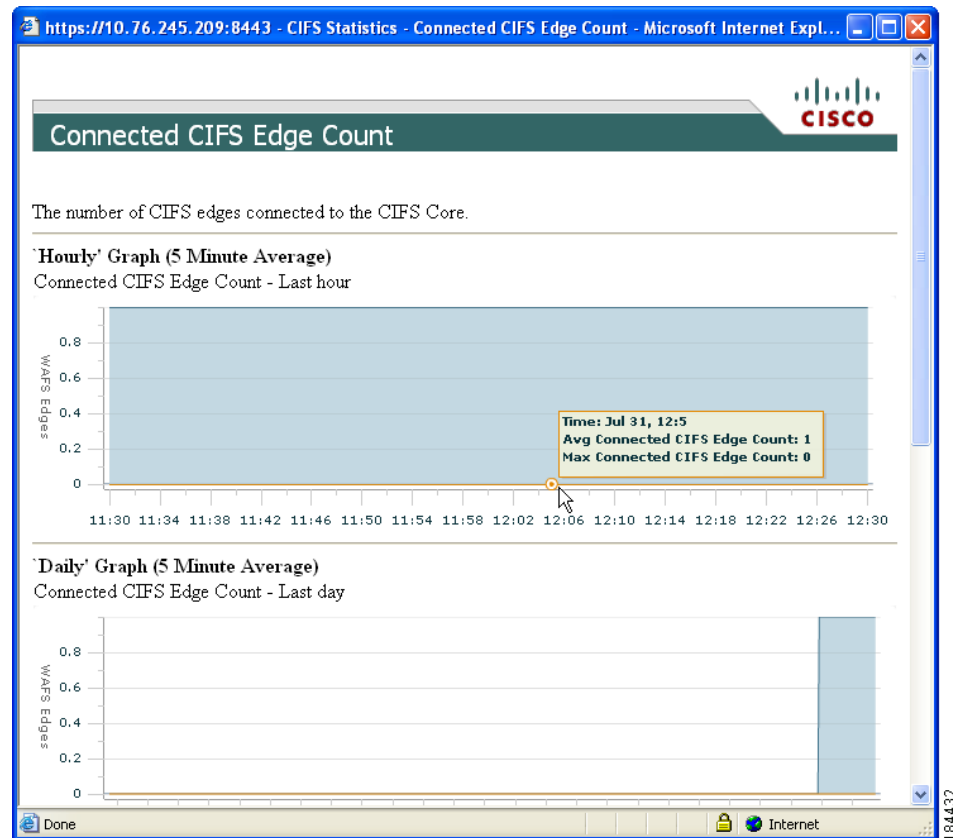


Figure 10-16 shows a sample screen when a user chooses to view the index graphs.

Figure 10-16 Sample Index Graph Window



Tip

Each graph in an index window acts as a link. Clicking on the graph displays all four historical graphs for the selected statistic. For example, clicking the Open Files Count graph in the WAFS Edge index graphs window displays the daily, weekly, monthly and yearly Open Files Count historical graphs. Clicking the Back button in the browser returns you to the index graphs.



Note

Graphs can be printed using the Print command in your browser.

Monitoring the Cisco WAE Component

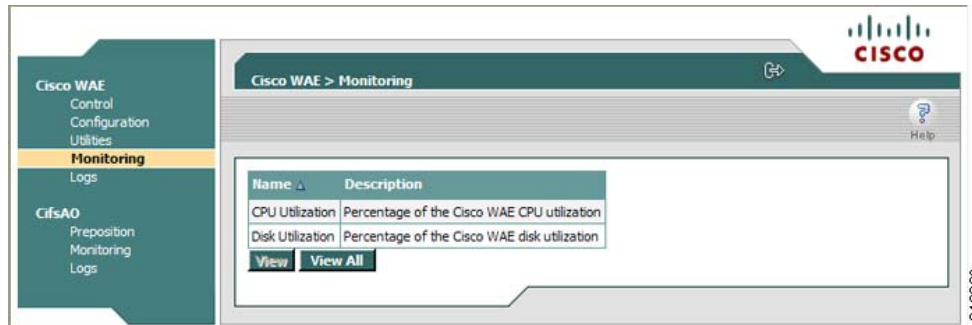
The Monitoring option for the Cisco WAE component displays a table with the statistics monitored on a WAE. From this table, you can display historical graphs that indicate the central processing unit (CPU) utilization and disk drive utilization on the WAE.

CPU utilization is a measure of the amount of bandwidth used by the CPU versus the total bandwidth available. The amount is expressed as a percentage. Disk drive utilization is a measure of the amount of disk space that is being used on all disk drives versus the total disk space available. This amount is also expressed as a percentage.

To monitor the WAE component, follow these steps:

- Step 1** In the navigation area, click **Monitoring** under the **Cisco WAE** menu item.
The Cisco WAE Monitoring window appears. (See [Figure 10-17](#).)

Figure 10-17 Cisco WAE Monitoring Window



- Step 2** Do one of the following:
- Choose the statistic that you want to view (by clicking in its row), and then click **View** to display a popup window that contains the historical graphs for that statistic.
 - Click **View All** to display the index window with the daily graphs for both statistics on the WAE component.

Monitoring a WAFS Core

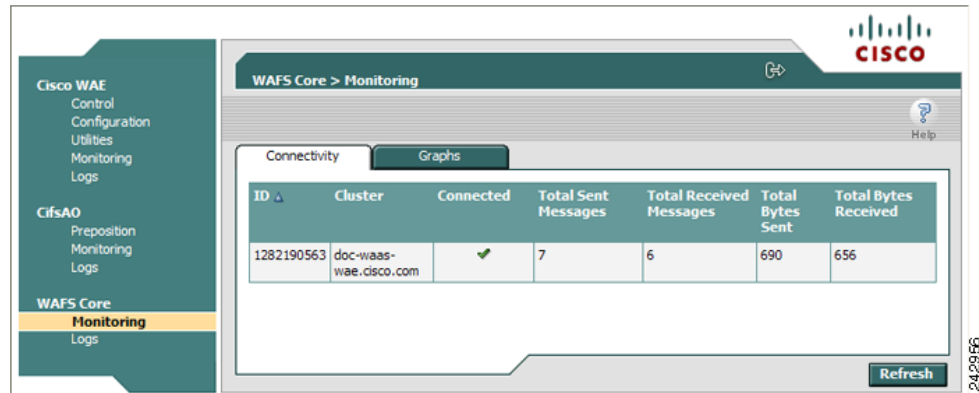
The Monitoring option for the WAFS Core menu item displays the following two tabs:

- **Connectivity**—Displays a table of connectivity statistics for the WAFS Core. This table is displayed by default.
- **Graphs**—Displays a list of graphs that are available for the WAFS Core.

To monitor a WAFS Core, follow these steps:

- Step 1** In the navigation area, click **Monitoring** under the **WAFS Core** component.
The Connectivity tab on the WAFS Core Monitoring window appears. (See [Figure 10-18](#).)

Figure 10-18 WAFS Core Monitoring—Connectivity Tab

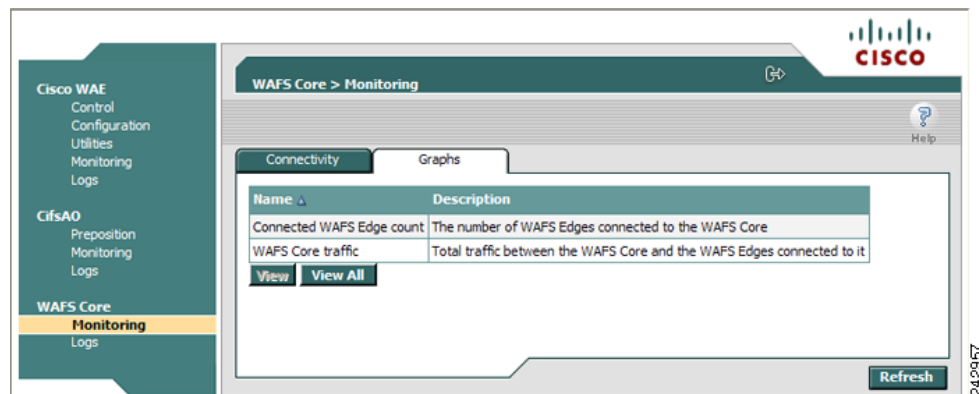


The Connectivity tab displays a table that contains the following data about the WAFS Core:

- ID—Alphanumeric system identifier for the WAFS Core.
- Cluster—Name of the core cluster to which this WAFS Core belongs, if any.
- Connected—Indicator of whether the WAFS Core is currently connected to (✓) or disconnected from (✗) its WAFS Edge devices.
- Total Sent Messages—Total number of messages sent from this WAFS Core since activation.
- Total Received Messages—Total number of messages received by this WAFS Core since activation.
- Total Bytes Sent—Total number of bytes sent from this WAFS Core since activation.
- Total Bytes Received—Total number of bytes received from this WAFS Core since activation.

Step 2 Click the **Graphs** tab. (See Figure 10-19.)

Figure 10-19 WAFS Core Monitoring – Graphs Tab



The following historical graphs are available for a WAFS Core component:

- Connected WAFS Edge counts—Number of WAFS Edge devices currently connected to the selected WAFS Core. This graph is useful for detecting WAFS Edge device disconnections.
- WAFS Core traffic—Total volume of traffic (in kilobits) between the WAFS Core and each of the WAFS Edge devices connected to it. The green line represents transmitted traffic; the blue line represents received traffic.

Step 3 Do one of the following:

- Choose the statistic that you want to view (by clicking in its row), and then click **View** to display a popup window that contains the historical graphs for that statistic.
- Click **View All** to display the index window with the daily graphs for both statistics on the WAFS Core component.

Monitoring a Transparent CIFS Accelerator or a WAFS Edge Device

Monitoring a transparent CIFS accelerator device or a WAFS Edge device is almost the same, except that the transparent CIFS accelerator does not monitor connectivity.

The Monitoring option displays the following tabs:

- **Connectivity**—Displays a table of connectivity statistics for the WAFS Edge device. This tab does not appear when using transparent CIFS accelerator mode.
- **CIFS**—Displays data about the status of the CIFS protocol and the selected device.
- **Cache**—Displays data about the device cache.
- **Graphs**—Displays a list of graphs that are available for the device.



Note

The SNMP parameters displayed in the CIFS and Cache tabs are contained in a special MIB file.

To monitor a transparent CIFS accelerator or WAFS Edge device, follow these steps:

Step 1 In the navigation area, click **Monitoring** under the **CifsAO** or **WAFS Edge** menu.

The Monitoring window appears. (See [Figure 10-20](#).) If you are using transparent CIFS accelerator mode, the Connectivity tab is not used and the CIFS tab is displayed first; skip to [Step 2](#).

Figure 10-20 WAFS Edge Monitoring—Connectivity Tab

ID	Cluster	Connected	Total Messages Sent	Total Messages Received	Total Bytes Sent	Total Bytes Received
[Empty Table]						

The Connectivity tab displays a table that contains the following data about the WAFS Edge device:

- ID—Alphanumeric system identifier for the WAFS Edge device.
- Cluster—Name of the Core cluster to which this WAFS Edge device is connected, if any.
- Connected—Indicator of whether the WAFS Edge device is currently connected to (✔) or disconnected from (✘) the WAFS Core.
- Total Messages Sent—Total number of messages sent from this WAFS Edge device since activation.
- Total Messages Received—Total number of messages received by this WAFS Edge device since activation.
- Total Bytes Sent—Total number of bytes sent from this WAFS Edge device since activation.
- Total Bytes Received—Total number of bytes received by this WAFS Edge device since activation.

Step 2 Click the **CIFS** tab.

The CIFS tab displays the following CIFS-related information:

- Total Time Saved—Total time saved by CIFS acceleration.
- Total KBytes read—Total number of kilobytes read by clients (both through the cache and remotely) from this device using the CIFS protocol.
- Total KBytes written—Total number of kilobytes written by clients to this device using the CIFS protocol.
- Remote requests count—Total number of client CIFS requests that were forwarded remotely over the WAN. The name of this statistic is a link that you can use to display its historical graphs (without first going to the Graphs tab). Local requests are also shown on these graphs.
- Local requests count—Total number of client CIFS requests handled locally by this device. The name of this statistic is a link that you can use to display its historical graphs (without first going to the Graphs tab). Remote requests are also shown on these graphs.
- Total remote time—Total amount of time, in milliseconds, spent by this device to process all client CIFS requests that were sent remotely over the WAN.
- Total local time—Total amount of time, in milliseconds, spent by this device to process all client CIFS requests that were handled locally.
- Connected sessions count—Total number of CIFS sessions connected on this device. The name of this statistic is a link that you can use to display its daily, weekly, monthly, and yearly graphs (without first going to the Graphs tab).
- Open files count—Total number of open CIFS files on this device. The name of this statistic is a link that you can use to display its daily, weekly, monthly, and yearly graphs (without first going to the Graphs tab).
- CIFS Command Statistics—Table of statistics on CIFS commands. For each command type, the table lists the total number of requests, the number of remote requests, the number of asynchronous requests, the average time in milliseconds spent by this device to process each request that was handled locally, and the average time in milliseconds spent by this device to process each request that was sent remotely over the WAN.

To reset the CIFS statistics, click the **Reset CIFS Statistics** button below the table.

Step 3 Click the **Cache** tab.

The Cache tab displays the following information:

- Maximum cache disk size—Maximum amount of disk space (in gigabytes) allocated to the WAFS device cache.

- Current cache disk usage—Current amount of disk space (in kilobytes) used by the WAFS device cache. The name of this statistic is a link that you can use to display its historical graphs (without first going to the Graphs tab).
- Maximum cache resources—Maximum number of resources (files and directories) allowed in the WAFS device cache.
- Current cache resources—Current number of resources contained in the WAFS device cache. The name of this statistic is a link that you can use to display its historical graphs (without first going to the Graphs tab).
- Evicted resources count—Number of resources that have been evicted from the cache since the device was started.
- Last eviction time—Time when a cache eviction last occurred.
- Cache size high watermark—Percentage of disk usage that causes the WAFS device to begin evicting resources.
- Cache size low watermark—Percentage of disk usage that causes the WAFS device to stop evicting resources.
- Cache resources high watermark—Percentage of total cache resources that causes the WAFS device to begin evicting resources.
- Cache resources low watermark—Percentage of total cache resources that causes the WAFS device to stop evicting resources.
- Last evicted resource age—Amount of time that the last-evicted resource spent in the WAFS device cache.
- Last evicted resource access time—Last time that the last-evicted resource was accessed.

Step 4 Click the **Graphs** tab (see [Figure 10-21](#)).

Figure 10-21 WAFS Edge Monitoring – Graphs Tab

Name	Description
Cache Disk Capacity	Amount of disk capacity used by the cache
Cache Object Count	Number of objects in cache
Cache Utilization	Cache capacity utilization
Connected WAFS Core count	The number of WAFS Cores connected to the WAFS Edge
Open Files Count	Number of open files
Optimized CIFS Sessions Count	Number of CIFS accelerated sessions/WAFS Edge
Request Hit Rate	Percentage of requests served locally
Requests Count	Local and remote requests count
WAFS Edge - WAFS Cores traffic	Total traffic between the WAFS Edge and the WAFS Cores connected to it
WAFS Edge - client average throughput	Average throughput between the WAFS Edge and its clients

The following historical graphs are available for the WAFS device:

- Cache Disk Capacity—Amount of disk space (in megabytes) used by the WAFS device cache.

- Cache Object Count—Total number of objects (files and directories) contained in the cache.
- Cache Utilization—Percentage of disk space and percentage of resources used by the cache, based on defined limits.
- Connected WAFS Core count—Number of WAFS Cores connected to the selected WAFS Edge device. This item appears only if you are using WAFS legacy mode.



Note The WAFS Edge device can be connected to multiple WAFS Cores for potential higher availability.

- Open Files Count—Total number of open CIFS files.
- Optimized CIFS Sessions count—Number of accelerated CIFS sessions on the device.
- Request Hit Rate—Percentage of user requests answered by the cache (as opposed to sending a request remotely over the WAN to the file server for the user-requested content).
- Requests Count—Average rate of requests handled locally (client requests answered through the cache) and average rate of requests handled remotely (client requests answered through the remote file server). The request count is displayed in requests per second.
- WAFS Edge - WAFS Core traffic—Total volume of traffic (in kilobytes) between the WAFS Edge device and each of the WAFS Cores connected to it. The green line represents transmitted traffic; the blue line represents received traffic. This item appears only if you are using WAFS legacy mode.
- WAFS Edge - client average throughput—Total volume of traffic between the WAFS Edge device and the clients it serves, divided by total uptime (including idle time). Displayed in kilobytes per second. This item appears only if you are using WAFS legacy mode.

Step 5 Do one of the following actions:

- Choose a graph in the table and then click **View** to display a popup window with all four historical graphs for the selected statistic.
 - Click **View All** to display the index window with the daily graphs for the WAFS Edge device.
-

Viewing WAE Logs

You can view event information logged by the Cisco WAE, CifsAO, WAFS Core, and WAFS Edge components. The event information available varies based on the component that you are viewing.

This section contains the following topics:

- [WAE Logs, page 10-31](#)
- [Viewing Cisco WAE Logs, page 10-33](#)

WAE Logs

You can configure what you want displayed for each log file and save the log to a file locally as described in the following sections:

- [Setting Display Criteria, page 10-32](#)
- [Viewing Log Entries, page 10-32](#)

- [Saving Log File Information, page 10-33](#)

Setting Display Criteria

All WAE logs allow you to set the criteria for the data that you want to display as shown in [Figure 10-22](#).

Figure 10-22 WAE Log Data Criteria

The screenshot shows a web form for setting log data criteria. It has two rows of date and time pickers. The first row is labeled 'From:' and the second 'To:'. Each row has dropdowns for year, month, day, hour, and minutes. To the right of these is a 'Log Level:' dropdown set to 'All' and a 'Lines' dropdown set to '100'. Below these is a 'Filter:' text input field and an 'Update' button. A vertical number '137327' is on the right edge of the form area.

To set the criteria for viewing log information, follow these steps:

-
- Step 1** Choose the beginning date (year, month, and day) and time (hour and minutes using a 24-hour clock format) from the **From** drop-down list.
 - Step 2** Choose the ending date (year, month, and day) and time (hour and minutes using a 24-hour clock format) from the **To** drop-down list.
 - Step 3** (Optional) Choose the minimum severity level of events to display from the **Log Level** drop-down list. By choosing the minimum severity level, all events with a severity level greater than that specified are displayed. The default is **All**.
 - Step 4** (Optional) Choose the number of events (one per line) to appear on a single page of the log from the **Lines** drop-down list. The default is 100 events.
 - Step 5** (Optional) Enter a filter string by which the log can be further filtered.
 - Step 6** Click **Update**.
-

Viewing Log Entries

Each log entry contains the date and time that the event occurred, the severity level of the event, and a description containing the log message. The log message format varies based on the type of event.

The severity level of an event indicates the seriousness of the event. Six choices are defined and provide the follow information:

- **All**—Displays events of all severity levels.
- **Debug**—Indicates events have occurred that match those specified for debugging purposes.
- **Info**—Indicates an event occurred regarding the proper operation of the component. No user action is required with this type of event.
- **Warning**—Indicates a minor problem occurred on a component. The component should be able to overcome the incident without user intervention.
- **Error**—Indicates a problem occurred that affected the proper operation of the component. User intervention is likely required.
- **Fatal**—Indicates a severe problem occurred on a component that may have caused it to stop operating. User intervention is required.

Saving Log File Information

You can save a log as a text file and download it to your local drive.

To save a log as a text file, follow these steps:

-
- Step 1** Set up your log with the date range and time frame that you want to save, using the **From** and **To** drop-down lists. (See the “[Setting Display Criteria](#)” section on page 10-32.)
 - Step 2** Set up the severity level of the events you want to view.
For more information, see the “[Setting Display Criteria](#)” section on page 10-32.
 - Step 3** Click **Update**.
 - Step 4** Click **Download**.
The File Download window appears.
 - Step 5** Click **Save** in the File Download window.
 - Step 6** Specify the directory where you want to save the log file.
 - Step 7** Click **OK**.
-

Viewing Cisco WAE Logs

Each WAE component generates its own log files.

The Cisco WAE component generates these logs:

- **Manager log**—Displays events related to the WAE Device Manager and WAAS Central Manager GUI components, such as configuration changes and WAE registrations and notifications that other WAE components were started or stopped.
- **WAFS Watchdog log**—Displays events related to the watchdog utility, which monitors the other application files inside the WAE and restarts them, if necessary.

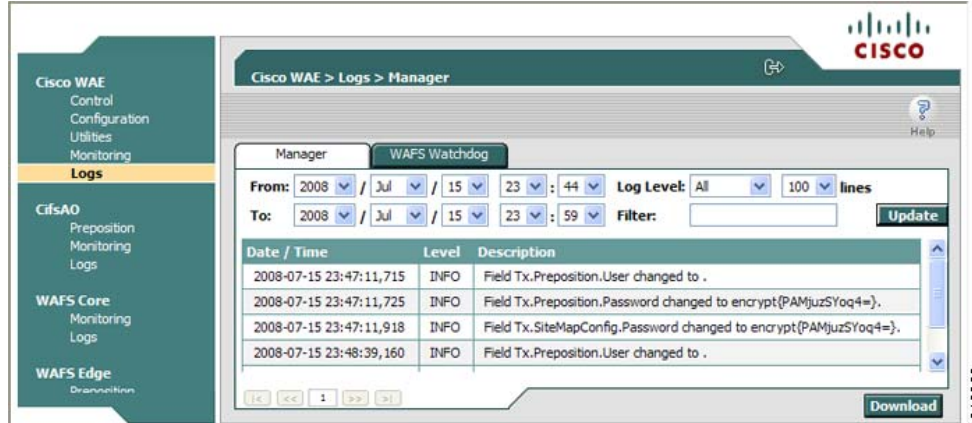
The WAFS Core generates one log that displays all events related to WAFS Core operation. The WAFS Edge device also generates one log that displays all events related to the WAFS Edge operation. If you are using transparent CIFS accelerator mode, the CIFS accelerator generates one log that displays all events related to CIFS accelerator operation.

To view Cisco WAE, CIFS accelerator, WAFS Core, or WAFS Edge logs, follow these steps:

-
- Step 1** In the navigation area, click the **Logs** option under the Cisco WAE, WAFS Core, WAFS Edge, or CifsAO component.

[Figure 10-23](#) shows the Logs window for the Cisco WAE component.

Figure 10-23 Cisco WAE Component Logs Window



- Step 2** If you selected the Cisco WAE, click the **Manager** or **WAFS Watchdog** tab to choose the log that you want to view.
- Step 3** Set up your display criteria using the **From**, **To**, **Level**, and **Lines** drop-down lists. (See the “[Setting Display Criteria](#)” section on page 10-32.)
- Step 4** (Optional) Set a filter on the log so that only events containing specific words or phrases are displayed by entering the relevant free text in the **Filter** text box.
- Step 5** Click **Update**. The Logs window is refreshed according to your selected criteria.



Note Navigation arrows () appear at the bottom of each log window when the number of events is greater than the number of lines selected per window.



PART 3

Configuring WAAS Services



CHAPTER 11

Configuring Wide Area File Services

This chapter describes how to configure Wide Area File Services (WAFS), which allows branch office users to more efficiently access data stored at centralized data centers. The WAFS feature overcomes the WAN latency and bandwidth limitations by caching data on Edge WAEs near branch office users.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [About File Services, page 11-1](#)
- [Overview of File Services Features, page 11-3](#)
- [Preparing for File Services, page 11-8](#)
- [Configuring File Services, page 11-9](#)
- [Managing File Services, page 11-32](#)

About File Services

Enterprises today have remote offices in different parts of the country and around the world. Typically, these remote offices have their own file servers to store and manage the data needed by their local users.

The problem with this method of operation is that it is costly to purchase, manage, and upgrade file servers at each remote office. A great deal of resources and manpower must be dedicated to maintaining these file servers, and especially to protect the data in case of server failure. To achieve the required level of data assurance, the remote office must devote resources to back up the data at the remote site and physically move it to a secure location, often at a considerable distance from the site. If you multiply this scenario by tens, hundreds, and thousands of remote offices, and you can see that this approach to enterprise data management not only raises costs exponentially, it also greatly increases the risks to critical data.

The logical solution in this scenario is to move all of the enterprise's important data to a central location containing the facilities, trained personnel, and storage mass required to manage the data properly. By having a data center provide backup and other storage management facilities, the enterprise can achieve better utilization of both personnel and storage, as well as a higher level of data assurance and security.

The WAN between the enterprise's data center and its remote offices tends to be unreliable and slow, with limited bandwidth and high latency. In addition, the WAN creates other obstacles to the implementation of the data center solution.

One obstacle is created by the file server protocols that operate over the WAN. CIFS, which is the file server protocol for Windows, was designed to operate over a LAN. Every file operation generates several exchanges of protocol messages between the client and the file server. This situation is usually not noticeable on the LAN, but quickly causes high latency over the WAN. Occasionally, this high latency breaks the file server protocol altogether.

Even in cases where the file server protocol is managing to function correctly over the WAN, there are typically long delays between each transaction. These delays can often cause timeouts in user applications such as word processing programs, image editing programs, and design tools, which stops them from functioning correctly.

All of these problems—unreliable WANs, file system protocol compatibility, and user application compatibility—contribute to an unfriendly work environment that negatively affects the user experience and diminishes productivity.

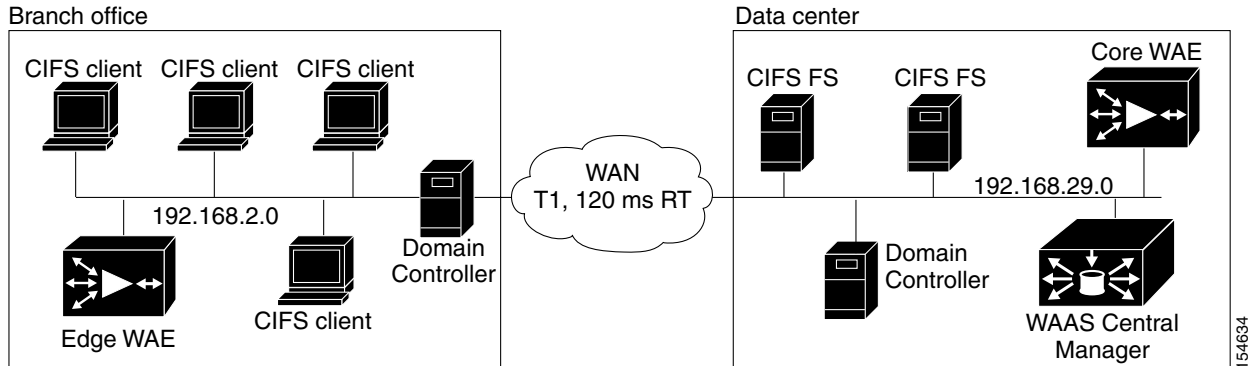
The WAAS file services feature overcomes the WAN latency and bandwidth limitations by caching data on Edge WAEs near the user. This data caching method allows branch office users to access centralized data at LAN-like speeds over the WAN. The solution is based on several key concepts:

- Use the WAN as little as possible—By minimizing the number of operations that need to traverse the WAN, WAAS effectively shields users from many of the obstacles that WANs create.
- Use the WAN optimally—The file services feature uses sophisticated caching, compression, and network optimization technologies, which enable the system to use the WAN optimally.
- Preserve file system protocol semantics—Although WAAS software uses its own proprietary protocol over the WAN, it leaves the complete semantics of the standard file system protocol commands intact. This is essential to preserve the correctness and coherency of the data in the network.
- Make the solution transparent to users—The best solutions are the ones that do their jobs unnoticed, without interfering with end users' operations or forcing users to change their ways of doing business. The WAAS file services solution does not require any software installations, either on the server side or at the client, and does not require the user to learn anything new. Users derive all the benefits of having a secure data center without needing to change any of their work habits.

By using the WAAS file services feature, enterprises can consolidate their file servers to a data center that provides the facilities, IT personnel, and storage devices required to manage the data properly.

[Figure 11-1](#) shows a typical deployment scenario after WAAS file services have been set up.

Figure 11-1 WAAS File Services Solution



Overview of File Services Features

This section provides an overview of the WAAS file services features and contains the following topics:

- [Automatic Discovery, page 11-4](#)
- [Prepositioning, page 11-4](#)
- [Data Coherency, page 11-5](#)
- [Data Concurrency, page 11-6](#)
- [Microsoft Interoperability, page 11-6](#)

WAAS version 4.1.1 supports two mutually exclusive WAFS modes:

- **Transparent CIFS accelerator mode**—This mode was introduced in WAAS version 4.1.1. The new transparent mode requires no core, edge, or connectivity configuration. It relies on automatic discovery and transparently accelerates CIFS traffic with no configuration needed. Disconnected mode is not supported. We recommend this mode for ease of use.
- **Legacy mode**—This mode, present in all WAAS versions, requires that you configure a Core cluster, Edge file services, and connections between the Core and Edge devices. Use this mode if you need to interoperate with WAAS 4.0.x devices or if disconnected mode operation is essential.

This mode also includes the ability to automatically discover file servers, but there are some limitations. For more information, see the [“Automatic Discovery with Legacy Mode” section on page 11-4](#).

If you enable the transparent CIFS accelerator on a WAE device or group, the system disables any existing Core or Edge configurations and the Core and Edge configuration windows; additionally, the device cannot belong to a Core cluster. In the CIFS accelerator mode, the WAE device acts as an Edge and a Core simultaneously, depending on the direction of each request. There is no need for a manual setting.



Note

WAFS acceleration operates only if the peer WAEs at each end of the connection use the same WAFS mode (transparent CIFS accelerator or legacy).

Automatic Discovery

The automatic discovery feature allows you to enable WAFS without having to register individual file servers in the WAAS Central Manager. With the automatic discovery feature, WAAS will attempt to automatically discover and connect to a new file server when a transparent mode CIFS request is received.

Automatic Discovery with Legacy Mode

The legacy mode of operation also includes the ability to automatically discover file servers, with some limitations. The automatic discovery feature operates by default for CIFS requests to unregistered file servers when you are using legacy mode.

If there are multiple paths to the file server, WAAS chooses the path with the lowest latency. If the latency between the core WAE and the discovered server is more than 25 milliseconds, the server is considered to be too far away, and the connection will not be optimized. Additionally, if the latency between the edge WAE and the server is less than 2 milliseconds, the server is considered to be local, and the connection will not be optimized.

**Note**

If you are using the WAFS legacy mode, and relying on automatic discovery instead of registering file servers, the following WAFS features are not available: positioning, dynamic shares, and disconnected mode. Additionally, if the file server requires a digital signature, WAFS cannot cache its data.

As new file servers are added to the policy engine dynamic map by this mode of automatic discovery, you can see them by using the **show policy-engine application dynamic EXEC** command. A file server remains in the dynamic map for three minutes after the last connection to it is closed.

Prepositioning

The prepositioning feature allows system administrators to proactively “push” frequently used files from the central storage into the cache of selected Edge WAEs. This operation provides users with faster first-time file access, and makes more efficient use of available bandwidth. You create preposition directives from the WAAS Central Manager GUI.

When an end user attempts to open a file that is not found in the Edge WAE cache, the Edge WAE retrieves it across the WAN from the file server where it is stored. Prepositioning is a feature that allows administrators to push large, frequently accessed files from file servers to selected Edge WAE caches according to a predefined schedule. Through the proper use of prepositioning, administrators can allow users to benefit from cache-level performance even during first-time access of these files. Prepositioning improves WAN bandwidth utilization by transferring heavy content when the network is otherwise idle (for example, at night), which frees up bandwidth for other applications during the day.

The WAAS Central Manager GUI allows administrators to create multiple, overlapping preposition policies (each with its own schedule), a list of target Edge WAEs, and defined time and size constraints.

**Note**

Prepositioning includes the ability to configure multiple roots. See the [“Creating a New Preposition Directive” section on page 11-25](#).

Data Coherency

WAAS software ensures data integrity across the system by using two interrelated features – *coherency*, which manages the freshness of the data, and *concurrency*, which controls the access to the data by multiple clients.

Maintaining multiple copies of data files in multiple locations increases the likelihood that one or more of these copies will be changed, causing it to lose consistency or coherency with the others. Coherency semantics are used to provide guarantees of freshness (whether the copy is up-to-date or not) and the propagation of updates to and from the origin file server.

The WAAS software applies the following coherency semantics to its built-in coherency policies:

- **Strict CIFS behavior for intra-site**—Users of the same cache are always guaranteed standard, strict CIFS coherency semantics.
- **Cache validation on CIFS open**—In CIFS, the File Open operation is passed through to the file server. For coherency purposes, WAAS software validates the freshness of the file on every file open, and invalidates the cached file if a new version exists on the file server.

WAAS software validates data by comparing the time stamp of a file in the cache to the time stamp of the file on the file server. If the time stamps are identical, the cached copy on the Edge WAE is considered valid and the user is permitted to open the file from the Edge WAE cache.

If the time stamps are different, the Edge WAE removes the file from its cache and requests a fresh copy from the file server.

- **Proactive cache updating**—WAAS software supports the use of change notifications in CIFS environments as a way to keep cached data on the Edge WAEs up-to-date.

When a client makes a change to a directory or file, the Edge WAE sends a change notification to the file server. The file server then sends to all the Edge WAEs a change notification that includes a list of the modified directories and files. Upon receiving the change notification, each Edge WAE checks its cache and invalidates the directories and files listed in the notification, and then updates its cache with the latest versions.

For example, if a user edits an existing Word document and saves the changes to the Edge WAE cache, the Edge WAE sends a change notification to the file server so it knows that the file has been modified. The Edge WAE then sends the changed sections to the file server, and the file server proactively sends change notifications to the other Edge WAEs in the network. These Edge WAEs then update their cache so the file is consistent across all access points.

This process also applies when you rename a directory, add a new subdirectory, rename a file, or create a new file in a cached directory.

- **Flush on CIFS close**—In CIFS, the File Close operation forces all write buffers to be flushed to the file server, and the Close request is only granted after all updates have been propagated to the file server. From a coherency standpoint, the combination of validate on file open and flush on file close ensures that well-behaved applications, such as Microsoft Office, operate in session semantics. The Open, Lock, Edit, Unlock, and Close commands are guaranteed to work correctly on the WAAS network.
- **Age-based validation on directories (CIFS)**—Directories are associated with a preconfigured age. When the age expires, the Edge WAE cache revalidates the directory.

When a user first attempts to view the contents of a directory, the Edge WAE enables the file server to perform the authorization check using the directory's access control list (ACL), which contains the user and group permissions. The Edge WAE monitors which directories the user has accessed and whether the file server permitted that access. If the user tries to access the same directory again during a short period of time (aging period), the Edge WAE does not contact the file server and

instead uses the cached permissions to determine if the user should be provided access. After the aging period expires, the Edge WAE contacts the file server to refresh the cached permission of the user.

This authorization process prevents users from accessing directories and files in the cache that they do not have permission to access on the file server.

Data Concurrency

Concurrency control is important when multiple users access the same cached data to read, or write, or both. Concurrency control synchronizes this access by establishing and removing file system locks. This file-locking feature ensures data integrity and provides the following benefits:

- Enables a client to aggressively cache file data so it does not have to rely on retrieving data from the remote file server.
- Provides a performance boost in many applications running on existing CIFS client implementations.
- Preserves data integrity because only one user at a time can make changes to a section of a file.

WAAS software supports the CIFS oplocks feature, which allows a user to lock a file so the user can safely read and write data to its local cache instead of using network bandwidth to perform these functions over the WAN on the file server. By using oplocks, a user can proactively cache read-ahead data because it knows that no other user is accessing the file so there is no chance the cached data can become stale. The user can also write data to its local cache and does not need to update the file server until it closes the file or until another user requests to open the same file.

Oplocks only applies to files. The file server does not grant oplock requests on directories and named pipes.

File-Locking Process

When a user opens a file, it sends a lock request to the file server. The Edge WAE intercepts and forwards all lock requests from the user to the file server as well as all responses from the file server to the user. If no other user has a lock on the file, the file server grants an exclusive lock request so that the user can safely cache the file.

If a second user requests to open the same file, the following actions occur:

1. The file server revokes the exclusive file lock obtained by the first user.
2. The first user performs the following actions:
 - Flushes any file changes stored in its cache to the file server. This action ensures that the second user opening the file receives the latest information from the file server.
 - Deletes any of its read-ahead buffers for the file because that data is no longer guaranteed to remain up-to-date now that a second user will open the file.
3. The file server allows the second user to open the file.

Microsoft Interoperability

The WAAS file services feature interoperates with these Microsoft CIFS features:

- Active Directory for user authentication and authorization

- Offline folders in Microsoft CIFS
- Microsoft DFS infrastructure
- Windows shadow copy for shared folders, as described in the “[Windows Shadow Copy for Shared Folders](#)” section on page 11-7)

Windows Shadow Copy for Shared Folders

WAAS file services support the Shadow Copy for Shared Folders feature that is part of the Windows Server 2003/2008 operating system. This feature uses the Microsoft Volume Shadow Copy Service to create snapshots of file systems so that users can easily view previous versions of folders and files.

In a WAAS environment, users view shadow copies in the same way they would in a native Windows environment by right-clicking a folder or file from the Edge WAE cache and choosing **Properties > Previous Version**.

For more information about Shadow Copy for Shared Folders, including the limitations of the feature, refer to your Microsoft Windows Server 2003/2008 documentation.

Users can perform the same tasks when accessing a shadow copy folder on the Edge WAE as they can in the native environment on the file server. These tasks include the following:

- Browsing the shadow copy folder
- Copying or restoring the contents of the shadow copy folder
- Viewing and copying files in the shadow copy folder

The Shadow Copy for Shared Folders feature does not support the following tasks:

- Renaming or deleting a shadow copy directory
- Renaming, creating, or deleting files in a shadow copy directory

Supported Servers and Clients

WAAS supports Shadow Copy for Shared Folders on the following file servers:

- Windows 2008
- Windows 2003 (with and without SP1)
- NetApp Data OPTap versions 6.5.2, 6.5.4 and 7.0
- EMC Celerra versions 5.3 and 5.4

WAAS supports Shadow Copy for Shared Folders for the following clients:

- Windows Vista
- Windows XP Professional
- Windows 2000 (with SP3 or later)
- Windows 2003



Note

Windows 2000 and Windows XP (without SP2) clients require the Previous Versions Client to be installed to support Shadow Copy for Shared Folders.

Preparing for File Services

Before enabling file services on your WAEs, ensure that you complete the following tasks:

- If you want to configure multiple devices with the same settings, ensure that you have created a device group that contains all the edge devices you want to enable with file services. For information on creating device groups, see [Chapter 3, “Using Device Groups and Device Locations.”](#)
- Identify the edge devices on which you want to enable file services. An edge device may also serve as a core device if it also exports local file servers to other edge devices.
- Identify the file servers that you want to export, and refer to [Table 11-1](#) to verify that these file servers can operate with WAAS software. Other file servers may operate with WAAS, but only those listed in the table were tested.



Note

The WAAS file services feature does not support file servers that use the FAT32 file system. You can use the policy engine rules to exclude any file servers that use the FAT32 file system from CIFS optimization.

Table 11-1 *Tested File Servers*

Vendor	Product	Version
Dell	PowerVault	715N
Network Appliance	FAS270	ONTAP 7.0.1R.1
	FAS250	ONTAP 7.0.1R.1
	F760	6.5.2R1P16
	F85	6.4.5
EMC	Celerra NS702	5.4.17.5
	Celerra NS702	5.4.14-3
	Celerra NS501	5.3.12-3
Microsoft	Windows NT 4.0	
	Windows Server 2000	No service pack, SP1, SP3, and SP4
	Windows Server 2003	No service pack, SP1, and R2
	Windows Server 2008 ¹	
Novell ²	6.5	SP-3
RedHat	Samba	3.0.1.4a

1. With Vista clients, WAAS transparently uses the SMB1 protocol.
2. WAAS supports Novell 6.5 for CIFS optimization, server consolidation, and generic network acceleration for NCP, eDirectory/NDS, and iPrint. If your Novell file server uses the NFAP option, WAAS can optimize your Novell traffic at the transport layer as well as at the protocol layer using the WAAS CIFS adapter. NFAP is Novell's Native File Access Pack that uses the CIFS protocol on top of Novell's NCP (Novell Core Protocol).

Using File Services on the NME-WAE

If you are running WAAS on a network module that is installed in a Cisco access router, there are specific memory requirements for supporting file services. The NME-WAE must contain the following amounts of memory in order to support file services:

- Transparent CIFS accelerator mode—1 GB RAM
- Legacy mode, edge file services—1 GB RAM
- Legacy mode, core (or both edge and core) file services—2 GB RAM

If you try to enable file services and the device does not contain enough memory, the WAAS Central Manager will display an error message.

You can check the amount of memory that a device contains in the Device Dashboard window. For details, see the [“Device Dashboard Window” section on page 16-9](#).

Configuring File Services

WAAS version 4.1.1 supports two mutually exclusive WAFS modes that are configured in different ways:

- Transparent CIFS accelerator mode—This mode requires no core, edge, or connectivity configuration. It relies on automatic discovery and transparently accelerates CIFS traffic with no configuration needed. We recommend this mode for ease of use.
[Table 11-2](#) provides an overview of the steps that you must complete to configure transparent CIFS accelerator mode. By using this mode, you can skip most of the configuration steps in this chapter.
- Legacy mode—This mode requires that you configure a Core cluster, Edge file services, and connections between the Core and Edge devices. Use this mode if you need to interoperate with WAAS 4.0.x devices or if disconnected mode operation is essential.

[Table 11-3](#) provides an overview of the steps that you must complete to configure file services.

Table 11-2 Checklist for Configuring Transparent Mode File Services

Task	Additional Information and Instructions
1. Prepare for file services.	Provides the tasks that you need to complete before enabling and configuring file services on your WAAS devices. For more information, see the “Preparing for File Services” section on page 11-8 .
2. Enable CIFS acceleration.	Enables the transparent CIFS accelerator. For more information, see the “Enabling and Disabling the Global Optimization Features” section on page 12-2 .
3. (Optional) Identify dynamic shares.	Identifies the dynamic shares on an exported file server. If your file server does not contain dynamic shares, you can skip this step. For more information, see the “Creating Dynamic Shares” section on page 11-20 .
4. (Optional) Create a preposition directive.	Defines which files are proactively copied from an exported file server to the Edge WAE cache. For more information, see the “Creating a Preposition Directive” section on page 11-25 .

Table 11-3 Checklist for Configuring Legacy Mode File Services

Task	Additional Information and Instructions
1. Prepare for file services.	Provides the tasks that you need to complete before enabling and configuring file services on your WAAS devices. For more information, see the “Preparing for File Services” section on page 11-8 .

Table 11-3 Checklist for Configuring Legacy Mode File Services (continued)

Task	Additional Information and Instructions
2. Configure a WAFS core cluster.	WAFS core clusters are required to copy data from the exported file server to the cache of the Edge WAEs. For more information, see the “Configuring the Core Cluster” section on page 11-10.
3. Configure the edge devices.	By default, file services are not enabled on your WAAS devices. To enable and start file services on edge devices, see the “Configuring the Edge Devices” section on page 11-13.
4. (Optional) Register a file server with the WAAS Central Manager.	Identifies to the WAAS system which file servers to export. This step also creates a link between a core cluster and the registered file server. For more information, see the “Setting Up File Servers to Export to the Edge WAE Cache” section on page 11-16. This step is optional if you are using automatic discovery.
5. (Optional) Identify dynamic shares.	Identifies the dynamic shares on a exported file server. If your file server does not contain dynamic shares, you can skip this step. For more information, see the “Creating Dynamic Shares” section on page 11-20.
6. Create a connection between a core cluster and your edge devices.	Enables a core cluster to copy data to the Edge WAE cache. For more information, see the “Creating a Connection Between a Core Cluster and Edge WAEs” section on page 11-22.
7. (Optional) Create a preposition directive.	Defines which files are proactively copied from an exported file server to the Edge WAE cache. For more information, see the “Creating a Preposition Directive” section on page 11-25.

Configuring the Core Cluster

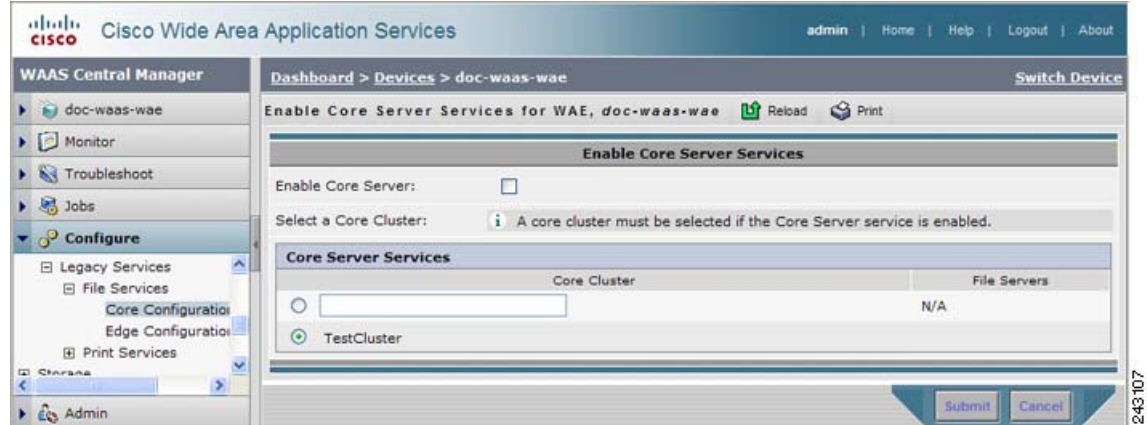
The first step in setting up file services in legacy mode is to enable Core services on a device and assign the device to a Core cluster. The Core cluster will be responsible for copying data from the exported file server (or multiple file servers) to the cache of the Edge WAEs. In later sections you will assign edge devices and, optionally, file servers to this core cluster, so the cluster knows which file servers to export and which edge devices to populate with cached data.

In Steps 1 through 7 you enable core server services and assign the device to a Core cluster. In Steps 8 through 12 you configure the new core cluster. The last step in this procedure describes how to reload the device, which is required for the device to function as a Core WAE.

To create a WAFS core cluster, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
The Devices window displays a list of devices created on your WAAS system.
- Step 2** Click the **Edit** button next to the device that you want to be a member of the new core cluster.
The Device Dashboard window appears.
- Step 3** From the navigation pane, choose **Configure > Acceleration > Legacy Services > File Services > Core Configuration**.
The Enable Core Server Services window appears. (See [Figure 11-2](#).)

Figure 11-2 Enabling Core Server Services



Step 4 Check the **Enable Core Server** check box.

Step 5 Use one of the following methods to assign this device to a core cluster:

- To create a new core cluster for this device, select the radio button next to the empty Core Cluster field, and enter a name for the new core cluster in this empty field. This name cannot contain spaces or special characters.
- To have this device join an existing core cluster, select the radio button next to that core cluster. If you do not have any existing core clusters, your only option is to create a new core cluster for this device.

Step 6 Click **Submit**.

A popup message is displayed that the device must be manually rebooted for the device to function as a Core server.

Step 7 Click **OK** after reading the popup message.

Core Server services are enabled on the device and the device joins the specified Core cluster. The last step in this section describes how to reboot the device, which is required for the Core services to be activated.

If you click **Cancel** on the popup message you are returned to the Enable Core Server window and your changes are not submitted.

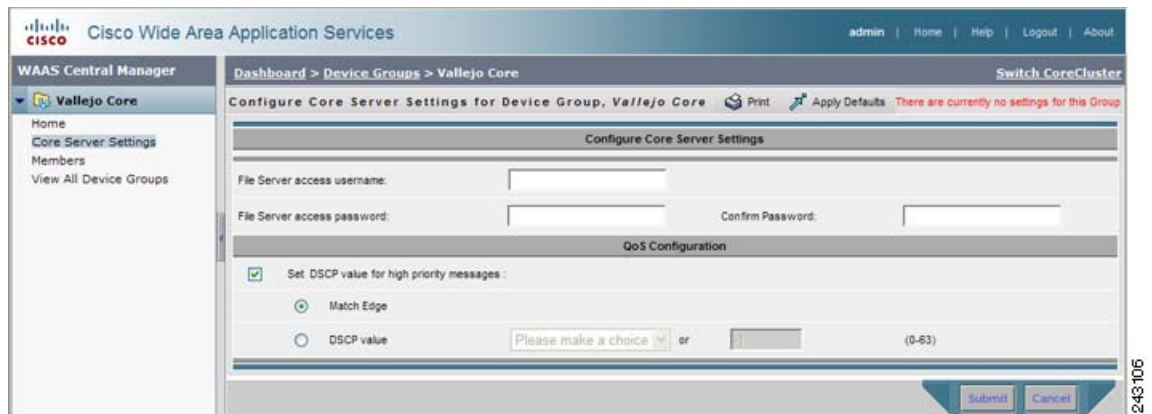
If you are relying on the automatic discovery feature instead of explicitly registering file servers, and you do not need to configure an optional differentiated services code point (DSCP) setting, you can skip to [Step 14](#).

Step 8 Click the Home link at the top right in the WAAS Central Manager GUI to return to the global context, then from the navigation pane, choose **My WAN > Manage Device Groups**.

Step 9 Click the **Edit** icon next to the new core cluster.

Step 10 From the navigation pane, choose *Cluster Name* > **Core Server Settings**. The Configure Core Server Settings window appears. (See [Figure 11-3](#).)

Figure 11-3 Configuring a Core Cluster Example



Step 11 In the File Server access username, File Server access password, and Confirm password fields, enter the access information that will be used for all of the CIFS file servers that are configured as part of this Core cluster. If you are relying on the automatic discovery feature instead of explicitly registering file servers, these fields are unnecessary.

You will specify which file servers this core cluster will export in the [“Setting Up File Servers to Export to the Edge WAE Cache”](#) section on page 11-16.

Step 12 (Optional) Configure a differentiated services code point (DSCP) value for high-priority messages, as follows:

- a. Check the **Set DSCP value for high priority messages** check box.
- b. Choose one of the following options:
 - **Match Edge**—Matches the DSCP value of the Edge WAEs connected to this core cluster. This matching takes place when you create a connection between edge and core devices, as described in the [“Creating a Connection Between a Core Cluster and Edge WAEs”](#) section on page 11-22.
 - **DSCP Value**—Allows you to specify a DSCP value for this core cluster.

Select a value from the drop-down list and refer to [Table 11-4 on page 11-15](#) for a description of the supported values. If you choose **Please Make a Choice** from the drop-down list, enter a value from 0 to 63 in the corresponding field.

DSCP is a field in an IP packet that enables different levels of service to be assigned to network traffic. Levels of service are assigned by marking each packet on the network with a DSCP code (shown in [Table 11-4](#)) and associating a corresponding level of service. DSCP is the combination of IP Precedence and Type of Service (ToS) fields. For more information, see RFC 2474.

We recommend setting a DSCP value for WAFS control traffic to improve system performance. This requires your routers to be configured to enforce the QoS markings accordingly.

Step 13 Click **Submit**.

Step 14 Reload the device by clicking the **Reload WAE** icon in the taskbar, or by completing the following steps:

- a. From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- b. Click the **Edit** icon next the device on which you enabled Core services. The Device Dashboard window appears.

- c. Click the **Reload WAE** icon in the taskbar. The device is rebooted and Core services are activated on the device.

Configuring the Edge Devices

After you create and configure the core cluster, the next step (for legacy mode) is to configure the edge devices that will contain the exported file server data in their cache.

To enable the edge server on a device or device group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).



Note We recommend enabling file services on an edge device group if WCCP is enabled on your network. If WCCP is disabled, you should enable file services on individual edge devices to prevent name conflicts.

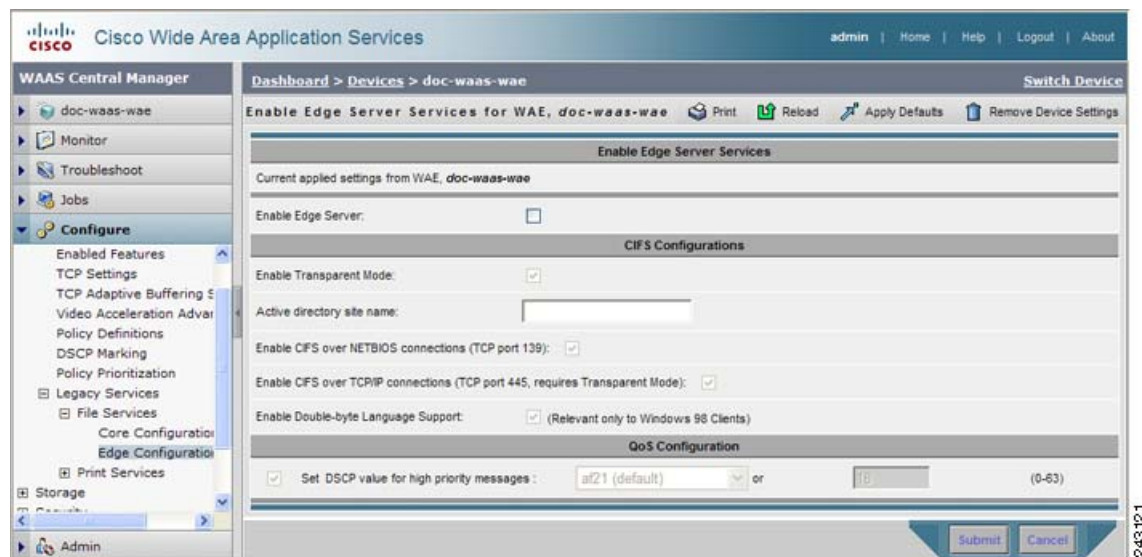
- Step 2** Click the **Edit** icon next to the edge device or device group on which you want to enable file services. The Device Dashboard window or the Modifying Device Group window appears depending on the selected option.

You cannot enable edge services on the WAAS Central Manager device.

- Step 3** From the navigation pane, choose **Configure > Acceleration > Legacy Services > File Services > Edge Configuration**.

The Enable Edge Server Services window appears. (See [Figure 11-4](#).)

Figure 11-4 Enabling File Services on Edge Devices



- Step 4** Check the **Enable Edge Server** check box.

The other fields in the window are enabled.

- Step 5** Check the **Enable Transparent Mode** check box if WCCP or PBR is enabled on your network, or if you are using inline mode.

The options for enabling TCP ports 139 and 445 are automatically updated based on whether transparent mode has been enabled.

If you enable transparent mode, the options for enabling TCP port 139 and port 445 are automatically selected. If you disable transparent mode (Enable Transparent Mode is not checked), the option for enabling TCP port 139 is selected and the option for enabling TCP port 445 is not selected, because port 445 is used only in transparent mode.

- Step 6** Enter the name of the active directory site in the provided field.

- Step 7** Enable the relevant ports on the Edge WAE by checking the following options (at least one must be checked):

- **Enable CIFS over NETBIOS connections (tcp port 139)**—Check this option if port 139 is open between your clients and the Edge WAEs, as well as between your core cluster and your file servers.

If port 139 is not open on your network for security reasons, uncheck this option, and then complete the following tasks:

- Enable WCCP on your routers and Edge WAEs, or enable inline mode on the Edge WAEs. For more information, see [Chapter 4, “Configuring Traffic Interception.”](#)
- Enable port 445 on the Edge WAE by checking the **Enable CIFS Over TCP/IP Connections** check box.

- **Enable CIFS over TCP/IP connections (tcp port 445, requires Transparent Mode)**—Check this option if port 445 is open on your network.

If port 445 is closed on your network, uncheck this option so that your Edge WAE does not try to establish a connection on this port, and then check the **Enable CIFS over NETBIOS connections** check box.

When you disable port 445 all clients connect directly to port 139 on the Edge WAE, then the core cluster connects to port 139 on the file server.



Note If you enable or disable connections on port 139 and port 445, existing clients will not lose their connection to the Edge WAEs.

- Step 8** Check the **Enable Double-byte Language Support** check box if you have Windows 98 clients that need to support two-byte languages such as Japanese.

Leave this option unchecked in the following situations:

- You do not have any Windows 98 clients in your environment.
- You have Windows 98 clients in your environment, but they only need to support one-byte languages.

English will always be supported regardless of how this option is configured.

- Step 9** (Optional) Configure a differentiated services code point (DSCP) value for high-priority messages, by following these steps:

- Place a check in the **Set DSCP value for high priority messages** check box.
- Select a value in the drop-down list. Refer to [Table 11-4](#) for a description of the supported values.

If you choose **Please Make a Choice** from the drop-down list, enter a value from 0 to 63 in the corresponding field.

DSCP is a field in an IP packet that enables different levels of service to be assigned to network traffic. Each packet on the network is marked with a DSCP code (shown in Table 11-4) and is assigned to the corresponding level of service. DSCP is the combination of IP Precedence and Type of Service (ToS) fields. For more information, see RFC 2474.

We recommend setting a DSCP value for WAFS control traffic to improve system performance. This requires your routers to be configured to enforce the QoS markings accordingly.

Table 11-4 DSCP Codes

DSCP Code	Description
af11	Sets packets with AF11 dscp (001010).
af12	Sets packets with AF11 dscp (001100).
af13	Sets packets with AF13 dscp (001110).
af21	Sets packets with AF21 dscp (010010).
af22	Sets packets with AF22 dscp (010100).
af23	Sets packets with AF23 dscp (010110).
af31	Sets packets with AF31 dscp (011010).
af32	Sets packets with AF32 dscp (011100).
af33	Sets packets with AF33 dscp (011110).
af41	Sets packets with AF41 dscp (100010).
af42	Sets packets with AF42 dscp (100100).
af43	Sets packets with AF43 dscp (100110).
cs1	Sets packets with CS1 (precedence 1) dscp (001000).
cs2	Sets packets with CS2 (precedence 2) dscp (010000).
cs3	Sets packets with CS3 (precedence 3) dscp (011000).
cs4	Sets packets with CS4 (precedence 4) dscp (100000).
cs5	Sets packets with CS5 (precedence 5) dscp (101000).
cs6	Sets packets with CS6 (precedence 6) dscp (110000).
cs7	Sets packets with CS7 (precedence 7) dscp (111000).
default	Sets packets with default dscp (000000).
ef	Sets packets with EF dscp (101110).

- Step 10** Click **Submit**. A popup message is displayed that the device must be manually rebooted for the device to function as an Edge server.
- Step 11** Click **OK** after reading the popup message. Edge Server services are enabled on the device.
If you click **Cancel** on the popup message, you are returned to the Edge Configuration window and your changes are not submitted.
- Step 12** Reload the device by clicking the **Reload WAE** icon in the taskbar, or by completing the following steps:
- From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Click the **Edit** icon next the device or device group on which you enabled Edge services.
 - Click the **Reload WAE** or the **Reboot All Devices** icon in the taskbar. The device(s) are rebooted and Edge services are activated on the device(s).

Setting Up File Servers to Export to the Edge WAE Cache

For legacy mode, after you enable file services on a core cluster and Edge WAEs, you can optionally use the WAAS Central Manager GUI to set up the file servers that you want to export. If your network has many file servers that you need to define on the WAAS network (10 or more, for example), you can create and import a comma-separated values (CSV) file to speed up the process.

If you do not want to set up file servers but still want to use legacy mode, you can rely on the automatic discovery feature of legacy mode to allow WAFS to automatically discover file servers when they are accessed by users. If you are not explicitly registering file servers, you can skip this section.

This section contains the following topics on setting up a file server in the WAAS Central Manager GUI:

- [Registering a File Server with the WAAS Central Manager](#), page 11-16
- [Importing File Server Definitions Using a CSV File](#), page 11-17
- [Assigning a Core Cluster to a Registered File Server](#), page 11-19
- [Creating Dynamic Shares](#), page 11-20

Registering a File Server with the WAAS Central Manager

To register a file server with the WAAS Central Manager, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > File Servers**. The File Servers window appears.

From this window, you can perform the following tasks:

- Edit the configuration of an existing file server by clicking the **Edit** icon next to the file server. You can then delete the file server configuration, or modify any of the file server settings.
- Import multiple file server definitions using a CSV file by clicking the **Import from CSV** icon in the task bar. (See the [“Importing File Server Definitions Using a CSV File”](#) section on page 11-17.)
- Identify a new file server to export, as described in the next steps.

- Step 2** Click the **Create New File Server** icon in the taskbar to identify a new file server to export. The Registering New File Server window appears. (See [Figure 11-5](#).)

Figure 11-5 Registering New File Server Window

The screenshot shows the Cisco Wide Area Application Services (WAAS) Central Manager GUI. The main content area is titled "Registering new File Server" and contains a "File Server Configuration Settings" form. The form has the following fields and options:

- File Server Name:** A text input field with an asterisk (*) indicating it is a required field. A tooltip icon indicates the user should "Enter NetBIOS or Fully-qualified DNS name".
- Type:** A dropdown menu currently set to "CIFS".
- Allow access on WAN Failure:** A checkbox that is currently unchecked.

At the bottom of the form, there is a note: "Note: * - Required Field". At the bottom right of the window, there are "Submit" and "Cancel" buttons. The left navigation pane shows the "Configure" menu expanded to "File Services" > "File Servers".

243-139

Step 3 In the **File Server Name** field, enter the hostname of the file server to export. You can enter the server's NetBIOS name, DNS name, or IP address.



Note If a file server has multiple NetBIOS or DNS names, you must register the file server separately under each one of its names. Otherwise, a client using a NetBIOS name that is not registered will not be able to connect. (Clients using CIFS over TCP port 445 will work fine, however.)

Step 4 Check the **Allow Access on WAN Failure** check box to provide CIFS clients with read-only access to the cached data on this Edge WAE in the event of a WAN failure.

When a WAN failure occurs, enabling this option allows CIFS clients to browse the cached directory structure and read fully cached files while authentication and authorization is maintained.

For more information, see the [“Preparing Your WAAS Network for WAN Failures” section on page 11-33](#).

Step 5 Click **Submit**.

The file server is registered with the WAAS system, and the navigation pane refreshes with additional options.

Step 6 Proceed to the [“Assigning a Core Cluster to a Registered File Server” section on page 11-19](#) to assign a core cluster to the registered file server.

Importing File Server Definitions Using a CSV File

If your network includes a high number (10 or more, for example) of file servers that you need to define on the WAAS network, you can create and import a comma-separated values (CSV) file to speed up the process. You can use Excel or another spreadsheet application to create the CSV file.

This section contains the following topics:

- [CSV File Creation Requirements, page 11-17](#)
- [CSV File Considerations, page 11-18](#)
- [Importing the CSV File, page 11-18](#)

CSV File Creation Requirements

[Table 11-5](#) specifies the CSV file requirements.

Table 11-5 CSV File Requirements

Column Heading	Syntax/Semantics	Comments
Name	Specify the name of the file server. Corresponds to the File Server Name field in the Registering New File Server window (Figure 11-5).	Required. Same constraints as in Step 3 in Registering a File Server with the WAAS Central Manager.
AllowDisconnected	Corresponds to the Allow access on WAN Failure check box in the Registering New File Server window (Figure 11-5). Set to “true” to apply; set to “false” when not applicable.	Optional. If not specified, assumed to be “false.”
Cluster	Specifies the name of an existing core cluster to which the file server is to be assigned.	Optional. If not specified, file server is not assigned to a core cluster. No error is reported if a cluster name is assigned to a file server more than one time.

CSV File Considerations

Keep the following in mind when creating CSV files:

- The first row must list the column headings that you are going to specify.
- At a minimum, the file must contain a “Name” column (other columns are optional).
- Column headings are not case sensitive and can be specified in any order.
- To assign a file server to multiple core clusters, you can specify multiple “Cluster” columns. The column headings row must contain multiple “Cluster” columns if you want to specify multiple clusters in the data rows.
- When you specify a row, it is not necessary to have a value for each column. However, you must specify the correct number of columns. That is, the number of columns must correspond to the number of objects defined in the headings row. The following example presents valid CSV file entries (assuming that core clusters c-1, c-2, and c-5 exist). The adjacent pairs of commas indicate that default values are to be used.

Example:


```
name,allowdisconnected,cluster,cluster
s71,TRUE,c-1,
s72,,c-2,c-5
```

Importing the CSV File

After you have created the CSV file, you use the WAAS Central Manager GUI to import the file.

To import the CSV file, follow these steps:




-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > File Servers**.

- Step 2** In the taskbar, click the **Import from CSV** icon ().
- The Importing File Server Definitions window appears.
- Step 3** Click **Browse**.
- The Choose File window opens.
- Step 4** Navigate to and select the CSV file that you want to import, then click **Open**. The path and file server name appear in the Path to File Server Definitions field.
- Step 5** In the Importing File Server Definitions window, click **Submit**.
- The CSV file is imported and a “successfully imported” message is displayed.
- The WAAS Central Manager checks the following:
- File headings are correct
 - File server name appears on each row
 - At least one file server is specified in the file
 - All rows have the correct number of columns and each row is syntactically correct
- If the file fails any of these checks, an error message appears in the WAAS Central Manager and no file servers are imported. Error messages may provide error explanations for up to 10 rows. However, if the error is related to the headings or the file cannot be read, no further checking occurs.


Assigning a Core Cluster to a Registered File Server


After you register a file server with the WAAS Central Manager, you need to assign at least one core cluster to the file server. The core cluster will be responsible for exporting the file server to the cache on the Edge WAEs. If you are relying on the automatic discovery feature rather than explicitly registering file servers, you do not need to perform this step.

To assign a core cluster to a registered file server, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > File Servers**.
- The File Servers window appears.
- Step 2** Click the **Edit** icon next to the file server that you want to assign to a core cluster.
- Step 3** Click the **Core Clusters** tab. The Core Cluster Assignments window appears.
- The Core Cluster Assignments window displays the device groups configured in your WAAS network. By default, the window displays 10 device groups.
- Step 4** Assign a core cluster to the file server by doing either of the following:
- Click  in the taskbar to assign all available core clusters to the file server.
 - Click  next to each core cluster that you want to assign to the file server. The icon changes to  when selected.




Note You can only assign core clusters to file servers. You cannot assign regular device groups (identified by ) to file servers.

Step 5 Click the **Resolve File Server Name** icon () for the WAFS Core Cluster you selected. This icon is located next to the Type column and verifies that the name you entered for the file server can be resolved to an IP address.

This icon is available only for WAFS Core Clusters. If the file server name does not resolve, an error message appears in the Comments column. If this occurs, ensure you entered the correct name for the file server.

Step 6 Click **Submit**.

The icon next to the Core Clusters you selected changes to .

Step 7 (Optional) If the file server that you just added contains a dynamic share, see the [“Creating Dynamic Shares” section on page 11-20](#).

When a file server contains a dynamic share, you must specify the dynamic share in the WAAS Central Manager GUI.

Creating Dynamic Shares

Many file servers use dynamic shares, which allow multiple users to access the same share but then be automatically mapped to a different directory based on the user’s credentials. Dynamic shares are most commonly used on file servers to set up user home directories.

For example, a directory named Home can be set up as a dynamic share on a file server so each user accessing that share is automatically redirected to their own personal directory.

If a file server contains a dynamic share, you must register that dynamic share with the WAAS Central Manager as described in this section.

Before adding a dynamic share, note the following limitations:

- Each dynamic share on a file server must be unique.
- You cannot add a dynamic share if that share has a preposition directive. You must remove the preposition policy before you can add the dynamic share.
- You can use the WAAS Central Manager GUI to define any directory as a dynamic share. However, if a directory is not set up as a dynamic share on the file server, all users will read or write the same content from the same directory and will not be redirected to different directories based on their credentials.
- If you are using legacy mode, you can add two different dynamic shares with the same file server name and the same share name, but each one needs to be associated with a different core cluster. Each share will have a different ID.
- If you are using legacy mode, you can add dynamic shares only for explicitly registered file servers. Dynamic shares are supported on automatically discovered file servers only if you are using transparent CIFS accelerator mode.

To add a dynamic share, follow these steps:

Step 1 Before adding a dynamic share, verify the following (only if you are using legacy mode):

- The dynamic share is already set up on the CIFS file server.
- You have set up the file server in the WAAS Central Manager GUI. For more information on identifying a file server, see the [“Setting Up File Servers to Export to the Edge WAE Cache” section on page 11-16](#).

Step 2 From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > Dynamic Shares**.

A list of dynamic shares appears. The Dynamic Shares window shows all the dynamic shares configured. From this window, you can perform the following tasks:

- Edit the configuration of an existing dynamic share by clicking the **Edit** icon next to the share. You can delete the dynamic share, or modify any of the dynamic share settings.
- Add a new dynamic share definition, as described in the next steps.

Step 3 Click the **Create New Dynamic Share** icon in the taskbar to add a new dynamic share. The Creating a new Dynamic Share window appears.

Step 4 In the Name field, enter a name for the dynamic share. This name appears to users when they access the share on the Edge WAE cache.

The following characters are not supported in the dynamic share name: / \ : * ? " < > |

Step 5 From the Assigned Domain drop-down list, choose the WAAS domain that you want to assign to the dynamic share. Only users who are also assigned to this domain have permission to access the dynamic share.

This kind of WAAS domain does not use entities. (When defining the domain, choose **None** for the Entity Type.) For more information on domains, see the [“Working with Domains” section on page 7-14](#).

Step 6 (Optional) If you are using legacy mode, check the **CIFS - Use WAFS transport mode** check box.

Checking this box hides certain fields in this window because some fields are appropriate only for transparent CIFS accelerator mode.

Step 7 In the File Server field, enter the name of the file server with the dynamic share.

The text field is not shown if you checked the CIFS - Use WAFS transport mode check box. Instead, registered file servers are displayed in a drop-down list. For information on registering a file server, see the [“Registering a File Server with the WAAS Central Manager” section on page 11-16](#). (Registering file servers is not required for transparent CIFS mode.)

Step 8 In the User name, Password, and Confirm fields, enter the username and password credentials for the file server. If the username is in a Windows domain, specify the domain name as part of the User name field, as follows: domain\username. (These fields are not shown if you checked the CIFS - Use WAFS transport mode check box.)

Step 9 In the Share Name field, specify the location of the dynamic share by doing one of the following tasks:

- Enter the name of the dynamic share on the file server. The following characters cannot be used in the share name: \ / : * ? “ < > |
- Click **Browse** next to the **Share Name** field to navigate to the correct root directory.



Note

To make the Browse button appear in legacy mode, you must assign the file server to a Core Cluster and the cluster must contain at least one Core WAE. If these conditions are not met, the Browse button is not displayed in legacy mode. In transparent CIFS accelerator mode, the Browse button appears only if you have at least one WAE device with the CIFS accelerator enabled and registered to the WAAS Central Manager.

Step 10 Ensure that the status of the share is set to enabled. If you change the status to disabled, the share will not be set up as a dynamic share in your WAAS environment.

Step 11 Click **Submit**.

The specified directory now functions as a dynamic share on the Edge WAE cache.

Creating a Connection Between a Core Cluster and Edge WAEs

After you have registered a file server with the WAAS system, you need to create a connection between a core cluster and your Edge WAEs (for legacy mode). This connection enables the core cluster to copy files to the cache on your Edge WAEs.

Before you define a connection that includes multiple core clusters and Edge WAEs, it is important to confirm that each core cluster-to-Edge WAE link has the same connection parameters, such as allocated bandwidth and roundtrip delay, as well as identical aliasing. If this is not the case, you must define a separate connection for each link.

To create a connection between a core cluster and one or more Edge WAEs, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > Connectivity**.

The Connectivity window appears.

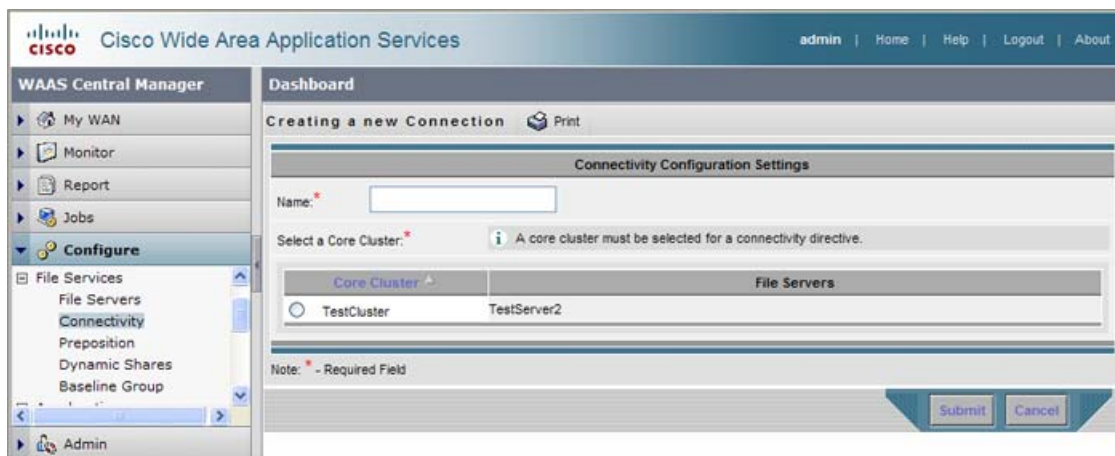
From this window, you can perform the following tasks:

- Edit the configuration of an existing connection by clicking the **Edit** icon next to the connection. You can delete the connection, or modify any of the connection settings.
- Add a new connection, as described in the next steps.

Step 2 Click the **Create New Connection** icon in the taskbar to add a new connection.

The Creating a New Connection window appears. (See [Figure 11-6](#).)

Figure 11-6 Creating a New Connectivity Directive Window



Step 3 Enter a name for the connection.

Step 4 Choose the radio button next to the core cluster that you want included in this connection.

Step 5 Click **Submit**.

A message appears explaining that if you do not want to export any file servers for this connection, you need to uncheck each file server on the File Server Settings window before you assign an Edge device or group to this connection.

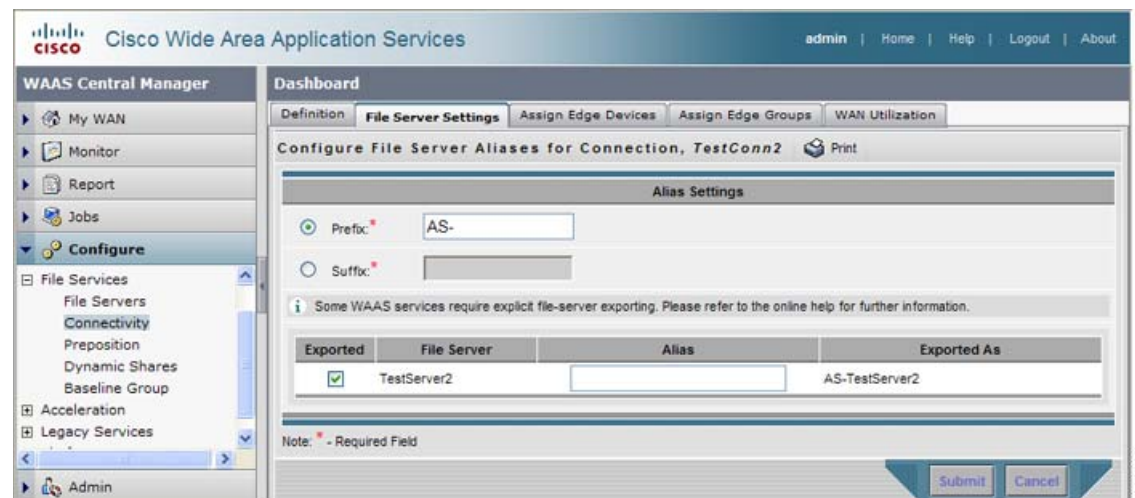
Step 6 Click **OK** after reading the message.

If you are relying on the automatic discovery feature instead of explicitly registering file servers, you do not need to configure file server settings and you can skip to [Step 12](#).

Step 7 Click the **File Server Settings** tab.

The Configure File Server Aliases window appears. (See [Figure 11-7](#).)

Figure 11-7 Configuring File Server Aliases



This window allows you to define the naming scheme for each file server. You can use the original file server name, the file server name plus a prefix or suffix, or an alias of your own design. For example, if you specify **as-** as a prefix and the name of the file server is **win3srv**, users will see this file server as **as-win3srv**.

This window also allows you to select the file servers that you want the core cluster to export.

Step 8 Specify a prefix or suffix value by selecting one of the following options:

- **Prefix**—Adds the prefix you enter to the beginning of the exported file server alias.
- **Suffix**—Adds the suffix you enter to the end of the exported file server alias.

The default behavior is for WAAS to add the prefix **AS-** to the beginning of the file server alias. You cannot enter a blank prefix or suffix value. If you specify an alias, as described in [Step 10](#), it overrides the prefix and suffix setting.

Step 9 Check the check box next to each file server that you want to export in this connection (at least one must be selected). By default, all file servers are selected.



Note If no file servers appear in this window, then you have not assigned this core cluster to a file server as described in the [“Assigning a Core Cluster to a Registered File Server”](#) section on [page 11-19](#). You must complete the procedures in that section before proceeding.

Step 10 (Optional) Enter an alias for the selected file servers in the Alias column.

An alias, which can be any name (maximum of 15 characters), overrides the default prefix and suffix setting defined in [Step 8](#).

Step 11 Click **Submit**.




The Exported As column displays the name of each exported file server as it will appear to your end users.

Step 12 Click one of the following tabs:


- **Assign Edge Devices** to assign individual edge devices to this connection.
- **Assign Edge Groups** to assign an edge device group to this connection.

The Edge Device Assignments window or the Edge Group Assignments window appears depending on the selected option.

Step 13 Choose the edge devices to include in this connection by doing either of the following:

- Click  in the taskbar to assign all available edge devices or groups to this connection.
- Click  next to each edge device or device group that you want to assign to this connection. The icon changes to  when selected.



Note You can only assign edge devices or device groups with edge services enabled on them. You cannot assign regular core clusters or offline devices (identified by ) to the connection. For information on enabling edge services, see the [“Configuring the Edge Devices”](#) section on [page 11-13](#).

Step 14 Click **Submit**.

The icon next to each edge device or device group you selected changes to .

Step 15 (Optional) Configure WAN utilization settings for this connection, by completing the following tasks:

- a. Click the **WAN Utilization** tab. The WAN Utilization window appears.
- b. Define the following WAN utilization settings that control the bandwidth that is used for WAFS traffic between the Edge and Core WAEs:
 - **Maximum allocated bandwidth**—Enter the maximum bandwidth allocated to the connection (in kilobits per second). This value must be less than or equal to the maximum bandwidth of the physical WAN link between the WAEs in this connection. This setting has a default value of 1544 KB per second. WAFS throttles its bandwidth usage to 1.5 times the value of this setting.
 - **Minimum roundtrip delay**—Enter the length of time (in milliseconds) it takes a bit to travel round-trip from one WAE to the other end and back when the link is idle. This setting has a default value of 80 msec.



Note If you later change any of the WAN utilization settings for this connection, you need to restart the Edge WAE for the new values to take effect.

Step 16 Click **Submit**.

Creating a Preposition Directive

A preposition directive allows you to determine which files should be proactively copied from CIFS file servers to the cache of selected Edge WAEs. Prepositioning enables you to take advantage of idle time on the WAN to transfer frequently accessed files to selected WAEs, where users can benefit from cache-level performance even during first-time access of these files.

You can add preposition directives only for explicitly registered file servers in legacy mode. Prepositioning is supported on automatically discovered file servers only in transparent CIFS accelerator mode.

When defining a preposition directive, you select the Edge WAEs that you want to be prepositioned with content from the file server, then specify the root directories on the file server to be prepositioned. Initially, the preposition directive is in the unscheduled state. You must create a schedule that determines when and how often the content is prepositioned. Because content can be prepositioned on a regular basis, you can specify whether each new iteration of the task should copy all designated files, or only those files that have changed over a specified time interval.

In addition, you can specify time and size limits to prevent a preposition task from consuming too much bandwidth on the WAN or too much space on the Edge WAE cache. We strongly recommend that you use these limits to optimize network efficiency and prevent misuse of this feature.

When the activation time of a preposition directive arrives, a preposition task starts on the Edge WAE. Each preposition task can be monitored in the WAAS Central Manager GUI during and after processing. You can also terminate active preposition tasks if required.

Prepositioning requires that the username and password needed to access the file server be specified in the Configure Core Server Settings window. For details, see [Step 11](#) in the “[Configuring the Core Cluster](#)” section on page 11-10.

Prepositioning includes the ability to configure multiple roots. See the “[Creating a New Preposition Directive](#)” section on page 11-25.

**Note**

A warning message appears if the required connections do not exist for defining preposition directives.

The following topics describe how to create a preposition directive:

- [Creating a New Preposition Directive, page 11-25](#)
- [Assigning Edge Devices to a Preposition Directive, page 11-30](#)
- [Creating a New Preposition Schedule, page 11-31](#)

Creating a New Preposition Directive

To create a preposition directive, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > Preposition**.

The Preposition Directives window appears. This window displays the following information about preposition directives that exist on the system:

- Preposition Directive—Name of the preposition directive.
- Type—Whether the preposition directive affects all files (Full) or just those that have changed since the last preposition task (Differential).

- When the type is Full, all the files that match the other filters of the task and that are found on the file server are sent to the Edge to be compared with the cache.
 - When the type is Differential, only the files that are found as changed since the last successful preposition are sent to the Edge cache. The time of the last successful preposition is taken from the Edge device, so ensure that the clock is synchronized with the file server. The first scan is always a full scan. If you change the preposition task, the last successful scan time is reset.
 - When the type is Since, only the files that are found as changed within a specified time period are sent to the Edge cache.
- Status—Whether the preposition directive is enabled or disabled.
 - File Server—Name of the exported file server.

From the Preposition Directive window, you can perform the following tasks:

- Edit the configuration of an existing preposition directive by clicking the **Edit** icon next to the directive. You can then delete the preposition directive, or modify any of the settings.
- Add a new preposition directive, as described in the following steps.

Step 2 Click the **Create New Preposition Directive** icon in the taskbar to create a new preposition directive.

The Creating New Preposition Directive window appears. (See [Figure 11-8](#).)

Figure 11-8 Creating a New Preposition Directive

- Step 3** Enter a name for the directive.
- Step 4** (Optional) If you are using legacy mode, check the **CIFS - Use WAFS transport mode** check box. Checking this box hides certain fields in this window because some fields are appropriate only for transparent CIFS accelerator mode.
- Step 5** From the Status drop-down list, choose either **enabled** or **disabled**. Disabled directives are not put into effect.
- Step 6** In the File Server field, enter the name of a file server to export.
The text field is not shown if you checked the CIFS - Use WAFS transport mode check box. Instead, registered file servers are displayed in a drop-down list. For information on registering a file server, see the “[Registering a File Server with the WAAS Central Manager](#)” section on page 11-16. (Registering file servers is not required for transparent CIFS mode.)
- Step 7** From the Location drop-down list, choose the device location that will provide browsing services for the file server. For the best browsing performance, specify a location that is close to the file server. For more information on defining locations, see the “[Working with Device Locations](#)” section on page 3-14. (The Location is not shown if you checked the CIFS - Use WAFS transport mode check box.)

Step 8 In the User name, Password, and Confirm fields, enter the username and password credentials for the file server. If the username is in a Windows domain, specify the domain name as part of the User name field, as follows: domain\username. (These fields are not shown if you checked the CIFS - Use WAFS transport mode check box.)

Step 9 (Optional) Check the **DSCP value for high priority messages** check box if you want to assign a DSCP marking value to the prepositioning traffic. Choose a DSCP value from the drop-down list or enter a number from 0–63 in the text field. See [Table 11-4 on page 11-15](#) for a description of the supported values. (The DSCP settings are not shown if you checked the CIFS - Use WAFS transport mode check box.)

DSCP is a field in an IP packet that enables different levels of service to be assigned to the network traffic. Levels of service are assigned by marking each packet on the network with a DSCP code and associating a corresponding level of service. DSCP is the combination of IP Precedence and Type of Service (ToS) fields. For more information, see RFC 2474.

Step 10 (Optional) Define the time and size limitations using the provided fields.

[Table 11-6](#) describes the time and size limitation fields.

Table 11-6 Preposition Time and Size Limitations

Field	Description
Total Size as % of Cache Volume	<p>Percentage of the overall Edge WAE cache that prepositioned files can consume. For example, if you do not want this prepositioning directive to consume more than 30 percent of a WAE's cache, enter 30 in this field. The default value is 5 percent.</p> <p>The percentage of the cache defined for a preposition task defines the maximum size that can be prepositioned in a single iteration of the task regardless of how much is already in the cache.</p> <p>When the cache is full, regardless of the reason, prepositioning operates like on-demand caching: an eviction process begins and the files with the oldest time-last-accessed values are removed from the cache.</p>
Max File Size	Maximum file size that can be exported. Files that are larger than this value are not exported to the WAE cache.
Min File Size	<p>Minimum file size that can be exported. Files that are smaller than this value are not exported to the WAE cache. It is inefficient to preposition files smaller than 20 KB because these files can be retrieved quickly over the WAN through normal WAAS.</p> <p>The default value is 20 KB.</p>

Table 11-6 Preposition Time and Size Limitations (continued)

Field	Description
Duration	<p>Maximum amount of time it should take WAAS to export the file server. If it takes WAAS longer than this amount of time to export the file server, WAAS stops the exporting process before all files are copied to the Edge WAE cache.</p> <p>If the preposition task does not start at the scheduled start time (for example, because the Edge and the Core have no connection), the start retries are counted in the duration.</p> <p>If you do not specify a value for this field, WAAS takes as much time as needed to export this file server.</p>
Type	<p>Time filter on the scan process. From the Type drop-down list, choose one of the following options:</p> <ul style="list-style-type: none"> • All Files—Exports all files to the Edge WAE cache. This is the default setting. • Files changed since last preposition—Exports only the files that have changed since the last preposition to the Edge WAE cache. This differential filter is applied from the second iteration of a task execution onward. <p>If a new directory is moved to an already prepositioned directory (without changing its last-modified time), this new directory is not prepositioned during the next prepositioning session when you choose this option.</p> <ul style="list-style-type: none"> • Files changed since last—Exports only the files that have changed within the specified time. For example, if you want to push out file updates that have been made on the file server in the last two hours, enter 2 in the provided field and choose hour from the drop-down list.



Note If one of these limits is exceeded during a prepositioning task, the task is terminated and a message is sent to the Administrator log. Any remaining files are exported the next time the task is run. If a user requests one of the missing files before this happens, it is fetched over the WAN through WAAS software as usual.

Step 11 (Optional) Check the **Ignore Hidden Directories** check box if you want to prevent hidden directories on the file server from being prepositioned. This check box is unchecked by default. If you leave this box unchecked, hidden directories will be prepositioned.



Note If you are using legacy mode and relying on the automatic discovery feature instead of explicitly registering file servers, this check box does not apply because prepositioning is not supported for automatically discovered file servers in legacy mode.

Step 12 In the Root Share and Directories field, enter the directories on the file server that you want to export. Use any of the following methods to identify a directory:

- Manually enter one or more directory paths in the following format: *protocol://server/share* or *server\share*. For example, *cifs://win12srv/home* or *win12srv\home*. You may enter multiple lines for multiple directories, with each full directory path on its own line.

When you define multiple root shares, the preposition sequence that is performed for a single root configuration is repeated for each root serially.

- Click the **Browse** button to browse the directories on the file server. To navigate into a directory, click the file folder icon to the left of the directory name. Check the check box next to the directory that you want to export and then click the **Select Directory** button. The browse window allows you to choose multiple directories.

In legacy mode, the Browse button appears only if you have configured the File Server access username and the File Server access password fields in the Core Server Settings configuration window. (See [Figure 11-3](#).) In transparent CIFS mode, the browse function operates best when you choose in the Location drop-down list the location of the nearest CIFS accelerator to the file server. If you do not choose a location, the browse request is sent to all devices that have the CIFS accelerator enabled, and the request may time out.

- Check the **Include Sub Directories** check box to include all subdirectories under the specified root directory. If this option is not selected, only the files in the specified root directory are prepositioned and you cannot select subdirectories when you are browsing.
- Narrow the policy definition to a particular type of file by choosing a pattern operator from the File Name drop-down list and entering the text that describes the pattern in the adjacent text box. For example, enter **ends with .doc**.

Step 13 Click **Submit**.

The directive is saved to the system and additional options appear in the navigation pane.

Assigning Edge Devices to a Preposition Directive

After you create a preposition directive, you need to assign Edge WAEs or device groups to the directive. This task determines which Edge WAEs will store preposition content in their cache.



Note

Prepositioning includes the ability to configure multiple roots. See the [“Creating a New Preposition Directive”](#) section on page 11-25.

To assign an Edge WAE or device group to a preposition directive, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > Preposition**.

The Preposition Directives window appears, which lists the preposition directives that exist on the system.




Step 2 Click the **Edit** icon next to the preposition directive that you want to assign to an Edge WAE or device group.

Step 3 Click one of the following tabs at the top of the window:


- **Assign Edge Devices**—Allows you to select one or more Edge WAEs to assign to this directive.
- **Assign Edge Groups**—Allows you to select a device group to assign to this directive.

The Edge Device Assignments window or the Device Groups Assignments window appears, depending on the selected option.


Step 4 Choose the Edge WAEs or device groups to assign to this preposition directive by doing either of the following:

- Click  in the taskbar to assign all available Edge WAEs or device groups to this directive.
- Click  next to the individual Edge WAE or device group that you want to assign to this directive. The icon changes to  when selected.



Note If a device or device group is offline (identified by ) , then you cannot assign that device or group to this directive. The preposition directive, when assigned to a device group, is applied only to connected Edge devices in the assigned device group.

Step 5 Click **Submit**.

The icon next to each edge device or device group you selected changes to  .

Creating a New Preposition Schedule

Once you create a preposition directive and assign WAEs to the directive, we recommend you create a schedule that determines when and how often prepositioning occurs.

For example, you may want to schedule prepositioning to occur at night to minimize the amount of traffic during business hours. Or you may want to schedule prepositioning to occur on a recurring basis if the exported data changes often. This will help ensure that the WAEs assigned to this directive have the latest file updates in their cache.

When a preposition task is scheduled to begin at the same time for multiple Edge WAEs that are located in different timezones, the task will begin on the Edge WAEs based on the Core WAE timezone. If the clocks of the Edge WAE and the Core WAE are not synchronized, the task will not start on time.

To create a preposition schedule, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > Preposition**.

The Preposition Directives window appears, which lists the preposition directives that exist on the system.

Step 2 Click the **Edit** icon next to the preposition directive for which you want to create a schedule.

Step 3 Click the **Schedule** tab at the top of the window.

The Creating New Preposition Schedule window appears. By default, no schedule is configured.

Step 4 Choose one of the following scheduling options:

- **Not Scheduled**—Prepositioning is not scheduled at this time.
- **Now**—Prepositioning occurs within a few minutes after you submit this schedule.
A Now schedule begins again each time you make a change to the preposition directive and click the **Submit** button. A Now schedule also begins again as soon as an edge device that has been reloaded comes back online.
- **Daily**—Prepositioning occurs daily at the defined time.
- **Date**—Prepositioning occurs at the defined time and date.
- **Weekly**—Prepositioning occurs on the selected days of the week at the defined time.
- **Monthly Days**—Prepositioning occurs on the selected days of the month at the defined time.

- **Monthly Weekdays**—Prepositioning occurs on the defined day (as opposed to a defined date) and time during the month. For example, you can schedule prepositioning to occur on the second Tuesday of every month.

Step 5 Specify a start time for the prepositioning task.

The time is expressed in 24-hour format with 00:00 representing midnight.



Note You cannot schedule a start time for the **Now** option.

Step 6 Click **Submit**.

The message Changes Submitted appears at the bottom of the window confirming that your schedule was saved.

Step 7 Verify that the preposition directive completed successfully by checking the preposition status. For more information, see the “[Checking the Preposition Status](#)” section on page 11-32.

Managing File Services

The following topics in this section describe how to manage file servers:

- [Checking the Preposition Status, page 11-32](#)
- [Starting and Stopping Preposition Tasks, page 11-33](#)
- [Preparing Your WAAS Network for WAN Failures, page 11-33](#)
- [Viewing Members of a Core Cluster, page 11-35](#)

Checking the Preposition Status

After you create one or more preposition directives, you can check the status of all the preposition tasks to ensure they completed successfully. If a task does not complete successfully, then some of the prepositioned files may have not been successfully copied to the Edge WAE cache.

To check the status of a prepositioning task, follow these steps:

Step 1 From the WAAS Central Manager GUI navigation pane, choose **Configure > File Services > Preposition**.

The Preposition Directives window appears, which lists the preposition directives that exist on the system.

Step 2 Click the **Edit** icon next to the preposition directive for which you want to check.

Step 3 Click the **Preposition Status** tab at the top of the window. The Preposition Status window appears.

This page displays the following information:

- **WAE**—The name of each Edge WAE that received the prepositioned files in its cache.
- **Start Time**—The time the preposition task started.
- **Duration**—The amount of time it took the preposition task to complete.
- **Amount Copied**—The amount of data copied to the WAE cache (in bytes).

- Status—Whether the preposition task completed successfully.
- Reason—The reason a preposition task failed.

Step 4 Ensure that the Status column shows Completed.

If this column shows a failure, look in the Reason column for an explanation that can help you troubleshoot why the preposition task failed. After resolving the issue, you can schedule the preposition task to run again now, or wait until the scheduled start time and check the status again later.

Starting and Stopping Preposition Tasks

You can start or stop a preposition task from the Device Manager GUI. For more information, see the [“Preposition Option” section on page 10-19](#).

Preparing Your WAAS Network for WAN Failures

When you set up a connectivity directive that links an Edge WAE to a core cluster, you have the option to configure the Edge WAE to operate in disconnected mode in the event a WAN failure breaks its link to the core cluster.

**Note**

Disconnected mode is not available when you are using the transparent CIFS accelerator mode of file services.

This section contains the following topics:

- [About Disconnected Mode, page 11-33](#)
- [DNS and Domain Controller Requirements, page 11-34](#)
- [Data Availability in Disconnected Mode, page 11-34](#)
- [Configuring Disconnected Mode, page 11-34](#)

About Disconnected Mode

Disconnected mode allows CIFS clients to continue to browse the cache directory and read fully cached files on an Edge WAE when a WAN failure occurs. Because the Edge WAE cannot verify its cached data against the file server during a WAN failure, CIFS clients are provided with read-only access to the cached data.

When the WAN connection between the Edge WAE and core cluster is restored, the Edge WAE automatically switches back to regular connected mode.

An Edge WAE switches to disconnected mode when the Edge WAE loses its connection to the core cluster. This is known as a WAN failure.

**Note**

A file server crash does not trigger a switch to disconnected mode (assuming the Edge WAE maintains its connection to the core cluster).

An Edge WAE can operate in disconnected mode for one connection and in regular connected mode for another connection. For example, if you create two connectivity directives for an Edge WAE where one directive links it to core cluster A and the other directive links it to core cluster B and a WAN failure breaks its link to core cluster A, then the Edge WAE switches to disconnected mode for that connection. The Edge WAE will remain in regular connected mode when interacting with core cluster B.

Disconnected mode operates only with explicitly registered file servers. Disconnected mode is not supported for automatically discovered file servers.

DNS and Domain Controller Requirements

Disconnected mode requires a local domain controller in the branch office to authenticate CIFS clients. An Edge WAE operating in disconnected mode supports all authentication methods except Kerberos.

In DNS-only environments, a local DNS server at the branch office is also required. If WINS is used instead of DNS, there must be a local WINS server in the branch office.

To enable disconnected mode access to cached files, you must add the Edge WAE to the Active Directory or Windows NT domain (to perform windows authentication in case of WAN failure).

**Note**

By default, Windows domain controllers enforce automatic machine account password changes as part of the authentication process. The machine account password for the Edge WAE is automatically negotiated and changed between the Edge WAE and the domain controller every seven days. However, if the authentication service is down, this process may not occur, and the machine account password for the Edge WAE may expire. To prevent this situation, we recommend that you disable automatic machine account password changes for the Edge WAE. For more information, see the [“Disabling the Automatic Machine Account Password Changes for the Edge WAE”](#) section on page 6-22.

**Note**

WINS registrations usually have a three-day timeout. As a result, if WCCP is enabled in disconnected mode there is a chance that the WINS registration of the original file servers will expire and clients will experience name resolution problems.

Data Availability in Disconnected Mode

When an Edge WAE is in disconnected mode, CIFS clients are allowed read-only access to fully cached files on the Edge WAE. CIFS clients are able to view partially cached files and non-cached files in the directory structure, but they are not able to open these files.

Directories are available in disconnected mode only if their ACL is cached. This means that shares that have never been accessed, and therefore are not in the cache, are not displayed.

The best way to ensure a file is available in disconnected mode is to set up a preposition directive that proactively places a copy of the file on the Edge WAE cache. For more information, see the [“Creating a New Preposition Directive”](#) section on page 11-25.

Configuring Disconnected Mode

When you register a file server with the WAAS Central Manager, you can configure an Edge WAE to operate in disconnected mode. For more information, see the [“Registering a File Server with the WAAS Central Manager”](#) section on page 11-16.

You also must add the Edge WAE to the Active Directory or Windows NT domain. For details, see the [“Configuring Windows Domain Server Settings on a WAAS Device”](#) section on page 6-17. Verify that the WAE was successfully added into the domain by clicking the **Show Authentication Status** button. Even if the authentication status is not OK, as long as the **wbinfo -t** command executed successfully (trust via RPC is successful), the WAE will provide authentication for Read Only disconnected mode.

Viewing Members of a Core Cluster

**Note**

This functionality is not available when you are using the transparent CIFS accelerator mode of file services because Core Clusters do not exist in this mode.

To view the Core WAEs that are members of a Core Cluster device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**. The Device Groups window appears.
 - Step 2** Click the **Edit** icon next to the WAFS Core Cluster device group for which you want to view its members. The Modifying Device Group window appears.
 - Step 3** From the navigation pane, choose **Members**. A list of the devices that belong to the selected device group appears.
-



CHAPTER 12

Configuring Application Acceleration

This chapter describes how to configure the application policies on your WAAS system that determine the types of application traffic that is accelerated over your WAN.



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [About Application Acceleration, page 12-1](#)
- [Enabling and Disabling the Global Optimization Features, page 12-2](#)
- [Creating a New Traffic Application Policy, page 12-7](#)
- [Managing Application Acceleration, page 12-15](#)

About Application Acceleration

The WAAS software comes with over 150 default application policies that determine the type of application traffic your WAAS system optimizes and accelerates. These default policies cover the most common type of application traffic on your network. For a list of the default policies, see [Appendix A, “Default Application Policies.”](#)

Each application policy contains the following elements:

- **Application definition**—Identifies general information about a specific application, such as the application name, the differentiated services code point (DSCP) marking value that is applied to the traffic, and whether the WAAS Central Manager collects statistics about this application.
- **Classifier**—Contains a matching condition that identifies specific types of traffic. For example, the default HTTP classifier matches all traffic going to ports 80, 8080, 8000, 8001, and 3128. You can create up to 512 classifiers and 1024 matching conditions.
- **Policy**—Combines the application definition and classifier into a single policy. This policy also determines what optimization and acceleration features (if any) a WAAS device applies to the defined traffic. You can create up to 512 policies. A policy can also contain a DSCP marking value that is applied to the traffic and that overrides a DSCP value set at the application or global level.

You can use the WAAS Central Manager GUI to modify the default policies and to create additional policies for other applications. For more information on creating application policies, see the [“Creating a New Traffic Application Policy” section on page 12-7](#). For more information on viewing reports, restoring policies, monitoring applications, and other functions, see the [“Managing Application Acceleration” section on page 12-15](#).

Enabling and Disabling the Global Optimization Features

The global optimization features determine if TFO Optimization, Data Redundancy Elimination (DRE), and Persistent Compression are enabled on a device or device group. By default, all of these features are enabled. If you choose to disable one of these features, the device will be unable to apply the full WAAS optimization techniques to the traffic that it intercepts.

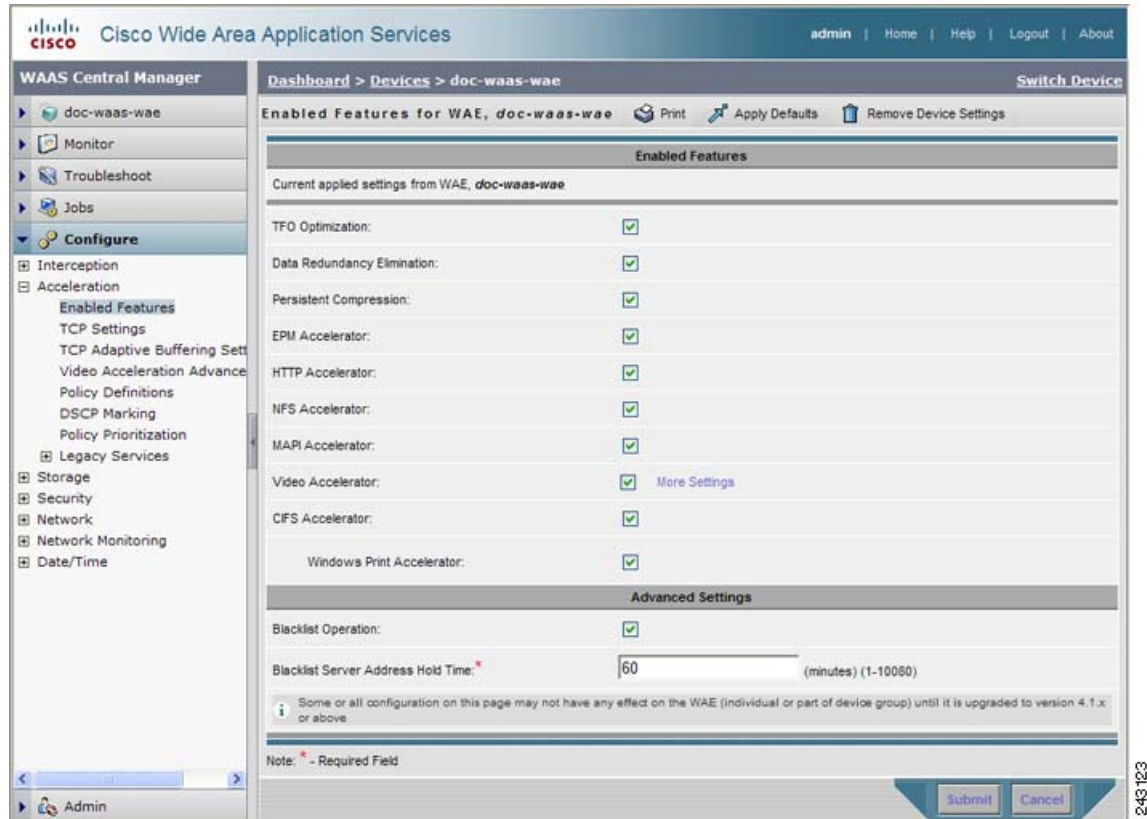
In addition, the global optimization features include each of the following application accelerators: EPM, CIFS, HTTP MAPI, NFS, and video. By default, all of the application accelerators are enabled. The application accelerators also require specific licenses to operate. For information on installing licenses, see the [“Managing Software Licenses” section on page 9-3](#).

You must enable the accelerator on both of the peer WAEs at either end of a WAN link for all application accelerators to operate.

To enable or disable a global optimization feature, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or device group for which you want to change the global optimization features.
 - Step 3** From the navigation pane, choose **Configure > Acceleration > Enabled Features**.
The Enabled Features window appears. (See [Figure 12-1](#).)

Figure 12-1 Modifying the Global Optimization Features



- Step 4** Place a check next to the optimization features that you want to enable, and uncheck the features that you want to disable. For a description of each of the optimization features, see the “[Key Services of Cisco WAAS](#)” section on page 1-4.
- Step 5** If you check the Video Accelerator check box, you can click the More Settings link as a shortcut to the Video Acceleration Configuration window. For more information, see the “[Configuring Video Acceleration](#)” section on page 12-5.
- Step 6** If you check the CIFS Accelerator check box, you have the following option:
- Windows Print Accelerator—Check this box to accelerate print traffic between clients and a Windows print server. This accelerator is enabled by default when you enable the CIFS accelerator.



Note If you are changing from WAFS legacy mode to the CIFS accelerator, you must disable the WAFS legacy mode before you can enable the CIFS accelerator. To disable WAFS legacy mode, you must disable Core and Edge file services. For WAFS configuration information, see [Chapter 11, “Configuring Wide Area File Services.”](#)



Note Do not disable Windows Print Acceleration during a client session as this can interfere with the client's use of print services. If you must disable Windows Print Acceleration, disconnect and then reestablish the client session.

Step 7 In the Advanced Settings area, uncheck the Blacklist Operation feature if you want to disable it. This feature allows a WAE to better handle situations in which TCP setup packets that have options are blocked or not returned to the WAE device. This behavior can result from network devices (such as firewalls) that block TCP setup packets that have options, and from asymmetric routes. The WAE can keep track of origin servers (such as those behind firewalls) that cannot receive optioned TCP packets and learns not to send out TCP packets with options to these blacklisted servers. WAAS is still able to accelerate traffic between branch and data center WAEs in situations where optioned TCP packets are dropped. We recommend leaving this feature enabled.

Step 8 If you want to change the default Blacklist Server Address Hold Time of 60 minutes, enter the new time in minutes in the Blacklist Server Address Hold Time field. The valid range is 1 minute to 10080 minutes (1 week).

When a server IP address is added to the blacklist, it remains there for configured hold time. After that time, subsequent connection attempts will again include TCP options so that the WAE can redetermine if the server can receive them. It is useful to retry sending TCP options periodically because network packet loss may cause a server to be erroneously blacklisted.

You can shorten or lengthen the blacklist time by changing the Blacklist Server Address Hold Time field.

Step 9 Click **Submit**.

The changes are saved to the device or device group.

To configure TFO optimization, DRE, and persistent compression from the CLI, use the **tfo optimize** global configuration command.

To configure EPM acceleration from the CLI, use the **accelerator epm** global configuration command.

To configure HTTP acceleration from the CLI, use the **accelerator http** global configuration command.

To configure NFS acceleration from the CLI, use the **accelerator nfs** global configuration command.

To configure MAPI acceleration from the CLI, use the **accelerator mapi** global configuration command.

To configure video acceleration from the CLI, use the **accelerator video** global configuration command.

To configure CIFS acceleration from the CLI, use the **accelerator cifs** and **accelerator cifs preposition** global configuration commands.

To configure Windows print acceleration from the CLI, use the **accelerator windows-print** global configuration command.

To configure the Blacklist Operation feature from the CLI, use the **tfo auto-discovery** global configuration command.

To display status and statistics on the application accelerators from the CLI, use the **show accelerator** and **show statistics accelerator** EXEC commands. To display statistics on the Windows print accelerator, use the **show statistics windows-print requests** EXEC command.

For details on using individual application accelerators, see the following sections:

- [Configuring HTTP Acceleration, page 12-4](#)
- [Configuring MAPI Acceleration, page 12-5](#)
- [Configuring Video Acceleration, page 12-5](#)

Configuring HTTP Acceleration

The HTTP application accelerator accelerates HTTP traffic.

The default Web application policy is defined to send traffic to the HTTP accelerator. The Web application policy uses the HTTP classifier, which matches traffic on ports 80, 8080, 8000, 8001, and 3128. If you expect HTTP traffic on other ports, add the other ports to the HTTP classifier.

Configuring MAPI Acceleration

The MAPI application accelerator accelerates Microsoft Outlook Exchange traffic that uses the Messaging Application Programming Interface (MAPI) protocol. Microsoft Outlook 2000–2007 clients are supported. Clients can be configured with Outlook in cached or noncached mode; both modes are accelerated.

Secure connections that use message authentication (signing) or encryption are not accelerated, and MAPI over HTTP is not accelerated.

**Note**

Microsoft Outlook 2007 has encryption enabled by default. You must disable encryption to benefit from the MAPI application accelerator.

The EPM application accelerator must be enabled for the MAPI application accelerator to operate. EPM is enabled by default. Additionally, the system must define an application policy of type EPM, specify the MAPI UUID, and have an Accelerate setting of MAPI. This policy, MAPI for the Email-and-Messaging application, is defined by default.

EPM traffic, such as MAPI, does not normally use a predefined port. If your Outlook administrator has configured Outlook in a nonstandard way to use a static port, you must create a new basic application policy that accelerates MAPI traffic with a classifier that matches the static port that was configured for Outlook.

**Note**

The MAPI application accelerator is not supported on a branch WAE device with the Cisco WAE Inline Network Adapter, where multiple inline devices are deployed in series. All connections must go through the same WAE. In the case of inline spillover load balancing, this scenario is not guaranteed to work. Outlook clients may receive errors in this case.

Configuring Video Acceleration

The video application accelerator accelerates Windows Media live video broadcasts that use RTSP over TCP. The video accelerator automatically splits one source video stream from the WAN into multiple streams to serve multiple clients on the LAN.

The video accelerator automatically causes the client that is requesting a UDP stream to do a protocol rollover to use TCP (if both the client and server allow TCP).

The default RTSP classifier for the Streaming application policy is defined to send traffic to the video accelerator.

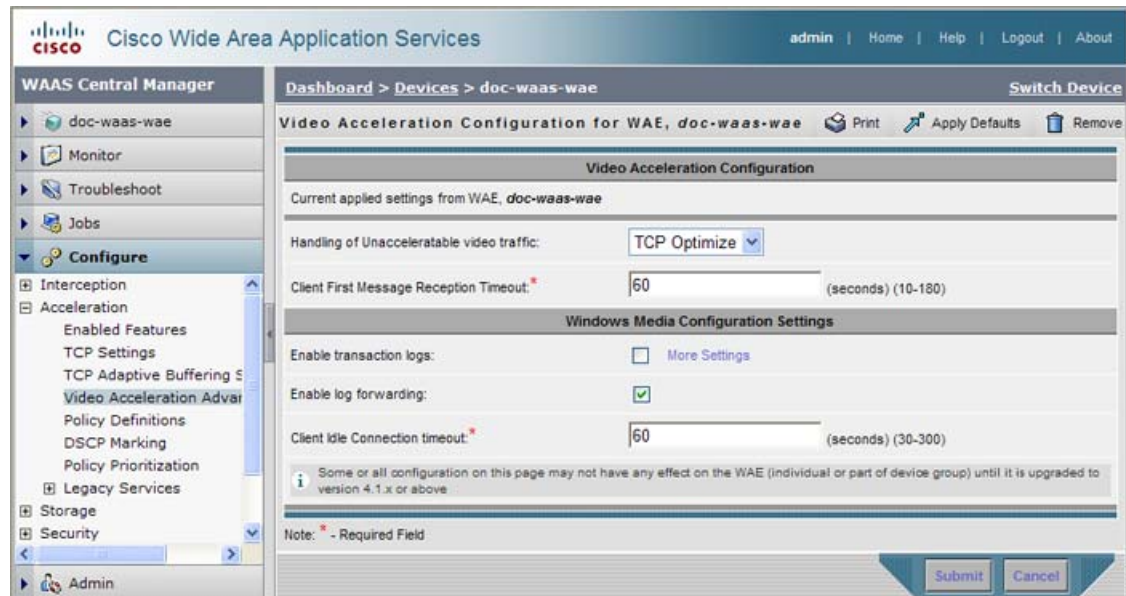
By default, the video accelerator sends any unaccelerated video traffic to be handled by the configured standard TCP optimization policy unless the video accelerator is explicitly configured to drop such traffic.

To enable the video accelerator, check the Video Accelerator check box in the Enabled Features window (see [Figure 12-1](#)).

To configure the video acceleration settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group for which you want to change the video acceleration configuration.
- Step 3** From the navigation pane, choose **Configure > Acceleration > Video Acceleration Advanced Settings**. The Video Acceleration Configuration window appears. (See [Figure 12-2](#).)

Figure 12-2 Modifying the Video Acceleration Configuration



- Step 4** In the Un-accelerated video traffic handling field, choose how to handle video traffic that is not being accelerated due to unsupported transport or format, or overload. Choose **TCP Optimize** (the default) to handle such connections with the configured TCP optimization policy, or choose **Drop** to drop the traffic. If you choose Drop, all Windows Media video-on-demand traffic and all non-Windows Media RTSP traffic is dropped.
- Step 5** In the Maximum Initial Setup Delay field, enter the number of seconds to wait for the first message from the client and the first response from the server, after the connection is accepted by the video accelerator, before timing out the connection. Valid values range from 10–180 seconds. The default is 60.
- Step 6** Check the **Enable transaction logs** check box to enable transaction logging. This feature will generate a large amount of logging data. This box is unchecked by default.
- Step 7** Check the **Enable log forwarding** check box to enable forwarding of Windows Media logs to the upstream Windows Media Server. This box is checked by default.
- Step 8** In the Client Idle Connection timeout field, enter the maximum number of seconds to wait after the initial client request, while the client connection is idle, before timing out the connection. Valid values range from 30–300 seconds. The default is 60.
- Step 9** Click **Submit**.

The changes are saved to the device or device group.

Creating a New Traffic Application Policy

Table 12-1 provides an overview of the steps that you must complete to create a new traffic application policy.

Table 12-1 Checklist for Creating a New Application Policy

Task	Additional Information and Instructions
1. Prepare for creating an application policy.	Provides the tasks you need to complete before creating a new application policy on your WAAS devices. For more information, see the “Preparing to Create an Application Policy” section on page 12-7.
2. Create an application definition.	Identifies general information about the application you want to optimize, such as the application name and whether the WAAS Central Manager collects statistics about this application. This step also allows you to assign the application definition to a device or device group. For more information, see the “Creating an Application Definition” section on page 12-8.
3. Create an application policy.	Determines the type of action your WAAS device or device group performs on specific application traffic. This step requires you to do the following: <ul style="list-style-type: none"> • Create application classifiers that allow a WAAS device to identify specific types of traffic. For example, you can create a condition that matches all traffic going to a specific IP address. • Specify the type of action your WAAS device or device group performs on the defined traffic. For example, you can specify that WAAS should apply TFO and LZ compression to all traffic for a specific application. For more information, see the “Creating an Application Policy” section on page 12-9.

Preparing to Create an Application Policy

Before you create a new application policy, complete the following preparation tasks:

- Review the list of application policies on your WAAS system and make sure that none of these policies already cover the type of traffic you want to define. To view a list of the default policies that come bundled with the WAAS system, see [Appendix A, “Default Application Policies.”](#)
- Identify a match condition for the new application traffic. For example, if the application uses a specific destination or source port, you can use that port number to create a match condition. You can also use a source or destination IP address for a match condition.
- Identify the device or device group that requires the new application policy. We recommend you create application policies on device groups so the policy is consistent across multiple WAAS devices.

Creating an Application Definition

The first step in creating an application policy is to set up an application definition that identifies general information about the application, such as the application name and whether you want the WAAS Central Manager to collect statistics about the application. After creating the application definition, you assign it to a device or device group. You can create up to 255 application definitions on your WAAS system.

To create an application definition, follow these steps:

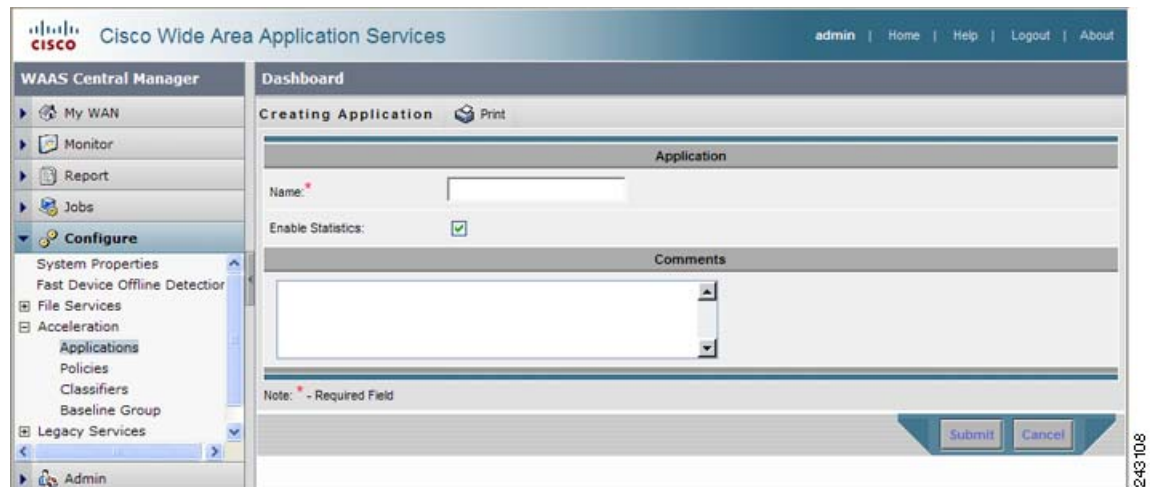
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Acceleration > Applications**.

The Applications window appears, which displays a list of all applications on your WAAS system. From this window, you can perform the following tasks:

- Click the **Edit** icon next to an application to modify or delete the definition.
- Determine if your WAAS system is collecting statistics on an application. The Monitor Enabled column displays Yes if statistics are being collected for the application.
- Create a new application as described in the steps that follow.

Click the **Create New Application** icon in the taskbar. The Creating Application window appears. (See [Figure 12-3](#).)

Figure 12-3 Creating a New Application



- Step 2** Enter a name for this application.

The name cannot contain spaces and special characters.





- Step 3** Check the **Enable Statistics** check box to allow the WAAS Central Manager to collect data for this application. To disable data collection for this application, uncheck this box.

The WAAS Central Manager GUI can display statistics for up to 20 applications, and an error message is displayed if you try to enable statistics for the twenty-first application. However, you can use the WAAS CLI to view statistics for all applications that have policies on a specific WAAS device. For more information, refer to the *Cisco Wide Area Application Services Command Reference*.

If you are collecting statistics for an application and decide to disable statistics collection, then reenabling statistics collection at a later time, the historical data will be retained, but a gap in data will exist for the time period when statistics collection was disabled. However, if you delete an application that you are collecting statistics for, then later recreate the application, the historical data for the application will be lost. Only data since the recreation of the application will be displayed.



Note The WAAS Central Manager does not start collecting data for this application until you finish creating the entire application policy.

- Step 4** (Optional) Enter a comment in the **Comments** field.
- The comment you enter appears in the Applications window shown in [Figure 12-3 on page 12-8](#).
- Step 5** Click **Submit**.
- The application definition is saved, and options appear in the navigation pane that allow you to assign the application to a device or device group.
- Step 6** From the navigation pane, click one of the following options:
- **Assign Device Groups**—Assigns the application to one or more device groups.
 - **Assign Devices**—Assigns the application to one or more WAAS devices.
- The Device Groups Assignments window or the WAE Assignments window appears depending on the selected option.
- Step 7** Choose the devices or device groups that you want to assign to this application. To select the devices, use one of the following procedures:
- Click  in the taskbar to assign all available WAAS devices or device groups.
 - Click  next to each WAAS device or device group that you want to assign. The icon changes to  when selected. To unassign a device or device group, click the icon again.
- Step 8** Click **Submit**.
- The icon next to the selected devices changes to , showing that the application has been successfully assigned to the devices.

Creating an Application Policy

After you create an application definition, you need to create an application policy that determines the action a WAAS device takes on the specified traffic. For example, you can create an application policy that makes a WAAS device apply TCP optimization and compression to all application traffic that travels over a specific port or to a specific IP address. You can create up to 512 application policies on your WAAS system.

The traffic matching rules are contained in the application classifier. These rules, known as match conditions, use Layer 2 and Layer 4 information in the TCP header to identify traffic.

To create an application policy, follow these steps:

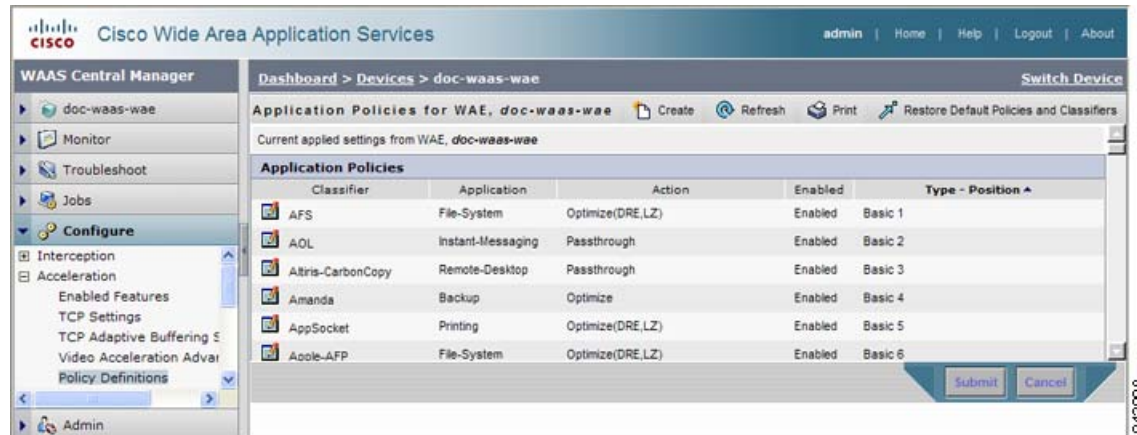
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group on which you want to create an application policy.

The Device Dashboard window or the Modifying Device Group window appears.

Step 3 From the navigation pane, choose **Configure > Acceleration > Policy Definitions**.

The Application Policies window appears. (See [Figure 12-4](#).)

Figure 12-4 Application Policies Window



This window displays information about all the application policies that reside on the selected device or device group. The last column shows the type of policy (Basic, WAFS transport, Port Mapper, or Other) and the position of the policy within that type. The position determines the order in which WAAS refers to that policy when determining how to handle application traffic. To change the position of a policy, see the [“Modifying the Position of an Application Policy”](#) section on page 12-18. This window also displays the classifier, application definition, and action assigned to each policy.

From the Application Policies window, you can perform the following tasks:

- Click the **Edit** icon next to an application policy to modify or delete that policy.
- Restore default policies and classifiers. For more information, see the [“Restoring Application Policies and Classifiers”](#) section on page 12-16.
- Create a new application policy as described in the steps that follow.

Step 4 Click the **Create New Policy** icon in the taskbar to create a new application policy.

The Creating New Application Policy window appears. (See [Figure 12-5](#).)

Figure 12-5 Creating a New Application Policy

Step 5 From the Type drop-down list, choose the type of application policy.

Table 12-2 describes the types of application policies.

Table 12-2 Application Policy Types

Option	Description
Basic	Standard type of application policy. Choose this option if none of the other types apply.
WAFS Transport	When you enable wide area file services (WAFS), all CIFS traffic going between a branch WAE and a data center WAE is optimized. Choose the WAFS Transport option to specify another action (such as passthrough) for CIFS traffic traveling between branch and data center WAEs. For more information on enabling file services, see Chapter 11, “Configuring Wide Area File Services.”
EPM	Type of policy for EPM-based applications. EndPoint Mapper (EPM) is a service that dynamically allocates server ports to certain applications. Unlike most applications that always use the same port, applications that rely on the EPM service can be assigned a different port at every request. Because EPM applications do not use a static port, you must specify the application’s UUID as a way to identify the application traffic to your WAAS system. When you select the EPM option, the UUID field is enabled so that you can select a preconfigured EPM application or enter the UUID for a custom application.

- Step 6** If you chose EPM for the policy type, choose one of the following EPM applications from the **UUID** drop-down list:
- **MAPI**—Uses the predefined UUID associated with the MAPI application, which is a4f1db00-ca47-1067-b31f-00dd010662da.
 - **MS-SQL-RPC**—Uses the predefined UUID associated with the SQL Session Manager application, which is 3f99b900-4d87-101b-99b7-aa0004007f07.
 - **MS-AD-Replication**—Uses the predefined UUID associated with the Active Directory application, which is e3514235-4b06-11d1-ab04-00c04fc2dcd2.
 - **MS-FRS**—Uses the predefined UUID associated with the file replication service, which is f5cc59b4-4264-101a-8c59-08002b2f8426.
 - **Custom**—Allows you to enter the UUID for a custom EPM application in the Custom UUID field.
- Step 7** Specify the application that you want to be associated with this policy by doing either of the following:
- From the Application drop-down list, choose an existing application like the one that you created in the “[Creating an Application Definition](#)” section on page 12-8. This list displays all default and new applications on your WAAS system.
 To modify an existing application, choose the application from the drop-down list and click **Edit Application**. You can then change the application’s name, add or remove comments, and enable or disable statistics collection for the application. After making the necessary changes, click **Submit** to save your changes and return to the Application Policy window.
 - Click **New Application** to create a new application. You can specify the application name, enable statistics collection, and specify the DSCP marking value. For the DSCP marking, you can choose to use the global default values (see the “[Defining Default DSCP Marking Values](#)” section on page 12-17) or select one of the other defined values. See [Table 11-4 on page 11-15](#) for a description of the supported DSCP marking values. In addition to the values listed in [Table 11-4](#), you can choose copy, which copies the DSCP value from the incoming packet and uses it for the outgoing packet. After specifying the application details, click **Submit** to save the new application and return to the Application Policy window. The new application is automatically assigned to this device or device group.
- Step 8** Choose the classifier from the Application Classifier drop-down list to select an existing classifier for this policy.
 To modify an existing classifier, select the classifier from the drop-down list and click **Edit Classifier**. You can then change classifier’s name, add or remove comments, create a new match condition, or edit the existing match condition. After making the necessary changes, click **Submit** to save your changes and return to the Application Policy window.
- Step 9** Click **New Classifier** to create a new classifier for this policy.
 The Creating New Application Classifier window then appears so that you can create a new classifier. Complete the following steps to create a new classifier:
- a. Enter a name for this application classifier. The name cannot contain spaces or special characters.
 - b. (Optional) Enter a comment that will appear on the Application Policies window shown in [Figure 12-4 on page 12-10](#).
 - c. In the Configure Match Conditions section, click the **Create New Match Condition** icon. (If you get a dialog box asking if you want to navigate away from the page, click **OK**.) The Creating New Match Condition window appears. (See [Figure 12-6](#).)

Figure 12-6 Creating a New Match Condition

The screenshot shows the Cisco Wide Area Application Services (WAAS) Central Manager interface. The main window is titled "Creating New Match Condition for Classifier, myapp". It features a "Match Condition" section with a "Match All" checkbox. Below this are two sections: "Destination Condition" and "Source Condition". Each section contains four input fields: "Destination IP Address", "Destination IP Wildcard", "Destination Port Start", and "Destination Port End" for the destination section; and "Source IP Address", "Source IP Wildcard", "Source Port Start", and "Source Port End" for the source section. The "Match All" checkbox is currently unchecked. The interface also includes a navigation menu on the left and a "Switch Device" button in the top right corner.

- d. Check the **Match All** check box to create a condition that matches all traffic. Checking the Match All check box automatically disables all other fields in the window.
- e. Enter a value in one of the destination or source condition fields to create a condition for a specific type of traffic.
For example, to match all traffic going to IP address 10.10.10.2, enter that IP address in the Destination IP Address field.



Note To specify a range of IP addresses, enter a wildcard subnet mask in either the destination or source IP Wildcard field.

- f. Click **Update Classifier**. You return to the Creating New Application Classifier window. The new match condition appears at the bottom of this window.
 - g. Click **Submit**. You return to the Creating New Application Policy window.
- Step 10** From the Action drop-down list, choose the action that your WAAS device should take on the defined traffic. [Table 12-3](#) describes each action.

Table 12-3 Action Descriptions

Action	Description
Passthrough	Prevents the WAAS device from optimizing the application traffic defined in this policy by using TFO, DRE, or compression. Traffic that matches this policy can still be accelerated if an accelerator is chosen from the Accelerate drop-down list.
TFO Only	Applies a variety of transport flow optimization (TFO) techniques to matching traffic. TFO techniques include BIC-TCP, window size maximization and scaling, and selective acknowledgement. For a more detailed description of the TFO features, see the “TFO Optimization” section on page 1-4 .
TFO with Data Redundancy Elimination	Applies both TFO and data redundancy elimination (DRE) to matching traffic. DRE removes redundant information before sending the shortened data stream over the WAN. DRE operates on large data streams (tens to hundreds of bytes or more).
TFO with LZ Compression	Applies both TFO and the LZ compression algorithm to matching traffic. LZ compression functions similarly to DRE but uses a different compression algorithm to compress smaller data streams and maintains a limited compression history.
Full Optimization	Applies TFO, DRE, and LZ compression to matching traffic.

Step 11 From the Accelerate drop-down list, choose one of the following additional acceleration actions that your WAAS device should take on the defined traffic:

- **Do Not Set**—No additional acceleration is done.
- **MS Port Mapper**—Accelerate using the Microsoft Endpoint Port Mapper (EPM).
- **CIFS**—Accelerate using the CIFS Accelerator.
- **HTTP**—Accelerate using the HTTP Accelerator.
- **NFS**—Accelerate using the NFS Accelerator.
- **MAPI**—Accelerate using the MAPI Accelerator.
- **VIDEO**—Accelerate using the Video Accelerator.

Step 12 Choose one of the following positions for this application policy by click the appropriate Position radio button:

- **First**—Places this policy at the top of the position list so that the WAAS device tries to classify traffic using this policy before moving onto the second policy in the list. If you already have a policy in the first position, that policy moves down to number two in the list.
- **Last**—Places this policy at the bottom of the position list, making it the last policy that the WAAS device uses to classify traffic. If you already have a policy in the last position, that policy becomes the second to last in the list.

If a device goes through all the policies in the list without making a match, then the WAAS device passes through the traffic unoptimized.

- **Specific**—Allows you to enter a specific position for this policy. If you already have a policy in the specified position, that policy moves down one in the list.

Step 13 (Optional) Select a value from the DSCP Marking drop-down list and see [Table 11-4 on page 11-15](#) for a description of the supported values. In addition to the values listed in [Table 11-4](#), you can choose `copy`, which copies the DSCP value from the incoming packet and uses it for the outgoing packet. If you choose `inherit-from-name` from the drop-down list, the DSCP value defined at the application or global level is used.

DSCP is a field in an IP packet that enables different levels of service to be assigned to network traffic. Levels of service are assigned by marking each packet on the network with a DSCP code and associating a corresponding level of service. DSCP is the combination of IP Precedence and Type of Service (ToS) fields. For more information, see RFC 2474.

DSCP marking does not apply to pass-through traffic.

The DSCP value set at the application level applies to all classifiers associated with the application. If you set a DSCP value in a policy, it overrides the DSCP value set at the application or global level.

Step 14 Check the **Enabled** check box to activate this policy. To disable this policy, uncheck this box.

Step 15 Click **Submit**.

The new policy appears in the Application Policies window. (See [Figure 12-4 on page 12-10](#).)

Managing Application Acceleration

This section contains the following topics:

- [Viewing a List of Applications, page 12-15](#)
- [Viewing a Policy Report, page 12-16](#)
- [Viewing a Classifier Report, page 12-16](#)
- [Restoring Application Policies and Classifiers, page 12-16](#)
- [Monitoring Applications, page 12-17](#)
- [Defining Default DSCP Marking Values, page 12-17](#)
- [Modifying the Position of an Application Policy, page 12-18](#)
- [Modifying the Acceleration TCP Settings, page 12-19](#)

Viewing a List of Applications

To view a list of applications that reside on a WAE device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group on which you want to view applications.
- Step 3** From the navigation pane, choose **Configure > Acceleration > Policy Definitions**. The Application Policies window appears.
- Step 4** Click the Application column header to sort the column by application name so you can more easily locate a specific application.
-

Viewing a Policy Report

To view a report of the policies that reside on each WAE device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Acceleration > Policies**. The policy report appears. It lists each device or device group and the number of active policies on the device or device group.
- Step 2** Click the **Edit** icon next to a device or group to see the application policies that are defined on it.
-

Viewing a Classifier Report

To view a report of the classifiers that reside on each WAE device or device group, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Acceleration > Classifiers**. The classifier report appears. It lists each classifier that is defined, and the number of devices on which it is configured.
- Step 2** Click the **View** icon next to a classifier to see a report of the devices and device groups on which the classifier is configured.
- Step 3** Click the **Edit** icon next to a device or group to see the application policies that are defined on it.
-

Restoring Application Policies and Classifiers

The WAAS system allows you to restore the default policies and classifiers that shipped with the WAAS system. For a list of the default policies, see [Appendix A, “Default Application Policies.”](#)

If you made changes to the default policies that have negatively impacted how a WAAS device handles application traffic, you can override your changes by restoring the default policy settings.

To restore default policies and classifiers, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices (or Manage Device Groups)**.
- Step 2** Click the **Edit** icon next to the device or group on which you want to restore policies.
- Step 3** From the navigation pane, choose **Configure > Acceleration > Policy Definitions**. The Application Policies window appears.
- Step 4** Click the **Restore Default Policies and Classifiers** taskbar icon to restore over 150 policies and classifiers that shipped with the WAAS software and remove any new policies that were created on the system. If a default policy has been changed, these changes are lost and the original settings are restored.
-

Monitoring Applications

After you create an application policy, you should monitor the associated application to make sure your WAAS system is handling the application traffic as expected. To monitor an application, you must have enabled statistics collection for that application, as described in the [“Creating an Application Definition” section on page 12-8](#).

You can use the Network Traffic Application Mix report to monitor a specific application. For more information, see the [“Using Predefined Reports to Monitor WAAS” section on page 16-18](#).

Defining Default DSCP Marking Values

According to policies that you define in an application definition and an application policy, the WAAS software allows you to set a DSCP value on packets that it processes.

A DSCP value is a field in an IP packet that enables different levels of service to be assigned to the network traffic. The levels of service are assigned by marking each packet on the network with a DSCP code and associating a corresponding level of service. The DSCP marking determines how packets for a connection are processed externally to WAAS. DSCP is the combination of IP Precedence and Type of Service (ToS) fields. For more information, see RFC 2474. DSCP values are predefined and cannot be changed.

This attribute can be defined at the following levels:

- **Global**—You can define global defaults for the DSCP value. This value applies to the traffic if a lower level value is not defined.
- **Application**—You can define the DSCP value in an application definition at the device or device group level but not at the global application definition level. This value applies to all traffic associated with the application on a particular device or device group and overrides the global default.
- **Policy**—You can define the DSCP value in an application policy. This value applies only to traffic that matches the classifiers defined in the policy and overrides the application or global DSCP value.

This section contains the following topic:

- [Defining the Default DSCP Marking Value, page 12-17](#)

Defining the Default DSCP Marking Value

To define the global default DSCP marking value, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or group where you want to define the default DSCP marking value.
 - Step 3** From the navigation pane, choose **Configure > Acceleration > DSCP Marking**. The Global DSCP Settings window appears.
 - Step 4** Choose a value from the Global Default DSCP Marking drop-down list and see [Table 11-4 on page 11-15](#) for a description of the supported values. In addition to the values listed in [Table 11-4](#), the default setting is copy, which copies the DSCP value from the incoming packet and uses it for the outgoing packet.

Step 5 Click **Submit** to save the settings.

Modifying the Position of an Application Policy

Each application policy has an assigned position that determines the order in which a WAAS device refers to the policy in an attempt to classify traffic. For example, when a WAAS device intercepts traffic, it refers to the first policy in the list to try to match the traffic to an application. If the first policy does not provide a match, the WAAS device moves on to the next policy in the list.

For information on how to assign a position to a new policy, see the [“Creating an Application Policy” section on page 12-9](#).

You should consider the position of policies that pass through traffic unoptimized because placing these policies at the top of the list can cancel out optimization policies that appear farther down the list. For example, if you have two application policies that match traffic going to IP address 10.10.10.2, and one policy optimizes this traffic and a second policy in a higher position passes through this traffic, then all traffic going to 10.10.10.2 will go through the WAAS system unoptimized. For this reason, you should make sure that your policies do not have overlapping matching conditions, and you should monitor the applications you create to make sure that WAAS is handling the traffic as expected. For more information on monitoring applications, see [Chapter 16, “Monitoring and Troubleshooting Your WAAS Network.”](#)

To modify the position of an application policy, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the device or group that contains the application policy to modify.
 - Step 3** From the navigation pane, choose **Configure > Acceleration > Policy Prioritization**.
 - Step 4** The Application Policies window appears. This window categorizes policies into these categories: Basic, Other, Port Mapper, and WAFS.
 - Step 5** Click the arrow next to the appropriate category to display the list of applications for that category. (See [Figure 12-7](#).)

In most cases, the application you want to change the position for will be located under the Basic Policies category because that category contains a majority of the default applications that shipped with the WAAS system. For a list of these default policies, see [Appendix A, “Default Application Policies.”](#)

Figure 12-7 Modifying the Position of Application Policies



- Step 6** Click the arrow next to the policy category to view the list of applications for that category.
- Step 7** Use the up and down arrows (▲ ▼) next to a policy to move that policy higher or lower in the list.
- Step 8** If you determine that a policy is not needed, follow these steps to delete the policy:
- Click the **Edit** icon next to the policy you want to delete.
The Modifying Application Policy window appears.
 - Click the **Delete** icon in the taskbar.

Modifying the Acceleration TCP Settings

In most cases, you do not need to modify the acceleration TCP settings because your WAAS system automatically configures the acceleration TCP settings based on the hardware platform of the WAE device. WAAS automatically configures the settings only under the following circumstances:

- When you first install the WAE device in your network.
- When you enter the **restore factory-default** command on the device. For more information about this command, see the *Cisco Wide Area Application Services Command Reference*.

The WAAS system automatically adjusts the maximum segment size (MSS) to match the advertised MSS of the client or server for each connection. The WAAS system uses the lower of 1432 or the MSS value advertised by the client or server.

If your network has high BDP links, you may need to adjust the default buffer settings automatically configured for your WAE device. For more information, see the “[Calculating the TCP Buffers for High BDP Links](#)” section on page 12-21.

If you want to adjust the default TCP adaptive buffering settings for your WAE device, see the “[Modifying the TCP Adaptive Buffering Settings](#)” section on page 12-21.

To modify the acceleration TCP settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).

- Step 2** Click the **Edit** icon next to the device or device group for which you want to change the acceleration TCP settings.
- Step 3** From the navigation pane, choose **Configure > Acceleration > TCP Settings**. The Acceleration TCP Settings window appears.
- Step 4** Keep the **Send TCP Keepalive** check box checked.



Note Enabling TCP keepalives between the branch and data center WAEs impacts the WAAS system's ability to accommodate network disruptions.

Checking the Send TCP Keepalive check box allows this WAE device or group to disconnect the TCP connection to its peer device if no response is received from the TCP keepalive exchange. In this case, the two peer WAE devices will exchange TCP keepalives on a TCP connection and if no response is received for the keepalives for a specific period, the TCP connection will be torn down. When the keepalive option is enabled, any short network disruption in the WAN will cause the TCP connection between peer WAE devices to be disconnected.

If the Send TCP Keepalive check box is not checked, TCP keepalives will not be sent and connections will be maintained unless they are explicitly disconnected. By default, this setting is enabled.

- Step 5** Modify the TCP acceleration settings as needed. See [Table 12-4](#) for a description of these settings.

For information on how to calculate these settings for high BDP links, see the [“Calculating the TCP Buffers for High BDP Links”](#) section on page 12-21.

Table 12-4 TCP Settings

TCP Setting	Description
Optimized Side	
Maximum Segment Size	Maximum packet size allowed between this WAAS device and other WAAS devices participating in the optimized connection. The default is 1432 bytes.
Send Buffer Size	Allowed TCP sending buffer size (in kilobytes) for TCP packets sent from this WAAS device to other WAAS devices participating in the optimized connection. The default is 512 KB.
Receive Buffer Size	Allowed TCP receiving buffer size (in kilobytes) for incoming TCP packets from other WAAS devices participating in the optimized connection. The default is 512 KB.
Original Side	
Maximum Segment Size	Maximum packet size allowed between the origin client or server and this WAAS device. The default is 1432 bytes.
Send Buffer Size	Allowed TCP sending buffers size (in kilobytes) for TCP packets sent from this WAAS device to the origin client or server. The default is 32 KB.
Receive Buffer Size	Allowed TCP receiving buffer size (in kilobytes) for incoming TCP packets from the origin client or server. The default is 32 KB.

- Step 6** If you are deploying the WAE across a high Bandwidth-Delay-Product (BDP) link, you can set recommended values for the send and receive buffer sizes by clicking the **Set High BDP recommended values** button. For more information about calculating TCP buffers for high BDP links, see the [“Calculating the TCP Buffers for High BDP Links”](#) section on page 12-21.

Step 7 Click **Submit**.

Calculating the TCP Buffers for High BDP Links

WAAS software can be deployed in different network environments, involving multiple link characteristics such as bandwidth, latency, and packet loss. All WAAS devices are configured to accommodate networks with maximum Bandwidth-Delay-Product (BDP) of up to the values listed below:

- WAE-511/512—Default BDP is 32 KB
- WAE-611/612—Default BDP is 512 KB
- WAE-674 —Default BDP is 2048 KB
- WAE-7326 —Default BDP is 2048 KB
- WAE-7341 —Default BDP is 2048 KB
- WAE-7371 —Default BDP is 2048 KB
- WAVE-274 —Default BDP is 2048 KB
- WAVE-474 —Default BDP is 2048 KB
- WAVE-574—Default BDP is 2048 KB

If your network provides higher bandwidth or higher latencies are involved, use the following formula to calculate the actual link BDP:

$$\text{BDP [Kbytes]} = (\text{link BW [Kbytes/sec]} * \text{Round-trip latency [Sec]})$$

When multiple links 1..N are the links for which the WAE is optimizing traffic, the maximum BDP should be calculated as follows:

$$\text{MaxBDP} = \text{Max (BDP(link 1),...,BDP(link N))}$$

If the calculated MaxBDP is greater than the DefaultBDP for your WAE model, the Acceleration TCP settings should be modified to accommodate that calculated BDP.

Once you calculate the size of the Max BDP, enter that value in the Send Buffer Size and Receive Buffer Size for the optimized connection on the Acceleration TCP Settings window.



Note

These manually configured buffer sizes apply only if TCP adaptive buffering is disabled. TCP adaptive buffering is normally enabled, and allows the WAAS system to dynamically vary the buffer sizes. For more information on TCP adaptive buffering, see the [“Modifying the TCP Adaptive Buffering Settings” section on page 12-21](#).

Modifying the TCP Adaptive Buffering Settings

In most cases, you do not need to modify the acceleration TCP adaptive buffering settings because your WAAS system automatically configures the TCP adaptive buffering settings based on the network bandwidth and delay experienced by each connection. Adaptive buffering allows the WAAS software to dynamically vary the size of the send and receive buffers to increase performance and more efficiently use the available network bandwidth.

To modify the acceleration TCP adaptive buffering settings, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
 - Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to configure the TCP adaptive buffering settings.
 - Step 3** In the navigation pane, choose **Configure > Acceleration > TCP Adaptive Buffering Settings**. The TCP Adaptive Buffering Settings window appears.
 - Step 4** To enable TCP adaptive buffering, check the **Enable** check box. The default is enabled.
 - Step 5** In the Send Buffer Size and Receive Buffer Size fields, enter the maximum size in kilobytes of the send and receive buffers.
 - Step 6** Click **Submit**.
-

To configure the TCP adaptive buffer settings from the CLI, use the **tfo tcp adaptive-buffer-sizing** global configuration command:

```
WAE(config)# tfo tcp adaptive-buffer-sizing receive-buffer-max 8192
```

To disable TCP adaptive buffering from the CLI, use the **no tfo tcp adaptive-buffer-sizing enable** global configuration command.

To show the default and configured adaptive buffer sizes, use the **show tfo tcp EXEC** command.



CHAPTER 13

Configuring and Managing WAAS Legacy Print Services

This chapter describes how to configure and manage the WAAS legacy print services feature that allows WAEs to function as print servers in your branch offices.

For information on other print services options, see the [“WAAS Print Services” section on page 1-8](#).



Note

Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

This chapter contains the following sections:

- [About WAAS Print Services, page 13-1](#)
- [Planning for Print Services, page 13-5](#)
- [Configuring Print Services, page 13-7](#)
- [Managing Print Services, page 13-25](#)
- [Troubleshooting Print Services, page 13-33](#)

About WAAS Print Services

The WAAS software includes print services that allow you to change a branch WAE into a print server. This functionality eliminates the need for a separate print server in the branch office. The WAAS print services feature is available for Windows clients and works with any IP-based network printer.

The WAAS Central Manager GUI allows you to distribute print drivers to specific WAAS print servers on a per-device or a per-device group basis. You can also manage the print queue and monitor the status of a print job from the Print Services Administration GUI that you can open from the WAAS Central Manager GUI.

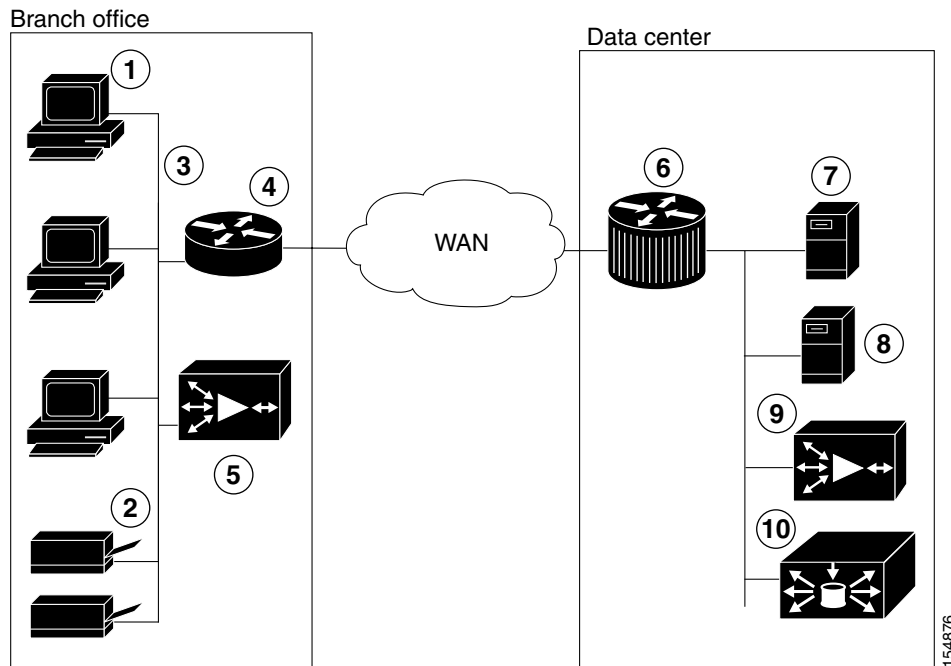
This section contains the following topics:

- [Branch Office Printing Topology, page 13-2](#)
- [WAAS Print Services, page 13-3](#)

Branch Office Printing Topology

A typical print server topology in a branch office consists of several client desktops using a single print server to proxy for multiple printers. The WAAS legacy print services solution allows you to host the print server on the branch WAE along with the WAAS software. Figure 13-1 shows the WAAS print services topology for branch offices and data centers.

Figure 13-1 Branch Office WAAS Print Services Topology



1	CIFS clients in the branch office	6	Cisco router in the data center
2	Networked printers in the branch office	7	File server in the data center
3	Local LAN in the branch office	8	Backup file server in the data center
4	Cisco router in the branch office	9	Data Center WAE
5	WAE (WAAS print server) in the branch office	10	WAAS Central Manager in the data center

In this configuration, the branch WAE provides local print services to branch clients. Microsoft clients use the WAAS print server in the same way that they may currently be using a Microsoft print server:

- Clients can add or delete print queues to their local computers by using the Windows Wizard.
- Clients can spool print jobs to the WAAS print server.
- The WAAS print server communicates with the printer for print functions.

WAAS Print Services

The WAAS print services solution on the branch WAE consists of two major components:

- Samba—WAAS uses Samba to enable Microsoft clients to add and delete print queues, add and delete drivers, browse for print queues, and spool jobs to the WAAS print server.
- Common Unix Printing System (CUPS)—WAAS uses CUPS for print queue management and for sending the Microsoft clients' spooled print jobs to the appropriate printers using TCP/IP.

This section provides information about the WAAS print services and contains the following topics:

- [Print Driver Support and Interoperability, page 13-3](#)
- [Printer Clustering, page 13-4](#)
- [Print Services Users, page 13-4](#)
- [Feature Support, page 13-4](#)

Print Driver Support and Interoperability

WAAS WAE incorporates a Print Server based on the integration of open source Samba and CUPS technology. During the testing process, it has been determined that certain Print Drivers with complex features, such as sophisticated paper handling, may not be Point-and-Print compatible with WAAS. Most notably, Fiery Drivers incorporated into some Printer Manufacturer solutions are not compatible with Samba. Other Multi Function Printers (MFP) may also have limited functionality when working with Samba and are not supported by WAAS.

To determine if a Print Driver is compatible with WAAS, perform the Add Driver processes with a WAE using the Add Printer Wizard. Compare all the client Print features available after creating a print queue and compare it to a similar installation on a Microsoft Windows Print Server. If there are obvious feature inconsistencies, it is indicative of a Print Driver that cannot be used with WAAS Print Server for Point-and-Print. As a workaround, an installation on each client desktop from a CD or other source will be required.

When using the WAAS print services in a Windows XP Pro/Windows 2003 Server environment, you must register the WAE with Active Directory for the automatic printer driver download feature to operate correctly. This is due to a default computer policy for domain members that does not allow the host to download drivers from an unregistered device. A user will see a message similar to the following when encountering this issue: "A policy is in effect on your computer which prevents you from connecting to this print queue. Please contact your system administrator."

Additionally, note the following:

- Printing is possible only when the branch WAE is running.
- The WAAS print solution does not offer authentication. Any user may access and send print jobs to the WAAS print server.
- Only IP-based network printers are supported in WAAS. We recommend that printers directly attached to the WAAS print server use parallel, serial, or USB IP adapters, such as those available from HP or Linksys.
- WAAS supports Raw Queue so that all rendering of files occurs on the client machine using vendor-provided printer drivers, and the print server performs Win2003-style print queue management.
- WAAS supports 32-bit drivers. The Samba version used in the WAAS software does not support 64-bit print drivers.

Printer Clustering

Printer clustering enables administrators to group several printers together to provide failover and load-balancing capabilities. You can include as many printers as you want in a printer cluster, but we recommend that you include no more than 12 printers. Only printers of the same model and capabilities should be grouped together. Printers in a cluster should be geographically close to each other. The default spooling space for all printers (including the printer cluster) is 1 GB.

The printer cluster appears as a single print queue to Microsoft clients using the WAAS print server. The WAAS print server does not support the selection of a default printer within a cluster. When you send a print job to a printer in a printer cluster, the print job is automatically forwarded by the WAAS print server, which then sends it to the first available printer.

Print Services Users

The following types of users exist in the WAAS print services environment:

- **Administrative User**—A user who can add and modify printer information and membership in printer clusters.
- **Print User**—A user who can print a job from a printer, but who cannot make any additions or changes to the printer configuration. A print user can delete and pause their own print jobs.



Note

Job owners can manage their own job in the Microsoft client and Print Services Administration GUI while the job is still spooling.

Feature Support

Various print services features are handled by the various software components, such as Samba, CUPS, and the WAAS software. [Table 13-1](#) shows which tool provides the capability for a specific print services feature.

Table 13-1 WAAS Print Services Feature Support

Function	Software that Provides the Function
Add, modify, or delete printers	CUPS
Add, modify, or delete printer cluster (called classes in CUPS)	CUPS
View and control print jobs	CUPS, Windows printer queue console
Monitor status of individual printers	CUPS
View list of printers attached to a WAAS print server, the drives associated with a specific printer, and the list of all distributed drivers	WAAS Central Manager GUI
Diagnostics and troubleshooting	CUPS and Samba perform their diagnostics. The WAAS Central Manager GUI displays error messages relating to driver distribution.
Client printer driver installation from print server	Samba ¹
Print driver distribution to print servers	WAAS Central Manager GUI

Table 13-1 WAAS Print Services Feature Support (continued)

Function	Software that Provides the Function
Advertising printer availability through Samba and Windows Active Directory	Samba
Log export	Manual FTP using the CLI
Admin authentication	WAAS Central Manager
Secure administration	WAAS software

1. The Samba version used in the WAAS software does not support 64-bit print drivers.

Planning for Print Services

This section describes the information that you should collect before you begin configuring print services. You need the information outlined in this section whether you are setting up WAAS print services for the first time, or migrating from Microsoft print services. When planning for print services, these steps will help avoid configuration errors:

1. Plan for your printers' network capabilities and driver support.

This information includes the printer type (Postscript, PCL, or other), the printer network protocol, and port (LPD, IPP, LPQ, LPR and port), and whether printers should be clustered together for failover. To obtain driver information, find either CDs or servers containing the printer drivers to be installed on the WAAS print server for support of point-and-print functionality.

2. Plan for print queue configuration.

This information includes the names and types of print queues to be created for a print server, and how they interact with the printers' networking capabilities and ports.

The following sections provide more information on planning for print services:

- [Identifying the Print Administration Users, page 13-5](#)
- [Obtaining Printer Information, page 13-6](#)
- [Planning Worksheets, page 13-6](#)

Identifying the Print Administration Users

All your branch office clients can use the print services on a WAAS print server, but only administrative users can perform printer management tasks such as managing print queues. These administrative users need to have admin accounts created on the branch WAE and on the WAAS Central Manager device.

Identify the users that you want to have print administrator privileges for because you will need to create these users on the WAAS print server and on the WAAS Central Manager device.



Note

We recommend limiting the number of admin users who have access to your printers. Each admin user who accesses a printer's properties causes the printer object to be updated, which forces all clients to update their copy of the printer object on their next session. If admin users access printers on a regular basis, delays and increased traffic can result.

Obtaining Printer Information

Before configuring print services, it is useful to obtain the following information about each of the printers on your network:

- Printer type
- Printer protocol
- Number and name of print queues
- Printer connectivity (direct network or using a print server gateway device)
- Printer drivers

Drivers may reside on a vendor-provided CD-ROM. Commonly used drivers are also bundled with the Windows operating system. To access these common drivers, open the Add Printer Wizard on a Windows system.

Planning Worksheets

You can use [Table 13-2](#), [Table 13-3](#), and [Table 13-4](#) as planning worksheets to help ensure a successful configuration of the WAAS print services.

Table 13-2 Security Model and Directory Services

Description	Value
Print server IP	
WINS server IP	
Print server NetBIOS name (optional) ¹	
Print server admin workstation user name	

1. If the NetBIOS name is not specified for the print server, the hostname is used instead. If the hostname is longer than fifteen characters, the hostname will be truncated to fifteen characters.

Table 13-3 Network Capabilities and Driver Support

Description	Value
Printer type (PostScript, PCL, other)	
Printer network protocol (LPD, IPP, LPQ, LPR)	
Printer port	
Printer cluster	
Driver file location and name	

Table 13-4 *Print Queue Configuration*

Description	Value
Print queue name	
Print queue type	

Configuring Print Services

This section describes how to configure print services in your WAAS network.

Configuration Checklist

[Table 13-5](#) lists the configuration steps you must complete to set up print services in your WAAS network.

Table 13-5 *Checklist for Configuring WAAS Print Services*

Task	Additional Information and Instructions
1. Review the information in the planning section.	Before configuring print services in your WAAS network, see the “Planning for Print Services” section on page 13-5.
2. Prepare your WAE device and WAAS Central Manager device for print services.	To prepare your WAAS system for print services, you need to specify the WINS server name and NetBIOS name for your WAE device and WAAS Central Manager device. In addition, you also need to enable either the CIFS accelerator or the legacy WAFS edge services on the WAE device. For more information, see the “Preparing your WAE Device and Central Manager for Print Services” section on page 13-8.
3. Create accounts with print admin privileges on the WAE device and the WAAS Central Manager device.	To configure print services using the Print Services Administration GUI and to install drivers in the central repository on the WAAS Central Manager device, you need to create an accounts with print admin privileges on each of these devices. For more information, see the “Creating Accounts with Print Admin Privileges” section on page 13-10.
4. Enable print services.	By default, the WAAS print services feature is disabled on all WAAS devices. To enable print services, see the “Enabling Print Services” section on page 13-11.
5. Add a printer to the WAAS print server.	To add printers to your new WAAS print server, see the “Adding a Printer to the WAAS Print Server” section on page 13-12.
6. Create print clusters (optional).	To provide failover functionality to print services, you can combine multiple printers into a print cluster. For more information, see the “Adding Printer Clusters” section on page 13-14.
7. Set up the WAAS Central Manager to be the central driver repository.	WAAS allows you to centrally manage all your print drivers from the WAAS Central Manager if it is set up as the main driver repository. For more information, see the “Setting Up the WAAS Central Manager as the Driver Repository” section on page 13-16.

Table 13-5 Checklist for Configuring WAAS Print Services (continued)

Task	Additional Information and Instructions
8. Distribute drivers to the WAAS print servers.	After you have set up the WAAS Central Manager as the driver repository and have loaded drives into the repository, you can distribute the drivers to all the print servers in your WAAS network. For more information, see the “Distributing Drivers to the WAAS Print Servers” section on page 13-19.
9. Associate the print driver with your printer.	After you distribute a driver to a WAAS print server, you need to associate the driver with the correct printer on the WAAS print server. For more information, see the “Associating a Driver with your Printer” section on page 13-22.
10. Initialize each print driver on your WAAS print servers.	To prevent printing issues, you need to initialize each print driver before they are installed and used by your branch office clients. For more information, see the “Initializing Print Drivers” section on page 13-22.
11. Add printers to your branch office clients.	After the print services have been properly configured, your branch office clients need to add printers using the Microsoft Add Printers wizard. For more information, see the “Adding the WAAS Print Server to Your Branch Office Clients” section on page 13-23.

Preparing your WAE Device and Central Manager for Print Services

Before you enable print services, you need to prepare your WAE device and Central Manager by specifying the WINS server name and the NetBIOS name. In addition, you also need to enable either the CIFS accelerator or the legacy WAFS edge services on the WAE device. In some cases, these settings may already have been configured when the WAE device and Central Manager were first set up.

To prepare your WAE device and Central Manager for print services, follow these steps:

- Step 1** (Optional) Specify the NetBIOS name of the WAE device:
- From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
 - Click the **Edit** icon next to the WAE device on which you want to enable print services.
 - From the navigation pane, choose *Device Name* > **Activation**. The Device Activation window appears.
 - Enter the NetBIOS name of the WAE device in the NetBIOS Name field.



Note If the WAE is operating in nontransparent mode, you must configure identical names for the NetBIOS name and the hostname of the device that you enter in the Name field.

- Click **Submit** to save your changes.

Once you enable print services on this WAE device, the NetBIOS name is used as the Print Server name for the device. If you do not specify a NetBIOS name, the hostname of the device is used instead. The hostname of the device is specified on the Activation page, described in the [“Modifying Device Properties”](#) section on page 9-1.

To use the CLI to specify the NetBIOS name, use the **windows-domain netbios-name** global configuration command.

- Step 2** Specify the NetBIOS name of WAAS Central Manager device:
- From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.

- b. Click the **Edit** icon next to the WAAS Central Manager device.
- c. From the navigation pane, choose *Device Name* > **Activation**. The Device Activation window appears.
- d. Enter the NetBIOS name of the WAAS Central Manager in the NetBIOS Name field.
- e. Click **Submit** to save your changes.

Step 3 Specify the WINS server name of the WAE device:

- a. From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- b. Click the **Edit** icon next to the WAE device on which you want to enable print services.
- c. From the navigation pane, choose **Configure > Network > Windows Name Services**.
- d. Enter the name of the WINS server in the WINS Server field.
- e. Click **Submit** to save your changes.

To use the CLI to specify the NetBIOS name, use the **windows-domain wins-server** global configuration command.

Step 4 Specify the WINS server name of the WAAS Central Manager device:

- a. From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- b. Click the **Edit** icon next to the WAAS Central Manager device.
- c. From the navigation pane, choose **Configure > Network > Windows Name Services**.
- d. Enter the name of the WINS server in the WINS Server field.
- e. Click **Submit** to save your changes.

Step 5 Enable the CIFS accelerator on the WAE device (or skip to Step 6):

- a. From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- b. Click the **Edit** icon next to the WAE device on which you want to enable print services.
- c. From the navigation pane, choose **Configure > Acceleration > Enabled Features**.
- d. Check the **CIFS Accelerator** check box.
- e. Click **Submit** to save your changes.

Step 6 Enable legacy WAFS edge services on the WAE device (or perform Step 5):

- a. From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- b. Click the **Edit** icon next to the WAE device on which you want to enable print services.
- c. From the navigation pane, choose **Configure > Acceleration > Legacy Services > File Services > Edge Configuration**.
- d. Check the **Enable Edge Server** check box. The CIFS and QoS configuration settings become enabled. For information on configuring these settings, see the [“Configuring the Edge Devices” section on page 11-13](#).
- e. Click **Submit** to save your changes.



Note You must reboot or reload the device after enabling edge services.

Creating Accounts with Print Admin Privileges

To configure print services using the Print Services Administration GUI, you need to create an account with print admin privileges on the WAAS Central Manager device. This account also lets you upload drivers to the central repository.

You also must assign a domain to any user account that has print admin privileges. A domain defines the device groups or WAEs that are accessible by the user. All WAEs to which the user needs access should be members in the assigned domain.

To create an account with print admin privileges on the WAAS Central Manager device, follow these steps:

-
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > AAA > Users**. The User Accounts window displays all the user accounts on the system.
 - Step 2** Click the **Create New User Accounts** icon. The Creating New User Account window appears.
 - Step 3** In the Username field, enter the user account name. User names are case-sensitive and support special characters.
 - Step 4** Check the **Local User** check box.
 - Step 5** In the Password field, enter a password for the local user account, and reenter the same password in the Confirm Password field. Passwords are case-sensitive.
 - Step 6** From the CLI Privilege Level drop-down list, choose either **0 (normal user)** or **15 (super user)**.
 - Step 7** Check the **Print Admin** check box.
 - Step 8** (Optional) Fill in the fields in the User Information and Comments section.
 - Step 9** Click **Submit** to save your changes.
Next you must assign the print role to the account.
 - Step 10** Click the **Role Management** tab.
The Role Management for User Account window appears with all configured role names listed.
 - Step 11** Click the **Assign** icon (blue cross mark) that appears next to the print role.
 - Step 12** Click **Submit**.
Next, you must assign a domain to the account.
 - Step 13** Click the **Domain Management** tab.
The Domain Management for User Account window appears with all configured domain names listed.
 - Step 14** Click the **Assign** icon (blue cross mark) that appears next to the domain that you want to assign to the account. All WAEs to which the user needs access should be members in the assigned domain.
 - Step 15** Click **Submit**.

For more information about creating accounts on the WAAS Central Manager device, see the [“Creating a New Account”](#) section on page 7-4.

To create an account with print admin privileges (privilege level 15) from the CLI, you can use the **username** global configuration command.

Enabling Print Services

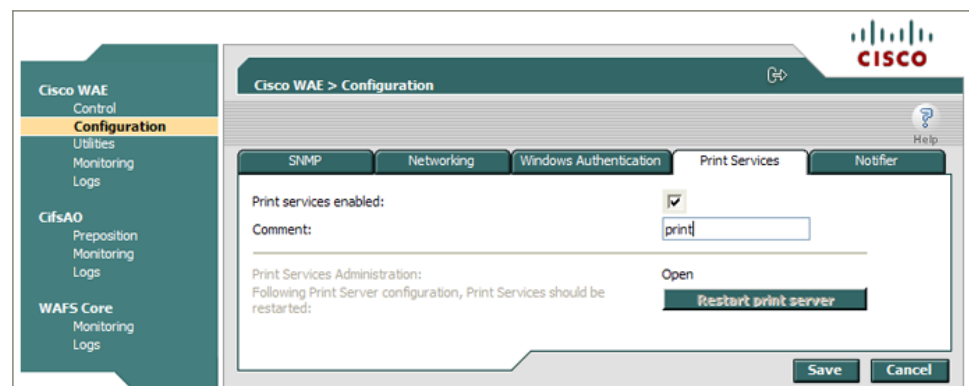
You must use the WAE Device Manager GUI to enable print services on a WAE.

You can enable print services on any WAE, but you cannot enable print services on the WAAS Central Manager. Once you enable print services, the branch WAE becomes a WAAS print server and an anonymous FTP user account is created on the device. This FTP account is used to access print drivers on the WAAS Central Manager.

To enable print services on a branch WAE, follow these steps:

-
- Step 1** Log into the WAE Device Manager GUI by going to the following URL:
<https://wae-ip-address/mgr>
wae-ip-address is the IP address of the branch WAE that you want to enable with print services.
- Step 2** Choose **Configuration** from the Cisco WAE menu, and click the **Print Services** tab.
 The Print Services window appears. (See [Figure 13-2](#).)

Figure 13-2 Print Services Window



- Step 3** Check the **Print services enabled** check box to enable print services.
- Step 4** (Optional) Enter a comment in the Comment field.
 This comment string is visible next to the print server when users are browsing in Windows Explorer.
- Step 5** Click **Save** to restart print services.
 Upon restart, the Open link for the Print Services Administration GUI is enabled. Once print services is enabled on the device, the device becomes a WAAS print server.



Note The **Restart Print Server** button is used when a change has been performed through the CLI and the print server must be restarted.

To enable print services from the CLI, you can use the **print-services enable** global configuration command.

Adding a Printer to the WAAS Print Server

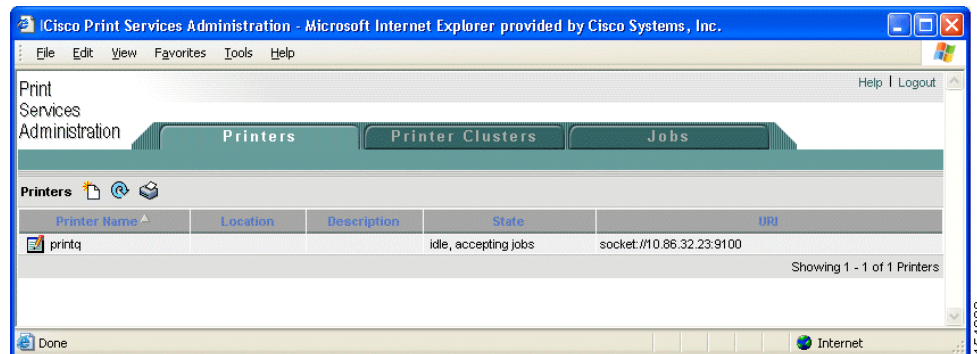
After you enable print services, you must add one or more printers to the new WAAS print server. When you add a printer, a print queue is also added that is used by Windows print clients to spool their jobs to the WAAS print server.

To add a printer to the WAAS print server, follow these steps:

- Step 1** Open the Print Services Administration GUI by doing either of the following:
- From the WAAS Central Manager GUI navigation pane, choose **Configure > Legacy Services > Print Services > Servers**, click the **Edit** icon next to the name of the print server that you want to add to a cluster, and then click the **CUPS** icon in the taskbar.
 - From the WAE Device Manager GUI, choose **Configuration** from the Cisco WAE menu, click the **Print Services** tab, and then click the **Open** link.

The Print Services Administration GUI opens. (See [Figure 13-3](#).)

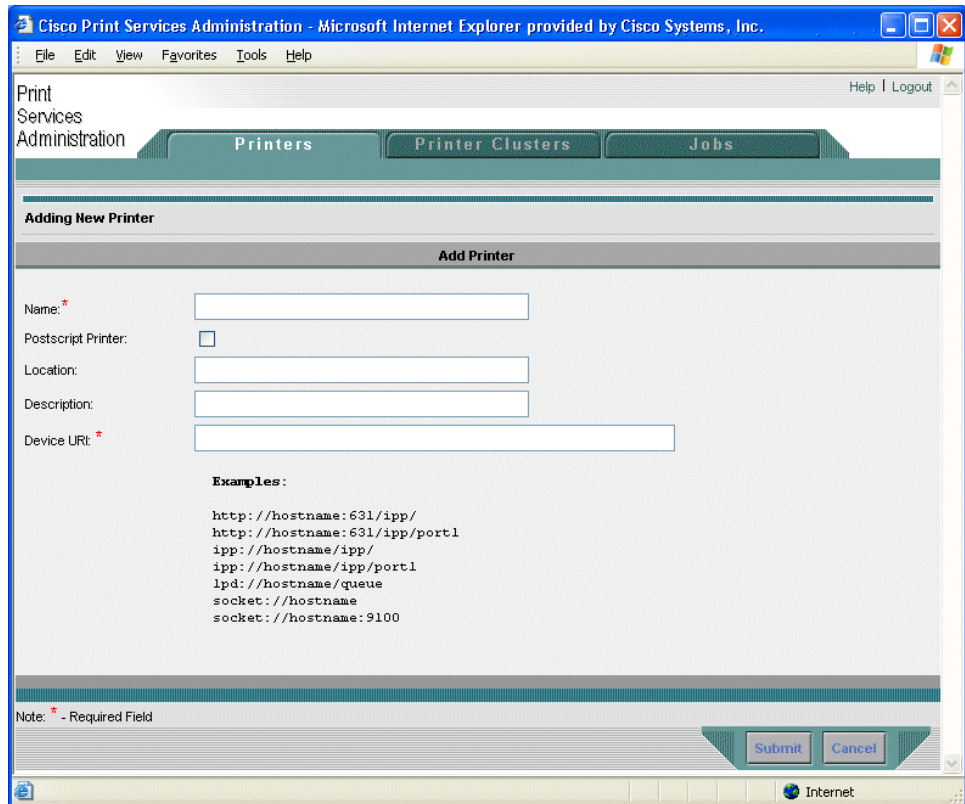
Figure 13-3 Print Services Administration GUI



- Step 2** Click the **Add Printer** icon. You are prompted to enter a username and password.
- Step 3** Enter the username and password for the print admin account you created on this WAE device, and click **OK**.

The Add Printer window appears. (See [Figure 13-4](#).) For more information on creating this account, see the “[Creating a New Account](#)” section on page 7-4.

Figure 13-4 Adding a Printer to the WAAS Print Server



Step 4 Enter the following information in the provided fields:

- **Printer name** (required)—User-defined name of the printer (maximum of 127 characters) that can contain only letters, numbers, and underscore. No spaces are allowed and the name must be unique across the system. For example, you should not use the same name for different printers. If a printer with the same name exists, the new configuration will replace the old one. If a printer cluster with the same name exists, an error appears.
- **Postscript printer**—Check box that allows you to specify if the printer is a postscript-capable printer or not (default is nonpostscript). For postscript printers, the generic.ppd is used. For nonpostscript printers, the PPD is set to raw. Postscript printer configuration supports printing test page and banner pages. This check box is visible only when adding a new printer. If you are modifying a printer, you will not see this check box.
- **Location**—User-specified location of the printer (maximum 127 characters).
- **Description**—User-specified description of the printer (maximum 127 characters).
- **Device URI** (required)—The device URI is the address of the printer, in the following form:

protocol://server:port/queue

A maximum of 1024 characters are allowed. The only allowed protocols are lpd, socket, ipp, and http. Validation check on the protocol will be performed but there is no other check on the URI string. A list of example URIs appears to help you enter it properly. You can get the information (printer port, protocol) for your specific printer from the printer manufacturer's manual from the test page of the printer, or from the printer's front panel.



Note Incorrectly specifying the protocol, port, or queue will lead to failure to print pages.

- Step 5** Click **Submit** to save your changes.
The new print queue will be visible to clients within one minute.
- Step 6** Repeat the process to add other printers to your WAAS print server.
-

After you add a printer, you should add it to the Windows Active Directory. To add a printer to Active Directory, follow these steps:

- Step 1** On the Windows domain controller, open Active Directory Users and Computers.
- Step 2** Right-click the container object folder in which you want to publish the printer, click **New**, and then click **Printer**.
The New Object-Printer dialog box appears.
- Step 3** In the text box, type the path to the printer, such as \\printserver\printername, and then click **OK**.
-

Adding Printer Clusters

Printer clustering allows you to group several printers together. This clustering provides failover and load-balancing capabilities. You can include up to 12 printers in a printer cluster. Only printers of the same model and capabilities should be grouped together. Printers in a cluster should be geographically close to each other.

The printer cluster appears as a single print queue to Microsoft clients using the WAAS print server. The WAAS print server does not support the selection of a default printer within a cluster. When you send a print job to a printer in a printer cluster, the print job is automatically forwarded by the WAAS print server to the first available printer.

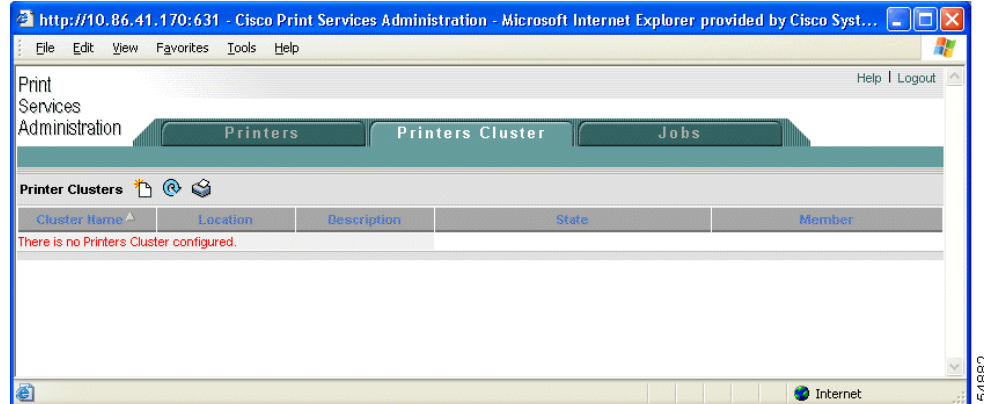
The default spooling space for all printers (including the printer cluster) is 1 GB.

To add a print cluster, follow these steps:

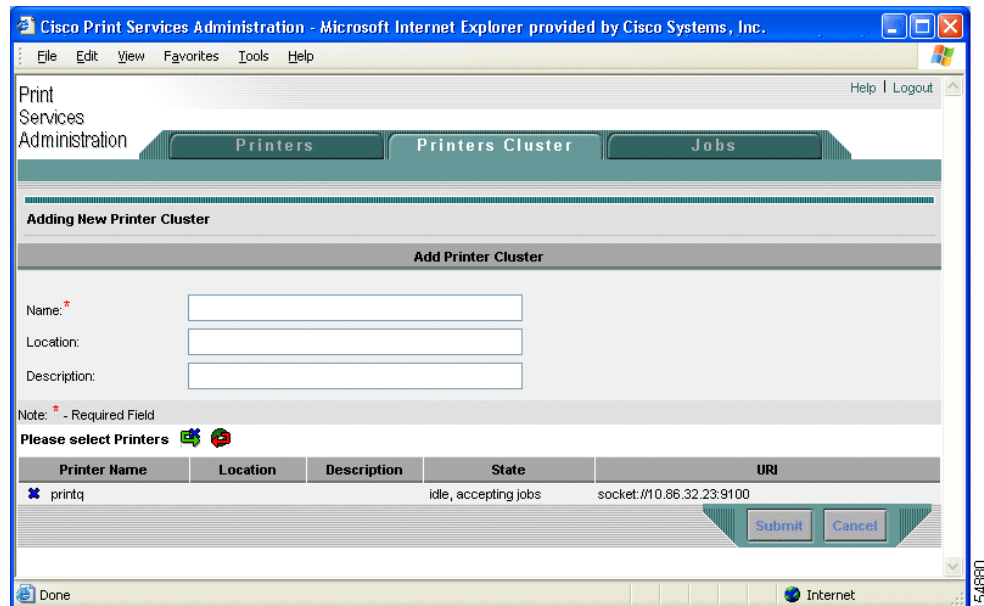
- Step 1** Open the Print Services Administration GUI by doing either of the following:
- From the WAAS Central Manager GUI navigation pane, choose **Configure > Legacy Services > Print Services > Servers**, click the **Edit** icon next to the name of the print server that you want to add to a cluster, and then click the **CUPS** icon in the taskbar.
 - From the WAE Device Manager GUI, choose **Configuration** from the Cisco WAE menu, click the **Print Services** tab, and then click the **Open** link.

The Print Services Administration GUI opens.

- Step 2** Click the **Printer Cluster** tab.
If you were not previously logged into the Print Services Administration GUI, you are prompted for the user name and password of the print admin account. Enter this information and then click **OK**.
The Printer Clusters window appears. (See [Figure 13-5](#).)

Figure 13-5 Print Services Administration Window—Printer Clusters Tab



- Step 3** Click the **Add Printer Cluster** icon in the taskbar.
The Add Printer Cluster window appears. (See [Figure 13-6](#).)

Figure 13-6 Adding New Printer Cluster

- Step 4** Enter a name for the printer cluster.
The printer cluster name can contain letters and numbers, but the only special character that is supported is the underscore (no spaces allowed). The name cannot exceed 127 characters and must be unique across the system. For example, you must not use the same name for different printer clusters. If a printer cluster exists with the same name, the new configuration replaces the old one. If a printer with the same name exists, an error appears.
- Step 5** Enter a name for the print cluster location (optional).
The location name cannot exceed 127 characters.
- Step 6** Enter a description for the Printer cluster (optional).

This description cannot exceed 127 characters.

Step 7 Choose the printers that you want to join this new cluster by doing one of the following:

- Click  to choose all the available printers.
- Click  next to each printer you want to join the cluster.

Step 8 Click **Submit**.

The configuration is saved.

The new print queue will be visible to clients within one minute.

Setting Up the WAAS Central Manager as the Driver Repository

You can set up the WAAS Central Manager as a print driver repository that stores all the drivers you want to distribute to your WAAS print servers. Steps 1 through 4 in this section describe how to configure the WAAS Central Manager as the driver repository; steps 5 through 10 describe how to add drivers to the central repository using the Windows Add Printer Driver Wizard.

If you do not set up the WAAS Central Manager as a driver repository, you cannot centrally distribute print drivers to your WAAS print servers. In this case, you must manually install the drivers on each WAAS print server. For more information on installing drivers on an individual print server, see the [“Installing Print Drivers on Individual WAAS Print Servers” section on page 13-18](#).

We recommend that you configure the WAAS Central Manager as a driver repository if you have more than one WAAS print server.

To configure the WAAS Central Manager as the print driver repository, follow these steps:

Step 1 Log into the WAAS Central Manager GUI using the print admin account that you created in the [“Creating Accounts with Print Admin Privileges” section on page 13-10](#).

Step 2 From the WAAS Central Manager GUI navigation pane, choose **Configure > Legacy Services > Print Services > Repository**.

The Print Driver Repository Settings window appears.

Step 3 Check the **Enable Central Manager as Driver Repository** check box.

Step 4 Click **Submit** to save your changes.

Step 5 Log into a Windows client and enter the following command to add drivers to the new central repository:

```
net use \\CM_netbios_name\print$ * /USER:username
```

The *CM_netbios_name* value is the NetBIOS name of the WAAS Central Manager device, and *username* is the same as the username you created in Step 1.

We recommend that you use postscript (PS) print drivers instead of PCL drivers because postscript drivers load much more quickly.

Step 6 From the Windows client, enter the following command in the Run window:

```
\\CM_netbios_name
```

The *CM_netbios_name* value is the NetBIOS name of the WAAS Central Manager device.

The Central Manager’s driver repository appears.

Step 7 Double-click the **Printers** icon.

The Printers on Device window appears.

Step 8 From the Printers on Device window, choose **File > Server Properties**.

The Print Server Properties window appears.

Step 9 Choose the **Drivers** tab, and click **Add...**

The Add Printer Driver Wizard opens.



Note If there is insufficient print share space to add drivers, you will see a Windows error message that indicates that a driver was unable to install because it is not compatible with Windows, or that Windows was unable to save all data due to a failure related to a computer hardware or network connection problem. If you see such a message, remove any drivers that may no longer be in use, then repeat the step to add the new drivers.

Step 10 Proceed through the wizard and add the necessary drivers to the repository on the WAAS Central Manager.



Note To avoid a possible error condition when adding drivers to the repository, do *not* click the Update or Replace button in the Drivers tab of the Print Server Properties window.

Step 11 After completing the wizard, verify that the drivers were successfully added to the repository by choosing **Configure > Legacy Services > Print Services > Drivers** in the WAAS Central Manager GUI.

It may take up to 5 minutes for the list of drivers to appear. Verify that the drivers that you just added appear in this list. You can configure the amount of time it takes the list to be updated by adjusting the System.datafeed.pollRate field described in the [“Modifying the Default System Configuration Properties”](#) section on page 9-16.



Note If an error message appears that indicates a driver was unable to install due to a lack of disk space, you will need to free up disk space by first removing any unused drivers from the repository, then repeating the steps to add the driver. Because Windows 95, 98, NT, and 2000 create an extra storage directory during the driver installation process, these operating systems require approximately twice the disk space to install a print driver (requiring that you free up disk space equivalent to at least twice the size of each driver to be installed). Additionally, in Windows 95, 98, and NT operating systems, you can also free up disk space by following the steps below to remove any temporary print driver directories that Windows has not removed. (Windows 2000 and XP automatically remove these temporary directories).

To remove temporary print driver directories, do the following:

- a. From the CLI on the WAAS Central Manager, change to the directory where the temporary print driver directories are located using the **cd** command. For example:


```
cd spool/samba/printers/W32X86
```
- b. List the directory contents using the **ls** command.
- c. Identify the temporary print driver directories by locating directories designated as: "**__SKIP__xxx**"
- d. Use the **rmdir** command to remove the temporary print driver directories.

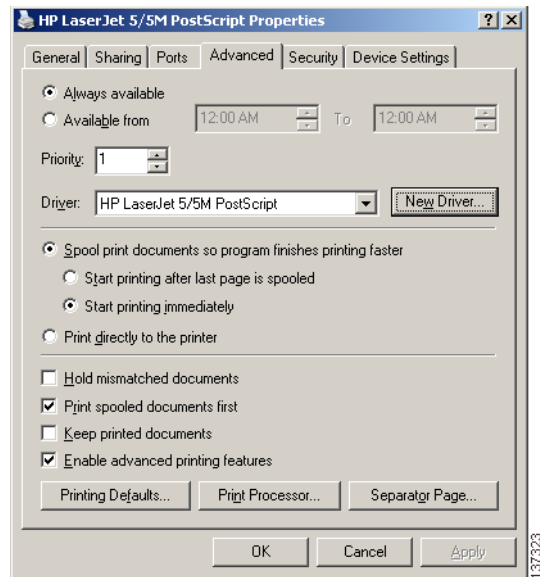
Installing Print Drivers on Individual WAAS Print Servers

If you do not want to set up the WAAS Central Manager as a driver repository and centrally distribute drivers, you can use the Windows Add Driver Wizard to install the necessary drivers on an individual WAAS print server.

To install printer drivers on a WAAS print server, follow these steps:

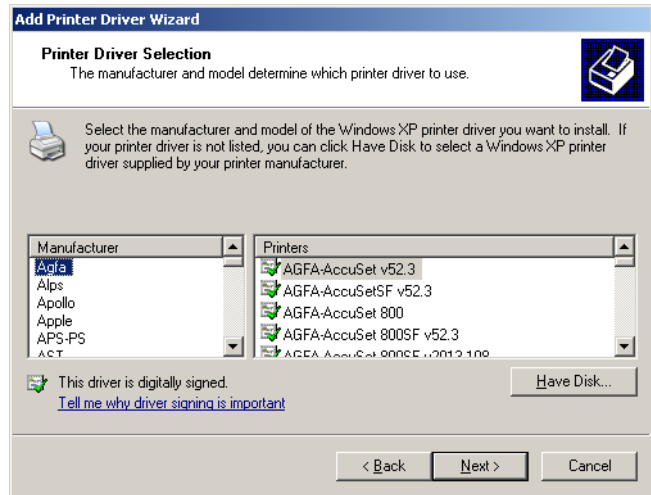
-
- Step 1** Log in to the windows client and enter the following command:
- ```
net use \\WAE_netbios_name\print$ * /USER:username
```
- The *WAE\_netbios\_name* value is the NetBIOS of the WAAS print server, and *username* is the username you specified in the “[Creating Accounts with Print Admin Privileges](#)” section on page 13-10.
- Step 2** Using Windows Network Neighborhood, find the Print Server share and click on it. Alternatively, you can open the Run window on the Windows system and enter `\\wae_netbios_name`.
- Step 3** View the printers configured in the WAAS Print Server by opening the Printers folder.
- Step 4** Choose the printer for which you want to upload a driver, right click on it, and choose **Properties**. (See [Figure 13-7](#).)

**Figure 13-7 Sample Printer Properties Sheet**



- Step 5** Locate the printer driver on the CD-ROM or server.
- Step 6** Click the **New Driver** button to start the Add Driver wizard.
- Step 7** Click **Next**.
- The Printer Driver Selection window appears. (See [Figure 13-8](#).)



**Figure 13-8** Driver Selection Window

**Step 8** If the necessary driver is not displayed in the Printer Driver Selection window, click **Have Disk** and browse for the location of the printer driver on the CD-ROM or server.

**Step 9** Click **OK** to finish installing the driver.

The driver has now been uploaded to the WAAS print server so that any user can download the driver to their client machine when printing.

**Step 10** Initialize the driver as described in the [“Initializing Print Drivers”](#) section on page 13-22.

## Distributing Drivers to the WAAS Print Servers

After you have set up the WAAS Central Manager as the driver repository and installed the drivers in the central repository, you can distribute the drivers to your WAAS print servers.

You can distribute drivers to WAAS print servers using one of the following methods:

- Choose the driver first, then choose the print servers to which you want to distribute the driver. This is the recommended method for distributing a single driver to multiple WAAS print servers or device groups. See the [“Distributing a Single Driver to Multiple Devices or Groups”](#) section on page 13-20.
- Choose a print server or device group first, and then choose the drivers that should be installed on the selected device. We recommend that you use this method for distributing multiple drivers to a single print server or device group. See the [“Distributing Multiple Drivers to a Single Device or Group”](#) section on page 13-20.

After you distribute a print driver to one or more WAAS print servers, you can verify the print driver distributions as described in the [“Verifying Print Driver Distribution”](#) section on page 13-21.







### Note

If you try to distribute a print driver to a WAE that has not been enabled with print services, the driver is not distributed to the WAE.


## Distributing a Single Driver to Multiple Devices or Groups




To distribute a single driver to multiple devices or groups, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Legacy Services > Print Services > Drivers**. The Drivers in the Repository window appears.
- Step 2** Click the **Edit** icon next to the driver that you want to distribute. The driver's home window appears. From this window, you can perform the following tasks:
- Distribute the driver to print servers as described in the steps that follow.
  - Delete the driver from the repository by clicking the **Trash** icon in the taskbar.
  - View details about the driver.
- Step 3** Click one of the following options in the navigation pane to distribute this driver:
- **Distribute to Print Server**—Distributes the driver to an individual WAAS print server.
  - **Distribute to Device Group**—Distributes the driver to a group of WAAS print servers that have been included in the same device group.
- The Print Server assignments window or the Device Group assignments window appears depending on the selected option.
- Step 4** Choose the devices to which you want to distribute the WAAS print driver. To choose the devices, use one of the following procedures:
- Click  in the taskbar to distribute the driver to all available print servers or device groups.
  - Click  next to each print server or device group to distribute the driver to these specific devices. The icon changes to  when selected.
- Step 5** Click **Submit**. The icon next to the selected devices changes to , and the driver is distributed to the specified devices.
- Step 6** Verify that the print driver was successfully distributed (see the [“Verifying Print Driver Distribution” section on page 13-21](#)).
- 

## Distributing Multiple Drivers to a Single Device or Group

To distribute multiple drivers to a single device or group, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group to which you want to distribute the print drivers. The Device Dashboard window or the Modifying Device Group window appears.
- Step 3** From the navigation pane, choose **Configure > Acceleration > Legacy Services > Print Services > Download Drivers**. The Drivers in the Repository window appears.
- Step 4** Choose the drivers to distribute by doing either of the following:
- Click  in the taskbar to choose all the drivers in the list.

- Click  next to each driver to distribute. The icon changes to  when selected.
- Step 5** Click **Submit**.
- The icon next to the selected drivers changes to  and the selected device or device group downloads the specified drivers.
- Step 6** Verify that the print drivers were successfully distributed (see the “[Verifying Print Driver Distribution](#)” section on page 13-21).
- 

## Verifying Print Driver Distribution

After you distribute a print driver to one or more WAAS print servers, you can use the WAAS Central Manager GUI to check for distribution errors and redistribute the drivers if necessary.

To verify that a print driver has been properly distributed to a WAAS print server, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Legacy Services > Print Services > Servers**.
- The Print Servers table appears. The Driver Distribution Status area of this table shows the number of completed and failed driver distribution attempts. This table also shows the number of drivers that are in the process of being downloaded by the print server.
- Step 2** Check the Print Server Errors column and the Failed column for an error count.
- These columns show the number of errors reported on a WAAS print server. The Failed column shows the number of driver distribution errors, and the Print Server Errors column shows the number of system errors on the print server.
- Step 3** If the Print Server Errors column or the Failed column contains a number other than 0 (for example, 1, 2 or 3), do the following:
- a. Click the number in the column. A list of errors appears.
  - b. Use the error information to resolve the print server or driver distribution problem.
  - c. Redistribute the failed print drivers by clicking the **Retry Downloading Failed Drivers** icon, and then repeat the previous steps to check for errors.
- The Retry Downloading Failed Drivers icon appears in the taskbar on the following pages in the WAAS Central Manager GUI:
- Go to **My WAN > Manage Devices**, click the **Edit** icon next to the appropriate print server, and then choose **Configure > Acceleration > Legacy Services > Print Services > Drivers** in the navigation pane.
  - Go to **My WAN > Manage Device Groups**, click the **Edit** icon for the appropriate device group, and then choose **Configure > Acceleration > Legacy Services > Print Services > Download Drivers** in the navigation pane.
- Step 4** If the Print Server Errors column and the Failed column for your WAAS print servers contains a 0 (no distribution errors), do the following:
- a. Click the **Edit** icon next to one of the print servers to which you distributed the print driver.
  - b. From the navigation pane, choose **Configure > Acceleration > Legacy Services > Print Services > Drivers**.
- A list of drivers installed on this device appears.

- c. Verify that the Download Status column for the drivers that you just distributed shows Completed. If the print driver does not appear in the list, wait up to 10 minutes and refresh the page. It can take up to 10 minutes for a newly distributed driver to appear in the list as Completed.

## Associating a Driver with your Printer

After you distribute a driver to a WAAS print server, you need to associate the driver with the printer that you added in the [“Adding a Printer to the WAAS Print Server”](#) section on page 13-12.

To associate a distributed driver with a printer, follow these steps:

- 
- Step 1** Log in to a Windows client.
  - Step 2** Run the following command to set the print admin privilege level:
 

```
net use \\WAE_netbios_name\print$ * /USER:username
```

The *WAE\_netbios\_name* is the NetBIOS name of the WAAS print server containing the printer you added in the [“Adding a Printer to the WAAS Print Server”](#) section on page 13-12, and *username* is the username you specified in the [“Creating Accounts with Print Admin Privileges”](#) section on page 13-10.
  - Step 3** Enter the following command in the Run window on the Windows client:
 

```
\\wae_netbios_name
```

The printer share window appears.
  - Step 4** Double-click the printer icon to view a list of printers.
  - Step 5** Right-click on the printer that you added in the [“Adding a Printer to the WAAS Print Server”](#) section on page 13-12 and choose **Properties**.
  - Step 6** Click the **Advanced** tab, and in the Driver drop-down list, choose the appropriate driver.
  - Step 7** Click **Apply** to save your changes, and then click **OK** to close the window.
- 

## Initializing Print Drivers

Before you install a print driver on a client, you need to initialize the driver so that your branch office clients can successfully install the driver and be able to print from applications such as Microsoft Word and PowerPoint. Uninitialized drivers often do not install successfully and can cause errors when clients use them to print from Microsoft Word and PowerPoint.

Manual initialization of a driver is required because the WAAS print server cannot execute Windows driver code locally to automatically initialize the driver.

To manually initialize a print driver, follow these steps:

- 
- Step 1** From a Windows client, log in to the WAAS print server as an administrative user.
  - Step 2** Open the Printers and Faxes folder on the WAAS print server.
  - Step 3** Choose the shared printer.
  - Step 4** Right-click on the printer and choose **Properties**.

- Step 5** From the General tab, choose **Printing Preferences**.
  - Step 6** Change the page orientation from Portrait to Landscape, click **Apply**, and then click **OK**.
  - Step 7** Reset the page orientation from Landscape back to Portrait, click **Apply**, and then click **OK**.  
Changing the page orientation ensures that the setting is applied correctly.
  - Step 8** (Optional) Set the desired printing defaults, which are then applied to all future client driver installations.
- 

After you complete driver initialization, follow these additional steps before continuing:

---

- Step 1** Run the `print_diff` utility for each print driver, to verify the driver installation on the Samba print server and to help you understand what printer features may not be supported. For details on this utility, see the [Print\\_Diff Utility](#) section in the document *Using the Print Utilities to Troubleshoot and Fix Samba Driver Installation Problems*.
  - Step 2** Run the `print_fix` utility for each print driver to resolve any differences between the Samba and Windows print driver properties. For details on this utility, see the [Print\\_Fix Utility](#) section in the document *Using the Print Utilities to Troubleshoot and Fix Samba Driver Installation Problems*.
  - Step 3** Run the `print_diff` utility again for each print driver to verify the driver properties after they were updated by the `print_fix` utility.
- 

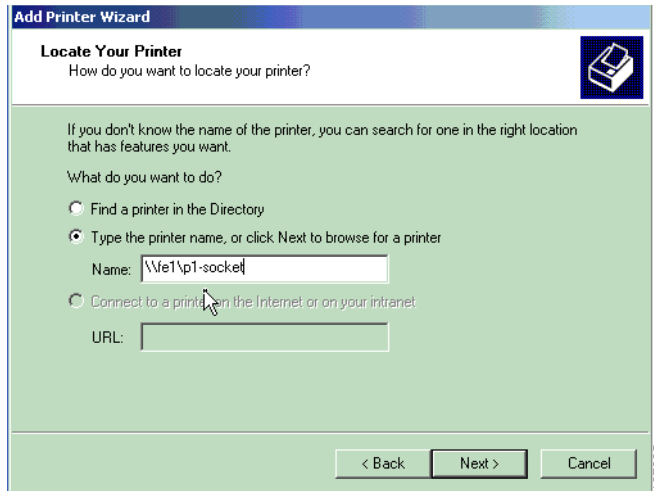
## Adding the WAAS Print Server to Your Branch Office Clients

Windows clients who will print using the WAAS print server and previously created print queues must run the Microsoft Add Printer Wizard.

To add a printer to a Windows client, follow these steps:

---

- Step 1** From a Windows client, choose **Printers and Faxes** from the Start menu.
- Step 2** Click **Add a Printer**.  
The Add Printer Wizard opens.
- Step 3** Click **Next**.
- Step 4** Click the radio button to choose a network printer.
- Step 5** Click **Next**.  
The Locating Your Printer window appears. (See [Figure 13-9](#).)

**Figure 13-9** Locating Your Printer

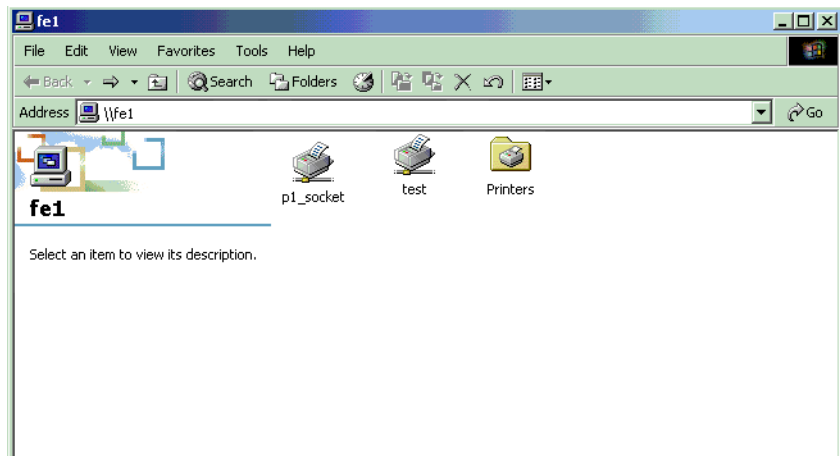
**Step 6** Use one of the following methods to choose the printer, and then click **Next**:

- Enter the printer name.
- Find the WAAS print server in the Active Directory (if the printer is published).
- Browse the domain for the WAAS print server.



**Note** Interoperability issues can occur when Windows browses for the WAAS Print Queue in the Add Printer Wizard. If they occur, you must explicitly type the printer name.

The printer appears in your list of printers. (See [Figure 13-10](#).)

**Figure 13-10** Printer Added Successfully

Once the printer is successfully added, you can begin printing.

# Managing Print Services

This section contains the following topics:

- [Viewing Print Server Details, page 13-25](#)
- [Configuring Aggregate Settings, page 13-26](#)
- [Using the Print Services Administration GUI, page 13-27](#)
- [Viewing the Print Server Page Log, page 13-32](#)

## Viewing Print Server Details

Once you set up print services, you can use the WAAS Central Manager GUI to view details about print drivers and the WAAS print servers installed in your network.

[Table 13-6](#) describes how to view print driver and print server details from the WAAS Central Manager GUI.

**Table 13-6** Viewing Print Server Details from the WAAS Central Manager GUI

| To view                                                               | Go to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All drivers that reside in the repository on the WAAS Central Manager | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Drivers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Detailed information about a driver                                   | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Drivers</b> , and click on the driver.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Drivers installed on a specific WAAS print server                     | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Servers</b> , and follow these steps: <ol style="list-style-type: none"> <li>1. Choose the WAAS print server.</li> <li>2. Click the <b>Driver</b> tab.</li> </ol> A list of all the drivers distributed to this WAAS print server appears. For information on how to distribute drivers, see the <a href="#">“Distributing Drivers to the WAAS Print Servers”</a> section on page 13-19.                                                                                                                                            |
| Printers associated with a WAAS print server                          | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Servers</b> , and follow these steps: <ol style="list-style-type: none"> <li>1. Choose the WAAS print server.</li> <li>2. Click the <b>Printer</b> tab (visible by default).</li> </ol> Or, go to <b>My WAN &gt; Manage Devices</b> , and follow these steps: <ol style="list-style-type: none"> <li>1. Choose the WAAS print server for which you want to view the print queue.</li> <li>2. From the navigation pane, choose <b>Configure &gt; Acceleration &gt; Legacy Services &gt; Print Services &gt; Printers</b>.</li> </ol> |
| A list of WAAS print servers in your network                          | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Servers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Table 13-6** Viewing Print Server Details from the WAAS Central Manager GUI (continued)

| To view                                                 | Go to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A list of WAAS print servers in a specific device group | <p><b>My WAN &gt; Manage Device Groups</b>, then follow these steps:</p> <ol style="list-style-type: none"> <li>1. Click the <b>Edit</b> icon next to the device group that contains the print servers you want to view.</li> <li>2. From the navigation pane, choose <b>Configure &gt; Acceleration &gt; Legacy Services &gt; Print Services &gt; Print Servers</b>.</li> </ol> <p>A list of print servers associated with the selected device group appears.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Driver distribution errors                              | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Servers</b> , and then click on the number in the Failed column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Print server errors                                     | <b>Configure &gt; Legacy Services &gt; Print Services &gt; Servers</b> , and then click on the number in the Print Server Errors column.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| The status of your WAAS print server                    | <p><b>Configure &gt; Legacy Services &gt; Print Services &gt; Servers</b>, and then follow these steps:</p> <ol style="list-style-type: none"> <li>1. View the Time Stamp column, and ensure that the time is not more than 5 minutes old. Each WAAS print server sends a status report to the WAAS Central Manager on a regular interval specified by the System.monitoring.collectRate field (described in the <a href="#">“Modifying the Default System Configuration Properties”</a> section on page 9-16). If a WAAS print server fails to send this report on time, the server is probably down.</li> <li>2. If a WAAS print server has not sent a status report in the last 5 minutes, do the following: <ol style="list-style-type: none"> <li>a. Go to <b>Admin &gt; Logs &gt; System Messages</b>.</li> <li>b. Search the message log for the reason the WAAS print server is not functioning correctly. You can use the Node Name column to quickly locate information for a specific WAAS print server.</li> </ol> </li> </ol> <p><b>Note</b> CUPS log files are rotated when the log file reaches the maximum size of 1MB.</p> |

## Configuring Aggregate Settings

Aggregate settings allow you to configure a WAAS print server to automatically download drivers that are distributed to a device group to which it is a member. For example, if a WAAS print server belongs to device group DG1 and is configured with aggregate settings enabled, the print server will automatically download any driver that you distribute to the DG1 device group. However, if the same print server is configured with aggregate settings disabled, the print server will not download drivers that you distribute to the DG1 device group.



The WAAS Central Manager does not redistribute drivers that already exist on a WAE device. For example, if a WAAS print server belongs to two device groups (DG1 and DG2) and the aggregate setting is enabled, the print server only downloads one instance of the driver in the event it is distributed to both device groups.

When you add a WAAS print server to a device group, the aggregate settings for the print server are enabled and the drivers belonging to the device group are automatically distributed to the print server. When you remove a print server from a device group when aggregate settings are enabled, all the drivers assigned to the device group are removed from the print server if the drivers are not being used by any printer.

To configure aggregate settings on a WAAS print server, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.  
The Devices window appears.
- Step 2** Click the **Edit** icon next to the WAAS print server for which you want to configure aggregate settings.  
The Device Dashboard window appears.
- Step 3** From the navigation pane, choose **Configure > Acceleration > Legacy Services > Print Services > Drivers**.  
A list of drivers installed on the WAAS print server appears.
- Step 4** Click the **Yes** radio button at the top of the list to enable aggregate settings, or click **No** to disable aggregate settings.  
A dialog box asks if you want to continue.
- Step 5** Click **OK**.  
If you enabled aggregate settings, the WAAS print server begins downloading all the drivers that have been distributed to its device group.
- 

## Using the Print Services Administration GUI

The Print Services Administration GUI allows you to perform a variety of tasks for a specific WAAS print server. You can open the Print Services Administration GUI from the WAAS Central Manager GUI or from the WAE Device Manager GUI.



### Note

After accessing the Print Services Administration GUI, you are prompted for the user name and password of the print admin account when you perform any task such as adding a printer. For information on creating a print admin account on a WAE device, see the [“Creating a New Account” section on page 7-4](#).

---

This section contains the following topics:

- [Opening the Print Services Administration GUI, page 13-28](#)
- [Adding a Printer, page 13-28](#)
- [Modifying the Printer Configuration, page 13-28](#)
- [Enabling Print Banners, page 13-30](#)
- [Setting Up Print Clusters, page 13-31](#)

- [Viewing Print Jobs, page 13-31](#)

## Opening the Print Services Administration GUI

You can open the Print Services Administration GUI from either the WAE Device Manager GUI or from the WAAS Central Manager GUI.

To open the Print Services Administration GUI from the WAE Device Manager GUI, follow these steps:

- 
- Step 1** From the WAE Device Manager GUI, choose **Cisco WAE > Configuration**.
- Step 2** Click the Print Services tab, and click the **Open** link. The Print Services Administration GUI opens.
- 

To open the Print Services Administration GUI from the WAAS Central Manager GUI, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Configure > Legacy Services > Print Services > Servers**.
- A list of the WAAS print servers installed in your network appears.
- Step 2** Click the **Edit** icon next to the WAAS print server that you want to manage.
- Step 3** Click the **CUPS** icon in the tool bar.
- The Print Services Administration GUI appears.
- 

## Adding a Printer

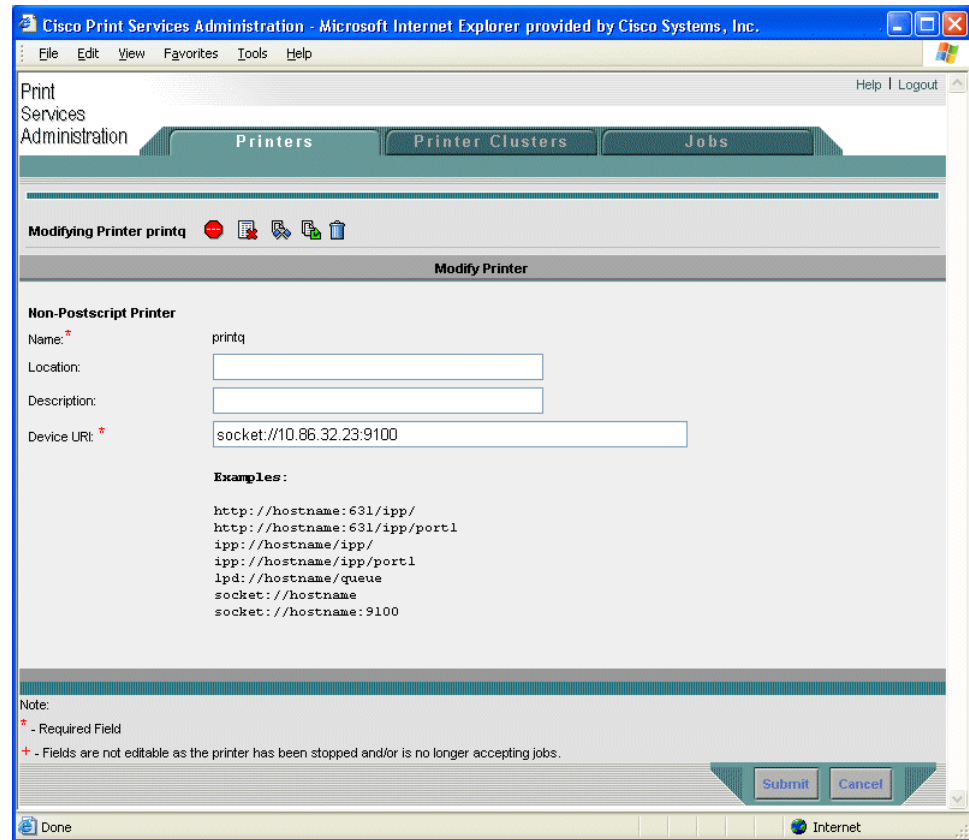
For instructions on how to add a printer to a WAAS print server, see the [“Adding a Printer to the WAAS Print Server”](#) section on page 13-12.

## Modifying the Printer Configuration

To modify the configuration of an existing printer, follow these steps:

- 
- Step 1** From the Printers tab in the Print Services Administration GUI, choose the printer to modify.
- The Modifying Printer window appears. (See [Figure 13-11](#).)

Figure 13-11 Modifying Printer Configuration



Use this window to modify the location, description, and device URI settings. The name field cannot be modified. You can also perform the following tasks by clicking the corresponding icons:

- Print a test page (for Postscript printer only)—Sends a test page to the printer.
- Configure printer (for Postscript printer only)—Displays the Configure Printer window that can be used to set starting and ending banner page options. For more information, see the “[Enabling Print Banners](#)” section on page 13-30.
- Stop/Start the printer—Allows you to stop and start the printer. A warning appears to ask for user confirmation before stopping the printer.
- Accept/Reject Jobs—Allows you to determine if any job can be sent to this printer.
- Show Completed Jobs—Displays the Job Listing Page with only completed jobs for this printer. For more information, see the “[Viewing Print Jobs](#)” section on page 13-31.
- Show Active Jobs—Displays the Job Listing Page with only active jobs for this printer. For more information, see the “[Viewing Print Jobs](#)” section on page 13-31.
- Delete this printer configuration—Allows you to delete this printer. If the printer belongs to a printer cluster, deleting the printer will remove that printer from the cluster. If the printer is the only printer in a cluster, the cluster itself is removed.

**Step 2** Modify any of the following configuration settings:

- Location—User-specified location of the printer (maximum 127 characters).
- Description—User-specified description of the printer (maximum 127 characters).

- **Device URI (required)**—The device URI is the address of the printer, in the form:

*protocol://server:port/queue*

A maximum of 1024 characters are allowed. The only allowed protocols are lpd, socket, ipp, and http. Validation check on the protocol will be performed but there is no other check on the URI string. A list of example URIs appears to help you enter it properly. You can obtain the information (printer port, protocol) for your specific printer from the printer manufacturer's manual, from the test page of the printer, or from the printer's front panel.




**Note** You can configure these fields only if the printer is running. If the printer is stopped or is rejecting jobs, the fields are read-only and a message appears indicating the printer status.

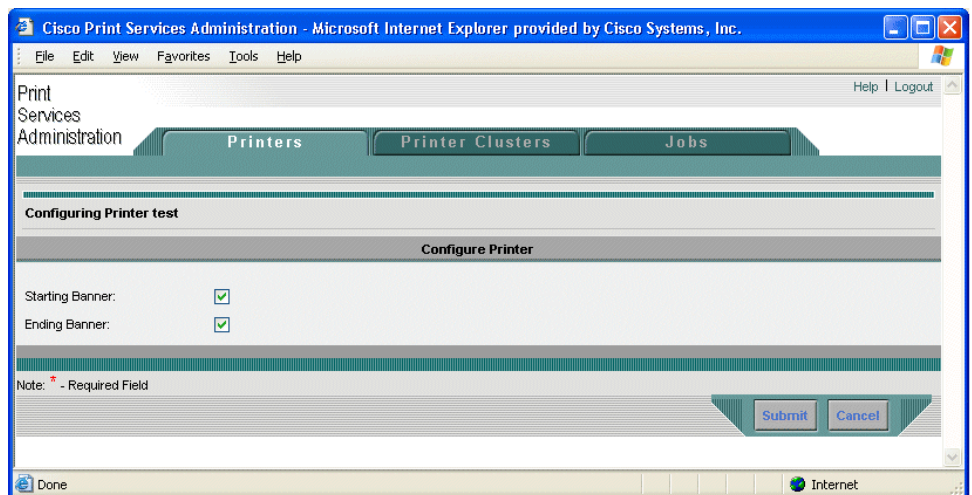
- Step 3** Click **Submit** to save your changes.  
The print queue change will be visible to clients within 1 minute.

## Enabling Print Banners

To enable a starting or ending banner for each print job, follow these steps:

- Step 1** From the Printers tab in the Print Services Administration GUI, choose the printer to modify. The Modifying Printer window appears. (See [Figure 13-11 on page 13-29](#).)
- Step 2** Click the **Configure** button (  ) in the tool bar. The Configuring Printer window appears. (See [Figure 13-12](#).)

**Figure 13-12** Configuring the Starting and Ending Print Banners



- Step 3** Check the check box next to the banner option that you want to enable:
- **Starting Banner**—Enables printing of a starting banner for each job.
  - **Ending Banner**—Enables printing of an ending banner for each job.

The starting and ending banners print the same information. These options just allow you to choose the location of the banner on the page.

**Step 4** Click **Submit**.



**Note**

If you incorrectly specify a nonpostscript printer as a postscript printer and enable the banner page, the printer will print something similar to “%!PS-Adobe-3.0. %% ...” then numerous blank pages. This message is an indication that the printer setup is incorrect. To print valid test page and banner pages, you must specify the printer postscript capability correctly.

## Setting Up Print Clusters

For information on setting up print clusters, see the [“Adding Printer Clusters”](#) section on page 13-14.

## Viewing Print Jobs

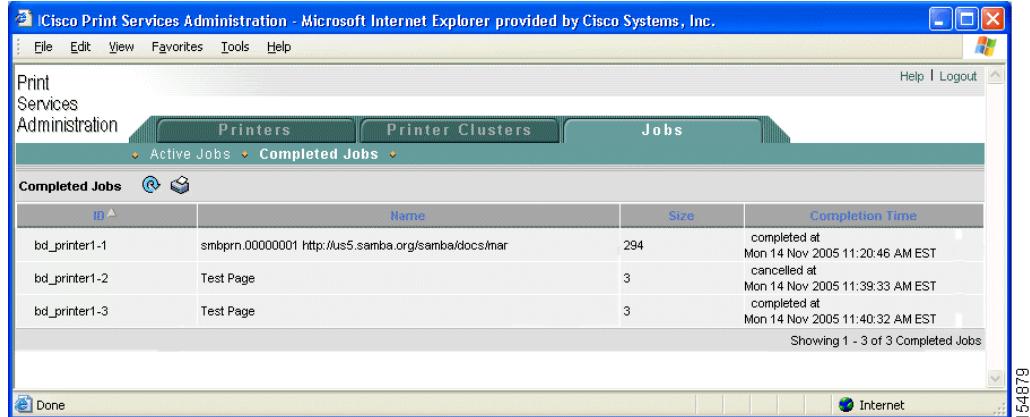
Use the Jobs tab in the Print Services Administration GUI to view a list of completed and active jobs.

The pages show the following job details:

- ID —Generated by concatenating the printer name with a sequence number.
- Name—Name of the job you selected to print.
- Size—Size of the job.
- Status—Reported status of the job; only available in Active Job Listing Page.
- Completion Time—Reported completion time of the job; only available in Completed Job Listing window.

The Completed Job Listing window (see [Figure 13-13](#)) only shows jobs that are still in the spool area (/local/local1/spool/cups). The spool area retains the last 500 completed jobs and has a 1-GB size limitation. Once the completed job limit is reached, the oldest job is removed to make room for the latest completed job. When a job is removed from the spool area, it is no longer listed in the Completed Job Listing window.

Figure 13-13 Completed Job Listing Window

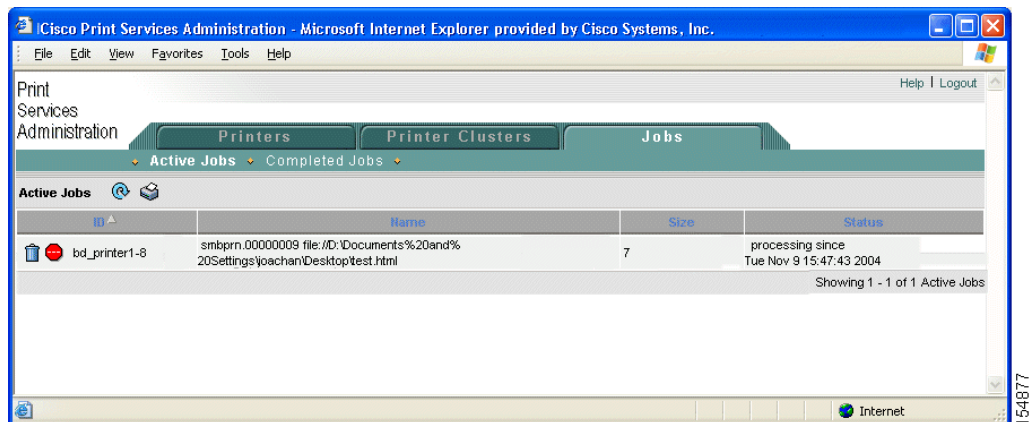


In the Active Job Listing window (see Figure 13-14), you can also perform the following tasks by clicking the corresponding icons next to the job:

- Stop Job—Stops the selected job.
- Delete Job—Deletes the selected job.

The Active Job Listing window shows all the print jobs that are not completed or cancelled.

Figure 13-14 Active Job Listing Window—Job Can Be Stopped or Deleted



## Viewing the Print Server Page Log

The WAAS print server page log is stored in `/local/local1/logs/cups_access_log`. The `cups_access_log` file lists each page that is sent to a printer. Each line contains the following information:

*printer user job-id date-time page-number num-copies job-billing hostname*

Here is an example of a log entry:

DeskJet root 2 [20/May/2008:19:21:05 +0000] 1 0 acme-123 localhost

The field descriptions are as follows:

- The *printer* field contains the name of the printer that printed the page. If you send a job to a printer class, this field will contain the name of the printer that was assigned the job.
- The *user* field contains the name of the user (the IPP requesting-user-name attribute) that submitted this file for printing.
- The *job-id* field contains the job number of the page being printed. Job numbers are reset to 1 whenever the CUPS server is started, so do not depend on this number being unique.
- The *date-time* field contains the date and time when the page started printing. The format of this field is identical to the *date-time* field in the *access\_log* file.
- The *page-number* and *num-pages* fields contain the page number and number of copies being printed of that page. For printers that cannot produce copies on their own, the *num-pages* field will always be 1.
- The *job-billing* field contains a copy of the job-billing attribute provided with the IPP create-job or print-job requests or "-" if none was provided.
- The *hostname* field contains the name of the host (the IPP job-originating-host-name attribute) that originated the print job.

## Troubleshooting Print Services

Troubleshooting issues are documented in the following categories:

- [General Known Issues, page 13-33](#)
- [Login and Access Problems, page 13-34](#)
- [Avoiding Print Problems, page 13-34](#)
- [Understanding Interactions Between the WAAS Central Manager and the WAAS CLI, page 13-35](#)

Also see the document [Using the Print Utilities to Troubleshoot and Fix Samba Driver Installation Problems](#), which explains how to troubleshoot and fix many common Samba print driver installation problems using the print utilities tools.

## General Known Issues

The following are general known issues with WAAS print services:

- Linksys devices do not support IPP 1.1 printing; use the LPD protocol only.
- A Linksys URI should use L1/2/3 instead of P1/2/3 as specified in the Linksys user guide.
- In some cases the Windows Print Queue status may not refresh correctly on a Windows client. If this happens, press F5 to manually refresh.
- After adding a printer in the Print Services Administration GUI, it can take up to one minute for the printer to appear on a Windows client system.
- In some cases the printer status and error messages are not displayed to the print client.
- The only printers that are supported are IP-based network printers. If you have directly attached printers, use Parallel/Serial/USB IP adapters.
- If you receive an "Access is denied" error when trying to load a driver to the central repository, ensure that the driver file is marked as Read/Write and not Read Only.



- Print problems can be caused by corrupted TDB files. To verify these files, use the **windows-domain diagnostics** CLI command. See the *Cisco Wide Area Application Services Command Reference* for more information about this command.

## Login and Access Problems

The following login and access issues can occur when using WAAS print services:

- Authentication information is contained in the **syslog.txt** file. You can raise the log level in this file by adding the relevant smb.conf directives using the **smb-conf** advanced command. Refer to the *Cisco Wide Area Application Services Command Reference* for more information.
- If you cannot access the WAAS print server from Windows, you should log out of Windows and enter the following command:

```
net use \\WAE_netbios_name\print$ * /USER:username
```

The *WAE\_netbios\_name* value is the NetBIOS name of the WAAS Central Manager device, and *username* is the username you specified in the “[Creating Accounts with Print Admin Privileges](#)” section on page 13-10.

- If the Admin user cannot add a driver to a printer, the user should log out of Windows and enter the following command:

```
net use \\WAE_name\print$ * /USER:username
```

The *WAE\_name* is the hostname or IP address of the WAAS Central Manager device, and *username* is the name of the account created in the “[Installing Print Drivers on Individual WAAS Print Servers](#)” section on page 13-18.

- To avoid issues with usernames, follow these guidelines:
  - The WAAS Central Manager checks for unique usernames in a case-insensitive manner (for example, “user1” is identical to “User1,” and you cannot add both).
  - The CLI command for creating users is case-sensitive, you can add both user1 and User1 using the CLI.

## Avoiding Print Problems

To avoid printing problems when using WAAS print services, follow these guidelines:

- When using a cluster, always use the cluster configuration window and do not configure the cluster members individually. This action may lead to inconsistent behavior, even when it is a cluster of one.
- Printer clusters should contain printers with similar capabilities. Failure to configure correctly may cause printing error. Deletion of a printer will also remove that printer from its associated clusters.
- Print test page and banner pages are only supported by PostScript printers. Nonpostscript printers will print unreadable output.
- If Point and Print does not work, ensure that the drivers have been properly distributed to the WAAS print servers as described in the “[Distributing Drivers to the WAAS Print Servers](#)” section on page 13-19.
- Jobs are reprinted from the beginning. If WAAS print services are restarted due to configuration changes, in-process jobs will be reprinted.



- If jobs are not being printed, do the following:
  - Ensure that the printer is functional.
  - Ensure that the URI is set correctly.
  - Ensure that the printer is not stopped or rejecting jobs in the WAAS print services configuration.
  - Ensure that either the CIFS accelerator or the legacy WAFS edge services on the print server are enabled and running.
  - Check if both **smbd** and **cupsd** processes are running.
  - Check if the spool directories are full.
  - Ensure that the printer driver has been properly distributed. For more information, see the [“Initializing Print Drivers” section on page 13-22](#).
- Minimize changes to the NetBIOS name of the WAAS print server. If you need to change the NetBIOS name, make sure to use either the WAAS Central Manager GUI or the **windows-domain** CLI command.
- If a PostScript job is sent to a nonpostscript printer, you will see a “%!PS-Adobe-3.0...” message. To fix this, configure the printer as nonpostscript, or send the print job to a PostScript printer.
- If you cannot check the check box for advanced features on a printer in the branch, it may be that “Enable advanced printing features” is allowing the client printer driver to communicate with the print server using Enhanced Metafile Spooling (EMF).

WAAS print services supports only RAW spooling and not EMF because no rendering is done on the WAAS print server. The client renders the print job, and then submits it in a RAW format, as if the printer is going to receive that job.

**Note**

No printer functionality is lost because of RAW spooling. The only functionality lost is the print rendering by the WAAS print server. In RAW spooling, the client is doing the rendering instead of having it done by the print server itself.

## Understanding Interactions Between the WAAS Central Manager and the WAAS CLI

Because you can use the WAAS Central Manager or the WAAS CLI to configure print services, you should be aware of the following interactions between these tools:

**Note**

Restarting CUPS may temporarily disrupt print jobs.

- If Print Services is not running, the Open link for Print Services Administration GUI is disabled in the WAAS Central Manager GUI. If you stop print services by entering the **no print-services enable** global configuration command in the CLI after the WAAS Central Manager is loaded, the message “The page cannot be displayed” appears after attempting to access print services.
- Some configuration changes made from the WAAS Central Manager GUI or the CLI require Samba and CUPS software to be restarted, temporarily interrupting print services availability and operation. User confirmation is required before configuration changes are made.

For more information about the print services CLI commands, see the *Cisco Wide Area Application Services Command Reference*.





# CHAPTER 14

## Configuring Virtual Blades

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This chapter describes how to configure virtual blades, which are computer emulators that reside in a WAE or WAVE device. A virtual blade allows you to allocate WAE system resources for use by additional operating systems that you install on the WAE hardware. You can host third-party applications in the isolated environment provided by a virtual blade. For example, you could configure a virtual blade in a WAE device to run Windows printing and domain lookup services.

For detailed information on installing and configuring Windows on a virtual blade, see the [Cisco WAAS Installation and Configuration Guide for Windows on a Virtual Blade](#).

Virtual blades are supported only on certain models of WAE and WAVE devices. On unsupported WAE and WAVE devices, the virtual blade configuration screens are nonfunctional.



### Note

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Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers, WAEs, and WAVEs in your network. The terms WAE and WAVE refer to WAE appliances, WAVE appliances, and WAE Network Modules (the NME-WAE family of devices).

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This chapter contains the following sections:

- [About Virtual Blades, page 14-1](#)
- [Preparing to Use Virtual Blades, page 14-2](#)
- [Configuring Virtual Blades, page 14-4](#)
- [Enabling and Disabling Virtual Blades, page 14-7](#)
- [Copying a Disk Image to a Virtual Blade, page 14-8](#)
- [Backing Up and Restoring a Virtual Blade, page 14-8](#)

## About Virtual Blades

WAAS virtual blades act as computer emulators within your WAE or WAVE device. You can install an operating system and applications on the virtual blade to work with your WAAS system and provide additional services for the users on your network.



### Note

---

WAAS virtual blades support only the Windows Server 2003 or Window Server 2008 operating systems, and the Active Directory, Print Services, DHCP, and DNS services. Although other operating systems and applications may operate on a virtual blade, the WAAS virtual blade does not support these other operating systems and applications.

---

Each virtual blade has its own virtualized CPUs, memory, firmware, disk drives, CD drives, and network interface cards. A virtual host bridge controls communications between the virtual blade, your WAE device, and the rest of your WAAS network.

**Note**

When you configure a virtual blade on your WAE or WAVE device, system resources are reserved for the virtual blade. These resources are not available to your WAAS system, even if the virtual blade is not active. This can affect the performance of your WAAS system.

With a virtual blade you can perform the following activities:

- Configure system characteristics of the virtual blade environment
- Install an operating system and applications
- Configure the network flow to and from the virtual blade
- Start and stop the virtual blade

Table 14-1 lists an overview of the steps required to set up and enable one or more virtual blades on your WAE.

**Table 14-1 Virtual Blade Configuration Overview**

| Step                                              | Description                                                                                                                                                                                                                                                |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Prepare your WAE for using virtual blades.     | Locates your operating system image and enables the virtual blade feature on your WAE. See the “ <a href="#">Preparing to Use Virtual Blades</a> ” section on page 14-2.                                                                                   |
| 2. Configure the virtual blade system parameters. | Sets up system resources and interfaces for your virtual blade. See the “ <a href="#">Configuring Virtual Blades</a> ” section on page 14-4.                                                                                                               |
| 3. Enable the virtual blade on your WAE.          | Activates the virtual blade resources. See the “ <a href="#">Enabling and Disabling Virtual Blades</a> ” section on page 14-7.                                                                                                                             |
| 4. Transfer files to the virtual blade.           | Copies files to the WAE hard drive for use by your virtual blade. See the “ <a href="#">Copying a Disk Image to a Virtual Blade</a> ” section on page 14-8, and see the “ <a href="#">Backing Up and Restoring a Virtual Blade</a> ” section on page 14-8. |

## Preparing to Use Virtual Blades

Before you configure and enable a virtual blade on your WAVE or WAE device, follow these steps:

**Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.

**Step 2** Click the **Edit** icon next to the WAE device that you want to configure.

**Note**

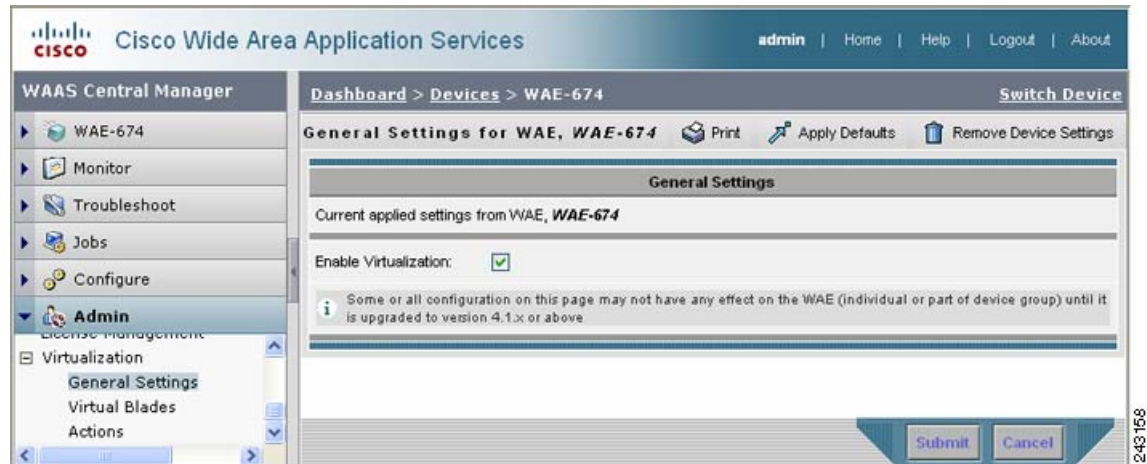
You can enable virtual blades only on application accelerator WAEs, not on Central Manager devices.



**Note** You can only configure virtual blades on individual WAAS devices. You cannot configure virtual blades on device groups.

- Step 3** From the navigation pane, choose **Admin > Virtualization > General Settings**. The General Settings window appears (see [Figure 14-1](#)).

**Figure 14-1** General Settings Window



- Step 4** Check **Enable Virtualization** to enable virtualization.

- Step 5** Click **Submit**.

You are prompted to confirm that you want to modify general settings. Doing so will reboot the WAE. After the reboot, the WAE will have a disk partition and other resources reserved for virtual blade use.



**Note** You will not be able to undo this change unless you restore the WAE from the rescue CD.



**Note** When you configure a virtual blade on your WAE device, system resources are reserved for the virtual blade. These resources are not available to your WAAS system, even if the virtual blade is not active. This can affect the performance of your WAAS system.

- Step 6** Click **OK**. The WAE restarts.

- Step 7** Locate the disk or image of the operating system that you want to run on the virtual blade. Make sure that you either have the CD-ROM available, or that you have copied the disk image to the WAE hard drive. See [“Backing Up and Restoring a Virtual Blade”](#) section on page 14-8.

To enable virtualization with the WAAS CLI, use the **virtual-blade** global configuration command.

# Configuring Virtual Blades

This section describes how to configure a new virtual blade or edit an existing blade. You can configure resources such as virtual blade number, description, boot method, disk allocation, and other parameters. Note that after a virtual blade is initially configured, the only resource parameters that can be changed are memory and the bridged interface. To change these parameters on a virtual blade, stop the virtual blade first, then start the virtual blade after making changes.

To configure a virtual blade on your WAE or WAVE device, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the WAE device that you want to configure.
- Step 3** From the navigation pane, choose **Admin > Virtualization > Virtual Blades**. The Virtual Blade Entries window appears (see [Figure 14-2](#)).

**Figure 14-2** Virtual Blade Entries List window

The screenshot shows the Cisco Wide Area Application Services (WAAS) Central Manager GUI. The navigation pane on the left is expanded to 'Admin > Virtualization > Virtual Blades'. The main content area displays the 'Virtual Blade Entries for WAE, WAE-674' window. The window includes a table with the following data:

| Blade Number | Description | Disk Space (GB) | Memory (MB) |
|--------------|-------------|-----------------|-------------|
| 1            | 2003 Server | 10              | 512         |
| 2            | 2008 Server | 20              | 1024        |

Any existing virtual blades are displayed in the Virtual Blade Entries list.

- Step 4** Click the **Edit** icon next to the virtual blade that you want to configure, or click the **Create** button to create a new virtual blade. The Virtual Blade configuration pane appears (see [Figure 14-3](#)).

Figure 14-3 Virtual Blade configuration pane

The screenshot displays the 'Virtual Blade' configuration page in the Cisco WAAS Central Manager. The page is for a device named 'WAE-674'. The configuration fields are as follows:

- Blade Number:** 1
- Description:** 2003 Server
- AutoStart:**
- Boot From:** cd-rom
- CD Image:** disk, /local1/vbs/wow.iso
- Floppy Image:** (empty)
- Disk Space:** 10 (1-1000) GB
- Memory:** 512 (100-8000) MB
- Disk Emulation:** IDE
- NIC Emulation:** rtl8139
- CPU Emulation:** qemu64

The 'Virtual Interfaces' table contains one entry:

| Interface Name | Bridge Interface    | MAC Address       |
|----------------|---------------------|-------------------|
| 1              | GigabitEthernet 1/0 | 00:16:3E:54:B6:23 |

A note at the bottom indicates: 'Some or all configuration on this page may not have any effect on the WAE (individual or part of device group) until it is upgraded to version 4.1.x or above.' Buttons for 'Submit' and 'Cancel' are located at the bottom right.

**Step 5** Configure the virtual blade system parameters as needed to run your operating system and applications:

- If you are creating a new virtual blade, type the number of the virtual blade that you want to create in the Blade Number field.  
The number of virtual blades you can configure depends on which model of WAAS appliance you are using, and the amount of memory installed in that appliance.
- (Optional) In the Description field, type a brief description of the virtual blade.
- (Optional) Check **Autostart** to set the virtual blade to start automatically whenever the WAE starts.
- Choose a source for the virtual blade to boot from using the Boot From list. Choose **cd-rom** to boot the virtual blade from a CD or a CD image, or choose **disk** to boot the virtual blade from an image located on the WAE hard drive.
- Specify the location of the boot disk image by doing one of the following:
  - If you set Boot From to **cd-rom**, choose the CD image using the CD Image list. Choose **cd-rom** to read the CD image from a physical CD in the WAE CD-ROM drive. Choose **disk** to read the CD image from an ISO file on the WAE hard drive. If you chose **disk**, type the ISO file's path (for example: /local1/vbs/windows\_2003.iso).
- If you want to reserve resources for a virtual floppy disk on your virtual blade, enter the name of the floppy disk image in the Floppy Image field.
- In the Disk Space field, allocate the amount of WAE hard disk space, in Gigabytes, that you want allocated for the virtual blade.
- In the Memory field, allocate the amount of WAE memory, in Megabytes, that you want to make available for the virtual blade.



The amount of memory that can be allocated for a virtual blade depends on the amount of memory in your WAE or WAVE appliance, and on the amount of memory that is assigned to other virtual blades. The minimum amount of memory that you can allocate for a single virtual blade is 512 MB.

- i. In the Disk Emulation list choose the type of disk emulation that the virtual blade uses. Choose **IDE** or **virtio**.

**IDE** specifies an IDE (ATA) type disk emulator. **Virtio** specifies a generic disk controller emulator optimized for virtual machines. If you select the virtio emulator, you must have the paravirtualization (PV) drivers installed on your system.

- j. On the NIC Emulation list, choose the type of network interface card emulation the virtual blade uses. Choose **rtl8139** or **virtio**.

**Rtl8139** specifies a Realtek network card emulator, and **virtio** specifies a generic NIC emulator optimized for virtual machines. If you select the virtio emulator, you must have the paravirtualization (PV) drivers installed on your system.

**Step 6** Configure the interface bridge you want to use between the virtual blade and the physical interfaces on your WAE by doing the following:

- a. In the Virtual Interfaces pane, click **Add**. The Virtual Interface Add pane is displayed (see [Figure 14-4](#)).

**Figure 14-4** Virtual Interfaces Add Display pane

| Interface Name | Bridge Interface    | MAC Address       |
|----------------|---------------------|-------------------|
| 1              | GigabitEthernet 1/0 | 00:16:3E:54:B6:23 |

**Add/Edit Interface**

Interface Number: \* 1 Bridge Interface: GigabitEthernet 1/0 \* MAC Address: 00:16:3E:54:B6:23

Buttons: Add to List, Cancel, Generate

- b. In the **Interface Number** field Enter the virtual blade interface to be bridged. Valid values are 1 or 2.
- c. In the **Bridge Interface** list, choose the physical WAE interface that the virtual blade interface is bridged to. Choose either **GigabitEthernet** or **PortChannel**.
- d. In the MAC Address field, enter the MAC address of the bridged interface or click **Generate** to have WAAS generate the MAC address for you.
- e. Click **Add to List** to add the virtual interface to the virtual blade interface list.



**Note** To access the virtual blade console use the IP address of the bridge interface, with the virtual blade number specified as the port number (separated by a colon). For example if you bridged the GigabitEthernet 1/0 interface, and its IP address is 10.10.10.20, use **10.10.10.20:1** to get to the virtual blade 1 console.

**Step 7** Choose the virtual interface by clicking its radio button on the display.

**Step 8** Click **Submit**.



To configure virtual blades with the WAAS CLI, use the following commands:

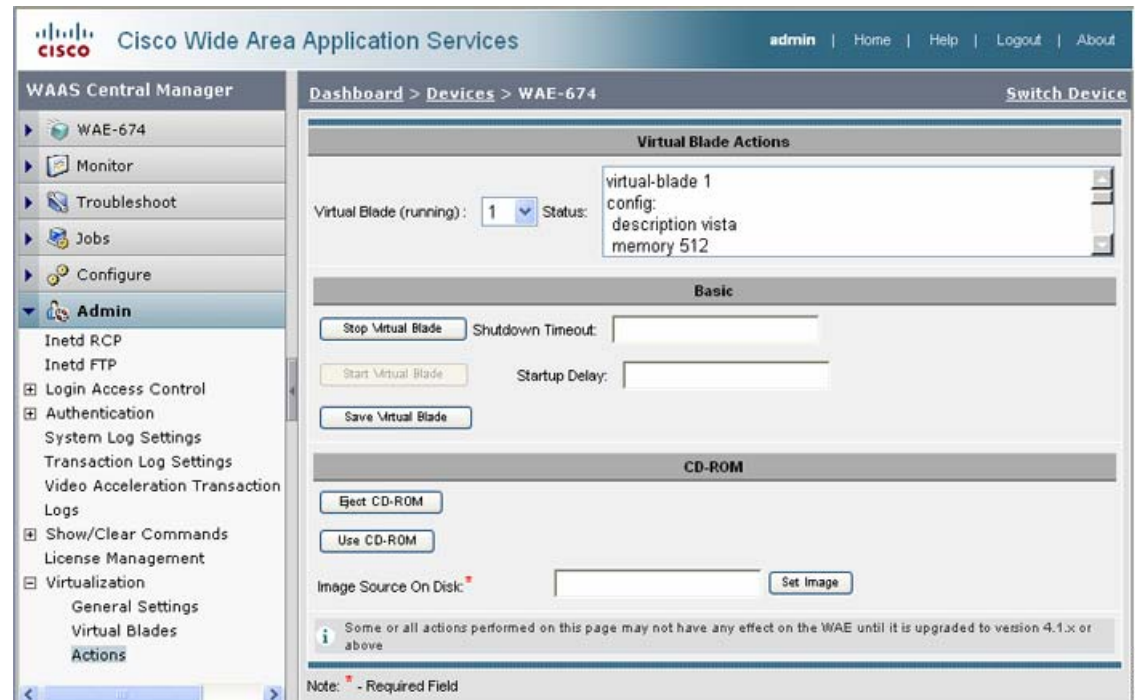
- **virtual-blade** (to enter virtual blade configuration mode)
- **(config-vb) autostart** to enable autostart
- **(config-vb) boot** to set the boot device
- **(config-vb) description** to enter a description for the virtual blade
- **(config-vb) device** to define the CPU, NIC, and disk emulators
- **(config-vb) disk** to allocate disk space for the virtual blade
- **(config-vb) interface** to bridge a virtual blade interface to an interface on your WAE
- **(config-vb) memory** to allocate system memory for the virtual blade

## Enabling and Disabling Virtual Blades

To enable or disable a virtual blade on your WAE, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the WAE device that you want to configure.
- Step 3** From the navigation pane, choose **Admin > Virtualization > Actions**. The Virtual Blade Actions window appears (see [Figure 14-5](#)).

**Figure 14-5** Virtual Blade Actions Display window



- Step 4** In the Virtual Blade list, choose the virtual blade that you want to enable or disable. The status of the virtual blade is displayed in the Status field.

The default selection for the Virtual Blade list is All. When All is selected, the Status field displays the current status for all virtual blades.

**Step 5** Click **Start Virtual Blade** to enable the selected virtual blade.

- (Optional) Enter a startup delay by typing a value, in seconds, in the **Startup Delay** field.

The startup delay can be used to give you time to connect a VNC session to the console before the virtual blade boots, so you can observe the initial startup.

**Step 6** Click **Stop Virtual Blade** to disable the selected virtual blade.

- (Optional) To give the virtual blade operating system time to shut down the virtual blade after you click the Stop Virtual Blade button, enter a value (in seconds) in the Shutdown Timeout field.

The shutdown timeout provides a delay period during which the operating system can shutdown gracefully. If the operating system has not shut down the virtual blade by the end of this period, WAAS forces the shutdown. A forced shutdown is comparable to pulling the power cord on a real computer.

If you set the Shutdown Timeout to 0, the WAAS will force a shutdown immediately.

To avoid losing data in open programs running on the virtual blade, it is safer to have the operating system perform the shutdown.



**Note**

The operating system on your virtual blade does not shut down and restart when you reboot a WAAS device. When you reboot a WAE or WAVE device, the WAAS software saves the virtual blade in its current state and then restores that state when the reboot is complete.

To enable a virtual blade with the WAAS CLI, use the **virtual-blade n start EXEC** command. To disable a virtual blade use the **virtual-blade n stop EXEC** command.

## Copying a Disk Image to a Virtual Blade

If you want to boot from a disk image stored on the WAAS device hard drive, you must copy that image file to the virtual blade directory. To copy the operating system ISO image to the virtual blade directory use the **copy ftp disk EXEC** command. For example, the following command copies the boot image `winserver.iso` from the WAAS directory on FTP server 10.10.10.200 to the virtual blade directory on the WAE device (`/local1/vbs/`):

```
wae# copy ftp disk 10.10.10.200 WAAS winserver.iso /local1/vbs/winserver.iso
```

## Backing Up and Restoring a Virtual Blade

You can use the WAAS CLI to backup and restore a virtual blade's disk image. The disk image is the bootable operating system and applications that run on the virtual blade. For example, your virtual blade might have a disk image of Windows Server 2003 running Print Services.

**Note**

---

WAAS virtual blades support only the Windows Server 2003 or Window Server 2008 operating systems, and the Active Directory, Print Services, DHCP, and DNS services. Although other operating systems and applications may operate on a virtual blade, the WAAS virtual blade does not support these other operating systems and applications.

---

To back up the disk image of a virtual blade on your WAE to an FTP server, use the **copy virtual-blade EXEC** command. For example, the following command transfers the file file.img from disk 1 on virtual blade 1 to FTP server 10.75.16.234:

```
wae# copy virtual-blade 1 disk 1 ftp 10.75.16.234 / file.img
```

To transfer a disk image to a virtual blade on your WAE, use the **copy ftp virtual-blade EXEC** command. For example, the following command transfers the file file.img from the FTP server 10.75.16.234 to disk 1 on virtual blade 1:

```
wae# copy ftp virtual-blade 1 disk 1 10.75.16.234 / file.img
```

**Note**

---

The disk image file must reside in the /local1/vbs directory on the virtual blade.

---





## **PART 4**

# **Maintaining, Monitoring, and Troubleshooting your WAAS Network**





# CHAPTER 15

## Maintaining Your WAAS System

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This chapter describes the tasks that you may need to perform to maintain your WAAS system.



**Note**

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Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

---

This chapter contains the following sections:

- [Upgrading the WAAS Software, page 15-1](#)
- [Backing Up and Restoring your WAAS System, page 15-11](#)
- [Performing Disk Maintenance for RAID-1 Systems, page 15-22](#)
- [Replacing Disks in RAID-5 Systems, page 15-23](#)
- [Switching a WAAS Central Manager from Standby to Primary, page 15-25](#)
- [Enabling Disk Encryption, page 15-26](#)
- [Configuring a Disk Error-Handling Method, page 15-28](#)
- [Activating All Inactive WAAS Devices, page 15-29](#)
- [Rebooting a Device or Device Group, page 15-29](#)
- [Performing a Controlled Shutdown, page 15-30](#)

## Upgrading the WAAS Software

[Table 15-1](#) outlines the steps you must complete to upgrade your WAAS software to a more recent version.

We recommend that all devices in your WAAS network should be running the same version of the WAAS software. If some of your WAAS devices are running different software versions, the WAAS Central Manager should be the highest version. This is a change from WAAS version 4.0.x, where the WAAS Central Manager should be the lowest version. For details on version interoperability limitations, see the *Release Note for Cisco Wide Area Application Services*.

If the WAAS Central Manager (version 4.1.1) sees any registered WAE devices that are at a higher version level, it raises a minor alarm to alert you. Additionally, the WAE devices are shown in red on the device listing page.

WAAS Central Manager version 4.1.1 can manage WAE devices that are running version 4.0.13 and later. Some WAAS Central Manager pages (with new features) will not be applicable to WAAS devices that are running a version lower than 4.1.1. If you modify the configuration on such pages, the configuration will be saved but it will have no effect on the device until the device is upgraded to version 4.1.1.

**Note**

WAAS version 4.1.1 does not support running in a mixed version WAAS network where any WAAS device is running a software version lower than 4.0.13. If you have any WAAS devices running version 4.0.11 or earlier, you must first upgrade them to version 4.0.13 (or a later 4.0.x version), before you install version 4.1.1. You should first upgrade any WAEs to version 4.0.13 (or a later 4.0.x version) and then upgrade any WAAS Central Managers to version 4.0.13 (or a later 4.0.x version). Then, you should begin the upgrade to version 4.1.1, starting with the WAAS Central Managers first.

**Table 15-1 Checklist for Upgrading the WAAS Software**

| Task                                                                    | Additional Information and Instructions                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Determine the current software version running on your WAAS network. | Check the software version that you are currently using so when you go to Cisco.com you know if there is a newer version to download.<br><br>For more information, see the <a href="#">“Determining the Current Software Version” section on page 15-3.</a>                                                         |
| 2. Obtain the new WAAS software version from Cisco.com.                 | Visit Cisco.com to download a newer software version and place this file on a local FTP or HTTP server.<br><br>For more information, see the <a href="#">“Obtaining the Latest Software Version from Cisco.com” section on page 15-3.</a>                                                                           |
| 3. Register the new software version with the WAAS Central Manager.     | Register the URL of the new software file so the WAAS Central Manager knows where to go to access the file.<br><br>For more information, see the <a href="#">“Specifying the Location of the Software File in the WAAS Central Manager GUI” section on page 15-4.</a>                                               |
| 4. Run the WAAS disk check tool.                                        | Before you upgrade your WAE from version 4.0.3 or earlier, you must run a script (the WAAS disk check tool) that checks the file system for errors that can result from a RAID synchronization failure.<br><br>For more information, see the <a href="#">“Using the WAAS Disk Check Tool” section on page 15-6.</a> |
| 5. Upgrade your WAAS Central Manager.                                   | Upgrade the standby and primary WAAS Central Managers.<br><br>For more information, see the <a href="#">“Upgrading the WAAS Central Manager” section on page 15-8.</a>                                                                                                                                              |
| 6. Upgrade your WAAS devices using Device Groups.                       | After upgrading the WAAS Central Manager, upgrade all your WAAS devices that are members of a device group.<br><br>For more information, see the <a href="#">“Upgrading Multiple Devices Using Device Groups” section on page 15-10.</a>                                                                            |
| 7. Delete the software version file.                                    | After completely upgrading your WAAS network, you can remove the software file if desired.<br><br>For more information, see the <a href="#">“Deleting a Software File” section on page 15-10.</a>                                                                                                                   |



If you need to downgrade or roll back the WAAS software from version 4.1.1 to a lower version, first downgrade or roll back the WAE devices, then the standby Central Manager (if applicable), and finally the primary Central Manager. For more information about downgrading, see the [Release Note for Cisco Wide Area Application Services](#).

## Determining the Current Software Version

To view the current software version running on any particular device, choose **My WAN > Manage Devices**. The Devices window displays the software version for each device listed.

You can also click the **Edit** icon next to the name of a device in the Devices window. The Device Dashboard window appears, listing the software version for that device.



**Note** The software version is not upgraded until a software upgrade has been successfully completed. If a software upgrade is in progress, the version number displayed is the base version, not the upgraded version number.

Alternatively, in the navigation pane for any given device, choose **Admin > Show/Clear Commands > Show Commands**. Choose **version** and click **Submit**. A secondary window pops up and displays the CLI output for the **show version** command.

## Obtaining the Latest Software Version from Cisco.com

To obtain the latest WAAS software version from Cisco.com, follow these steps:

- Step 1** Launch your preferred web browser and open this location:  
<http://www.cisco.com/kobayashi/sw-center/sw-content.shtml>
- Step 2** When prompted, log in to Cisco.com using your designated username and password. The Content Networking window appears, listing the available software products.
- Step 3** Choose a link to the content networking software product that you want. The Software Download window appears.
- Step 4** Click the **Download WAAS Software images (contains strong encryption)** link.  
The Content Networking window for Cisco WAAS Software appears.
- Step 5** Click the link to the WAAS cryptographic software release that you want.  
The window refreshes, listing all the software files (and meta files) available for that release.
- Step 6** Locate the software file that you want to download by consulting the Release column for the proper release version of the software.  
The software files will have names similar to the following: WAAS-4.1.1-K9.bin
- Step 7** Click the link for the software file that you want to download.  
The Enter Network Password dialog box appears. Enter your username and password, click **OK**, and proceed as follows:
  - If this is the first time you have downloaded a software file from Cisco.com, the Encryption Software Export Distribution Authorization form appears.

- Fill out the form and click **Submit**. The Cisco Systems Inc., Encryption Software Usage Handling and Distribution Policy appears.
  - Read the policy and click **I Accept**. The Encryption Software Export/Distribution Form appears.
  - If you previously filled out the Encryption Software Export Distribution Authorization form and read and accepted the Cisco Systems Inc., Encryption Software Usage Handling and Distribution Policy, these forms are not displayed again. Instead, the Encryption Software Export/Distribution Form appears after you click **OK** in the Enter Network Password dialog box.
- Step 8** Read the Encryption Software Export/Distribution Form, click the **Yes** or **No** radio button, and click **Submit**. A security alert dialog box pops up.
- Step 9** Click **Yes** in the Security Alert dialog box. The Software Download window reappears.
- Step 10** Right-click the software file link to download the software and use the **Save Link As** or the **Save Link Target As** option to save the file to your FTP or HTTP server.
- Step 11** Register the location of the software file in the WAAS Central Manager GUI, as described in the section that follows.
- 

## Specifying the Location of the Software File in the WAAS Central Manager GUI

To upgrade your WAAS software, you must first specify the location of the WAAS software file in the WAAS Central Manager GUI and configure the software file settings. The software file settings form in the WAAS Central Manager GUI defines the software file (.bin) and can be used to specify how to obtain the software file, and whether to preposition it or download it directly to a device.

To configure the software file settings form, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Jobs > Software Update**.
- Step 2** Click the **Create New Software File** icon in the taskbar.
- The Creating New Software File window appears. (See [Figure 15-1](#).)

Figure 15-1 Creating New Software File Window

- Step 3** In the Software File URL field, specify the location of the new WAAS software file as follows:
- Choose a protocol (**http** or **ftp**) from the drop-down list.
  - Enter the URL for the .bin software file that you downloaded from Cisco.com. For example, a valid URL might look like the following:  

```
http://internal.mysite.com/waas/WAAS-4.x.x-K9.bin
```

 where *WAAS-4.x.x-K9* is the name of the software upgrade file. (The filename might include the version number.)
- Step 4** If your server requires user login authentication, enter your username in the Username field and enter your login password in the Password field. Enter the same password in the Confirm Password field.
- Step 5** Enter the software version number in the Software Version field.  
 You can copy this number from the version portion of the software filename in the software file URL. Specify the version in this format: X.Y.Zk, where X = major version, Y = minor version, Z = maintenance version, and k = patch letter (not used if this is not a patch version).



**Note** If you are upgrading a version 4.0.x WAAS Central Manager to version 4.1.1, from a version 4.0.x WAAS Central Manager, enter 4.1.1.0.1 in the Software Version field. If you are upgrading to a maintenance release such as 4.1.1a, enter 4.1.1.a.1 in the Software Version field. For other maintenance releases, replace the “a” with the appropriate letter.

- Step 6** If you want the size of the software file considered during validation, enter a file size (in bytes) in the File Size field.  
 If you leave this field blank, the URL is checked without regard to the software file size.
- Step 7** Click the **Validate Software File Settings** button to validate the Software File URL, Username, and Password fields.

When you click the Validate Software File Settings button, the following occurs:

- The software file URL is resolved.
- A connection to the software file URL is established using the username and password, if specified.
- If a file size is specified, the actual size of the software file is obtained and compared against the value in the File Size field.
- A message is returned, indicating success or errors encountered.

**Step 8** In the Advanced Settings section, check the **Auto Reload** check box to automatically reload a device when you upgrade the software. If you do not check this box, you will need to manually reload a device after you upgrade the software on it, to complete the upgrade process.

**Step 9** (Optional) Enter comments in the field provided.

**Step 10** Click **Submit**.

A message appears indicating that the upgrade is successful. Click **OK**.



#### Caution

If your browser is configured to save the username and password for the WAAS Central Manager GUI, the browser will autopopulate the username and password fields in the Creating New Software File window. You must clear these fields before you click **Submit**.

The software file that you want to use is now registered with the WAAS Central Manager. When you perform the software upgrade or downgrade, the URL that you just registered becomes one of the choices available in the Update Software window.

To reload a device from the CLI, use the **reload EXEC** command.

## Using the WAAS Disk Check Tool

Before you upgrade your WAE from version 4.0.3 or earlier, you must run a script (the WAAS disk check tool) that checks the file system for errors that can result from a RAID synchronization failure. (For more information about RAID synchronization, see the “[Ensuring RAID Pairs Rebuild Successfully](#)” section on page 15-7.) This script is not necessary when upgrading from WAAS version 4.0.5 or later, unless the system was running version 4.0.3 or earlier at some time in the past and the script was never run.

You can obtain the WAAS disk check tool from the following URL:

<http://www.cisco.com/cgi-bin/tablebuild.pl/waas40>



#### Note

When you run the WAAS disk check tool, you will be logged out of the device. The device automatically reboots after it has completed checking the file system. Because this operation results in a reboot, we recommend that you perform this operation after normal business hours.

Copy the script to your WAE device by using the **copy ftp disk** command.

```
WAE# copy ftp disk <ftp-server> <remote_file_dir> disk_check.sh
```

Run the script from the CLI, as shown in the following example:

```
WAE# script execute disk_check.sh
This script will check if there is any file system issue on the attached disks
Activating the script will result in:
```

```

Stopping all services. This will log you out.
Perform file system check for few minutes.
and record the result in the following files:
/local1/disk_status.txt - result summary
/local1/disk_check_log.txt - detailed log
System reboot
If the system doesn't reboot in 10 minutes, please re-login and check the result files.
Continue?[yes/no] yes
Please disk_status.txt after reboot for result summary
umount: /state: device is busy
umount: /local/1PAM_unix[26162]: ### pam_unix: pam_sm_close_session (su) session closed
for user root
waitpid returns error: No child processes
No child alive.

```

After the device reboots and you log in, locate and open the following two files to view the file system status:

- `disk_status.txt`— Lists each file system and shows if it is “OK,” or if it contains an error that requires attention.
- `disk_check_log.txt`— Contains a detailed log for each file system checked.

If no repair is needed, then each file system will be listed as “OK,” as shown in the following example:

```

WAE# type disk_status.txt
Thu Feb 1 00:40:01 UTC 2007
device /dev/md1 (/swstore) is OK
device /dev/md0 (/sw) is OK
device /dev/md2 (/state) is OK
device /dev/md6 (/local/local1/spool) is OK
device /dev/md5 (/local/local1) is OK
device /dev/md4 (/disk00-04) is OK

```

If any file system contains errors, the `disk_status.txt` file instructs you to repair it.

## Ensuring RAID Pairs Rebuild Successfully

You must ensure that all RAID pairs are done rebuilding before you reboot your WAE device. If you reboot while the device is rebuilding, you risk corrupting the file system.

RAID pairs will rebuild on the next reboot after you enable legacy WAFS core or edge services, use the **restore factory-default** command, replace or add a hard disk drive, delete disk partitions, or reinstall WAAS from the booted recovery CD-ROM.

To view the status of the drives and check if the RAID pairs are in “NORMAL OPERATION” or in “REBUILDING” status, use the **show disk details EXEC** command. When you see that RAID is rebuilding, you must let it complete that rebuild process. This rebuild process can take several hours.

If you do not wait for the RAID pairs to complete the rebuild process before you reboot the device, you may see the following symptoms indicating a problem:

- The device is offline in the Central Manager GUI.
- CMS can not be loaded.
- Error messages say that the file system is read-only.
- The syslog contains errors such as “Aborting journal on device md2,” “Journal commit I/O error,” “Journal has aborted,” and “ext3\_readdir: bad entry in directory.”
- Other unusual behaviors related to disk operations or the inability to perform them.

If you encounter any of these symptoms, run the WAAS disk check tool to locate the problem.

## Upgrading the WAAS Central Manager

When upgrading software in your WAAS network, begin with WAAS Central Manager before upgrading the WAE devices.



### Note

With WAAS version 4.0.x, you should upgrade the WAE devices before the WAAS Central Manager.

Primary and standby WAAS Central Manager devices must be running the same version of WAAS software. If they are not, the standby WAAS Central Manager detects this and will not process any configuration updates it receives from the primary WAAS Central Manager. If the primary WAAS Central Manager (version 4.1.1) sees that the standby WAAS Central Manager has a different version level, it shows the standby WAAS Central Manager in red on the device listing page.

If you use the primary WAAS Central Manager to perform the software upgrade, you need to upgrade your standby WAAS Central Manager first, then upgrade your primary WAAS Central Manager. We also recommend that you create a database backup for the primary WAAS Central Manager and copy the database backup file to a safe place before you upgrade the software.

Use this upgrade procedure for WAAS Central Manager devices. You can also use this upgrade procedure to upgrade WAAS devices one at a time (after the WAAS Central Manager).

To upgrade your software to another WAAS software release on a single device, follow these steps:

**Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.

**Step 2** Click the **Edit** icon of the device that you want to upgrade.

The Device Dashboard window appears.

**Step 3** Verify that the device is not already running the version to which you plan to upgrade.

**Step 4** Click the **Jobs > Update Software** button.

The Software Update window appears.

**Step 5** Choose the software file URL from the Software Files list by clicking the radio button next to the filename.



### Note

If the software file URL is not displayed, click **Edit Software Files**. This button brings you to the System > Software Files window where you can specify the location of the software file as described in the [“Specifying the Location of the Software File in the WAAS Central Manager GUI”](#) section on page 15-4.

**Step 6** Click **Submit**, and then click **OK** to confirm your decision.

The Devices listing window reappears. You can monitor the progress of your upgrade from this window.

Software upgrade status messages are displayed in the Software Version column. These intermediate messages are also written to the system log on the WAAS devices. See [Table 15-2](#) for a description of upgrade status messages.

- Step 7** Close your browser and restart the browser session to the WAAS Central Manager, if you upgraded the primary WAAS Central Manager.

The WAAS Central Manager may reboot at the conclusion of the upgrade procedure (if Auto Reload was checked in the Creating New Software File window), causing you to temporarily lose contact with the device and the graphical user interface.

**Table 15-2 Upgrade Status Messages**

| Upgrade Status Message                  | Condition                                                                                                                                            |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pending                                 | The request has yet to be sent from the WAAS Central Manager to the device, or receipt of the request has yet to be acknowledged by the device.      |
| Downloading                             | The download method for the software file is being determined.                                                                                       |
| Proceeding with Download                | The download method for the software file is determined to be direct download. Proceeding with the request for direct download of the software file. |
| Download in Progress (Completed ...)    | The direct download of the software file is being processed. "Completed" indicates the number of megabytes processed.                                |
| Download Successful                     | The direct download of the software file has been successful.                                                                                        |
| Download Failed                         | The direct download of the software file cannot be processed. Further troubleshooting is required; see the device system message log.                |
| Proceeding with Flash Write             | A request has been made to write the software file to the device flash memory.                                                                       |
| Flash Write in Progress (Completed ...) | The write of the device flash memory is being processed. "Completed" indicates the number of megabytes processed.                                    |
| Flash Write Successful                  | The flash write of the software file has been successful.                                                                                            |
| Reloading                               | A request to reload the device has been made in order to complete the software upgrade. The device may be offline for several minutes.               |
| Reload Needed                           | A request to reload the device has not been made. The device must be reloaded manually to complete the software upgrade.                             |
| Cancelled                               | The software upgrade request was interrupted, or a previous software upgrade request was bypassed from the CLI.                                      |
| Update Failed                           | The software upgrade could not be completed. Troubleshooting is required; see the device system message log.                                         |

## Upgrading Multiple Devices Using Device Groups



**Note** This procedure is for WAE devices only. WAAS Central Manager devices cannot be upgraded using device groups.

To upgrade to a more recent WAAS software release on multiple devices, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Device Groups**. The Device Groups listing window appears, listing all the device groups in your WAAS network.
- Step 2** Click the **Edit** icon next to the name of the device group that you want to upgrade. The Modifying Device Group window appears.
- Step 3** In the navigation pane, choose **Jobs > Software Update**. The Software Update for Device Group window appears.
- Step 4** Choose the software file URL from the Software File URL list by clicking the radio button next to the filename.



**Note** If the software file URL is not displayed, click **Edit Software Files**. This button brings you to the Software Files window where you can specify the location of the software file as described in the [“Specifying the Location of the Software File in the WAAS Central Manager GUI” section on page 15-4](#).

- Step 5** Click **Submit**.  
To view the progress of an upgrade, go to the Devices window (**My WAN > Manage Devices**) and view the software upgrade status message in the Software Version column. These intermediate messages are also written to the system log on WAAS devices. See [Table 15-2](#) for a description of the upgrade status messages.

## Deleting a Software File

After you have successfully upgraded your WAAS devices, you can remove the software file from your WAAS system.



**Note** You may want to wait a few days before removing a software file in the event you need to downgrade your system for any reason.

To delete a WAAS software file, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Jobs > Software Update**.
- Step 2** Click the **Edit** icon next to the software file that you want to delete. The Modifying Software File window appears.
- Step 3** Click the **Trash** icon in the taskbar.



You are prompted to confirm your decision to delete the software file.

**Step 4** Click **OK**.

You are returned to the Software Files listing window with the selected software file removed from the WAAS network.

---

## Backing Up and Restoring your WAAS System

This section contains the following topics:

- [Backing Up and Restoring the WAAS Central Manager Database, page 15-11](#)
- [Backing Up and Restoring a WAE Device, page 15-13](#)
- [Using the Cisco WAAS Software Recovery CD-ROM, page 15-13](#)
- [Recovering the System Software, page 15-17](#)
- [Recovering a Lost Administrator Password, page 15-19](#)
- [Recovering from Missing Disk-Based Software, page 15-20](#)
- [Recovering WAAS Device Registration Information, page 15-21](#)

## Backing Up and Restoring the WAAS Central Manager Database

The WAAS Central Manager device stores WAAS network-wide device configuration information in its Centralized Management System (CMS) database. You can manually back up the CMS database contents for greater system reliability.

The CMS database backup is in a proprietary format that contains an archive database dump, WAAS Central Manager registration information, and device information that the WAAS Central Manager uses to communicate with other WAAS devices. CMS database backup files are not interchangeable between primary and standby WAAS Central Manager devices. This means you cannot use the backup file from a primary WAAS Central Manager to restore a standby WAAS Central Manager.

To back up the CMS database for the WAAS Central Manager, use the **cms database backup** EXEC command. For database backups, you need to specify the location, password, and user ID of the remote server that you want to store the backup file.



### Note

The CMS database backup does not back up print drivers. When you perform a Central Manager database backup, you must reinstall your print drivers if you are using WAAS print services.

---

To back up and restore the CMS database, follow these steps:

---

**Step 1** On the WAAS Central Manager GUI device, use the **cms database backup** command to back up the CMS database to a file, as shown in the following example:

```
CDM# cms database backup
creating backup file with label 'backup'
backup file local1/waas-db-7-22-2006-17-36.dump is ready. use 'copy' commands to move the
backup file to a remote host.
```




---

**Note** The backup file is automatically given a name in the following format `cms-db-date-timestamp.dump`. For example, `cms-db-7-22-2006-17-36.dump`. Note that the timestamp is in 24-hour format (HH:MM) that does not show seconds.

---

**Step 2** Save the file to a remote server by using the **copy disk ftp** command.

This command copies the file from the local disk to a remote FTP server, as shown in the following example:

```
CDM# cd /local1
CDM# copy disk ftp 10.86.32.82 /incoming waas-db-7-22-2006-17-36.dump
waas-db-7-22-2006-17-36.dump

Enter username for remote ftp server:ftp
Enter password for remote ftp server:*****
Initiating FTP upload...
Sending:USER ftp
10.86.32.82 FTP server (Version wu-2.6.1-18) ready.
Password required for ftp.
Sending:PASS *****
User ftp logged in.
Sending:TYPE I
Type set to I.
Sending:PASV
Entering Passive Mode (10,86,32,82,112,221)
Sending:CWD /incoming
CWD command successful.
Sending PASV
Entering Passive Mode (10,86,32,82,203,135)
Sending:STOR acns-db-9-22-2002-17-36.dump
Opening BINARY mode data connection for waas-db-7-22-2006-17-36.dump.
Transfer complete.
Sent 18155 bytes
```

**Step 3** Restore the CMS database as follows:

a. Disable the CMS service:

```
CDM# no cms enable
```




---

**Note** Stopping the CMS service disables the WAAS Central Manager GUI. All users currently logged into this GUI are automatically logged out once the CMS service is disabled.

---

b. Delete the existing CMS database:

```
CDM# cms database delete
```

c. Restore the CMS database contents from the backup file:

```
CDM# cms database restore waas-db-7-22-2006-17-36.dump
```

d. Enable the CMS service:

```
CDM# cms enable
```

---

## Backing Up and Restoring a WAE Device

You should back up the database of each WAAS device on a regular basis in case a system failure should occur.

**Note**

The backup and restore methods described in this section apply only to a WAE device that is not configured as a WAAS Central Manager. For information on backing up the WAAS Central Manager device, see the [“Backing Up and Restoring the WAAS Central Manager Database” section on page 15-11](#).

You can use either of the following methods to back up and restore the database of an individual WAE device:

- WAE Device Manager—For information on using the WAE Device Manager to back up and restore a device’s database, see the [“Backing Up the Configuration Files” section on page 10-7](#).
- CLI—You can use the following commands to back up and restore a device’s database:
  - **wafs backup-config**—Saves the entire legacy WAFS system configuration to a file, including the configuration for file servers, printers, and users. We strongly recommend that you register your WAE again after you use this command.
  - **wafs restore-config**—Restores configuration based on the specified backup file. This command automatically performs a reload function.
  - **copy running-config**—Saves the currently running network configuration to the startup configuration.

Additionally, you can restore a WAE to the default configuration that it was manufactured with at any time by removing the user data from the disk and Flash memory, and erasing all existing files cached on the appliance. Basic configuration information, such as network settings, can be preserved. The appliance is accessible through Telnet and Secure Shell (SSH) after it reboots.

**Note**

If software upgrades have been applied, the restoration process returns to the defaults of the currently installed version and not the factory defaults.

To restore a WAE to its factory defaults or the defaults of the current configuration from the CLI, use the **restore factory-default [preserve basic-config] EXEC** command.

For more information about the CLI commands, see the *Cisco Wide Area Application Services Command Reference*.

## Using the Cisco WAAS Software Recovery CD-ROM

A software recovery CD-ROM ships with WAE hardware devices. This section contains instructions for using the software recovery CD-ROM to reinstall your system software if for some reason the software that is installed has failed.

**Caution**

If you upgraded your software after you received your software recovery CD-ROM, using the CD-ROM software images may downgrade your system.

The WAAS software consists of three basic components:

- Disk-based software
- Flash-based software
- Hardware platform cookie (stored in flash memory)

All of these components must be correctly installed for WAAS software to work properly.

The software is contained in two types of software images provided by Cisco Systems:

- A .bin image that contains disk and flash memory components
- A .sysimg image that contains a flash memory component only

An installation that contains only the WAAS flash memory-based software, without the corresponding disk-based software, boots and operates in a limited mode, allowing for further disk configuration before completing a full installation.

The .sysimg component is provided for recovery purposes and allows for repair of flash memory only without modifying the disk contents.

These options are available from the software recovery CD-ROM installer menu:

- Option 1: Configure Network—If the .bin image you need to install is located on the network instead of the CD-ROM (which may be the case when an older CD-ROM is used to install new software), then you must choose this option to configure the network before attempting to install the .bin image.

This option is performed automatically if you install a .sysimg file from the network.

- Option 2: Manufacture Flash—This option verifies the flash memory and, if invalid, automatically reformats it to contain a Cisco standard layout. If reformatting is required, a new cookie is installed automatically.

This option is performed automatically as part of a .bin or .sysimg installation.

- Option 3: Install Flash Cookie—This option generates a hardware-specific platform cookie and installs it in flash memory. You need to use this option only if there has been a change in the hardware components, such as replacing the motherboard, or if you moved a flash memory card between systems.

This option is performed automatically during the flash manufacturing process, if needed, as part of a .bin or .sysimg installation.

- Option 4: Install Flash Image from Network and Option 5: Install Flash Image from CD-ROM —These options allow installation of the flash memory .sysimg only and do not modify disk contents. They may be used when a new chassis has been provided and populated with the customer's old disks that need to be preserved.

These options automatically perform flash verification and hardware cookie installation, if required. When installing from the network, you are prompted to configure the network if you have not already done so.

- Option 6: Install Flash Image from Disk—This option is reserved for future expansion and is not available.
- Option 7: Wipe Out Disks and Install .bin Image—This option provides the preferred procedure for installing the WAAS software.




---

**Caution** Option 7 erases the content from all disk drives in your device.

---

This option performs the following steps:

- a. Checks that flash memory is formatted to Cisco specifications. If yes, the system continues to step b. If no, the system reformats the flash memory, which installs the Cisco file system, and generates and installs a platform-specific cookie for the hardware.
  - b. Erases data from all drives.
  - c. Remanufactures the default Cisco file system layout on the disk.
  - d. Installs the flash memory component from the .bin image.
  - e. Installs the disk component from the .bin image.
- Option 8: Recreate RAID device—This option appears only for WAE-7341, WAE-7371, and WAE-674 devices and recreates the RAID array.
  - Option 9: Exit and Reboot—This option reboots the device. Remove the CD-ROM before rebooting in order to boot from flash memory. (For all WAE devices except WAE-7341, WAE-7371, and WAE-674 devices, this option is Option 8.)

To reinstall the system software on a WAE appliance using the software recovery CD-ROM, follow these steps:

**Step 1** Connect a serial console to the WAE appliance to be upgraded and use the console for the following steps.

**Step 2** Insert the WAAS 4.1.x CD-ROM in the CD drive of the WAE device.

**Step 3** Reboot the WAE. After the WAE boots, you see the following menu:

```

Installer Main Menu:
 1. Configure Network
 2. Manufacture flash
 3. Install flash cookie
 4. Install flash image from network
 5. Install flash image from cdrom
 6. Install flash image from disk
 7. Wipe out disks and install .bin image
 8. Recreate RAID device
 9. Exit (and reboot)
Choice [0]:

```

Option 8 appears only for WAE-7341, WAE-7371, and WAE-674 devices. For other devices, option 8 is Exit (and reboot).

**Step 4** Choose option 2 to prepare the flash memory.

This step prepares a cookie for the device and also retrieves the network configuration that was being used by the WAAS software. This network configuration is stored in the flash memory and is used to configure the network when the WAAS software boots up after installation.

**Step 5** Choose option 3 to install the flash cookie that you prepared in the previous step.

**Step 6** Choose option 5 to install the flash image from the CD-ROM.

**Step 7** (Optional) If you are working with a WAE-7341, WAE-7371, or WAE-674 device, choose option 8 to recreate the RAID array.

**Step 8** Choose option 7 to wipe the disks and install the binary image.

This step prepares the disks by erasing them. The WAAS 4.1.x image is installed.

**Step 9** Remove the CD-ROM from the drive.

**Step 10** Choose the option (8 or 9, depending on your WAE model) to reboot the WAE.

After the WAE reboots, it is running the WAAS 4.1.x software. The WAE has a minimal network configuration and is accessible via the terminal console for further configuration.

To reinstall the system software on an NME-WAE network module installed in a Cisco access router, follow these steps:

**Step 1** Log in to the Cisco router in which the NME-WAE module is installed, and reload the NME-WAE module:

```
router-2851> enable
router-2851# service-module integrated-Service-Engine 1/0 reload
```

**Step 2** Immediately open a session on the module:

```
router-2851# service-module integrated-Service-Engine 1/0 session
```

**Step 3** While the module is reloading, you will see the following option during boot phase 3. Enter \*\*\* as instructed:

```
[BOOT-PHASE3]: enter `***' for rescue image: ***
```

**Step 4** The rescue image dialog appears. The following example demonstrates how to interact with the rescue dialog (user input is denoted by entries in bold typeface):

```
This is the rescue image. The purpose of this software is to let
you install a new system image onto your system's boot flash
device. This software has been invoked either manually
(if you entered `***' to the bootloader prompt) or has been
invoked by the bootloader if it discovered that your system image
in flash had been corrupted.
```

To download an image from network, this software will request the following information from you:

- which network interface to use
- IP address and netmask for the selected interface
- default gateway IP address
- FTP server IP address
- username and password on FTP server
- path to system image on server

Please enter an interface from the following list:

```
0: GigabitEthernet 1/0
1: GigabitEthernet 2/0
```

enter choice: **0**

Using interface GigabitEthernet 1/0

Please enter the local IP address to use for this interface:

```
[Enter IP Address]: 10.1.13.2
```

Please enter the netmask for this interface:

```
[Enter Netmask]: 255.255.255.240
```

Please enter the IP address for the default gateway:

```
[Enter Gateway IP Address]: 10.1.13.1
```

Please enter the IP address for the FTP server where you wish to obtain the new system image:

```
[Enter Server IP Address]: 10.107.193.240
```

Please enter your username on the FTP server (or 'anonymous'):

```
[Enter Username on server (e.g. anonymous)]: username
```

Please enter the password for username 'username' on FTP server:

Please enter the directory containing the image file on the FTP server:  
[Enter Directory on server (e.g. /)]: /

Please enter the file name of the system image file on the FTP server:  
[Enter Filename on server]: **WAAS-4.1.1-K9.sysimg**

Here is the configuration you have entered:

```
Current config:
 IP Address: 10.1.13.2
 Netmask: 255.255.255.240
 Gateway Address: 10.1.13.1
 Server Address: 10.107.193.240
 Username: username
 Password: *****
 Image directory: /
 Image filename: WAAS-4.1.1-K9.sysimg
```

```
Attempting download...
Downloaded 15821824 byte image file
A new system image has been downloaded.
You should write it to flash at this time.
Please enter 'yes' below to indicate that this is what you want to do:
[Enter confirmation ('yes' or 'no')]: yes
Ok, writing new image to flash
..... done.
Finished writing image to flash.
Enter 'reboot' to reboot, or 'again' to download and install a new image:
[Enter reboot confirmation ('reboot' or 'again')]: reboot
Restarting system.
```

**Step 5** After the module reboots, install the .bin image from an HTTP server:

```
NM-WAE-1# copy http install 10.77.156.3 /waas WAAS-4.1.1-k9.bin
```

**Step 6** Reload the module:

```
NM-WAE-1# reload
```

After the module reboots, it is running the WAAS 4.1.x software.

## Recovering the System Software

WAAS devices have a resident rescue system image that is invoked if the image in flash memory is corrupted. A corrupted system image can result from a power failure that occurs while a system image is being written to flash memory. The rescue image can download a system image to the main memory of the device and write it to flash memory.

To install a new system image using the rescue image, follow these steps:

**Step 1** Download the system image file (\*.sysimg) to a host that is running an FTP server.

**Step 2** Establish a console connection to the device and open a terminal session.

**Step 3** Reboot the device by toggling the power on/off switch.

The rescue image dialog appears. The following example demonstrates how to interact with the rescue dialog (user input is denoted by entries in bold typeface):

This is the rescue image. The purpose of this software is to let you download and install a new system image onto your system's boot flash device. This software has been invoked either manually (if you entered `\*\*\*' to the bootloader prompt) or has been invoked by the bootloader if it discovered that your system image in flash had been corrupted.

To download an image, this software will request the following information from you:

- which network interface to use
- IP address and netmask for the selected interface
- default gateway IP address
- server IP address
- which protocol to use to connect to server
- username/password (if applicable)
- path to system image on server

Please enter an interface from the following list:

```
0: FastEthernet 0/0
1: FastEthernet 0/1
0
```

Using interface FastEthernet 0/0

Please enter the local IP address to use for this interface:

```
[Enter IP Address]: 172.16.22.22
```

Please enter the netmask for this interface:

```
[Enter Netmask]: 255.255.255.224
```

Please enter the IP address for the default gateway:

```
[Enter Gateway IP Address]: 172.16.22.1
```

Please enter the IP address for the FTP server where you wish to obtain the new system image:

```
[Enter Server IP Address]: 172.16.10.10
```

Please enter your username on the FTP server (or 'anonymous'):

```
[Enter Username on server (e.g. anonymous)]: anonymous
```

Please enter the password for username 'anonymous' on FTP server (an email address):

Please enter the directory containing the image file on the FTP server:

```
[Enter Directory on server (e.g. /)]: /
```

Please enter the file name of the system image file on the FTP server:

```
[Enter Filename on server]: WAAS-4.1.1-K9.sysimg
```

Here is the configuration you have entered:

Current config:

```
IP Address: 172.16.22.22
Netmask: 255.255.255.224
Gateway Address: 172.16.22.1
Server Address: 172.16.10.10
Username: anonymous
Password:
Image directory: /
Image filename: WAAS-4.1.1-K9.sysimg
```

Attempting download...

Downloaded 10711040 byte image file

A new system image has been downloaded.



```

You should write it to flash at this time.
Please enter 'yes' below to indicate that this is what you want to do:
[Enter confirmation ('yes' or 'no')]: yes
Ok, writing new image to flash
.....Finished
writing image to flash.
Enter 'reboot' to reboot, or 'again' to download and install a new image:
[Enter reboot confirmation ('reboot' or 'again')]: reboot
Restarting system.
Initializing memory. Please wait.

```

**Step 4** Log in to the device as username **admin**. Verify that you are running the correct version by entering the **show version** command.

```

Username: admin
Password:

```

```

Console> enable
Console# show version
Wide Area Application Services (WAAS)
Copyright (c) 1999-2008 by Cisco Systems, Inc.
Wide Area Application Services Release 4.1.1
Version: ce507-5.2.0

```

```

Compiled 02:34:38 May 8 2008 by (cisco)
Compile Time Options: PP SS

```

```

System was restarted on Thu June 22 16:03:51 2008.
The system has been up for 4 weeks, 1 day, 6 hours, 7 minutes, 23 seconds.

```

## Recovering a Lost Administrator Password

If an administrator password is forgotten, lost, or misconfigured, you will need to reset the password on the device.



### Note

You cannot restore a lost administrator password. You must reset the password to a new one, as described in this procedure.

To reset the password, follow these steps:

**Step 1** Establish a console connection to the device and open a terminal session.

**Step 2** Reboot the device.

While the device is rebooting, watch for the following prompt, then press **Enter** when you see it:

```
Cisco WAAS boot:hit RETURN to set boot flags:0009
```

**Step 3** When prompted to enter bootflags, enter the following value: **0x8000**

```

Available boot flags (enter the sum of the desired flags):
0x4000 - bypass nvram config
0x8000 - disable login security

```

```
[CE boot - enter bootflags]:0x8000
```

```
You have entered boot flags = 0x8000
Boot with these flags? [yes]:yes
```

[Display output omitted]

Setting the configuration flags to **0x8000** lets you into the system, bypassing all security. Setting the configuration flags field to **0x4000** lets you bypass the NVRAM configuration.

- Step 4** When the device completes the boot sequence, you are prompted to enter the username to access the CLI. Enter the default administrator username (**admin**).

```
Cisco WAE Console
```

```
Username: admin
```

- Step 5** When you see the CLI prompt, set the password for the user using the **username password** command in global configuration mode.

```
WAE# configure
WAE(config)# username admin password 0 password
```

You can specify that the password be either cleartext or encrypted.




---

**Note** Do not set the user ID (uid).

---

- Step 6** Save the configuration change:

```
WAE(config)# exit
WAE# write memory
```

- Step 7** (Optional) Reboot your device:

```
WAE# reload
```

Rebooting is optional; however, you might want to reboot to ensure that the boot flags are reset, and to ensure that subsequent console administrator logins do not bypass the password check.




---

**Note** In the WAAS software, the bootflags are reset to 0x0 on every reboot.

---

## Recovering from Missing Disk-Based Software

This section describes how to recover from the following types of disk drive issues:

- Your WAAS device contains a single disk drive that needs to be replaced due to a disk failure.
- Your WAAS device contains two disk drives and you intentionally deleted the disk partitions on both drives (diks00 and disk01).

Systems with two or more disk drives are normally protected automatically by RAID-1 on critical system partitions, so the procedures in this section do not need to be followed when replacing a disk drive in a multi-drive system.

To recover from this condition, follow these steps:

- 
- Step 1** Deactivate the device by completing the following steps:
- From the WAAS Central Manager GUI navigation pane, go to **My WAN > Manage Devices**.
  - Click the **Edit** icon next to the device that you want to deactivate.
  - From the navigation pane, choose *Device Name* > **Activation**. The Device Activation window appears.
  - Uncheck the **Activate** check box, and then click **Submit**.  
The device is deactivated.
- Step 2** Power down the device and replace the failed hard drive.
- Step 3** Power on the device.
- Step 4** Install the WAAS software. For more information, see the *Cisco Wide Area Application Services Quick Configuration Guide*.
- Step 5** Use the CMS identity recovery procedure to recover the device CMS identity and associate this device with the existing device record on the WAAS Central Manager. For more information, see the [“Recovering WAAS Device Registration Information” section on page 15-21](#).
- 

## Recovering WAAS Device Registration Information

Device registration information is stored both on the device itself and on the WAAS Central Manager. If a device loses its registration identity or needs to be replaced because of a hardware failure, the WAAS network administrator can issue a CLI command to recover the lost information, or in the case of adding a new device, assume the identity of the failed device.

To recover lost registration information, or to replace a failed device with a new one having the same registration information, follow these steps:

- 
- Step 1** Mark the failed device as “Inactive” and “Replaceable” by completing the following steps:
- From the WAAS GUI, choose **My WAN > Manage Devices**.
  - Click the **Edit** icon next to the device that you want to deactivate. The Device Dashboard window appears.
  - In the navigation pane, choose *Device Name* > **Activation**.
  - Uncheck the **Activate** check box. The window refreshes, displaying a check box for marking the device as replaceable.
  - Check the **Replaceable** check box, and click **Submit**.



---

**Note** This check box appears in the GUI only when the device is inactive.

---

- Step 2** Configure a system device recovery key as follows:
- From the WAAS Central Manager GUI navigation pane, choose **Configure > System Properties**.
  - Click the **Edit** icon next to the System.device.recovery.key property. The Modifying Config Property window appears.

c. Enter a password in the Value field, and click **Submit**. The default password is **default**.

**Step 3** Configure the basic network settings for the new device.

**Step 4** Open a Telnet session to the device CLI and enter the **cms recover identity** *keyword* EXEC command. *keyword* is the device recovery key that you configured in the WAAS Central Manager GUI.

When the WAAS Central Manager receives the recovery request from the WAAS device, it searches its database for the device record that meets the following criteria:

- The record is inactive and replaceable.
- The record has the same hostname or primary IP address as given in the recovery request.

If the recovery request matches the device record, then the WAAS Central Manager updates the existing record and sends the requesting device a registration response. The replaceable state is cleared so that no other device can assume the same identity. When the WAAS device receives its recovered registration information, it writes it to file, initializes its database tables, and starts.

**Step 5** Activate the device:

- a. From the WAAS GUI, choose **My WAN > Manage Devices**.
- b. Click the **Edit** icon next to the WAAS device that you want to activate. The Device Dashboard window appears.
- c. In the navigation pane, choose *Device Name* > **Activation**. The WAAS device status should be Online.
- d. Check the **Activate** check box, and click **Submit**.

## Performing Disk Maintenance for RAID-1 Systems

WAAS supports hot-swap functionality for both failed disk replacement and scheduled disk maintenance. When a disk fails, WAAS automatically detects the disk failure, marks the disk as bad, and removes the disk from the RAID-1 volume. To schedule disk maintenance, you must manually shut down the disk.

You must wait for the disk to be completely shut down before you physically remove the disk from the WAE. When the RAID removal process is complete, WAAS generates a disk failure alarm and trap. In addition, a syslog ERROR message is logged.



### Note

If the removal event (such as, a disk failure or software shutdown) occurs while the RAID array is in the rebuild process, the RAID removal process may take up to 1 minute to complete. The duration of this process depends on the size of the disk.

If the WAAS software removes a failed disk during the RAID rebuild process, a RAID rebuild failure alarm is generated. If you administratively shut down the disk during the RAID rebuild process, a RAID rebuild abort alarm is generated instead.

When you install a replacement disk, the WAAS software detects the replacement disk and performs compatibility checks on the disk, initializes the disk by creating partitions, and adds the disk to the software RAID to start the RAID rebuild process.

If the newly inserted disk has the same disk ID as a disk that was previously marked bad in the same physical slot, then the disk will not be mounted, and the post-replacement checks, initialization, and RAID rebuilding will not occur.

A newly installed disk must be of the same type as the old disk and it must meet the following compatibility requirements:

- If the replacement disk is for disk00, disk02, or disk04 of a RAID pair, the replacement disk must be the same size as the running disk in the array.
- If the replacement disk is for disk01, disk03, or disk05 of a RAID pair, then the replacement disk must have the same or greater RAID capacity as the running disk in the array.

Compatibility checks, which are part of the hot-swap process, check for capacity compatibility. Incompatibility generates an alarm and aborts the hot-swap process.

Table 15-3 shows the drive-type compatibility for the WAE-612. All drives must be the same type.


**Table 15-3 WAE-612 Drive-Type Compatibility Matrix**

| Drive Types | SAS <sup>1</sup> | SATA2 <sup>2</sup> |
|-------------|------------------|--------------------|
| SAS         | Ok               | No                 |
| SATA2       | No               | Ok                 |

1. Serial Attached SCSI

2. Serial Advanced Technology Attachment 2

To perform disk maintenance, follow these steps:

- 
- Step 1** Manually shut down the disk.
- Enter the **disk disk-name diskxx shutdown** command in global configuration mode.
  - Wait for the disk to be completely shut down before you physically remove the disk from the WAE. When the RAID removal process is complete, WAAS generates a disk failure alarm and trap. In addition, a syslog ERROR message is logged.
-  **Note** We recommend that you disable the **disk error-handling reload** option, if enabled, because it is not necessary to power down the system to remove a disk.
- 
- Step 2** Insert a replacement disk into the slot in the WAE. The replacement disk must have a disk ID number that is different from the disk that it is replacing.
- Step 3** Reenable the disk by entering the **no disk disk-name diskxx shutdown** global configuration command.
- 

## Replacing Disks in RAID-5 Systems

To remove and replace a physical disk drive in a system that uses a RAID-5 logical drive, follow these steps:

- 
- Step 1** Enter the **disk disk-name diskxx replace** command in EXEC mode at the WAAS CLI on the WAE.
- Step 2** Verify that the disk drive *diskxx* is in the Defunct state by entering the **show disks details** command in EXEC mode. The RAID logical drive is in the Critical state at this point.
- Step 3** Move the handle on the drive to the open position (perpendicular to the drive).

- Step 4** Pull the hot-swap drive assembly from the bay.
- Step 5** Wait for one minute and then insert the new drive into the same slot by aligning the replacement drive assembly with guide rails in the bay and sliding the drive assembly into the bay until it stops. Make sure that the drive is properly seated in the bay.
- Step 6** Close the drive handle.
- Step 7** Check the hard disk drive status LED to verify that the hard disk drive is operating correctly. If the amber hard disk drive status LED for a drive is lit continuously, that drive is faulty and must be replaced. If the green hard disk drive activity LED is flashing, the drive is being accessed.
- Step 8** Wait 1 minute and then verify that the replaced disk drive is in the Rebuilding state by using the **show disks details** command in EXEC mode.




---

**Note** The ServeRAID controller automatically starts the rebuild operation when it detects the removal and reinsertion of a drive that is part of the logical RAID drive.

---

- Step 9** Wait until the rebuild operation is complete. You can check if the rebuild operation is complete by using the **show disks details** command in EXEC mode. The physical drive state will be Online and the RAID logical drive state will be Okay after the rebuild operation is completed.
- 

A 300-GB SAS drive may take up to 5 hours to finish rebuilding.

If you have multiple disk failures and your RAID-5 logical status is Offline, you must recreate the RAID-5 array by following these steps:

---

- Step 1** Enter the **disk logical shutdown** command in global configuration mode to disable the RAID-5 array.
- Step 2** Enter the **write** command in EXEC mode to save the running configuration to NVRAM.
- Step 3** Enter the **reload** command in EXEC mode to reload the system.
- Step 4** Enter the **show disks details** command in EXEC mode to check the system configuration after the system is rebooted. At this point, the disks are not mounted and the logical RAID drive should be in the Shutdown state.
- Step 5** Enter the **disk recreate-raid** command in EXEC mode to recreate the RAID-5 array.
- Step 6** After successful execution of the previous command, enter the **no disk logical shutdown** command in global configuration mode to disable the logical disk shutdown configuration.
- Step 7** Enter the **write** command in EXEC mode to save the configuration to NVRAM.
- Step 8** Enter the **reload** command in EXEC mode to reload the system.
- Step 9** Enter the **show disks details** command in EXEC mode to check the system configuration after the system is rebooted. At this point, the disks should be mounted and the logical RAID drive should not be in the Shutdown state.
- Step 10** Wait until the rebuild operation is complete. You can check if the rebuild operation is complete by using the **show disks details** command in EXEC mode. The physical drive state will be Online and the RAID logical drive state will be Okay after the rebuild operation is completed.
- 

It takes several hours to finish rebuilding the RAID-5 array.

## Switching a WAAS Central Manager from Standby to Primary

The WAAS software implements a standby WAAS Central Manager. This process allows you to maintain a copy of the WAAS network configuration on a second WAAS Central Manager device. If the primary WAAS Central Manager fails, the standby can be used to replace the primary.

For interoperability, when a standby WAAS Central Manager is used, it must be at the same software version as the primary WAAS Central Manager to maintain the full WAAS Central Manager configuration. Otherwise, the standby WAAS Central Manager detects this status and does not process any configuration updates that it receives from the primary WAAS Central Manager until the problem is corrected.

**Note**

Before you configure a standby Central Manager, you must manually install your print drivers if you are using WAAS print services. Print drivers are not automatically replicated from the primary Central Manager database to the standby device.

If your primary WAAS Central Manager becomes inoperable, you can manually reconfigure one of your warm standby WAAS Central Managers to be the primary WAAS Central Manager. Configure the new role by using the global configuration **central-manager role primary** command as follows:

```
WAE# configure
WAE(config)# central-manager role primary
```

This command changes the role from standby to primary and restarts the management service to recognize the change.

If you switch a warm standby WAAS Central Manager to primary while your primary WAAS Central Manager is still online and active, both WAAS Central Managers detect each other, automatically shut themselves down, and disable management services. The WAAS Central Managers are switched to halted, which is automatically saved in flash memory.

To return halted WAAS Central Managers to an online status, decide which Central Manager should be the primary device and which should be the standby device. On the primary device, execute the following CLI commands:

```
WAE# configure
WAE(config)# central-manager role primary
WAE(config)# cms enable
```

On the standby device, execute the following CLI commands:

```
WAE# configure
WAE(config)# central-manager role standby
WAE(config)# central-manager address primary-CM-ip
WAE(config)# cms enable
```

**Caution**

When you switch a WAAS Central Manager from primary to standby, the configuration on the Central Manager is erased. The Central Manager, after becoming a standby, will begin replicating its configuration information from whichever Central Manager is now the primary. If standby and primary units are not synchronized before switching roles, important configuration information can be lost.

Before you switch Central Manager roles, follow these steps:

- 
- Step 1** Ensure that your Central Manager devices are running the same version of WAAS software.
- Step 2** Synchronize the physical clocks on both devices so that both WAAS Central Managers have the same Coordinated Universal Time (UTC) configured.
- Step 3** Ensure that the standby is synchronized with the primary by checking the status of the following items:
- a. Check the online status of your devices.  
The original standby Central Manager and all currently active devices should be showing as online in the Central Manager GUI. This step ensures that all other devices know about both Central Managers.
  - b. Check the status of recent updates from the primary WAAS Central Manager.  
Use the **show cms info EXEC** command and check the time of the last update. To be current, the value of the Time of last config-sync field should be between 1 and 5 minutes old. You are verifying that the standby WAAS Central Manager has fully replicated the primary WAAS Central Manager configuration.  
  
If the update time is not current, determine whether or not there is a connectivity problem or if the primary WAAS Central Manager is down. Fix the problem, if necessary, and wait until the configuration has replicated, as indicated by the time of the last update.
- Step 4** Switch roles in the following order:
- a. Switch the original primary to standby mode:  

```
WAE1# configure
WAE1(config)# central-manager role standby
WAE(config)# cms enable
```
  - b. Switch the original standby to primary mode:  

```
WAE2# configure
WAE2(config)# central-manager role primary
WAE(config)# cms enable
```

The CMS service is restarted automatically when you configure a role change.

---

## Enabling Disk Encryption

Disk encryption addresses the need to securely protect sensitive information that flows through deployed WAAS systems and that is stored in WAAS persistent storage. The disk encryption feature includes two aspects: the actual data encryption on the WAE disk and the encryption key storage and management.

When you enable disk encryption, all data in WAAS persistent storage will be encrypted. The encryption key for unlocking the encrypted data is stored on the Central Manager, and key management is handled by the Central Manager. When you reboot the WAE after configuring disk encryption, the WAE retrieves the key from the Central Manager automatically, allowing normal access to the data that is stored in WAAS persistent storage.



**Note**

If a WAE is unable to reach the WAAS Central Manager during a reboot, it will do everything except mount the encrypted partitions. In this state, all traffic will be handled as pass-through. Once communication with the WAAS Central Manager is restored (and the encryption key is obtained), the encrypted partitions are mounted. There is no loss of cache content.

Disk encryption requirements are as follows:

- You must have a Central Manager configured for use in your network.
- Your WAE devices must be registered with the Central Manager.
- Your WAE devices must be online (have an active connection) with the Central Manager. This requirement applies only if you are enabling disk encryption.
- You must reboot your WAE for the disk encryption configuration to take effect.

After you reboot your WAE, the encryption partitions are created using the new key, and any previously existing data is removed from the partition.

Any change to the disk encryption configuration, whether to enable or disable encryption, causes the disk to clear its cache. This feature protects sensitive customer data from being decrypted and accessed should the WAE ever be stolen.

If you enable disk encryption and then downgrade to a software version that does not support this feature, you will not be able to use the data partitions. In such cases, you must delete the disk partitions after you downgrade.

To enable and disable disk encryption from the Central Manager GUI, choose **My WAN > Manage Devices**, choose a device, then choose **Configure > Storage > Disk Encryption**. To enable disk encryption, check the **Enable** check box and click **Submit**. This box is unchecked by default. To disable disk encryption, uncheck the **Enable** check box and click **Submit**.

To enable and disable disk encryption from the WAE CLI, use the **disk encrypt** global configuration command.

When you enable or disable disk encryption, the file system is reinitialized during the first subsequent reboot. Reinitialization may take from ten minutes to several hours, depending on the size of the disk partitions. During this time, the WAE will be accessible, but it will not be providing any services.

If you change the Central Manager IP address, or if you relocate the Central Manager, or replace one Central Manager with another Central Manager that has not copied over all of the information from the original Central Manager, and you reload the WAE when disk encryption is enabled, the WAE file system will not be able to complete the reinitialization process or obtain the encryption key from the Central Manager.

If the WAE fails to obtain the encryption key, disable disk encryption by using the **no disk encrypt enable** global configuration command from the CLI, and reload the WAE. Ensure connectivity to the Central Manager before you enable disk encryption and reload the WAE. This process will clear the disk cache.

**Note**

When a standby Central Manager has been in service for at least 2 times the datafeed poll rate time interval (approximately 10 minutes) and has received management updates from the primary Central Manager, the updates will include the latest version of the encryption key. Failover to the standby in this situation occurs transparently to the WAE. The datafeed poll rate defines the interval for the WAE to poll the Central Manager for configuration changes. This interval is 300 seconds by default.

To view the encryption status details, use the **show disks details** EXEC command. While the file system is initializing, **show disks details** displays the following message: “System initialization is not finished, please wait...” You may also view the disk encryption status, whether it is enabled or disabled, in the Central Manager GUI, Device Dashboard window.

## Configuring a Disk Error-Handling Method



### Note

Configuring and enabling disk error handling, in particular the **reload** option, is no longer necessary for devices that support disk hot-swap. In WAAS 4.0.13 and later, the software automatically removes from service any disk with a critical error.

The WAAS software allows you to configure how disk errors should be handled and to define a disk device error-handling threshold.

If the bad disk drive is a critical disk drive, and the automatic reload feature (**disk error-handling reload** command) is enabled, then the WAAS software marks the disk drive “bad” and the WAAS device is automatically reloaded. After the WAAS device is reloaded, a syslog message and an SNMP trap are generated.

The disk error-handling threshold option determines how many disk errors can be detected before the disk drive is automatically marked “bad.” By default, this threshold is set to 10. To change the default threshold, use the **disk error-handling threshold** global configuration command. Specify **0** if you never want the disk drive to be marked “bad.”

In the following example, five disk drive errors for a particular disk drive (for example, disk00) will be allowed before the disk drive is automatically marked “bad”:

```
WAE(config)# disk error-handling threshold 5
```

To configure a disk error-handling method using the WAAS Central Manager GUI, follow these steps:

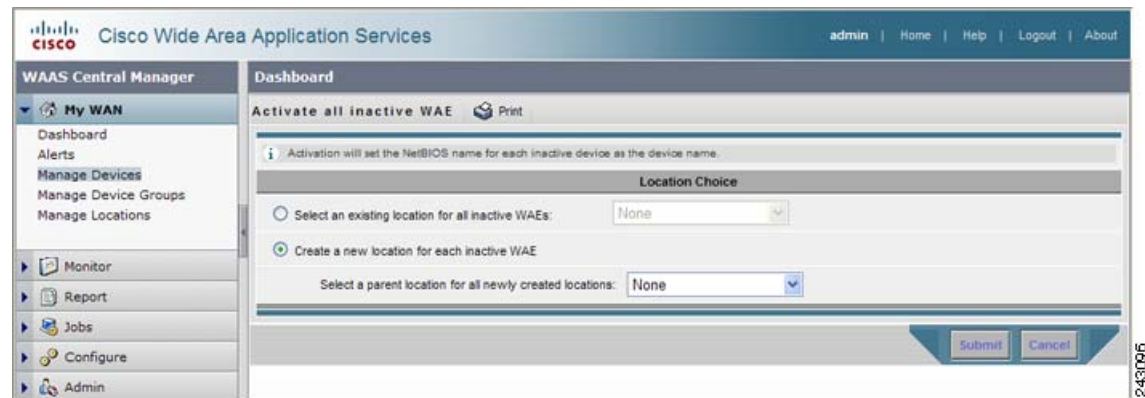
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device (or device group) for which you want to configure the disk error handling method.
- Step 3** In the navigation pane, choose **Configure > Storage > Disk Error Handling**.  
The Disk Error Handling Settings window appears.
- Step 4** Check the **Enable** check box to enable the window for configuration, and then check the following options as necessary:
  - **Enable Disk Error Handling Reload**—Forces the device to reload the disk if the file system (sysfs) (disk00) has problems. This option is disabled by default.
  - **Enable Disk Error Handling Remap**—Forces the disks to attempt to remap disk errors automatically. This option is enabled by default.
  - **Enable Disk Error Handling Threshold**—Specifies the number of disk errors allowed before the disk is marked as bad. You must enter a number between 0 to 100 in the Threshold field. The default threshold is 10. This option is disabled by default.
- Step 5** Click **Submit** to save the settings.

## Activating All Inactive WAAS Devices

To activate all inactivated WAAS devices in your network, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices listing window appears.
- Step 2** Click the **Activate all inactive WAEs** icon in the taskbar. The Activate All Inactive WAEs window appears. (See [Figure 15-2](#).)

**Figure 15-2**     *Activating Inactive Devices*



- Step 3** Choose an existing location for all inactivated WAAS devices by clicking the **Select an existing location for all inactive WAEs** radio button, and then choose a location from the drop-down list.  
Alternatively, choose to create a new location for each inactive device by clicking the **Create a new location for each inactive WAE** radio button. Specify a parent location for all newly created locations by choosing a location from the Select a parent location for all newly created locations drop-down list.
- Step 4** Click **Submit**. The inactive WAEs are reactivated and placed in the specified location.

## Rebooting a Device or Device Group

Using the WAAS Central Manager GUI, you can reboot a device or device group remotely.

To reboot an individual device, follow these steps:

- Step 1** From the WAAS GUI, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the name of the device that you want to reboot. The Device Dashboard window appears.
- Step 3** In the taskbar, click the **Reload WAE** icon. You are prompted to confirm your decision.
- Step 4** Click **OK** to confirm that you want to reboot the device.

To reboot a device from the CLI, use the **reload** EXEC command.

If you reboot a WAAS Central Manager that has the secure store enabled, you must reopen the secure store after the reboot by using the **cms secure-store open** EXEC command.

To reboot an entire device group, follow these steps:

- 
- Step 1** From the WAAS GUI, choose **My WAN > Manage Device Groups**.
  - Step 2** Click the **Edit** icon next to the name of the device group that you want to reboot. The Modifying Device Group window appears.
  - Step 3** In the taskbar, click the **Reboot All Devices in Device Group** icon. You are prompted to confirm your decision.
  - Step 4** Click **OK** to confirm that you want to reboot the device group.
- 

## Performing a Controlled Shutdown

A controlled shutdown refers to the process of properly shutting down a WAAS device without turning off the power on the device (the fans continue to run and the power LED remains on). With a controlled shutdown, all of the application activities and the operating system are properly stopped on the appliance, but the power remains on. Controlled shutdowns can help you minimize the downtime when the appliance is being serviced.



### Caution

If a controlled shutdown is not performed, the WAAS file system can be corrupted. It also takes longer to reboot the appliance if it was not properly shut down.

You can perform a controlled shutdown from the CLI by using the **shutdown** EXEC command. For more details, see the *Cisco Wide Area Application Services Command Reference*.

If you are running WAAS on a network module that is installed in a Cisco access router, perform a controlled shutdown from the router CLI by using the **service-module integrated-service-engine slot/unit shutdown** EXEC command. For more details, see the document *Configuring Cisco WAAS Network Modules for Cisco Access Routers*.



# CHAPTER 16

## Monitoring and Troubleshooting Your WAAS Network

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This chapter describes the monitoring and troubleshooting tools available in the WAAS Central Manager GUI that can help you identify and resolve issues with your WAAS system.



### Note

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Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

---

This chapter contains the following sections:

- [Viewing System Information from the System Dashboard Window, page 16-2](#)
- [Troubleshooting Devices Using Alerts, page 16-6](#)
- [Viewing Device Information, page 16-7](#)
- [Customizing a Dashboard or Report, page 16-10](#)
- [Using Predefined Reports to Monitor WAAS, page 16-18](#)
- [Configuring Flow Monitoring, page 16-23](#)
- [Managing Reports, page 16-25](#)
- [Configuring System Logging, page 16-29](#)
- [Configuring Transaction Logging, page 16-32](#)
- [Viewing the System Message Log, page 16-35](#)
- [Viewing the Audit Trail Log, page 16-36](#)
- [Viewing the Device Log, page 16-37](#)
- [Enabling the Kernel Debugger, page 16-37](#)
- [Troubleshooting Using Diagnostic Tests, page 16-38](#)
- [Using the show and clear Commands from the WAAS Central Manager GUI, page 16-39](#)

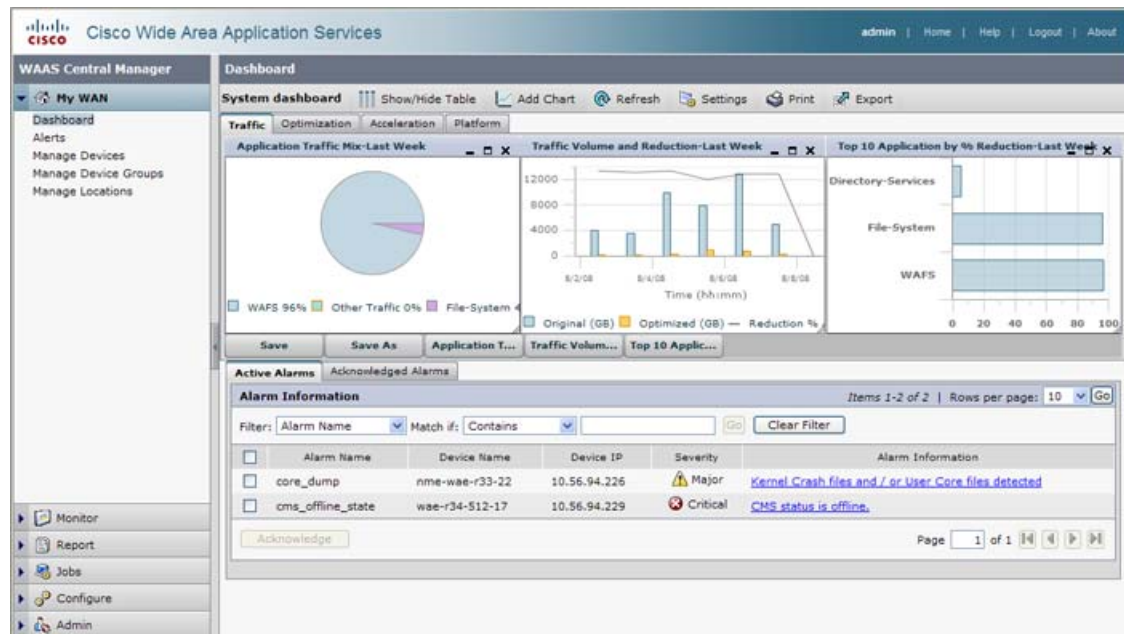
# Viewing System Information from the System Dashboard Window

The WAAS Central Manager GUI allows you to view general and detailed information about your WAAS network from the System Dashboard window. This section describes the System Dashboard window and contains the following topics:

- [Monitoring Graphs and Charts, page 16-2](#)
- [Alarm Panel, page 16-3](#)
- [Device Alarms, page 16-5](#)

Figure 16-1 shows the System Dashboard window.

**Figure 16-1** System Dashboard Window



The information displayed in the charts in the System Dashboard window is based on a snapshot of your WAAS network that represents the state of your WAE devices at the end of every two polling periods. You may configure the interval between polls in the WAAS Central Manager GUI (**Configure > System Properties > System.monitoring.collectRate**). The default polling rate is 300 seconds (5 minutes). Alarms are presented in real time and are independent of the polling rate.

## Monitoring Graphs and Charts

The default System Dashboard window contains four tabs that show several graphical displays about the application traffic processed by your WAAS system:

- The Traffic tab contains the following graphical displays:
  - Application Traffic Mix chart—Displays the nine applications with the highest percentage of traffic in the WAAS network for the last day.

- Traffic Volume and Reduction chart—Displays the volume of original and optimized traffic, and the percentage of traffic reduction, for the last day.
- Traffic % Reduction chart—Displays the ten applications with the highest percentage of traffic reduction for the WAAS network for the last day. The percent calculation includes pass-through traffic.
- The Optimization tab contains the following graphical displays:
  - Pass-through Traffic Mix chart—Displays the percentage of pass-through traffic due to various reasons.
  - Reduction Excluding Pass-through chart—Displays the percentage of traffic reduction, excluding pass-through traffic.
  - Optimized vs. Pass-through Traffic graph—Displays the amount of optimized and pass-through traffic for the last seven days.
- The Acceleration tab contains the following graphical displays:
  - HTTP: Estimate Time Saved % graph—Displays an estimate of the amount of connection setup time saved for HTTP traffic for the last day due to the HTTP accelerator.
  - MAPI: Estimate Time Saved % graph—Displays an estimate of the amount of response time saved for MAPI traffic for the last day due to the MAPI accelerator.
  - NFS: Estimate Time Saved % graph—Displays an estimate of the amount of response time saved for NFS traffic for the last day due to the NFS accelerator.
  - Video: Byte Savings for Video AO graph—Displays the amount of bytes saved for video traffic for the last day due to the video accelerator.
- The Platform tab contains the following graphical display:
  - Managed Devices Information—Displays the total number of WAAS devices in your network, showing the number that are online, offline, inactive, and pending. This display also shows the number of alarms of different severities and the software versions that are deployed in your network.

Numbers shown in charts and graphs are rounded to whole units (KB, MB, or GB), while those displayed in tables are rounded to three decimal places. Data values exported to CSV files are in bytes, so are not rounded.

You can customize the graphical displays and tables that are displayed on the system dashboard. For more information see the [“Customizing a Dashboard or Report” section on page 16-10](#).

Much of the device, statistical, and alarm information that is presented in the system dashboard and associated graphs and charts is also available programmatically through the monitoring API. For more information, see the [Cisco Wide Area Application Services API Reference](#).

**Note**

---

You must synchronize the clock on each WAE device within a half hour of the WAAS Central Manager clock for statistics to be displayed.

---

## Alarm Panel

The alarm panel in the System Dashboard window provides a near real-time view of incoming alarms. The panel refreshes every 2 minutes to reflect updates to the system alarm database.

The alarm panel contains two tabs: Active Alarms and Acknowledged Alarms. The Active Alarms tab displays a dynamic view of all incoming alarms. You may remove an alarm from the active display by acknowledging the alarm. Acknowledged alarms are moved to the Acknowledged Alarms view. You may choose to unacknowledged an alarm and return it to the Active view at any time.

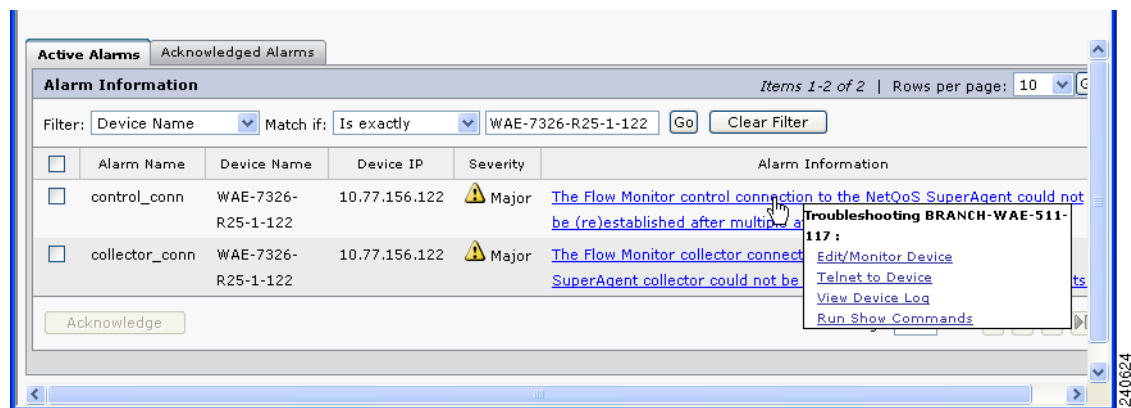
Only Active alarms can be acknowledged in the alarm panel. Pending, Offline, and Inactive alarms cannot be acknowledged in the alarm panel.

For either view, the alarm panel also allows you to filter your view of the alarms in the list. Filtering allows you to find alarms in the list that match the criteria that you set.

When you roll your mouse over an item under the Alarm Information column, a contextual popup menu appears. The popup menu provides links to the troubleshooting and monitoring windows in the WAAS Central Manager GUI. For more information on these links, see the “[Troubleshooting Devices Using Alerts](#)” section on page 16-6.

Figure 16-2 shows the alarm panel in the System Dashboard window.

**Figure 16-2** System Dashboard Window Alarm Panel



To acknowledge an active alarm and move it from Active Alarms to the separate Acknowledged Alarms section, follow these steps:

- 
- Step 1** From the System Dashboard window alarm panel, check the check box next to the name of the alarm that you want to acknowledge.
  - Step 2** Click the **Acknowledge** button.  
A dialog box pops up that allows you to enter comments about the alarm.
  - Step 3** Enter a comment and click **OK**. Alternatively, click **Cancel** to return to the Active Alarm panel without completing the acknowledge action.

Comments enable you to share information about the cause or solution of a particular problem that caused the alarm. The comments field accepts up to 512 characters. You may use any combination of alpha, numeric, and special characters in this field.

The alarm will be moved to the Acknowledged Alarms tab.

To filter and sort alarms displayed in the System Dashboard window alarm panel, follow these steps:

- 
- Step 1** From the Filter drop-down list, choose one of the following filtering options:



- **Alarm Name**
- **Device Name**
- **Device IP**
- **Severity**
- **Alarm Information**

**Step 2** From the Match if drop-down list, choose one of the following match conditions:

- **Contains**
- **Doesn't contain**
- **Starts with**
- **Ends with**
- **Is exactly**
- **Is not**
- **Is empty**
- **Is not empty**

**Step 3** Enter a match string in the text entry field. This field accepts any alphanumeric text, including special characters.

**Step 4** Click **Go**.

**Step 5** To sort alarm entries, click a column header.

Entries are sorted alphabetically (in ASCII order). The sort order (ascending or descending) is indicated by an arrow in the column header that points up for ascending order.

**Step 6** To clear the filter, click **Clear**.

## Device Alarms

Device alarms are associated with device objects and pertain to applications and services running on your WAAS devices. Device alarms are defined by the reporting application or service. Device alarms can also reflect reporting problems between the device and the WAAS Central Manager GUI. [Table 16-1](#) describes the various device alarms that can appear.

**Table 16-1** *Device Alarms for Reporting Problems*

| <b>Alarm</b>                      | <b>Alarm Severity</b> | <b>Device Status</b> | <b>Description</b>                                                                                             |
|-----------------------------------|-----------------------|----------------------|----------------------------------------------------------------------------------------------------------------|
| Device is offline                 | Critical              | Offline              | The device has failed to communicate with the WAAS Central Manager.                                            |
| Device is pending                 | Major                 | Pending              | The device status cannot be determined.                                                                        |
| Device is inactive                | Minor                 | Inactive             | The device has not yet been activated or accepted by the WAAS Central Manager.                                 |
| Device has lower software version | Minor                 | Online               | The device has an earlier software version than the WAAS Central Manager and it may not support some features. |

# Troubleshooting Devices Using Alerts

The WAAS Central Manager GUI allows you to view the alarms on each device and troubleshoot a device in the Troubleshooting Devices window.

To troubleshoot a device from the Troubleshooting Devices window, follow these steps:

**Step 1** From the WAAS Central Manager GUI navigation pane, invoke the Troubleshooting Devices window in one of these ways:

- Choose **My WAN > Alerts** to view alarms on all devices.
- Choose **My WAN > Manage Devices** and click the device alarm light bar in the Device Status column to view alarms on a single device.

The Troubleshooting Devices window appears, either in the WAAS Central Manager window or as a separate popup window. (See [Figure 16-3](#).)

**Figure 16-3** Troubleshooting Devices Window



**Step 2** In the Alarm Information column, hold your mouse over an alarm message until the Troubleshooting tools contextual menu appears. The popup menu provides links to the troubleshooting and monitoring windows in the WAAS Central Manager GUI.

**Step 3** Choose the troubleshooting tool that you want to use, and click the link. The link takes you to the appropriate window in the WAAS Central Manager GUI. [Table 16-2](#) describes the tools available for device alarms.

**Table 16-2** Troubleshooting Tools for Device Alarms

| Item                | Navigation                                      | Description                                                                                                                     |
|---------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Update Software     | Choose device, <b>Jobs &gt; Software Update</b> | Displays Software Update window for this device. Appears only if the device software version is lower than the Central Manager. |
| Edit/Monitor Device | Device Dashboard                                | Displays Device Dashboard window for configuration.                                                                             |

**Table 16-2** Troubleshooting Tools for Device Alarms (continued)

| Item              | Navigation                                                              | Description                                                                                                                                                          |
|-------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Telnet to Device  | Opens a Telnet window                                                   | Initiates a Telnet session using the device IP address.                                                                                                              |
| View Device Log   | Choose device, <b>Admin &gt; Logs</b>                                   | Displays system message logs filtered for this device.                                                                                                               |
| Run Show Commands | Choose device, <b>Admin &gt; Show/Clear Commands &gt; Show Commands</b> | Displays device <b>show</b> command tool. For more information, see the “Using the show and clear Commands from the WAAS Central Manager GUI” section on page 16-39. |

## Viewing Device Information

The WAAS Central Manager GUI allows you to view basic and detailed information about a device from the following two windows:

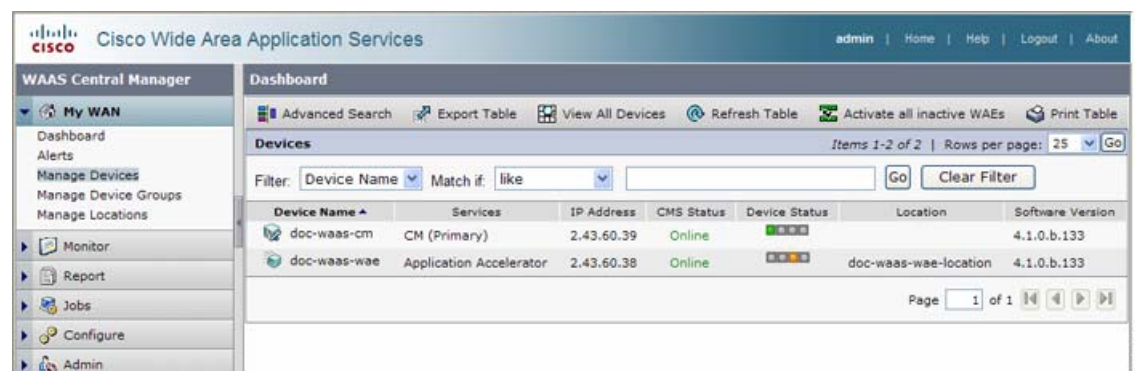
- **Devices Window**—Displays a list of all the devices in your WAAS network along with basic information about each device such as the device status and the current software version installed on the device.
- **Device Dashboard Window**—Displays detailed information about a specific device, such as the installed software version and whether the device is online or offline.

Each window is explained in the sections that follow.

## Devices Window

The Devices window lists all the WAAS devices that are registered with the WAAS Central Manager. To view this list, choose **My WAN > Manage Devices** in the WAAS Central Manager GUI.

Figure 16-4 shows an example of the Devices window.

**Figure 16-4** Devices Window

This window displays the following information about each device:

- Services enabled on the device. See Table 16-3 for a description of these services.

- IP address of the device.
- CMS Status (online, offline, pending, or inactive). For more information about the status, see the [“Device Alarms” section on page 16-5](#).
- Device Status. The system status reporting mechanism uses four alarm lights to identify problems that need to be resolved. Each light represents a different alarm level as follows:
  - Green—No alarms (the system is in excellent health)
  - Yellow—Minor alarms
  - Orange—Major alarms
  - Red—Critical alarms

When you roll your mouse over the alarm light bar, a popup message provides further details about the number of alarms. Click the alarm light bar to troubleshoot the device. For more information, see the [“Troubleshooting Devices Using Alerts” section on page 16-6](#).

- Location associated with the device. For more information about locations, see [Chapter 3, “Using Device Groups and Device Locations.”](#)
- Software version installed and running on the device.

Any WAE devices that are at a higher software version level than the WAAS Central Manager are shown in red. Also, if the standby WAAS Central Manager has a different version level from the primary WAAS Central Manager, the standby WAAS Central Manager is shown in red.

**Table 16-3 Service Descriptions**

| Service                 | Description                                                                                                                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CM (Primary)            | The device has been enabled as the primary WAAS Central Manager. For information on primary and standby Central Manager devices, see the <a href="#">“Switching a WAAS Central Manager from Standby to Primary” section on page 15-25</a> .           |
| CM (Standby)            | The device has been enabled as a standby WAAS Central Manager. For information on primary and standby Central Manager devices, see the <a href="#">“Switching a WAAS Central Manager from Standby to Primary” section on page 15-25</a> .             |
| Application Accelerator | The device has been enabled as an application accelerator.                                                                                                                                                                                            |
| Replication Accelerator | The device has been enabled as a replication accelerator. (Supported only on 4.0.19 or later 4.0.x devices.)                                                                                                                                          |
| Edge                    | The device has been enabled with legacy WAFS Edge services so it can accelerate data stored on a remote file server. For information on enabling WAFS, see <a href="#">Chapter 11, “Configuring Wide Area File Services.”</a>                         |
| Core                    | The device has been enabled with legacy WAFS Core services so it can accelerate data stored on a remote file server. For information on enabling WAFS, see <a href="#">Chapter 11, “Configuring Wide Area File Services.”</a>                         |
| Print                   | The device has been enabled with legacy print services so it can act as a print server to branch office clients. For information on setting up a print server, see <a href="#">Chapter 13, “Configuring and Managing WAAS Legacy Print Services.”</a> |

## Device Dashboard Window

The Device Dashboard window provides detailed information about a WAAS device such as the device model, IP address, interception method, and device-specific charts. (See [Figure 16-5](#).)

To access the Device Dashboard window, go to **My WAN > Manage Devices** and click the **Edit** icon next to the device that you want to view.

**Figure 16-5** Device Dashboard Window



From the Device Dashboard window, you can perform the following tasks:

- View charts and graphs about the application traffic processed by the selected WAE device. (No charts or graphs are displayed if a WAAS Central Manager device is selected.)
- Customize the charts displayed in the chart panel in the top of the window. For more information, see the “[Customizing a Dashboard or Report](#)” section on page 16-10.
- View basic details such as whether the device is online, the device’s IP address and hostname, the software version running on the device, and the amount of memory installed in the device.
- View the device groups to which the device belongs. For more information about device groups, see [Chapter 3, “Using Device Groups and Device Locations.”](#)
- Click **Update Software** to update the software on the device. For more information, see [Chapter 15, “Maintaining Your WAAS System.”](#)
- Click **Device GUI** to open the WAE Device Manager. For more information on managing a device using this GUI, see [Chapter 10, “Using the WAE Device Manager GUI.”](#)
- Click **Telnet** to establish a Telnet session into the device and issue CLI commands.
- Assign and unassign the device to baseline groups. For more information, see [Chapter 3, “Using Device Groups and Device Locations.”](#)

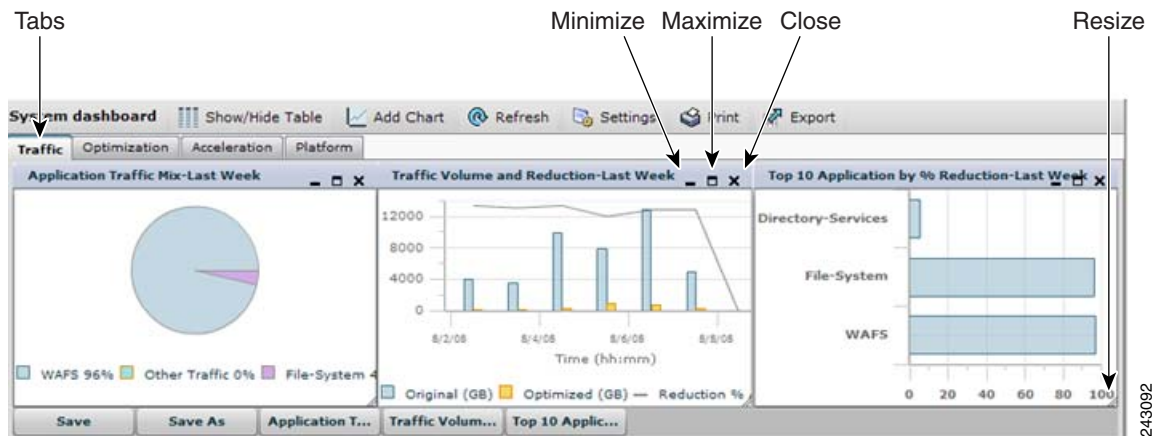
## Customizing a Dashboard or Report

You can customize the system and device dashboards and any report. The dashboards and reports work the same way. For more information about creating custom reports, see the “[Managing Reports](#)” section on page 16-25.

If the charts panel (see [Figure 16-6](#)) in the upper part of the window has tabs, you can click other tabs to display other groups of charts.

You can use the minimize, maximize, and close buttons on the top of individual chart panes to minimize, maximize, and close the chart. When a chart is maximized, the middle button changes to a restore button that restores the chart to its smaller size. You can move a chart pane by clicking and dragging its title bar. You can resize a chart by clicking and dragging on the resize control in the lower right corner of the chart pane.

**Figure 16-6** Charts Panel



Icons across the top of the dashboard allow you to do the following:

- **Show/Hide Table**—Shows or hides the table panel in the lower part of the window. For the system dashboard, this is the Alarms table, and for the device dashboard, it is the Device Information table. Dashboard tables are fixed and cannot be changed. You can include different tables in custom reports.
- **Add Chart**—Adds a graphical chart to the charts panel. You can display a maximum of six charts. For details on adding a chart, see the “[Adding a Chart](#)” section on page 16-11.
- **Refresh**—Refreshes the charts and tables with new information.
- **Settings**—Sets the time frame and included applications for the data presented in each chart. For details on these settings, see the “[Configuring Chart Settings](#)” section on page 16-17.
- **Print**—Prints the charts panel.
- **Export**—Exports the chart statistical data to a CSV file. The statistical data shown in charts is rounded to whole units (KB, MB, or GB), while the exported data contains exact byte values.

Buttons below the charts panel allow you to do the following:

- **Save**—Saves the dashboard or report with its current settings. The next time you view it, it is displayed with these settings.
- **Save As**—Saves the report with its current settings under a new name.
- **Chart Names**—Displays or hides the named chart.



## Adding a Chart

To add a chart to a dashboard or report, follow these steps:

- Step 1** From the dashboard or report chart panel, click the **Add Chart** icon in the taskbar. The Add Chart window is displayed, as shown in [Figure 16-7](#).

**Figure 16-7 Adding a Chart**



- Step 2** Expand any of the chart categories by clicking on the plus sign next to the category.
- Step 3** Check the box next to each chart that you want to display. See [Table 16-4](#) for a description of the charts. Remember that a report can contain a maximum of six charts.
- Step 4** Click **Add**.

[Table 16-4](#) describes the charts that you can choose to include in a dashboard or report.

**Table 16-4 Chart Descriptions**

| Chart                             | Description                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Traffic Analysis</b>           |                                                                                                                                                                                                                                                                                                                                               |
| Application Traffic Mix           | <p>Displays the top nine applications with the highest percent of traffic. Each section in the pie chart represents an application as a percent of the total traffic on your network or device. Nonclassified, nonmonitored, and applications with less than 2 percent of the total traffic are grouped together into the Other category.</p> |
| Application Traffic (All Traffic) | <p>Displays a graph of the amount of traffic processed on the WAE device. You can choose which applications to include; the default is all traffic.</p>                                                                                                                                                                                       |

Table 16-4 Chart Descriptions (continued)

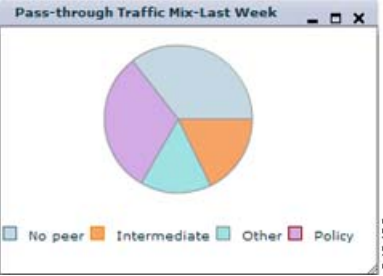



| Chart                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pass-through Traffic Mix          |  <p>Displays a pie chart showing the most common reasons that traffic passed through the WAE device unoptimized. WAAS devices will pass-through traffic unoptimized for the following reasons:</p> <ul style="list-style-type: none"> <li>•No peer—At least two WAAS devices are required to optimize traffic over a WAN. If only one WAAS device exists along the traffic’s route, then the traffic is not optimized because there is no peer WAAS device to participate in the optimization.</li> <li>•Intermediate—When a WAE exists between two other WAEs involved in an optimized connection, traffic going through the middle WAE is passed through unoptimized.</li> <li>•Other—Traffic that is unoptimized due to WAAS device overload, asymmetric routing, blacklisting, and several other reasons.</li> <li>•Policy—An application policy specifies that the traffic should pass-through your network unoptimized. For information about creating and configuring application policies, see the <a href="#">“Creating a New Traffic Application Policy”</a> section on page 12-7.</li> </ul> |
| Pass-through Traffic              |  <p>Displays a graph of the amount of pass-through traffic. You can choose which applications to include; the default is all traffic.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Optimization</b>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Top 10 Application by % Reduction |  <p>Displays a bar chart of the top ten applications with the highest percentage of traffic reduction.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Reduction (All Traffic)           |  <p>Displays a bar chart of the percent of total traffic that was reduced on the WAE device using the WAAS optimization techniques.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



Table 16-4 Chart Descriptions (continued)


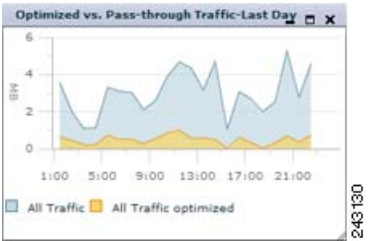
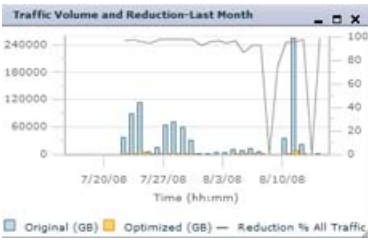
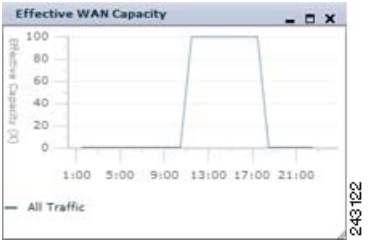
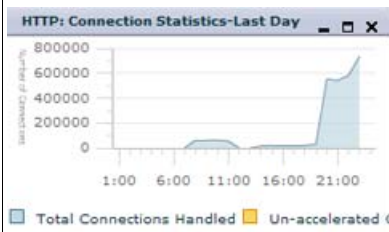
| Chart                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reduction Incl PT                  |  <p>Displays a graph of the percent of total traffic that was reduced on the WAE device using the WAAS optimization techniques. This chart includes pass-through traffic in the total results, so the total percent of reduction is less because pass-through traffic is unoptimized (not reduced). You can choose which applications to include; the default is all traffic.</p> |
| Reduction Excl PT                  | <p>Displays a graph of the percent of total traffic that was reduced on the WAE device using the WAAS optimization techniques. This chart excludes pass-through traffic in the total results. You can choose which applications to include; the default is all traffic. This graph is similar to the Reduction Incl PT graph, but it excludes pass-through traffic.</p>                                                                                            |
| Optimized vs. Pass-through Traffic |  <p>Displays a graph of the amount of optimized and pass-through traffic on the WAE device. The chart in the display is a stacked graph; the pass-through traffic data is indicated by the color blue and is shown behind the optimized data which is indicated by the color orange.</p>                                                                                          |
| Traffic Volume and Reduction       |  <p>Displays the amount of original and optimized traffic in a bar chart, along with the percentage of traffic reduction.</p>                                                                                                                                                                                                                                                    |
| Effective WAN Capacity             |  <p>Displays the effective increased bandwidth capacity of the WAN link as a result of WAAS optimization, as a value between 1X (times) and 100X. You can choose which applications to include; the default is all traffic.</p>                                                                                                                                                 |
| <b>Acceleration</b>                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| CIFS: Optimized CIFS Session Count | Displays the optimized CIFS session count. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                                                                                                                                                                                                                                                               |
| CIFS: Open File Count              | Displays the open CIFS file count. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                                                                                                                                                                                                                                                                       |
| CIFS: Request Hit Rate             | Displays the hit rate for the CIFS cache. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                                                                                                                                                                                                                                                                |
| CIFS: Cache Object Count           | Displays the object count for the CIFS cache. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                                                                                                                                                                                                                                                            |
| CIFS: Cache Utilization            | Displays the utilization percentage of the CIFS cache. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                                                                                                                                                                                                                                                   |

Table 16-4 Chart Descriptions (continued)

| Chart                           | Description                                                                                                                                                                                                              |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CIFS: Request Count             | Displays the CIFS request count. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                               |
| CIFS: Cache Disk Capacity       | Displays the CIFS cache disk capacity. Available only for a device that is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device.                                                         |
| CIFS: Connected CIFS Core Count | Displays the count of connected WAFS Core devices. Available only for a device that is operating in WAFS legacy mode as an Edge device.                                                                                  |
| CIFS: Connected CIFS Edge Count | Displays the count of connected WAFS Edge devices. Available only for a device that is operating in WAFS legacy mode as a Core device.                                                                                   |
| HTTP: Estimate Time Saved %     | Displays an estimate of the percentage of connection setup time saved by the HTTP accelerator. For example, a value of 50% indicates that 50% of the HTTP connections were reused.                                       |
| HTTP: Connection Statistics     | Displays the HTTP session connection statistics, showing the total number of connections handled along with the number of unaccelerated connections.                                                                     |
| HTTP: Effective WAN Capacity    | Displays the effective bandwidth capacity of the WAN link as a result of HTTP acceleration, as a multiplier of its base capacity. Effective capacity is shown for all traffic and for web (HTTP) traffic.                |
| MAPI: Response Counts           | Displays the percentage of local and remote MAPI command responses. A local response is one that is sent to the client without waiting for a response from the peer WAE. A remote response comes from the remote server. |
| MAPI: Average Response Time     | Compares the average time (in milliseconds) used for local and remote MAPI responses.                                                                                                                                    |



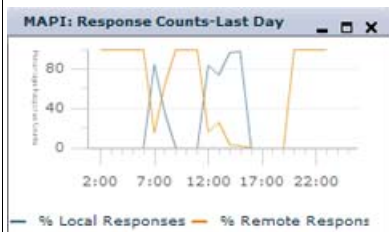
243278



243276



243277



243282



243279

Table 16-4 Chart Descriptions (continued)

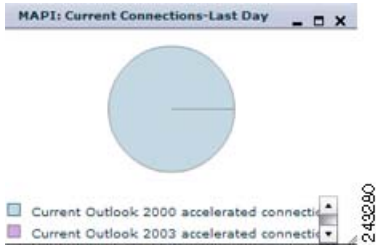

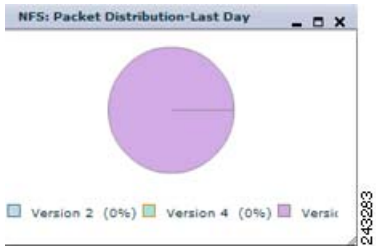
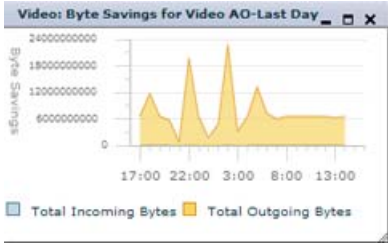
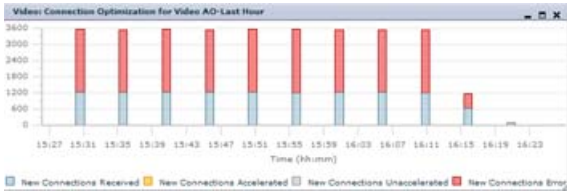


| Chart                                       | Description                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAPI: Current Connections                   |  <p>Displays a pie chart of the current number of active MAPI connections.</p>                                                                                                                                             |
| MAPI: Estimate Time Saved %                 | <p>Displays an estimate of the percentage of response time saved by the MAPI accelerator. This graph is similar to the HTTP: Estimate Time Saved % graph.</p>                                                                                                                                               |
| MAPI: Connection Statistics                 | <p>Displays the MAPI session connection statistics, showing the total number of connections handled along with the number of unaccelerated connections. This graph is similar to the HTTP: Connection Statistics graph.</p>                                                                                 |
| MAPI: Reason for un-accelerations           |  <p>Displays a pie chart of the reasons that MAPI traffic is not accelerated.</p>                                                                                                                                         |
| MAPI: Effective WAN Capacity                | <p>Displays the effective bandwidth capacity of the WAN link as a result of MAPI acceleration, as a multiplier of its base capacity. Effective capacity is shown for other traffic and for email and messaging (MAPI) traffic. This graph is similar to the HTTP: Effective WAN Capacity graph.</p>         |
| NFS: Local Vs. Remote Response Count        | <p>Displays the percentage of local and remote NFS responses. A local response is one that is sent to the client without waiting for a response from the peer WAE. A remote response comes from the remote server. This graph is similar to the MAPI: Response Counts graph.</p>                            |
| NFS: Local Vs. Remote Average Response Time | <p>Compares the average time (in milliseconds) used for local and remote NFS responses. This graph is similar to the MAPI: Average Response Time graph.</p>                                                                                                                                                 |
| NFS: Packet Distribution                    |  <p>Displays a pie chart of the number of NFS messages seen for each NFS version (2, 3, and 4). The NFS accelerator works with NFS version 3 traffic, so you will want to see this kind of traffic for best results.</p> |
| NFS: Estimate Time Saved %                  | <p>Displays an estimate of the percentage of response time saved by the NFS accelerator. This graph is similar to the HTTP: Estimate Time Saved % graph.</p>                                                                                                                                                |
| NFS: Connection Statistics                  | <p>Displays the NFS session connection statistics, showing the total number of connections handled along with the number of unaccelerated connections. This graph is similar to the HTTP: Connection Statistics graph.</p>                                                                                  |
| NFS: Reason for un-accelerations            | <p>Displays a pie chart of the reasons that NFS traffic is not accelerated. This graph is similar to the MAPI: Reason for un-accelerations graph.</p>                                                                                                                                                       |

Table 16-4 Chart Descriptions (continued)

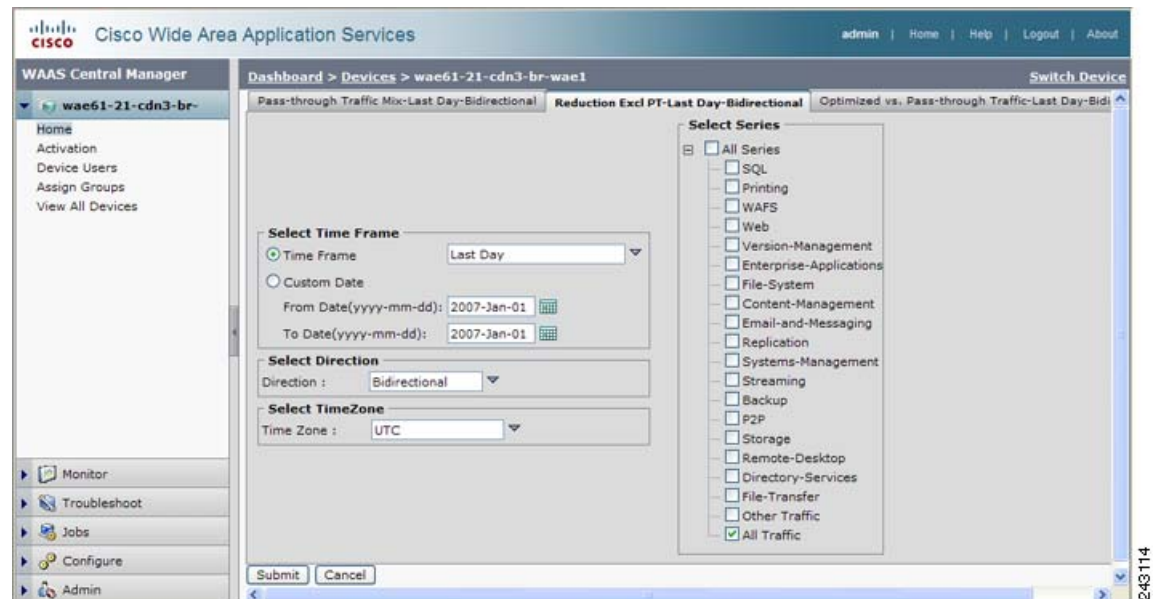
| Chart                                       | Description                                                                                                                                                                                                                                                                        |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NFS: Effective WAN Capacity                 | Displays the effective bandwidth capacity of the WAN link as a result of NFS acceleration, as a multiplier of its base capacity. Effective capacity is shown for other traffic and for file system (NFS) traffic. This graph is similar to the HTTP: Effective WAN Capacity graph. |
| VIDEO: Byte Savings for Video AO            |  <p>Displays the percentage of byte savings for the video accelerator.</p>                                                                                                                        |
| VIDEO: Connection Optimization for Video AO |  <p>Displays the number of video connections received, accelerated, not accelerated, and received with errors by the video accelerator.</p>                                                       |
| VIDEO: Connection Statistics                | Displays the video session connection statistics, showing the total number of connections handled along with the number of unaccelerated connections. This graph is similar to the HTTP: Connection Statistics graph.                                                              |
| VIDEO: Reason for un-accelerations          | Displays a pie chart of the reasons that video traffic is not accelerated. This graph is similar to the MAPI: Reason for un-accelerations graph.                                                                                                                                   |
| VIDEO: Effective WAN Capacity               | Displays the effective bandwidth capacity of the WAN link as a result of video acceleration, as a multiplier of its base capacity. Effective capacity is shown for all traffic and for streaming (video) traffic. This graph is similar to the HTTP: Effective WAN Capacity graph. |
| <b>Platform</b>                             |                                                                                                                                                                                                                                                                                    |
| CPU Statistics                              |  <p>Displays the percentage of CPU utilization for the device.</p>                                                                                                                              |
| Managed Devices Information                 |  <p>Displays information about the number of devices managed by the WAAS Central Manager, the device status, number of alarms, and software versions.</p>                                       |

## Configuring Chart Settings

To configure the data presented in a chart, follow these steps:

- Step 1** From the dashboard or report chart panel, click the **Settings** icon in the taskbar. The Settings window is displayed, as shown in [Figure 16-8](#).

**Figure 16-8** Chart Settings



- Step 2** Click on the tab corresponding to the chart that you want to change.
- Step 3** In the Select Time Frame area, choose a time frame for the chart. Choose one of these options by clicking on the appropriate radio button:
- **Time Frame**—Choose one of several common time frames from the drop-down list:
    - **Last Hour**—Displays data for the past hour (in five-minute intervals). You can change this interval using the `System.monitoring.collectRate` configuration setting described in the [“Modifying the Default System Configuration Properties”](#) section on page 9-16.
    - **Last Day**—Displays data for the past day (in hourly intervals).
    - **Last Week**—Displays data for the past week (in daily intervals).
    - **Last Month**—Displays data for the past month (in daily intervals).
  - **Custom Date**—Enter starting and ending dates in the From Date and To Date fields. Click the calendar icon to choose dates from a popup calendar.
- Step 4** From the Direction drop-down list, choose one of the following options:
- **Bidirectional**—Includes LAN to WAN traffic as well as WAN to LAN traffic traveling through this WAAS device.
  - **Inbound**—Includes traffic from the WAN to the client through this WAAS device
  - **Outbound**—Includes traffic traveling from a client to the WAN through this WAAS device.

The Select Direction area appears only when you are configuring certain device level charts.

- Step 5** From the Time Zone drop-down list, choose one of the following options:
- **UTC**—Sets the time zone of the report to UTC.
  - **CDM Local Time**—Sets the time zone of the report to the time zone of the WAAS Central Manager.
  - **CE Local Time**—Sets the time zone of the report to the time zone of the WAE device. This option appears only when you are configuring a device level chart.
- Step 6** In the Select Series area, click the plus sign to expand the All Series list. Place a check mark next to the applications whose statistics you want to include in the chart data. This optional area applies only to specific chart types. To include all applications, choose **All Traffic**.
- Step 7** Click **Submit**.
- 

## Using Predefined Reports to Monitor WAAS

The WAAS Central Manager includes a number of predefined reports that you can use to monitor the system operation. These reports are available in the Monitor drawer in the navigation pane.

You can customize these predefined reports by editing them with the **Manage Report** function available in the Report drawer, as described in the [“Viewing and Editing Reports”](#) section on page 16-27.

The following predefined reports are available at the WAAS system level and at the WAE device level:

- Optimization
  - Network Traffic Summary Report—Displays a summary of all traffic.
  - Network Traffic Application Mix—Displays the application traffic mix.
  - Network Pass Through Report—Displays the pass-through traffic.
- Acceleration
  - Acceleration reports for HTTP, Video, MAPI, and NFS traffic—Displays a report showing graphs of time saved (or bytes saved), effective WAN capacity, connection statistics, and reasons for unaccelerated traffic, and a table of acceleration statistics for five-minute intervals.
- Topology—Displays a graphical representation of all connections between WAE devices. For more information, see the [“Viewing Connections and Peer Devices”](#) section on page 16-19.

The following predefined reports are available only at the device level:

- Traffic Analysis
  - Volume Analysis Report—Displays a traffic volume analysis.
  - Connections Statistics—Displays TCP connection information. For more information, see the [“Monitoring Device TCP Connections”](#) section on page 16-20.
- Acceleration
  - CIFS Acceleration Report—Includes the following WAFS detail charts. Most of these charts (except as noted) are available only when the device is operating in transparent CIFS accelerator mode or WAFS legacy mode as an Edge device. These graphs are the same WAFS Edge device and WAFS Core traffic monitoring graphs that are available from the WAE Device Manager GUI. These graphs are described in the [“Monitoring the WAE”](#) section on page 10-23.
    - Request Hit Rate—Displays the hit rate for the CIFS cache.
    - Cache Object Count—Displays the object count for the CIFS cache.
    - Optimized CIFS Sessions Count—Displays the optimized CIFS session count.



Cache Utilization—Displays the utilization percentage of the CIFS cache.  
 Open File Count—Displays the open CIFS file count.  
 Cache Disk Capacity—Displays the CIFS cache disk capacity.  
 Request Count—Displays the CIFS request count.  
 Connected CIFS Core Count—Displays the count of connected WAFS Core devices. Available only when the device is operating in WAFS legacy mode as an Edge device.  
 Connected CIFS Edge Count—Displays the count of connected WAFS Edge devices. Available only when the device is operating in WAFS legacy mode as a Core device.

- Platform
  - CPU Statistics—Displays the CPU utilization percentage. For more information, see the [“Viewing CPU Utilization”](#) section on page 16-21.
  - Disks—Displays device disk information. For more information, see the [“Viewing Disk Information”](#) section on page 16-22.

## Viewing Connections and Peer Devices

The WAAS Central Manager GUI lets you view a list of all the peer devices connected to a specific WAE so that you can see the relationship between devices in your WAAS network. You can also use the WAAS Central Manager GUI to view a topology map so that you see a graphical representation of all the connections between the WAE devices. For example, if you are interested in seeing the WAEs that have participated in TFO connections with Device A, you can use the topology map or the device list to view these connections.



### Note

The WAAS Central Manager device does not have any peers because it does not participate with any WAEs to optimize traffic. For this reason, the topology feature is not available on the WAAS Central Manager device.

To view the topology for a WAE device, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the device for which you want to view its TFO peers. The Device Dashboard window appears.
- Step 3** From the navigation pane, choose **Monitor > Topology**. The TFO List Reported by Device window appears.

This window displays information about each peer device involved in optimized connections with this WAE.

If a peer device is not registered with the WAAS Central Manager, the MAC address for the peer device name is shown and “unknown” is displayed for the IP address.

- Step 4** View a topology map that displays a grid of all the connections between your WAE devices, by doing one of the following steps:
  - From the TFO List Reported by Device window, click the **View Topology** icon in the taskbar.
  - From the global context (with no device or device group chosen), choose **Monitor > Topology**.

The topology map uses blue squares to show connections between devices. Use the legend to the right of the grid to associate the device name with the number that appears at the top of the grid.

- Step 5** Use the drop-down lists at the top of the window to perform the following tasks:

- Display connections between your various locations instead of between devices.
- Sort the grid by the number of connections instead of by device name.

**Step 6** Click the **View** icon next to the WAE to view a list of peer devices for a specific WAE. The TFO Peer List window appears.

## Monitoring Device TCP Connections

To view the device TCP connection information, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the device for which you want to view TCP connection information.
- Step 3** Choose **Monitor > Traffic Analysis > Connections Statistics**. The Connection Summary Table for Device window appears.

This window displays all of the TCP connections handled by the device and corresponds to the **show tfo connections summary EXEC mode command**. (See [Figure 16-9](#).)

**Figure 16-9** Device Connections Summary Table

| Source IP:Port   | Dest IP:Port  | Peer Id               | Applied Policy | Open Duration | Org Bytes   | Opt Bytes   | % Comp | Classifier Name |
|------------------|---------------|-----------------------|----------------|---------------|-------------|-------------|--------|-----------------|
| 2.53.10.130:2383 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | TFO            | 15:9:52       | 151.1313 MB | 100.7226 MB | 33%    | **Map Default** |
| 2.53.10.130:3895 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | DRE            | 15:8:56       | 150.9939 MB | 95.4497 MB  | 37%    | **Map Default** |
| 2.53.10.130:4103 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | LZ             | 15:8:54       | 150.9904 MB | 96.6595 MB  | 36%    | **Map Default** |
| 2.53.10.130:1174 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | TFO            | 15:0:17       | 148.9012 MB | 75.3929 MB  | 49%    | **Map Default** |
| 2.53.10.130:4141 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | DRE            | 4:25:47       | 40.6574 MB  | 16.9062 MB  | 58%    | **Map Default** |
| 2.53.10.130:2635 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | LZ             | 4:9:41        | 38.0987 MB  | 27.1555 MB  | 29%    | **Map Default** |
| 2.53.10.130:1398 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | TFO            | 4:2:19        | 523.3282 MB | 244.023 MB  | 53%    | **Map Default** |
| 2.53.10.130:3820 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | DRE            | 3:8:45        | 407.8651 MB | 190.719 MB  | 53%    | **Map Default** |
| 2.53.10.130:4165 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | LZ             | 3:2:16        | 28.677 MB   | 15.2453 MB  | 47%    | **Map Default** |
| 2.53.10.130:4628 | 2.53.10.2:554 | wae61-21-cdn3-br-wae1 | TFO            | 2:44:52       | 356.1114 MB | 288.2538 MB | 19%    | **Map Default** |

This window displays the following information about each connection:

- Source IP address and port
- Destination IP address and port
- Peer ID—Hostname of the peer device
- Applied Policy (icons represent TFO, DRE, and LZ, respectively)
- Open Duration—Number of hours, minutes, and seconds that the connection has been open
- Total number of original bytes
- Total number of optimized bytes



- Percentage of compression
- Classifier name

The data in the Connection Summary Table is retrieved from the device one time when you view the window for the first time.

**Step 4** Click the **Refresh** button at the bottom of the window to refresh the data in the Connection Summary Table.

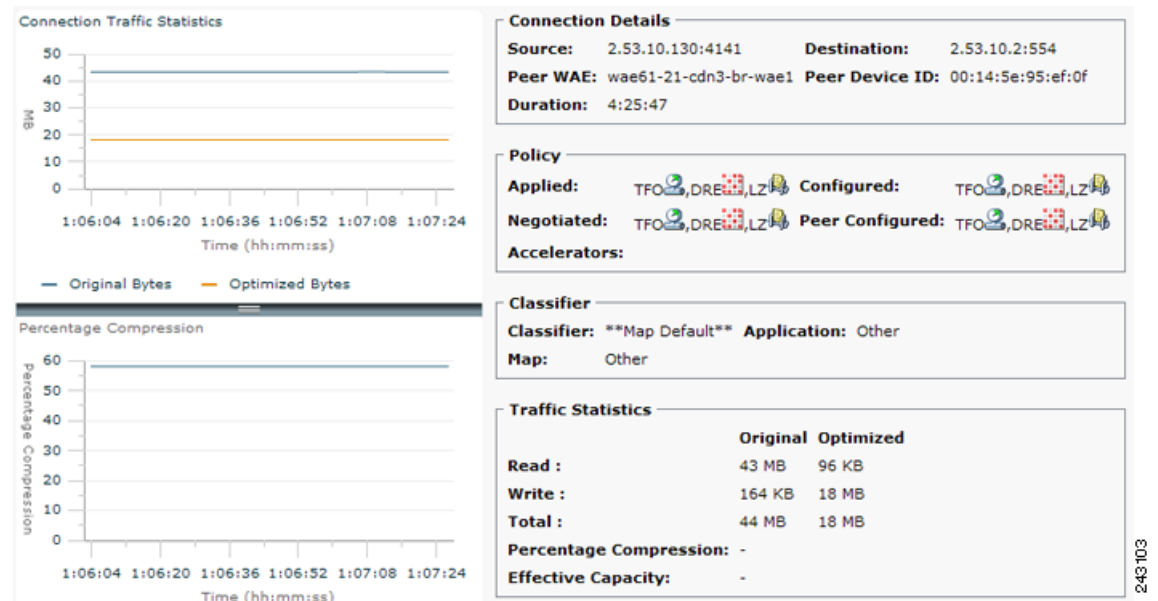
From the Connection Summary Table for Device window, you may perform the following tasks:

- Apply filter settings to display particular connections based on criteria that you choose.
- View connection details.

**Step 5** Click the **Details** icon next to the connection entry in the summary table to view connection details.

The Connection Details window appears. This window contains connection addresses, port information, policy information, and traffic statistics. The Connection Details window also displays a graph that plots real-time traffic statistics. (See [Figure 16-10](#).)

**Figure 16-10 Connection Details**



**Note** If the value for Percentage Compression is negative, the Percentage Compression and Effective Capacity values do not appear.

## Viewing CPU Utilization

To view the CPU Utilization report and configure the reporting options, follow these steps:

**Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.

- Step 2** Click the **Edit** icon next to the WAAS device for which you want to view CPU utilization.
- Step 3** In the navigation pane, choose **Monitor > Platform > CPU Statistics**. The CPU Utilization Report window appears, displaying the statistical data. You can do the following:
- To change the report parameters and display characteristics, modify the report options as needed.
  - To generate a new report based on the modified report options, click **Update**.

## Viewing Disk Information

The WAAS Central Manager GUI allows you to monitor physical and logical disk information. The Device Dashboard window shows the number of local disks and the RAID level. View further disk information details in the Disk Information for device window (**My WAN > Manage Devices > Monitor > Platform > Disks**). (See [Figure 16-11](#).)

This window displays the following information about each disk:

- Physical disk information, including the disk name, serial number, and disk size.
- Present status. The Present field will show either Yes if the disk is present, or Not Applicable if the disk is administratively shut down.
- Operational status (NORMAL, REBUILD, BAD, or UNKNOWN).
- Administrative status (ENABLED or DISABLED). When the Administrative Status field shows DISABLED, the Present field will show Not Applicable.
- Current and future disk encryption status.
- RAID level. For RAID-5 devices, the Disk Information window includes the RAID device name, RAID status, and RAID device size.

From this window, you may save all disk information details to an Excel spreadsheet by clicking the **Export Table** icon in the taskbar.

**Figure 16-11** Disk Information for Device Window



The screenshot shows the Cisco Wide Area Application Services (WAAS) Central Manager GUI. The main window is titled "Disk Information for device, wae61-20-cdn3-dc-wae1". It displays a table of physical disks and a section for disk information.

| Name   | Serial Number   | Size       | Present | Operational Status | Administrative Status |
|--------|-----------------|------------|---------|--------------------|-----------------------|
| disk00 | WD-WMAM9DM05057 | 78156225KB | YES     | NORMAL             | ENABLED               |
| disk01 | WD-WMAM9DS22580 | 78156225KB | YES     | NORMAL             | ENABLED               |

Below the table, the "Disk Information" section shows:

- Disk Encryption Status current: DISABLED
- Disk Encryption Status future: DISABLED
- Raid Level: RAID-1

# Configuring Flow Monitoring

Flow monitoring applications collect traffic data that is used for application trend studies, network planning, and vendor-deployment impact studies. This section describes how to configure the flow monitoring feature on the WAE and includes the following topics:

- [Alarms for Flow Monitoring](#)
- [Example Using NetQoS for Flow Monitoring](#)

The NetQoS monitoring application can interoperate with the WAAS software to provide flow monitoring. To integrate this application with the WAAS software, you configure the NetQoS FlowAgent module on the WAE devices. The NetQoS FlowAgent module on the WAE collects important metrics of packet flows, which are then sent across the network to the NetQoS SuperAgent. This monitoring agent analyzes the data and generates reports. For this feature to work, additional configuration is required on the NetQoS FlowAgent. (See the [“Example Using NetQoS for Flow Monitoring”](#) section on page 16-25.)

The monitoring agent is composed of two modules: the console (or host) and the collector. The WAE initiates two types of connections to these two monitoring agent modules: a temporary connection to the console and a persistent connection to the collector. You configure the console IP address on the WAE by entering the **flow monitor tcpstat-v1 host** configuration mode command in either the WAE CLI or through the Central Manager GUI. This temporary connection is referred to as the control connection. The control connection uses TCP port 7878. Its purpose is to obtain the IP address and port number of the collector to which the WAE is assigned. The WAE also pulls the configuration information regarding which servers are to be monitored over the control connection. Once the WAE obtains the IP address and port number of the collector, the WAE opens a persistent connection to the collector. Collected summary data for the servers that are being monitored is sent over this persistent connection.

You may place the console (or host) module and the collector module on a single device or on separate devices. These connections are independent of one another. A failure of one connection does not cause the failure of the other connection and vice versa.

The state of these connections and various operation statistics display when you use the **show statistics flow monitor tcpstat-v1 EXEC** mode command. Connection errors and data transfer errors trigger alarms on the WAE and in the Central Manager GUI. (See the [“Alarms for Flow Monitoring”](#) section on page 16-24.) To display debug information, use the **debug flow monitor tcpstat-v1 EXEC** mode command.

To configure flow monitoring on your WAEs using the Central Manager GUI, follow these steps:

- 
- Step 1** Create a new device group for configuring flow monitoring on multiple devices. Choose **My WAN > Manage Device Groups > Create New Device Group** to create a device group.
    - a. When you create the device group, check the **Automatically assign all newly activated devices to this group** check box to enable this option.
    - b. Add your existing WAE devices to this new device group.
  - Step 2** From the Device Group listing window, click the **Edit** icon next to the name of the flow monitoring configuration device group that you want to configure.
  - Step 3** In the navigation pane, choose **Configure > Network Monitoring > Flow Monitor**. The Flow Monitor Settings for Device Group window appears.
  - Step 4** Check the **Enable** check box.
  - Step 5** In the tcpstat-v1 Host field, enter the IP address of the monitoring agent console.

This configuration allows the WAE to establish a temporary connection (a control connection) to the console for the purpose of obtaining the IP address of the collector device. You must configure the collector IP address information from the console device. (See the configuration documentation for your third-party flow monitoring application software.)

**Step 6** Click **Submit** to apply the settings to the devices in this device group.

---

To configure flow monitoring on the WAE using the CLI, follow these steps:

**Step 1** Register the WAE with the IP address of the monitoring agent console:

```
WAE(config)# flow monitor tcpstat-v1 host 10.1.2.3
```

This configuration allows the WAE to establish a temporary connection (a control connection) to the console (or host) for the purpose of obtaining the IP address of the collector device. You must configure the collector IP address information from the console device. (See the configuration documentation for your third-party flow monitoring application software.)

**Step 2** Enable flow monitoring on the WAE appliance:

```
WAE(config)# flow monitor tcpstat-v1 enable
```

**Step 3** Check the configuration by using the **show running-config EXEC** command.

---

## Alarms for Flow Monitoring

Table 16-5 describes the four different alarms that may be raised when errors occur with flow monitoring.

**Table 16-5** Alarms for Flow Monitoring

| Name               | Severity | Description                                                                                                                                                                                                                                                                                                           |
|--------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONTROL_CONN       | Major    | Indicates a problem with the control connection.                                                                                                                                                                                                                                                                      |
| COLLECTOR_CONN     | Major    | Indicates a problem with the collector connection.                                                                                                                                                                                                                                                                    |
| SUMMARY_COLLECTION | Minor    | Indicates a problem with the collection of packet summary information.<br><br>Summary packets may be dropped because the buffer queue limit has been reached or because of a TFO error, such as not being able to allocate memory.<br><br>Summary packet collection may also be dependant on available WAN bandwidth. |
| DATA_UPDATE        | Minor    | Indicates a problem with the ability of the WAE to send updates the collector agent.                                                                                                                                                                                                                                  |

## Example Using NetQoS for Flow Monitoring

NetQoS integrates with the WAAS software by running the NetQoS FlowAgent on WAE devices. FlowAgent is a software module developed by NetQoS that resides on the WAE appliance. The FlowAgent collects metrics about the packet flows, which are then sent across the network to a NetQoS SuperAgent. The SuperAgent measures the round-trip times, server response times, and data transfer times, analyzes the data, and generates reports.

**Note**

When you use flow monitoring with the NetQoS SuperAgent, the flow monitor on the WAE captures optimized traffic only.

To configure flow monitoring with NetQoS, follow these steps:

**Step 1** From the WAE CLI or Central Manager GUI, enter the SuperAgent Master Console IP address in the tcpstat-v1 Host field on your WAE appliances.

If you are configuring multiple appliances through a device group, wait for the configuration to propagate to all the appliances in the device list.

**Step 2** From the NetQoS SuperAgent console, assign a WAE to a SuperAgent Aggregator (known as the collector in WAAS terminology) and configure the NetQoS Networks, Servers, and Applications entities.

**Note**

For information about using the NetQoS SuperAgent Master Console and configuring NetQoS SuperAgent entities, go to the following website: <http://www.netqos.com>

## Managing Reports

The WAAS Central Manager allows you to edit any of the predefined reports and to create custom reports. Additionally, you can schedule reports to be generated periodically such as daily, weekly, or monthly. When a scheduled report is generated, a link to the report is e-mailed to notify the recipients.

This section contains the following topics:

- [Creating Custom Reports, page 16-25](#)
- [Viewing and Editing Reports, page 16-27](#)
- [Scheduling Reports, page 16-27](#)
- [Managing Scheduled Reports, page 16-28](#)

## Creating Custom Reports

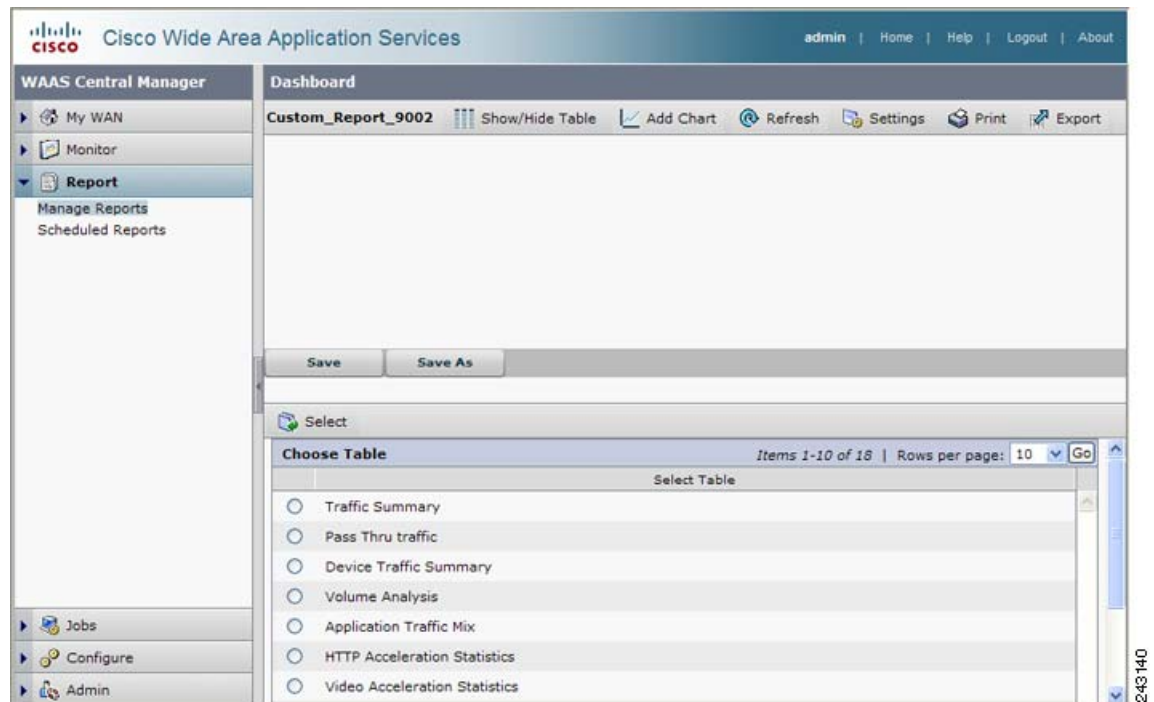
A report consists of one or more charts in the chart panel (upper portion of the window) and a table in the table panel (lower portion of the window). The system and device dashboard displays are examples of predefined reports, along with the other reports available in the Monitor drawer.

Reports can be created only at the system level, not at the device level.

To create a custom report, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Report > Manage Reports**.
- Step 2** Click the **Create New Report** icon in the taskbar. The Custom Report window appears, as shown in [Figure 16-12](#).

**Figure 16-12** Creating a Report



- Step 3** Choose a table to display in the lower table panel of the report by clicking the radio button next to the table in the Choose Table area and then clicking the **Select** button above the Choose Table area.
- Step 4** Add one or more charts to be displayed in the upper chart panel of the report by clicking the **Add Chart** icon in the taskbar. The Add Chart window is displayed, as shown in [Figure 16-7](#).
- Step 5** Expand any of the chart categories by clicking on the plus sign next to the category.
- Step 6** Check the box next to each chart that you want to display. See [Table 16-4](#) for a description of the charts. A report can contain a maximum of six charts.
- Step 7** Click **Add**.
- Step 8** Customize any of the chart settings by clicking the **Settings** icon in the taskbar. For more information, see the “[Configuring Chart Settings](#)” section on page 16-17.
- Step 9** Click the **Save As** button below the chart panel to save the report with a new name. The Save As popup window appears.  
(If you use the Save button, the report is saved with a default name such as Custom\_Report\_9001.)
- Step 10** Enter the report name and any notes about the report.
- Step 11** Click **Submit**.

All of the taskbar icons above the charts panel and the buttons below the charts panel work as described in the “[Customizing a Dashboard or Report](#)” section on page 16-10.

## Viewing and Editing Reports

To view or edit a report, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Report > Manage Reports**.
  - Step 2** Check the box next to the report that you want to view or edit.  
If you do not see the report that you are looking for, you may need to navigate to another page of the Reports table.
  - Step 3** To delete a report, click the **Delete** icon in the taskbar.
  - Step 4** To view or edit a report, click the **Edit** icon in the taskbar. The report is displayed.
  - Step 5** If you want to change any of the charts in the report, use the standard chart editing methods as described in the “[Creating Custom Reports](#)” section on page 16-25.
  - Step 6** Click **Save** or **Save As** to save the report.
- 

When editing a report, you cannot change the table that is displayed in the table panel. If you want to change the table, you must create a new report.

When viewing a report, click the **Refresh** button below the table panel to refresh the data in the table.

## Scheduling Reports

You can schedule reports to be generated once or periodically such as daily, weekly, or monthly. When a scheduled report is generated, a link to the report is e-mailed to notify the recipients.

To schedule a report, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Report > Manage Reports**.
  - Step 2** Check the box next to the report that you want to schedule.  
If you do not see the report that you are looking for, you may need to navigate to another page of the Reports table.
  - Step 3** Click the **Schedule** icon in the taskbar. The scheduling window appears, as shown in [Figure 16-13](#).



Figure 16-13 Scheduling a Report

The screenshot displays the 'Schedule Report' configuration interface in the Cisco WAAS Central Manager. The left-hand navigation pane shows the 'Report' menu item selected. The main area contains the following fields and options:

- Report Name:** System Traffic Summary
- Schedule Date:** 2008-Aug-14 (with a calendar icon and format YYYY-MM-DD)
- Schedule Time:** 0:00 (CM TimeZone)
- Frequency:** Once
- No. Of Reports:** 1
- Email Id:** (empty field)
- Subject:** (empty field)
- Select Devices:**
  - AllDevicesGroup
  - East
  - TestCluster
- Find Device Group:** (search input field)

Buttons for 'Submit' and 'Cancel' are located at the bottom right of the form area.

- Step 4** In the Schedule Date field, enter the schedule date in the format YYYY-MM-DD, or click the calendar icon to display a calendar popup window from which to choose the date.
- Step 5** In the Schedule Time field, choose the hours and minutes from the drop-down lists. The time represents the local time at the WAAS Central Manager.
- Step 6** In the Frequency drop-down list, choose Once, Daily, Weekly, or Monthly for the report frequency.
- Step 7** In the No. of Reports field, enter the number of times that a reoccurring report is to be generated. After being generated the specified number of times, the report is no longer generated.
- Step 8** In the Email Id field, enter the e-mail addresses of the report recipients, separated by commas.
- Step 9** In the Subject field, enter the subject of the e-mail message.
- Step 10** In the Select Devices area, select the devices that are to be included in the statistics for the report. Place a check in the box next to each device or device group that you want to include.
- To find (highlight) a device group in a long list, enter the device group name in the field above the list and click **Find Device Group**. The search is case sensitive.
- Step 11** Click **Submit**.
- Step 12** Configure the e-mail server settings for e-mail notification when reports are generated. For more information, see the [“Configuring the E-mail Notification Server”](#) section on page 9-20.

## Managing Scheduled Reports

To view or delete a scheduled report, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Report > Scheduled Reports**. The Scheduled Reports window lists the scheduled reports.
- Step 2** (Optional) If you want to view a report, click the plus sign on the row for the schedule. The row expands to show the report instances for the schedule. Each instance shows the report name, devices selected, scheduled time, completed time, frequency, and status.



Check the box next to the report instance that you want to view and click the **View Completed Report** icon on the taskbar; or, click the Completed link in the status column. You can view only completed reports. If a report instance has a status of Not Started or In Progress, you must wait for it to complete before you can view the report.

- Step 3** (Optional) If you want to delete a report, check the box next to one or more report instances that you want to delete and click the **Delete Selected Reports** icon on the taskbar. You must select report instances, not the schedule name above a group of instances. If all report instances are deleted, the schedule is also deleted.

---

WAAS stores the 10 most recently completed or failed report instances for each custom report. This number is configurable by the System.monitoring.maxReports system property. For details on changing this property, see the [“Modifying the Default System Configuration Properties”](#) section on page 9-16.

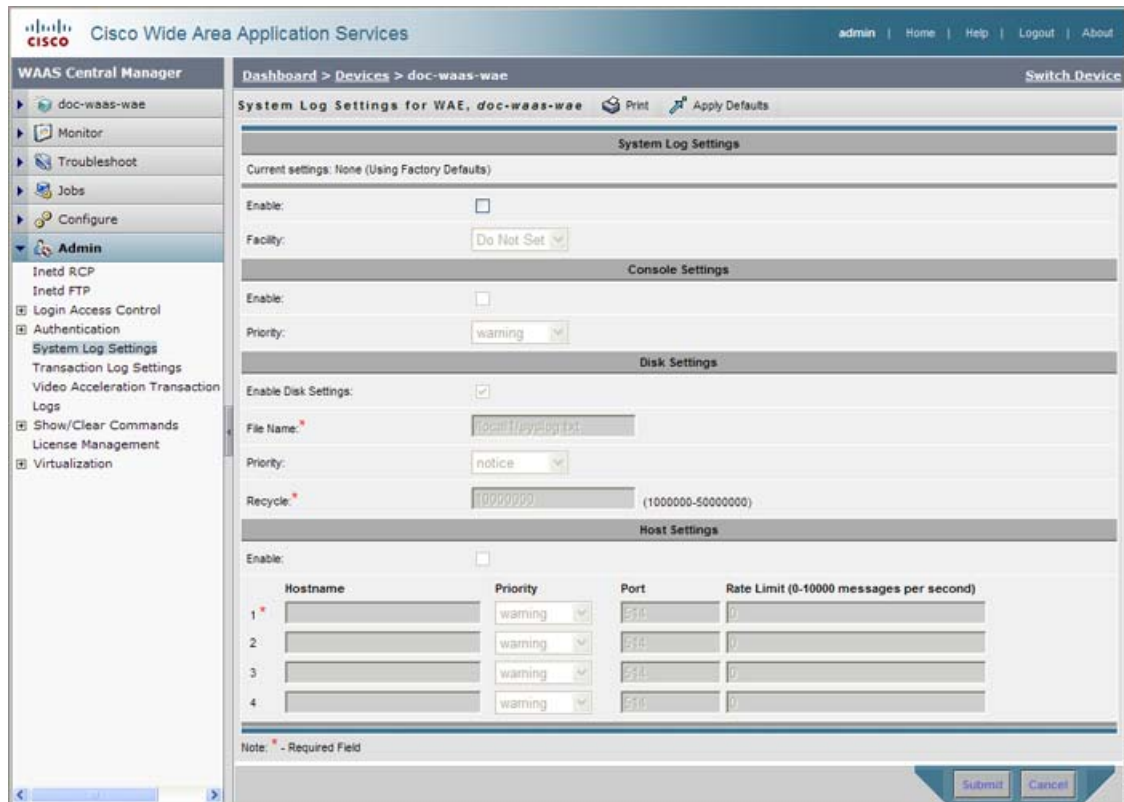
## Configuring System Logging

Use the WAAS system logging feature to set specific parameters for the system log file (syslog). This file contains authentication entries, privilege level settings, and administrative details. The system log file is located on the system file system (sysfs) partition as /local1/syslog.txt.

To enable system logging, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the device or device group for which you want to enable system logging.
- Step 3** From the navigation pane, choose **Admin > System Log Settings**. The System Log Settings window appears. (See [Figure 16-14](#).)

Figure 16-14 System Log Settings Window



- Step 4** Under the System Log Settings section, check the **Enable** check box to enable system logging. By default, this option is disabled.
- Step 5** From the Facility drop-down list, choose the appropriate facility.
- Step 6** Enable system log files to be sent to the console:
  - a. In the Console Settings section, check the **Enable** check box.
  - b. From the Priority drop-down list, choose the severity level of the message that should be sent to the specified remote syslog host. The default priority-code is “warning” (level 4). Each syslog host is capable of receiving a different level of event messages. (See [Table 16-6 on page 16-31](#) for a list of priority levels.)
- Step 7** Enable syslog files to be sent to disk:
  - a. In the Disk Settings section, check the **Enable Disk Settings** check box.
  - b. In the File Name field, enter a path and a filename where the syslog files will be stored on disk.
  - c. From the Priority drop-down list, choose the severity level of the message that should be sent to the specified remote syslog host. The default priority-code is “warning” (level 4). Each syslog host is capable of receiving a different level of event messages. (See [Table 16-6 on page 16-31](#) for a list of priority levels.)
  - d. In the Recycle field, specify the size of the syslog file (in bytes) that can be recycled when it is stored on disk. The default value of the file size is 10000000.

Whenever the current log file size surpasses the recycle size, the log file is rotated. (The default recycle size for the log file is 10,000,000 bytes.) The log file cycles through at most five rotations, and each rotation is saved as *log\_file\_name.[1-5]* under the same directory as the original log.

The rotated log file is configured in the File Name field (or by using the **logging disk filename** command).

**Step 8** Enable syslog files to be sent to a host:

- a. In the Host Settings section, check the **Enable** check box. You can configure up to four hosts to which syslog messages can be sent. For more information, see the “[Multiple Hosts for System Logging](#)” section on page 16-32.”
- b. In the Hostname field, enter a hostname or IP address of the remote syslog host. Specify up to three more remote syslog hosts in the Hostname fields 2 through 4. You must specify at least one hostname if you have enabled system logging to a host.
- c. From the Priority drop-down list, choose the severity level of the message that should be sent to the specified remote syslog host. The default priority-code is “warning” (level 4). Each syslog host is capable of receiving a different level of event messages. (See [Table 16-6](#) for a list of priority levels.)
- d. In the Port field, specify the destination port on the remote host to which the WAAS device should send the message. The default port number is 514.
- e. In the Rate Limit field, specify the number of messages per second that are allowed to be sent to the remote syslog host. To limit bandwidth and other resource consumption, messages to the remote syslog host can be rate limited. If this limit is exceeded, the specified remote syslog host drops the messages. There is no default rate limit, and by default all syslog messages are sent to all of the configured syslog hosts.

**Step 9** Click **Submit**.

To configure system logging from the CLI, you can use the **logging** global configuration command.

This section contains the following topics:

- [Priority Levels, page 16-31](#)
- [Multiple Hosts for System Logging, page 16-32](#)

## Priority Levels

[Table 16-6](#) lists the different priority levels of detail to send to the recipient of the syslog messages for a corresponding event.

**Table 16-6** System Logging Priority Levels and Descriptions

| Priority Code | Condition   | Description                        |
|---------------|-------------|------------------------------------|
| 0             | Emergency   | System is unusable.                |
| 1             | Alert       | Immediate action needed.           |
| 2             | Critical    | Critical condition.                |
| 3             | Error       | Error conditions.                  |
| 4             | Warning     | Warning conditions.                |
| 5             | Notice      | Normal but significant conditions. |
| 6             | Information | Informational messages.            |
| 7             | Debug       | Debugging messages.                |

## Multiple Hosts for System Logging

Each syslog host can receive different priority levels of syslog messages. You can configure different syslog hosts with a different syslog message priority code to enable the WAAS device to send varying levels of syslog messages to the four external syslog hosts. For example, a WAAS device can be configured to send messages that have a priority code of “error” (level 3) to the remote syslog host that has an IP address of 10.10.10.1 and messages that have a priority code of “warning” (level 4) to the remote syslog host that has an IP address of 10.10.10.2.

If you want to achieve syslog host redundancy or failover to a different syslog host, you must configure multiple syslog hosts on the WAAS device and assign the same priority code to each configured syslog host (for example, assigning a priority code of “critical” (level 2) to syslog host 1, syslog host 2, and syslog host 3).

In addition to configuring up to four logging hosts, you can also configure the following for multiple syslog hosts:

- A port number different from the default port number, 514, on the WAAS device to send syslog messages to a logging host.
- A rate limit for the syslog messages, which limits the rate at which messages are sent to the remote syslog server (messages per second) to control the amount of bandwidth used by syslog messages.

## Configuring Transaction Logging

This section contains the following topics:

- [Enabling Transaction Logging, page 16-32](#)
- [Transaction Logs, page 16-34](#)

## Enabling Transaction Logging

To enable transaction logging for TFO flows and video streams, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
  - Step 2** Click the **Edit** icon next to the device or device group for which you want to enable system logging. The Device Dashboard window or the Modifying Device Group window appears.
  - Step 3** From the navigation pane, choose **Admin > Transaction Log Settings** for TFO transaction logging, or **Admin > Video Acceleration Transaction Log Settings** for video transaction logging. The Transaction Log Settings window appears. (See [Figure 16-15](#).) The Video Transaction Log Settings window looks the same, but does not include the General Settings area at the top.

Figure 16-15 Transaction Log Settings Window

The screenshot shows the 'Transaction Log Settings' window for a WAAS device. The interface includes a left-hand navigation pane with 'Admin' selected, and a main configuration area. The main area is titled 'Transaction Log Settings for WAE, doc-waas-wae' and contains the following sections:

- General Settings:** 'TFO Transaction Log Enable' is checked. 'Access Control List Name' is an empty text field.
- Archive Settings:** 'Max size of Archive File' is set to 2000000 (KB). 'Archive occurs' is set to 'every day' with an interval of 1 hour.
- Export Settings:** 'Enable Export' and 'Compress Files before Export' are unchecked. 'Export occurs' is set to 'every 2 minutes'.

Buttons for 'Submit' and 'Cancel' are located at the bottom right of the configuration area.

- Step 4** Under the General Settings heading, check the **TFO Transaction Log Enable** check box to enable transaction logging. This check box does not appear for video transaction logging.
- The fields on the window become active.
- Step 5** In the Access Control List Name field, optionally enter the name of an access control list that you want to use to limit transaction logging. If you specify an access control list, only transactions from hosts that are defined in the access list are logged. This field does not appear for video transaction logging.
- Use the **ip access-list** global configuration command to define an access list.
- Step 6** Under the Archive Settings heading, specify values for the following fields:
- **Max Size of Archive File**—Maximum size (in kilobytes) of the archive file to be maintained on the local disk. This value is the maximum size of the archived file to be maintained on the local disk. The range is 1000 to 2000000. The default is 2000000.
  - **Archive Occurs Every (interval)**—Interval at which the working log data is cleared and moved into the archive log.
- Step 7** Configure the fields in the Export Settings section to export the transaction log file to an FTP server. [Table 16-7](#) describes the fields in the Export Settings section.

**Table 16-7** Export Settings

| Field                          | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enable Export                  | Enables transaction logging to be exported to an FTP server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Compress Files before Export   | Enables compression of archived log files into gzip format before exporting them to external FTP servers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Export occurs every (interval) | Interval at which the working log should be cleared by moving data to the FTP server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Export Server                  | <p>The FTP export feature can support up to four servers. Each server must be configured with a username, password, and directory that are valid for that server.</p> <ul style="list-style-type: none"> <li>• Export Server—The IP address or hostname of the FTP server.</li> <li>• Name—The user ID of the account used to access the FTP server.</li> <li>• Password/Confirm Password—The password of the FTP user account specified in the Name field. You must enter this password in both the Password and Confirm Password fields.</li> <li>• Directory—The name of a working directory that will contain the transaction logs on the FTP server. The user specified in the Name field must have write permission to this directory.</li> <li>• SFTP—If the specified FTP server is a secure FTP server, place a check in the SFTP check box.</li> </ul> |

**Step 8** Click **Submit**.

A “Click Submit to Save” message appears in red next to the Current Settings line when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured settings by clicking **Reset**. The Reset button is visible only when you have applied default or group settings to change the current device settings but have not yet submitted the changes.

If you try to leave this window without saving the modified settings, a warning dialog box prompts you to submit the changes. This dialog box only appears if you are using the Internet Explorer browser.

To enable and configure transaction logging from the CLI, you can use the **transaction-logs** global configuration command.

## Transaction Logs

TFO transaction logs are kept on the local disk in the directory `/local1/logs/tfo`. Video (Windows media) logs are kept in the directory `/local1/logs/wmt/wms-90`.

When you enable transaction logging, you can specify the interval at which the working log should be archived by moving the data to an archive log. The archive log files are located on the local disk in the directory `/local1/logs/`.

Because multiple archive files are saved, the filename includes the time stamp when the file was archived. Because the files can be exported to an FTP/SFTP server, the filename also contains the IP address of this WAAS device.

The archive filenames for TFO transactions use this format:

tfo\_IPADDRESS\_YYYYMMDD\_HHMMSS.txt.

The archive filenames for Windows media transactions use this format:

wms\_90\_IPADDRESS\_YYYYMMDD\_HHMMSS.txt.

## Viewing the System Message Log

Using the system message log feature of the WAAS Central Manager GUI, you can view information about events that have occurred in your WAAS network. The WAAS Central Manager logs messages from registered devices with a severity level of “warning” or higher.

To view logged information for your WAAS network, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > Logs > System Messages**. The System Message Log window appears. (See [Figure 16-16](#).)

**Figure 16-16** System Message Log

| Time                         | Node Type | Node Name            | Module    | Severity | Description                                                        |
|------------------------------|-----------|----------------------|-----------|----------|--------------------------------------------------------------------|
| Wed Jul 23 01:05:57 UTC 2008 | CM        | DC1-WAE-01.cisco.com | ServantCe | info     | CM sends device a full update                                      |
| Wed Jul 23 01:05:57 UTC 2008 | CM        | DC1-WAE-01.cisco.com | ServantCe | info     | CM sends device a full update                                      |
| Wed Jul 23 01:05:52 UTC 2008 | CM        | DC1-WAE-01.cisco.com | ServantCe | info     | CM sends device a full update                                      |
| Wed Jul 23 01:05:52 UTC 2008 | CM        | DC1-WAE-01.cisco.com | ServantCe | info     | CM sends device a full update                                      |
| Wed Jul 23 01:05:51 UTC 2008 | CM        | DC1-WAE-01.cisco.com | ServantCe | info     | CM sends device a full update                                      |
| Wed Jul 23 01:05:51 UTC 2008 | CM        | DC1-WAE-01.cisco.com | ServantCe | info     | CM sends device a full update                                      |
| Wed Jul 23 01:05:50 UTC 2008 | CM        | DC1-WAE-01.cisco.com | Server    | info     | The device is operational and ready to participate in the network. |
| Wed Jul 23 01:05:50 UTC 2008 | CM        | DC1-WAE-01.cisco.com | Server    | info     | The device is operational and ready to participate in the network. |
| Wed Jul 23 01:05:50 UTC 2008 | CM        | DC1-WAE-01.cisco.com | Server    | info     | Server started                                                     |

- Step 2** From the System Message Log drop-down list, choose one of the following types of messages to display:

- All
- CLI
- Critical
- Database

- Step 3** (Optional) Click a column heading by node type, node name, module, or message text to sort the messages. By default, messages are listed chronologically.



**Note** If no name is available for a node, the name displayed is “Unavailable.” This might occur if the node has been deleted or has been reregistered with WAAS software.

- Step 4** (Optional) Truncate the message log so that not as many messages appear in the table, by completing the following steps:

- a. Click the **Truncate** icon in the taskbar. The Truncate System Message Log window appears.
- b. Choose one of the following options:



- **Size Truncation**—Limits the messages in the log to the number you specify. The log uses a first in, first out process to remove old messages once the log reaches the specified number.
- **Date Truncation**—Limits the messages in the log to the number of days you specify.
- **Message Truncation**—Removes messages from the log that match the specified pattern.

c. Click **Submit** when finished specifying the truncation parameters.

**Step 5** If you have many event messages, you may need to view multiple pages to view the activity in which you are interested. Click the forward (>>) and back (<<) buttons to move between pages. Alternatively, click the link for a specific page number to jump to that page.

## Viewing the Audit Trail Log

The WAAS Central Manager logs user activity in the system. The only activities that are logged are those that change the WAAS network. This feature provides accountability for users' actions by describing the time and action of the task. Logged activities include the following:

- Creation of WAAS network entities
- Modification and deletion of WAAS network entities
- System configurations

To view audit trail logs, follow these steps:

**Step 1** From the WAAS Central Manager GUI navigation pane, choose **Admin > Logs > Audit Trail Logs**.

The Audit Log window appears. (See [Figure 16-17](#).) All logged transactions in the WAAS Central Manager are listed by date and time, user, actual transaction that was logged, and the IP address of the machine that was used.

**Figure 16-17** Audit Log Window

| When                                    | Who   | What                                  | Where        |
|-----------------------------------------|-------|---------------------------------------|--------------|
| Friday, July 18, 2008 6:06:20 PM GMT    | admin | Modify Cdm doc-waas-cm                | 10.21.91.252 |
| Friday, July 18, 2008 6:05:27 PM GMT    | admin | Modify Content Engine doc-waas-wae    | 10.21.91.252 |
| Wednesday, July 16, 2008 1:14:35 AM GMT | admin | Modify Preposition Directive Test2    | 10.21.85.236 |
| Wednesday, July 16, 2008 1:12:29 AM GMT | admin | Configure                             | 10.21.85.236 |
| Wednesday, July 16, 2008 1:09:24 AM GMT | admin | Create Preposition Directive Test2    | 10.21.85.236 |
| Wednesday, July 16, 2008 1:06:41 AM GMT | admin | Configure Content Engine doc-waas-wae | 10.21.85.236 |
| Monday, July 14, 2008 6:57:46 PM GMT    | admin | Configure Content Engine doc-waas-wae | 10.21.79.49  |

**Step 2** Choose a number from the Rows drop-down list to determine the number of rows that you want to display.



## Viewing the Device Log

To view information about events that have occurred on a specific device in your WAAS network, you can use the system message log feature available in the WAAS Central Manager GUI.

To view events that have occurred on your entire WAAS network, see the [“Viewing the System Message Log” section on page 16-35](#).

To view the logged information for a WAAS device, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**. The Devices window appears.
  - Step 2** Click the **Edit** icon next to the device for which you want to view the system message log details. The Device Dashboard window appears.
  - Step 3** In the navigation pane, choose **Admin > Logs**. The System Message Log for Device window appears.
  - Step 4** Choose the type of messages to be displayed from the System Message Log drop-down list.  
You can view the following types of messages in the system log:
    - All (default)
    - CLI
    - Critical
    - Database
  - Step 5** Click a column heading to arrange the messages chronologically by node type, node name, or module. By default, messages are displayed chronologically.  
If no name is available for a node because the node has been deleted or reregistered with the WAAS software, the message displayed is “Unavailable.”
  - Step 6** If you have many event messages, you may need to use the forward (>>) and back (<<) buttons to move between pages. Alternatively, click the link for a specific page number to move to that particular page.
- 

## Enabling the Kernel Debugger

The WAAS Central Manager GUI allows you to enable or disable access to the kernel debugger (kdb). Once enabled, kernel debugger is automatically activated when kernel problems occur.

To enable the kernel debugger, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
  - Step 2** Click the **Edit** icon next to the WAAS device (or device group) that you want to debug.
  - Step 3** In the navigation Pane, choose **Troubleshoot > Kernel Debugger**. The Kernel Debugger window appears.
  - Step 4** Check the **Enable** check box to enable the kernel debugger, and click **Submit**. By default, this option is disabled.
-

## Troubleshooting Using Diagnostic Tests

WAAS includes various troubleshooting tools as described in the following sections:

- [Troubleshooting Using the GUI, page 16-38](#)
- [Troubleshooting Using the CLI, page 16-38](#)

## Troubleshooting Using the GUI

The WAAS Central Manager includes a troubleshooting and diagnostic reporting facility.

To perform diagnostic tests, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**).
- Step 2** Click the **Edit** icon next to the name of the device (or device group) for which you want to perform diagnostic tests.
- Step 3** In the navigation pane, choose **Troubleshoot > Diagnostics Tests**. The Diagnostic Tool window appears.
- Step 4** Check the check box next to each diagnostic test that you want to run, or check the top check box to run all tests. The following tests are available:
- Device Operation—Check device status, presence of coredump files or alarms of major or critical severity.
  - Basic Configuration—Check device basic network configuration.
  - Basic Connectivity—Check device connectivity to configured external devices (DNS, authentication, NTP servers, etc.).
  - Physical Interface—Check configuration and operation of device physical interfaces.
  - Traffic Optimization—Check TFO configuration and operation.
  - WCCP configuration and operation—Check configuration and operation of WCCP traffic interception.
  - Inline configuration and operation—Check configuration and operation of inline group interfaces.
  - WAFS configuration and operation—Check configuration and operation of WAFS services.
- Step 5** Click **Run**.
- Step 6** View the test results in the lower part of the window. You may have to scroll the window to see all results. For tests that fail, error messages describe the problem and provide recommended solutions.
- 

You can run the same diagnostic tests again and refresh the results by clicking the **Refresh** icon in the taskbar.

To print the results, click the **Print** icon in the taskbar.

## Troubleshooting Using the CLI

You can use the **test EXEC** command to perform diagnostic and connectivity tests.

You can use network-level tools to intercept and analyze packets as they pass through your network. Two of these tools are TCPdump and Tethereal, which you can access from the CLI by using the **tcpdump** and **tethereal EXEC** commands.

The WAAS device also supports multiple debugging modes, reached with the **debug EXEC** command. These modes allow you to troubleshoot problems from configuration errors to print spooler problems. We recommend that you use the **debug** command only at the direction of Cisco TAC.

The output associated with the **debug** command is written to either the syslog file in /local1/syslog.txt or the debug log associated with the module in the file /local1/errorlog/module\_name-errorlog.current.

The output associated with the **debug accelerator name module** command for an application accelerator is written to the file nameao-errorlog.current, where *name* is the accelerator name. The accelerator information manager debug output is written to the file aoim-errorlog.current.

The debug log file associated with a module will be rotated to a backup file when the current file reaches its maximum size. The backup files are named as follows: *name-errorlog.#*, where # is the backup file number.

For any **debug** command, system logging must be enabled. The command to enable logging is the **logging disk enable** global configuration command, which is enabled by default.

If a **debug** command module uses the syslog for debug output, then the **logging disk priority debug** global configuration command must be configured (the default is **logging disk priority notice**).

If a **debug** command module uses the debug log for output, then the output can be filtered based on priority level configuration for the four different levels of debug log output, as follows:

- For filtering on critical debug messages only, use the following global configuration command: **logging disk priority critical**.
- For filtering on critical and error level debug messages, use the following global configuration command: **logging disk priority error**.
- For filtering on critical, error, and trace debug level debug messages, use the following global configuration command: **logging disk priority debug**.
- For seeing all debug log messages, which include critical, error, trace and detail messages, use the following global configuration command: **logging disk priority detail**.

Regardless of the priority level configuration, any syslog messages at the LOG\_ERROR or higher priority will be automatically written to the debug log associated with a module.

For more details on these CLI commands, see the *Cisco Wide Area Application Services Command Reference*.

## Using the show and clear Commands from the WAAS Central Manager GUI

To use the WAAS Central Manager GUI **show** and **clear** command tool, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices**.
- Step 2** Click the **Edit** icon next to the device for which you want to issue a **show** or **clear** command.
- Step 3** From navigation pane, choose **Admin > Show/Clear Commands** and then click either **Show Commands** or **Clear Commands**.
- Step 4** From the drop-down list, choose a **show** or **clear** command.

**Step 5** Enter arguments for the command, if any.

**Step 6** Click **Submit** to display the command output.

A window appears, displaying the command output for that device.

---

You can also use the **show EXEC** commands from the CLI. For more information, see the *Cisco Wide Area Application Services Command Reference*.



# CHAPTER 17

## Configuring SNMP Monitoring

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This chapter describes how to configure SNMP traps, recipients, community strings and group associations, user security model groups, and user access permissions.



### Note

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Throughout this chapter, the term WAAS device is used to refer collectively to the WAAS Central Managers and WAEs in your network. The term WAE refers to WAE appliances and WAE Network Modules (the NME-WAE family of devices).

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This chapter contains the following sections:

- [About SNMP, page 17-1](#)
- [Checklist for Configuring SNMP, page 17-8](#)
- [Preparing for SNMP Monitoring, page 17-9](#)
- [Enabling SNMP Traps, page 17-9](#)
- [Defining SNMP Traps, page 17-12](#)
- [Specifying the SNMP Host, page 17-13](#)
- [Specifying the SNMP Community String, page 17-14](#)
- [Creating SNMP Views, page 17-16](#)
- [Creating an SNMP Group, page 17-17](#)
- [Creating an SNMP User, page 17-18](#)
- [Configuring SNMP Asset Tag Settings, page 17-19](#)
- [Configuring SNMP Contact Settings, page 17-20](#)

## About SNMP

Simple Network Management Protocol (SNMP) is an interoperable standards-based protocol that allows for external monitoring of WAAS devices through an SNMP agent.

An SNMP-managed network consists of the following primary components:

- **Managed device**—A network node that contains an SNMP agent and resides on a managed network. Managed devices include routers, access servers, switches, bridges, hubs, computer hosts, and printers. Each WAAS device running the WAAS software has an SNMP agent.

- **SNMP agent**—A software module that resides on a managed device. An agent has local knowledge of management information and translates that information into a form compatible with SNMP. The SNMP agent gathers data from the Management Information Base (MIB), which is the repository for information about device parameters and network data. The agent can also send traps, or notification of certain events, to the management system.
- **Management station**—Also known as the SNMP host, the management station uses SNMP to send the agent an SNMP Get request to obtain information from the WAAS device. The managed devices then collect and store management information and use SNMP to make this information available to the management station.

Before you can access this SNMP information, you must have deployed an SNMP management application on a management station. This SNMP management station is referred to as the SNMP host because it uses SNMP to send the device agent an SNMP Get request to obtain information from the WAAS device.

This section contains the following topics:

- [SNMP Communication Process, page 17-2](#)
- [Supported SNMP Versions, page 17-3](#)
- [SNMP Security Models and Security Levels, page 17-3](#)
- [Supported MIBs, page 17-4](#)
- [Downloading MIB Files to a WAAS Device, page 17-7](#)
- [Enabling the SNMP Agent on a WAAS Device, page 17-8](#)

## SNMP Communication Process

The SNMP management station and the SNMP agent that resides on a WAAS device use SNMP to communicate as follows:

1. The SNMP management station (the SNMP host) uses SNMP to request information from the WAAS device.
2. After receiving these SNMP requests, the SNMP agent on the WAAS device accesses a table that contains information about the individual device. This table, or database, is called a Management Information Base (MIB).

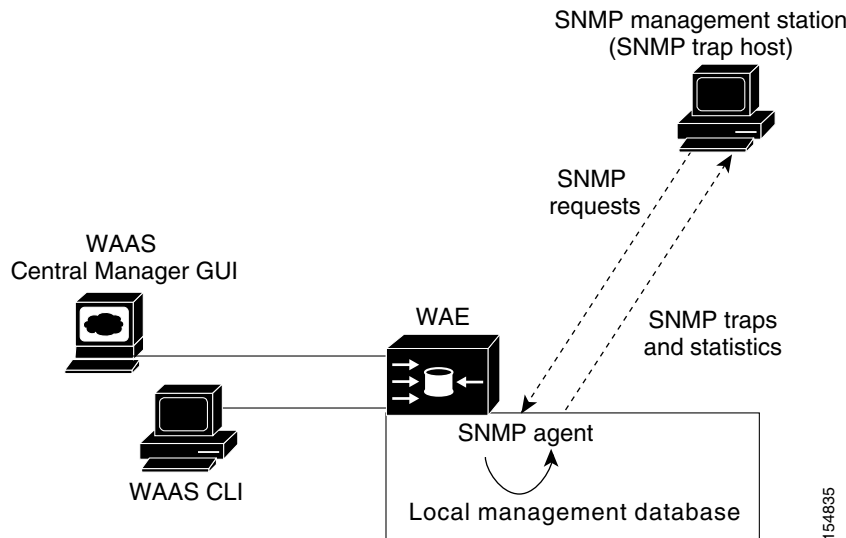


**Note** The SNMP agent on the WAAS device only initiates communication with the SNMP host under unusual conditions; it will initiate communication when it has a trap it needs to send to the host. For more information on this topic, see the [“Enabling SNMP Traps” section on page 17-9](#).

3. After locating the specified information in the MIB, the agent uses SNMP to send the information to the SNMP management station.

[Figure 17-1](#) illustrates these SNMP operations for an individual WAAS device.

Figure 17-1 SNMP Components in a WAAS Network



## Supported SNMP Versions

The WAAS software supports the following versions of SNMP:

- Version 1 (SNMPv1)—This is the initial implementation of SNMP. See the RFC 1157 for a full description of its functionality.
- Version 2 (SNMPv2c)—This is the second release of SNMP, described in RFC 1902. It provides additions to data types, counter size, and protocol operations.
- Version 3 (SNMPv3)—This is the most recent version of SNMP, defined in RFC 2271 through RFC 2275.

Each Cisco device running WAAS software contains the software necessary to communicate information about device configuration and activity using the SNMP protocol.

## SNMP Security Models and Security Levels

SNMPv1 and SNMPv2c do not have any security (that is, authentication or privacy) features to keep SNMP packet traffic confidential. As a result, packets on the wire can be detected and SNMP community strings compromised.

To solve the security shortcomings of SNMPv1 and SNMPv2c, SNMPv3 provides secure access to WAAS devices by authenticating and encrypting packets over the network. The SNMP agent in the WAAS software supports SNMPv3 as well as SNMPv1 and SNMPv2c.

The following security features are provided in SNMPv3:

- Message integrity—Ensures that nothing has interfered with a packet during transmission.
- Authentication—Determines that the message is from a valid source.
- Encryption—Scrambles the contents of a packet to prevent it from being seen by an unauthorized source.

SNMPv3 provides security models as well as security levels. A security model is an authentication process that is set up for a user and the group in which the user resides. A security level is the permitted level of security within a security model. A combination of a security model and a security level determines which security process is used when an SNMP packet is handled. Three security models are available: SNMPv1, SNMPv2c, and SNMPv3.

Table 17-1 describes the combinations of security models and security levels.

**Table 17-1** *SNMP Security Models and Security Levels*

| Model | Level        | Authentication                                        | Encryption | Process                                                                                                                                                                                                                 |
|-------|--------------|-------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| v1    | noAuthNoPriv | Community string                                      | No         | Uses a community string match for user authentication.                                                                                                                                                                  |
| v2c   | noAuthNoPriv | Community string                                      | No         | Uses a community string match for user authentication.                                                                                                                                                                  |
| v3    | noAuthNoPriv | Username                                              | No         | Uses a username match for user authentication.                                                                                                                                                                          |
| v3    | AuthNoPriv   | Message Digest 5 (MD5) or Secure Hash Algorithm (SHA) | No         | Provides authentication based on the Hash-Based Message Authentication Code (HMAC)-MD5 or HMAC-SHA algorithms.                                                                                                          |
| v3    | AuthPriv     | MD5 or SHA                                            | Yes        | Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms. Provides Data Encryption Standard (DES) 56-bit encryption (packet authentication) based on the cipher block chaining (CBC)-DES (DES-56) standard. |

The SNMPv3 agent can be used in the following modes:

- noAuthNoPriv mode (that is, no security mechanisms turned on for packets)
- AuthNoPriv mode (for packets that do not need to be encrypted using the privacy algorithm [DES 56])
- AuthPriv mode (for packets that must be encrypted; privacy requires that authentication be performed on the packet)

Using SNMPv3, users can securely collect management information from their SNMP agents without worrying that the data has been tampered with. Also, confidential information, such as SNMP set packets that change a Content Engine's configuration, can be encrypted to prevent their contents from being exposed on the wire. Also, the group-based administrative model allows different users to access the same SNMP agent with varying access privileges.

## Supported MIBs

This section describes the Cisco-specific MIBs that are supported by WAAS. MIBs are listed in alphabetical order. The following Cisco-specific MIBs are supported:

- [ACTONA-ACTASTOR-MIB](#)
- [CISCO-CDP-MIB](#)
- [CISCO-CONFIG-MAN-MIB](#)
- [CISCO-CONTENT-ENGINE-MIB](#)
- [CISCO-ENTITY-ASSET-MIB](#)
- [CISCO-SMI](#)



- CISCO-TC
- ENTITY-MIB
- EVENT-MIB
- HOST-RESOURCES-MIB
- MIB-II
- SNMP-COMMUNITY-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-NOTIFICATION-MIB
- SNMP-TARGET-MIB
- SNMP-USM-MIB
- SNMPV2-MIB
- SNMP-VACM-MIB

## ACTONA-ACTASTOR-MIB

This MIB provides WAFS statistics and log traps for the WAFS component in WAAS.

## CISCO-CDP-MIB

This MIB displays the ifIndex value of the local interface. For 802.3 repeaters on which the repeater ports do not have ifIndex values assigned, this value is a unique value for the port and is greater than any ifIndex value supported by the repeater. In this example, the specific port is indicated by the corresponding values of cdpInterfaceGroup and cdpInterfacePort, where these values correspond to the group number and the port number values of RFC 1516.

## CISCO-CONFIG-MAN-MIB

This MIB represents a model of configuration data that exists in various locations:

- running—In use by the running system
- terminal—Attached hardware
- local—Saved locally in NVRAM or in flash memory
- remote—Saved to a server on the network

This MIB includes only operations that are specifically related to configuration, although some of the system functions can be used for general file storage and transfer.

## CISCO-CONTENT-ENGINE-MIB

This is the MIB module for the Cisco WAE device from Cisco Systems, Inc. The following objects from this MIB are supported:

- cceAlarmCriticalCount
- cceAlarmMajorCount
- cceAlarmMinorCount

- `cceAlarmHistTableSize`

## CISCO-ENTITY-ASSET-MIB

This MIB monitors the asset information of items in the ENTITY-MIB (RFC 2037) `entPhysicalTable`. This MIB lists the orderable part number, serial number, hardware revision, manufacturing assembly number and revision, firmware ID and revision (if any) and software ID and revision (if any) of relevant entities listed in ENTITY-MIB `entPhysicalTable`.

Entities that have none of this data available are not listed in this MIB. The table in this MIB is sparsely populated, so some variables may not exist for a particular entity at a particular time. For example, a row that represents a powered-off module may have no values for software ID (`ceAssetSoftwareID`) and revision (`ceAssetSoftwareRevision`). Similarly, a power supply would probably never have firmware or software information listed in the table.

Although the data may have other items encoded in it (for example, a manufacturing date in the serial number), consider all data items to be a single unit. Do not decompose the items or parse them. Use only string equal and unequal operations on them.

## CISCO-SMI

This is the MIB module for Cisco Enterprise Structure of Management Information.

## CISCO-TC

This is the MIB module for Cisco MIB Textual Conventions.

## ENTITY-MIB

This is the MIB module for representing multiple logical entities supported by a single SNMP agent. This MIB is documented in RFC 2737. The following groups from this MIB are supported:

- `entityPhysicalGroup`
- `entityPhysical2Group`
- `entityGeneralGroup`
- `entityNotificationsGroup`

The `entConfigChange` notification is supported.

## EVENT-MIB

This MIB defines event triggers and actions for network management purposes. The MIB is published as RFC 2981.

## HOST-RESOURCES-MIB

This MIB manages host systems. The term “host” implies any computer that communicates with other similar computers connected to the Internet. The HOST-RESOURCES-MIB does not necessarily apply to devices whose primary function is communications services (terminal servers, routers, bridges, monitoring equipment). This MIB provides attributes that are common to all Internet hosts, for example, personal computers and systems that run variants of UNIX.

## MIB-II

MIB-II is the Internet Standard MIB. The MIB-II is documented in RFC 1213 and is for use with network management protocols in TCP/IP-based internets. This MIB is found in the RFC1213-MIB file.

## SNMP-COMMUNITY-MIB

This MIB is documented in RFC 2576.

## SNMP-FRAMEWORK-MIB

This MIB is documented in RFC 2571.

## SNMP-NOTIFICATION-MIB

This MIB is documented in RFC 3413.

## SNMP-TARGET-MIB

This MIB is documented in RFC 3413.

## SNMP-USM-MIB

This MIB is documented in RFC 2574.

## SNMPV2-MIB

This MIB is documented in RFC 1907. This MIB supports the following notifications:

- coldStart
- warmStart
- linkUp (not supported in WAAS)
- linkDown (not supported in WAAS)
- authenticationFailure
- egpNeighborLoss

## SNMP-VACM-MIB

This MIB is documented in RFC 2575.

## Downloading MIB Files to a WAAS Device

You can download the MIB files for most of the MIBS that are supported by a device that is running the WAAS software from the following Cisco FTP site:

<ftp://ftp.cisco.com/pub/mibs/v2>

You can download the RFC1213-MIB file (for MIB-II) from the following Cisco FTP site:

<ftp://ftp.cisco.com/pub/mibs/v1>

The MIB objects that are defined in each MIB are described in the MIB files at the above FTP sites and are self-explanatory.

## Enabling the SNMP Agent on a WAAS Device

By default, the SNMP agent on WAAS devices is disabled and an SNMP community string is not defined. The SNMP community string is used as a password for authentication when accessing the SNMP agent on a WAAS device. To be authenticated, the Community Name field of any SNMP message sent to the WAAS device must match the SNMP community string defined on the WAAS device.

The SNMP agent on a WAAS device is enabled when you define the SNMP community string on the device. The WAAS Central Manager GUI allows you to define the SNMP community string on a device or device group.

If the SNMPv3 protocol is going to be used for SNMP requests, the next step is to define an SNMP user account that can be used to access a WAAS device through SNMP. For more information on how to create an SNMPv3 user account on a WAAS device, see the “[Creating an SNMP User](#)” section on [page 17-18](#).

## Checklist for Configuring SNMP

[Table 17-2](#) describes the process for enabling SNMP monitoring on a WAAS device or device group.

**Table 17-2** Checklist for Configuring SNMP

| Task                                                   | Additional Information and Instructions                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Prepare for SNMP monitoring.                        | For more information, see the “ <a href="#">Preparing for SNMP Monitoring</a> ” section on <a href="#">page 17-9</a> .                                                                                                                                                                                                                                |
| 2. Select the SNMP traps that you want to enable.      | The WAAS Central Manager provides a wide-range of traps that you can enable on a WAAS device or device group.<br><br>For more information, see the “ <a href="#">Enabling SNMP Traps</a> ” section on <a href="#">page 17-9</a> . To define additional traps, see the “ <a href="#">Defining SNMP Traps</a> ” section on <a href="#">page 17-12</a> . |
| 3. Specify the SNMP host that receives the SNMP traps. | Specify the SNMP host to that the WAAS device or device group should send their traps to. You can specify multiple hosts so different WAAS devices send traps to different hosts.<br><br>For more information, see the “ <a href="#">Specifying the SNMP Host</a> ” section on <a href="#">page 17-13</a> .                                           |
| 4. Specify the SNMP community string.                  | Specify the SNMP community string so external users can read or write to the MIB.<br><br>For more information, see the “ <a href="#">Specifying the SNMP Community String</a> ” section on <a href="#">page 17-14</a> .                                                                                                                               |
| 5. Set up SNMP views.                                  | To restrict an SNMP group to a specific view, you must create a view that specifies the MIB subtree that you want the group to view.<br><br>For more information, see the “ <a href="#">Creating SNMP Views</a> ” section on <a href="#">page 17-16</a> .                                                                                             |

Table 17-2 Checklist for Configuring SNMP (continued)

| Task                                | Additional Information and Instructions                                                                                                                                                                                                                                                                            |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. Create an SNMP group.            | You must set up an SNMP group if are going to create any SNMP users or want to restrict a group to view a specific MIB subtree.<br><br>For more information, see the “ <a href="#">Creating an SNMP Group</a> ” section on <a href="#">page 17-17</a> .                                                            |
| 7. Create an SNMP user.             | If the SNMPv3 protocol is going to be used for SNMP requests, you must create at least one SNMPv3 user account on the WAAS device in order for the WAAS device to be accessed through SNMP.<br><br>For more information, see the “ <a href="#">Creating an SNMP User</a> ” section on <a href="#">page 17-18</a> . |
| 8. Configure SNMP contact settings. | For more information, see the “ <a href="#">Configuring SNMP Contact Settings</a> ” section on <a href="#">page 17-20</a> .                                                                                                                                                                                        |

## Preparing for SNMP Monitoring

Before you configure your WAAS network for SNMP monitoring, complete the following preparation tasks:

- Set up the SNMP host (management station) that the WAAS devices will use to send SNMP traps.
- Determine if all your WAAS devices will be sending traps to the same host, or to different hosts. Write down the IP address or hostname of each SNMP host.
- Obtain the community string used to access the SNMP agents.
- Determine if you want to create SNMP groups so you can restrict views by group.
- Determine what additional SNMP traps you need.

## Enabling SNMP Traps

To enable a WAAS device to send SNMP traps, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears depending on your selection.
- Step 2** Click the **Edit** icon next to the device or device group that you want to configure SNMP traps for. The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > General Settings**. The SNMP General Settings window appears. (See [Figure 17-2](#).) [Table 17-3](#) describes the fields in this window.

Figure 17-2 SNMP General Settings Window

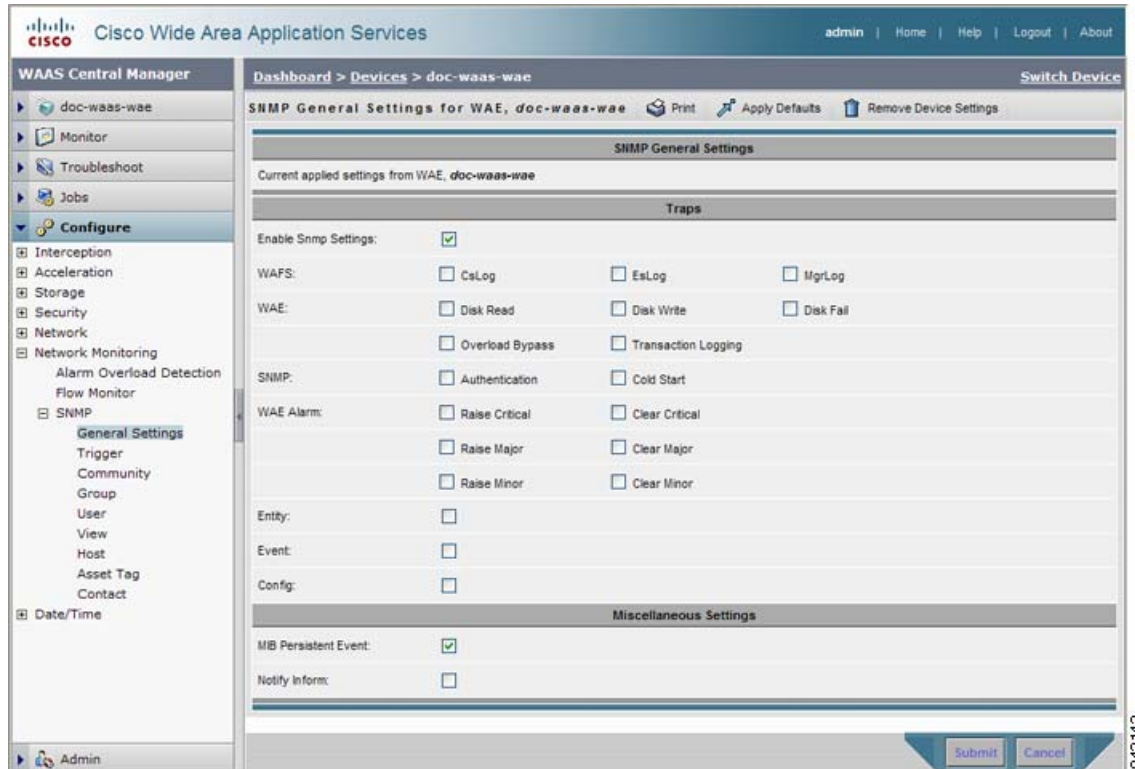


Table 17-3 SNMP General Settings

| GUI Parameter        | Function                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Traps</b>         |                                                                                                                                                                                                                                                                                                                                                                             |
| Enable Snmp Settings | Enables SNMP traps.                                                                                                                                                                                                                                                                                                                                                         |
| WAFS                 | Enables SNMP WAFS traps: <ul style="list-style-type: none"> <li>• CsLog—Enables WAFS legacy mode Core Server error traps.</li> <li>• EsLog—Enables WAFS legacy mode Edge Server error traps.</li> <li>• MgrLog—Enables WAAS Central Manager error traps.</li> </ul>                                                                                                         |
| WAE                  | Enables SNMP WAE traps: <ul style="list-style-type: none"> <li>• Disk Read—Enables disk read error trap.</li> <li>• Disk Write—Enables disk write error trap.</li> <li>• Disk Fail—Enables disk failure error trap.</li> <li>• Overload Bypass—Enables WCCP overload bypass error trap.</li> <li>• Transaction Logging—Enables transaction log write error trap.</li> </ul> |
| SNMP                 | Enables SNMP-specific traps: <ul style="list-style-type: none"> <li>• Authentication—Enables authentication trap.</li> <li>• Cold Start—Enables cold start trap.</li> </ul>                                                                                                                                                                                                 |

Table 17-3 *SNMP General Settings (continued)*

| GUI Parameter                 | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WAE Alarm                     | Enables WAE alarm traps: <ul style="list-style-type: none"> <li>• Raise Critical—Enables raise-critical alarm trap</li> <li>• Clear Critical—Enables clear-critical alarm trap</li> <li>• Raise Major—Enables raise-major alarm trap</li> <li>• Clear Major—Enables clear-major alarm trap</li> <li>• Raise Minor—Enables raise-minor alarm trap</li> <li>• Clear Minor—Enables clear-minor alarm trap</li> </ul>                                                                                                                                                              |
| Entity                        | Enables SNMP entity traps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Event                         | Enables the Event MIB.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Config                        | Enables CiscoConfigManEvent error traps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Miscellaneous Settings</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| MIB Persistent Event          | Enables persistence for the SNMP Event MIB.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notify Inform                 | Enables the SNMP notify inform request. Inform requests are more reliable than traps but consume more resources in the router and in the network.<br><br>Traps are unreliable because the receiver does not send any acknowledgment when it receives a trap. The sender cannot determine if the trap was received. However, an SNMP manager that receives an inform request acknowledges the message with an SNMP response. If the sender never receives a response, the inform request can be sent again. Thus, informs are more likely to reach their intended destinations. |

**Step 4** Check the appropriate check boxes to enable SNMP traps.

**Step 5** Click **Submit**.

A “Click Submit to Save” message appears in red next to the current settings when there are pending changes to be saved after you have applied default or device group settings. You can also revert to the previously configured window settings by clicking **Reset**. The Reset button is visible only when you apply default or device group settings to change the current device settings but the settings have not yet been submitted.

To enable SNMP traps from the CLI, you can use the **snmp-server enable traps** global configuration command.

To define additional SNMP traps for other MIB objects of interest to your particular configuration, see the “[Defining SNMP Traps](#)” section on page 17-12.

# Defining SNMP Traps

To define additional SNMP traps for other MIB objects of interest to your particular configuration, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears depending on your selection.
- Step 2** Click the **Edit** icon next to the device or device group that you want to define SNMP traps for. The Device Dashboard window appears.
- Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > Trigger**. The SNMP Trigger List Entries window appears. The columns in this window are the same as the parameters described in [Table 17-5](#).
- Step 4** In the taskbar, click the **Create New SNMP Trigger List Entry** icon. The Creating New SNMP Trigger window appears. [Table 17-4](#) describes the fields in this window.

**Table 17-4** Creating New SNMP Trigger Settings

| GUI Parameter | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MIB Name      | MIB variable name of the object that you want to monitor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Wild Card     | (Optional) Check this check box if the MIB Name value is a wildcard.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Frequency     | Number of seconds (60–600) to wait between trigger samples.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Test          | <p>Test used to trigger the SNMP trap. Choose one of the following tests:</p> <ul style="list-style-type: none"> <li>• <b>absent</b>—A specified MIB object that was present at the last sampling is no longer present as of the current sampling.</li> <li>• <b>equal</b>—The value of the specified MIB object is equal to the specified threshold.</li> <li>• <b>falling</b>—The value of the specified MIB object has fallen below the specified threshold value. After a trap is generated against this condition, another trap for this same condition is not generated until the sampled MIB object value rises above the threshold value and then falls below the falling threshold value again.</li> <li>• <b>greater-than</b>—The value of the specified MIB object is greater than the specified threshold value.</li> <li>• <b>less-than</b>—The value of the specified MIB object is less than the specified threshold value.</li> <li>• <b>on-change</b>—The value of the specified MIB object has changed since the last sampling.</li> <li>• <b>present</b>—A specified MIB object is present as of the current sampling that was not present at the previous sampling.</li> <li>• <b>rising</b>—The value of the specified MIB object has risen above the specified threshold. After a trap is generated against this condition, another trap for this same condition is not generated until the sampled MIB object value falls below the threshold value and then rises above the rising threshold value again.</li> </ul> |



**Table 17-4** *Creating New SNMP Trigger Settings (continued)*

| GUI Parameter                    | Function                                                                                                                                                                                                                                                                                                                |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sample Type                      | (Optional) Sample type, as follows: <ul style="list-style-type: none"> <li>absolute—The test is evaluated against a fixed integer value between zero and 4294967295.</li> <li>delta—The test is evaluated against the change in the MIB object value between the current sampling and the previous sampling.</li> </ul> |
| Threshold Value                  | Threshold value of the MIB object. This field is not used if absent, on-change, or present is chosen in the Test drop-down list.                                                                                                                                                                                        |
| MIB Var1<br>MIB Var2<br>MIB Var3 | (Optional) Names of up to three alternate MIB variables to add to the notification. Validation of these names is not supported, so be sure to enter them correctly.                                                                                                                                                     |
| Comments                         | Description of the trap.                                                                                                                                                                                                                                                                                                |

- Step 5** In the appropriate fields, enter the MIB name, frequency, test, sample type, threshold value, and comments.
- Step 6** Click **Submit**.

The new SNMP trap is listed in the SNMP Trigger List window.

You can edit an SNMP trap by clicking the **Edit** icon next to the MIB name in the SNMP Trigger List Entries window.

You can delete an SNMP trap by clicking the **Edit** icon next to the MIB name and then clicking the **Delete** taskbar icon.

You can use the **snmp trigger EXEC** command to define SNMP traps from the CLI.

## Aggregating SNMP Traps

An individual WAE device can have custom SNMP traps defined and can belong to device groups that have other custom SNMP traps defined.

In the SNMP Trigger List Entries window, the Aggregate Settings radio button controls how SNMP traps are aggregated for an individual device, as follows:

- Choose **Yes** if you want to configure the device with all custom SNMP traps that are defined for itself and for device groups to which it belongs.
- Choose **No** if you want to limit the device to just the custom SNMP traps that are defined for itself.

When you change the setting, you get the following confirmation message: “This option will take effect immediately and will affect the device configuration. Do you wish to continue?” Click **OK** to continue.

## Specifying the SNMP Host

Hosts are listed in the order in which they have been created. The maximum number of SNMP hosts that can be created is four.

To specify the SNMP host, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.
- Step 2** Click the **Edit** icon next to the device or device group for which you want to define an SNMP host. The Device Dashboard window or the Modifying Device Groups window appears.
- Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > Host**. The SNMP Hosts window appears.
- Step 4** In the taskbar, click the **Create New SNMP Host** icon. The Creating New SNMP Host window appears. [Table 17-5](#) describes the fields in this window.

**Table 17-5** *SNMP Host Settings*

| GUI Parameter  | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trap Host      | Hostname or IP address of the SNMP trap host that is sent in SNMP trap messages from the WAE. This is a required field.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Community/User | Name of the SNMP community or user (256 characters maximum) that is sent in SNMP trap messages from the WAE. This is a required field.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Authentication | Security model to use for sending notification to the recipient of an SNMP trap operation. Choose one of the following options from the drop-down list: <ul style="list-style-type: none"> <li>• <b>No-auth</b>—Sends notification without any security mechanism.</li> <li>• <b>v2c</b>—Sends notification using Version 2c security.</li> <li>• <b>v3-auth</b>—Sends notification using SNMP Version 3 AuthNoPriv.</li> <li>• <b>v3-noauth</b>—Sends notification using SNMP Version 3 NoAuthNoPriv security.</li> <li>• <b>v3-priv</b>—Sends notification using SNMP Version 3 AuthPriv security.</li> </ul> |
| Retry          | Number of retries (1–10) allowed for the inform request. The default is 2 tries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Timeout        | Timeout for the inform request in seconds (1–1000). The default is 15 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

- Step 5** Enter the hostname or IP address of an SNMP trap host, SNMP community or user name, security model to send notification, and retry count and timeout for inform requests.
- Step 6** Click **Submit**.
- 

To specify the SNMP host from the CLI, you can use the **snmp-server host** global configuration command.

## Specifying the SNMP Community String

An SNMP community string is the password used to access an SNMP agent that resides on WAAS devices. There are two types of community strings: group and read-write. Community strings enhance the security of your SNMP messages.

Community strings are listed in the order in which they have been created. The maximum number of SNMP communities that can be created is ten. By default, an SNMP agent is disabled, and a community string is not configured. When a community string is configured, it permits read-only access to all agents by default.

To enable the SNMP agent and configure a community string to permit access to the SNMP agent, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.
- Step 2** Click the **Edit** icon next to the device or device group for which you want to configure an SNMP community setting.
- Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > Community**. The SNMP Community Strings window appears.
- Step 4** In the taskbar, click the **Create New SNMP Community String** icon. The Creating New SNMP Community String window appears. [Table 17-6](#) describes the fields in this window.

**Table 17-6** *SNMP Community Settings*

| GUI Parameter | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Community     | Community string used as a password for authentication when you access the SNMP agent of the WAE. The “Community Name” field of any SNMP message sent to the WAE must match the community string defined here in order to be authenticated. Entering a community string enables the SNMP agent on the WAE. You can enter a maximum of 256 characters in this field.<br>This is a required field.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Group name/rw | Group to which the community string belongs. The Read/Write option allows a read or write group to be associated with this community string. The Read/Write option permits access to only a portion of the MIB subtree. Choose one of the following three options from the drop-down list: <ul style="list-style-type: none"> <li>• <b>None</b>—Choose this option if you do not want to specify a group name to be associated with the community string. The Group Name field remains disabled if you select this option.</li> <li>• <b>Group</b>—Choose this option if you want to specify a group name.</li> <li>• <b>Read/Write</b>—Choose this option if you want to allow read-write access to the group associated with a community string. The Group Name field remains disabled if you select this option.</li> </ul> This is a required field. |
| Group Name    | Name of the group to which the community string belongs. You can enter a maximum of 256 characters in this field. This field is available only if you have chosen the Group option in the previous field.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

- Step 5** In the appropriate fields, enter the community string, choose whether or not read-write access to the group is allowed, and enter the group name.
- Step 6** Click **Submit**.
-

To configure a community string from the CLI, you can use the **snmp-server community** global configuration command.

## Creating SNMP Views

To restrict a group of users to view a specific MIB tree, you must create an SNMP view using the WAAS Central Manager GUI. Once you create the view, you need to create an SNMP group and SNMP users that belong to this group as described in later sections.

Views are listed in the order in which they have been created. The maximum number of views that can be created is ten.

To create a Version 2 SNMP (SNMPv2) MIB view, follow these steps:

- 
- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.
  - Step 2** Click the **Edit** icon next to the device or device group for which you want to create an SNMPv2 view.
  - Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > View**. The SNMP Views window appears.
  - Step 4** In the taskbar, click the **Create New View** icon. The Creating New SNMP View window appears. [Table 17-7](#) describes the fields in this window.

**Table 17-7** SNMPv2 View Settings

| GUI Parameter | Function                                                                                                                                                                                                                                                                                                                                  |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name          | String representing the name of this family of view subtrees (256 characters maximum). The family name must be a valid MIB name such as ENTITY-MIB. This is a required field.                                                                                                                                                             |
| Family        | Object identifier (256 characters maximum) that identifies a subtree of the MIB. This is a required field.                                                                                                                                                                                                                                |
| View Type     | View option that determines the inclusion or exclusion of the MIB family from the view. Choose one of the following two options from the drop-down list: <ul style="list-style-type: none"> <li>• <b>Included</b>—The MIB family is included in the view.</li> <li>• <b>Excluded</b>—The MIB family is excluded from the view.</li> </ul> |

- Step 5** In the appropriate fields, enter the view name, the family name, and the view type.
  - Step 6** Click **Submit**.
  - Step 7** Create an SNMP group that will be assigned to this view as described in the section that follows.
- 

To create an SNMP view from the CLI, you can use the **snmp-server view** global configuration command.

## Creating an SNMP Group


You must set up an SNMP group if you are going to create any SNMP users or want to restrict a group of users to view a specific MIB subtree.

Groups are listed in the order in which they have been created. The maximum number of SNMP groups that can be created is ten.

To define a user security model group, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.
- Step 2** Click the **Edit** icon next to the device or device group for which you want to create an SNMP group. The Device Dashboard or the Modifying Device Group window appears.
- Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > Group**. The SNMP Group Strings for WAE window appears.
- Step 4** In the taskbar, click the **Create New SNMP Group String** icon. The Creating New SNMP Group String for WAE window appears. [Table 17-8](#) describes the fields in this window.

**Table 17-8** *SNMP Group Settings*

| GUI Parameter | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name          | Name of the SNMP group. You can enter a maximum of 256 characters. This is a required field.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Sec Model     | <p>Security model for the group. Choose one of the following options from the drop-down list:</p> <ul style="list-style-type: none"> <li>• <b>v1</b>—Version 1 security model (SNMP Version 1 [noAuthNoPriv]).</li> <li>• <b>v2c</b>—Version 2c security model (SNMP Version 2 [noAuthNoPriv]).</li> <li>• <b>v3-auth</b>—User security level SNMP Version 3 AuthNoPriv.</li> <li>• <b>v3-noauth</b>—User security level SNMP Version 3 noAuthNoPriv.</li> <li>• <b>v3-priv</b>—User security level SNMP Version 3 AuthPriv.</li> </ul> <p> <b>Note</b> A group defined with the SNMPv1 or SNMPv2c security model should not be associated with SNMP users; they should only be associated with the community strings.</p> |
| Read View     | <p>Name of the view (a maximum of 64 characters) that enables you only to view the contents of the agent. By default, no view is defined. In order to provide read access to users of the group, a view must be specified.</p> <p>For information on creating SNMP views, see the <a href="#">“Creating SNMP Views” section on page 17-16</a>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

**Table 17-8** *SNMP Group Settings (continued)*

| GUI Parameter | Function                                                                                                                                                                                                                                                                |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Write View    | Name of the view (a maximum of 64 characters) that enables you to enter data and configure the contents of the agent. By default, no view is defined.<br>For information on creating SNMP views, see the “ <a href="#">Creating SNMP Views</a> ” section on page 17-16. |
| Notify View   | Name of the view (a maximum of 64 characters) that enables you to specify a notify, inform, or trap. By default, no view is defined.<br>For information on creating SNMP views, see the “ <a href="#">Creating SNMP Views</a> ” section on page 17-16.                  |

- Step 5** In the appropriate fields, enter the SNMP group configuration name, the security model, and the names of the read, write, and notify views.
- Step 6** Click **Submit**.
- Step 7** Create SNMP users that belong to this new group as described in the section that follows.

To create an SNMP group from the CLI, you can use the **snmp-server group** global configuration command.

## Creating an SNMP User

Users are listed in the order in which they have been created. The maximum number of users that can be created is ten.

To define a user who can access the SNMP engine, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.
- Step 2** Click the **Edit** icon next to the device or device group for which you want to create an SNMP user.
- Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > User**. A list of SNMP users for the device or device group appears.
- Step 4** In the taskbar, click the **Create New SNMP User** icon. The Creating New SNMP User window appears. [Table 17-9](#) describes the fields in this window.

**Table 17-9** *SNMP User Settings*

| GUI Parameter | Function                                                                                                                               |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Name          | String representing the name of the user (256 characters maximum) who can access the device or device group. This is a required field. |
| Group         | Name of the group (256 characters maximum) to which the user belongs. This is a required field.                                        |

Table 17-9 SNMP User Settings (continued)

| GUI Parameter            | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote SNMP ID           | Globally unique identifier for a remote SNMP entity. To send an SNMPv3 message to the WAE, at least one user with a remote SnmpID must be configured on the WAE. The SnmpID must be entered in octet string format.                                                                                                                                                                                                                                                                                                                                                          |
| Authentication Algorithm | Authentication algorithm that ensures the integrity of SNMP packets during transmission. Choose one of the following three options from the drop-down list: <ul style="list-style-type: none"> <li>• <b>No-auth</b>—Requires no security mechanism to be turned on for SNMP packets.</li> <li>• <b>MD5</b>—Provides authentication based on the hash-based Message Authentication Code Message Digest 5 (HMAC-MD5) algorithm.</li> <li>• <b>SHA</b>—Provides authentication based on the hash-based Message Authentication Code Secure Hash (HMAC-SHA) algorithm.</li> </ul> |
| Authentication Password  | String (256 characters maximum) that configures the user authentication (HMAC-MD5 or HMAC-SHA) password. The number of characters is adjusted to fit the display area if it exceeds the limit for display.<br><br>This field is optional if the <b>no-auth</b> option is chosen for the authentication algorithm. Otherwise, this field must contain a value.                                                                                                                                                                                                                |
| Confirmation Password    | Authentication password for confirmation. The reentered password must be the same as the one entered in the previous field.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Private Password         | String (256 characters maximum) that configures the authentication (HMAC-MD5 or HMAC-SHA) parameters to enable the SNMP agent to receive packets from the SNMP host. The number of characters is adjusted to fit the display area if it exceeds the limit for display.                                                                                                                                                                                                                                                                                                       |
| Confirmation Password    | Private password for confirmation. The reentered password must be the same as the one entered in the previous field.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Step 5** In the appropriate fields, enter the username, the group to which the user belongs, the engine identity of the remote entity to which the user belongs, the authentication algorithm used to protect SNMP traffic from tampering, the user authentication parameters, and the authentication parameters for the packet.

**Step 6** Click **Submit**.

To create an SNMP user from the CLI, you can use the **snmp-server user** global configuration command.

## Configuring SNMP Asset Tag Settings

To configure SNMP asset tag settings, which create values in the CISCO-ENTITY-ASSET-MIB, follow these steps:

**Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.

- Step 2** Click the **Edit** icon next to the device or device group for which you want to define an SNMP asset tag. The Device Dashboard or the Modifying Device Groups window appears.
  - Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > Asset Tag**. The SNMP Asset Tag Settings window appears.
  - Step 4** In the Asset Tag Name field, enter a name for the asset tag.
  - Step 5** Click **Submit**.
- 

To configure SNMP asset tag settings from the CLI, you can use the **asset tag** global configuration command.

## Configuring SNMP Contact Settings

To configure SNMP contact settings, follow these steps:

- Step 1** From the WAAS Central Manager GUI navigation pane, choose **My WAN > Manage Devices** (or **Manage Device Groups**). The Devices or Device Groups window appears.
  - Step 2** Click the **Edit** icon next to the device or device group for which you want to configure an SNMP contact. The Device Dashboard or the Modifying Device Groups window appears.
  - Step 3** In the navigation pane, choose **Configure > Network Monitoring > SNMP > Contact**. The SNMP Contact Settings window appears.
  - Step 4** Enter a contact name and location in the provided fields.
  - Step 5** Click **Submit**.
- 

To configure SNMP contact settings from the CLI, you can use the **snmp-server contact** global configuration command.





# APPENDIX **A**

## Default Application Policies

---

The WAAS software includes over 150 default application policies that help your WAAS system classify and optimize some of the most common traffic on your network.

[Table A-1](#) lists the default applications and classifiers that WAAS will either optimize or pass through based on the policies that are provided with the system.

Before you create a new application policy, we recommend that you review the default policies and modify them as appropriate. Often, you can more easily modify an existing policy than create a new one.

When reviewing [Table A-1](#), note the following information:

- The subheadings represent the application names, and the associated classifiers are listed under these subheadings. For example, Authentication is a type of application and Kerberos is a classifier for that application.
- Applications with the word (*monitored*) next to them are monitored by the WAAS Central Manager, which can display statistics for only 20 applications at a time. To view statistics for one of the unmonitored applications, use one of the following methods:
  - Use the WAAS CLI, which can display statistics for all applications on a WAAS device. For more information, see the *Cisco Wide Area Application Services Command Reference*.
  - Modify the application settings so the WAAS Central Manager GUI displays statistics for the desired application. For more information, see [Chapter 12, “Configuring Application Acceleration.”](#)

The WAAS software uses the following optimization technologies based on the type of traffic that it encounters:

- TFO (transport flow optimization)—A collection of optimization technologies such as automatic windows scaling, increased buffering, and selective acknowledgement that optimize all TCP traffic over your network.
- RE (redundancy elimination)—A compression technology that reduces the size of transmitted data by removing redundant information before sending the shortened data stream over the WAN. RE operates on significantly larger streams and maintains a much larger compression history than LZ compression.
- LZ (compression)—Another compression technology that operates on smaller data streams and keeps limited compression history compared to RE.
- Application accelerator—A collection of individual application accelerators for the following traffic types: CIFS, EPM, HTTP, MAPI, NFS, and streaming video.

Table A-1 Default Traffic Policies

| Classifier                            | WAAS Action | Destination Ports                                   |
|---------------------------------------|-------------|-----------------------------------------------------|
| <b>Authentication</b>                 |             |                                                     |
| Kerberos                              | Passthrough | 88, 2053, 754, 888, 543, 464, 544, 749              |
| SASL                                  | Passthrough | 3659                                                |
| TACACS                                | Passthrough | 49                                                  |
| <b>Backup (monitored)</b>             |             |                                                     |
| Amanda                                | TFO         | 10080                                               |
| BackupExpress                         | TFO         | 6123                                                |
| CommVault                             | TFO         | 8400–8403                                           |
| Connected-DataProtector               | TFO         | 16384                                               |
| IBM-TSM                               | LZ+TFO+DRE  | 1500-1502                                           |
| Legato-NetWorker                      | TFO         | 7937, 7938, 7939                                    |
| Legato-RepliStor                      | TFO         | 7144, 7145                                          |
| Veritas-BackupExec                    | TFO         | 6101, 6102, 6106, 3527, 1125                        |
| Veritas-NetBackup                     | TFO         | 13720, 13721, 13782, 13785                          |
| <b>CAD</b>                            |             |                                                     |
| PDMWorks                              | LZ+TFO+DRE  | 30000, 40000                                        |
| <b>Call-Management</b>                |             |                                                     |
| Cisco-CallManager                     | Passthrough | 2443, 2748                                          |
| SIP-secure                            | Passthrough | 5061                                                |
| VoIP-Control                          | Passthrough | 1300, 2428, 2000–2002, 1718–1720, 5060, 11000–11999 |
| <b>Conferencing</b>                   |             |                                                     |
| CU-SeeMe                              | Passthrough | 7640, 7642, 7648, 7649                              |
| ezMeeting                             | Passthrough | 10101–10103, 26260–26261                            |
| Intel-Proshare                        | Passthrough | 5713–5717                                           |
| MS-NetMeeting                         | Passthrough | 522, 1503, 1731                                     |
| VocalTec                              | Passthrough | 1490, 6670, 25793, 22555                            |
| <b>Console</b>                        |             |                                                     |
| SSL-Shell                             | Passthrough | 614                                                 |
| Telnet                                | Passthrough | 23, 107, 513                                        |
| Telnets                               | Passthrough | 992                                                 |
| Unix-Remote-Execution                 | Passthrough | 514, 512                                            |
| <b>Content-Management (monitored)</b> |             |                                                     |
| Documentum                            | LZ+TFO+DRE  | 1489                                                |
| Filenet                               | LZ+TFO+DRE  | 32768–32774                                         |
| ProjectWise-FileTransfer              | LZ+TFO+DRE  | 5800                                                |

**Table A-1** *Default Traffic Policies (continued)*

| <b>Classifier</b>                                 | <b>WAAS Action</b>              | <b>Destination Ports</b>                                                                                |
|---------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Directory-Services</b> <i>(monitored)</i>      |                                 |                                                                                                         |
| LDAP                                              | LZ+TFO+DRE                      | 389, 8404                                                                                               |
| LDAP-Global-Catalog                               | LZ+TFO+DRE                      | 3268                                                                                                    |
| LDAP-Global-Catalog-Secure                        | Passthrough                     | 3269                                                                                                    |
| LDAP-secure                                       | Passthrough                     | 636                                                                                                     |
| <b>Email-and-Messaging</b> <i>(monitored)</i>     |                                 |                                                                                                         |
| HP-OpenMail                                       | LZ+TFO+DRE                      | 5755, 5757, 5766, 5767, 5768, 5729                                                                      |
| Internet-Mail                                     | LZ+TFO+DRE                      | 25, 110, 143, 220                                                                                       |
| Internet-Mail-secure                              | TFO                             | 995, 993, 465                                                                                           |
| Lotus-Notes                                       | LZ+TFO+DRE                      | 1352                                                                                                    |
| MAPI <sup>1</sup>                                 | LZ+TFO+DRE+<br>MAPI accelerator | UUID:a4f1db00-ca47-1067-b31f-00dd0106<br>62da                                                           |
| MDaemon                                           | LZ+TFO+DRE                      | 3000, 3001                                                                                              |
| NNTP                                              | LZ+TFO+DRE                      | 119                                                                                                     |
| NNTP-secure                                       | TFO                             | 563                                                                                                     |
| Novell-Groupwise                                  | LZ+TFO+DRE                      | 1677, 1099, 9850, 7205, 3800, 7100, 7180,<br>7101, 7181, 2800                                           |
| PCMail-Server                                     | LZ+TFO+DRE                      | 158                                                                                                     |
| QMTTP                                             | LZ+TFO+DRE                      | 209                                                                                                     |
| X400                                              | LZ+TFO+DRE                      | 102                                                                                                     |
| <b>Enterprise-Applications</b> <i>(monitored)</i> |                                 |                                                                                                         |
| SAP                                               | LZ+TFO+DRE                      | 3200-3219, 3221-3224, 3226-3267,<br>3270-3282, 3284-3305, 3307-3388,<br>3390-3399, 3600-3659, 3662-3699 |
| Siebel                                            | LZ+TFO+DRE                      | 8448, 2320, 2321                                                                                        |
| <b>File-System</b> <i>(monitored)</i>             |                                 |                                                                                                         |
| AFS                                               | LZ+TFO+DRE                      | 7000–7009                                                                                               |
| Apple-AFP                                         | LZ+TFO+DRE                      | 548                                                                                                     |
| NFS                                               | LZ+TFO+DRE+<br>NFS accelerator  | 2049                                                                                                    |
| Novell-NetWare                                    | LZ+TFO+DRE                      | 524                                                                                                     |
| Sun-RPC                                           | Passthrough                     | 111                                                                                                     |
| <b>File-Transfer</b> <i>(monitored)</i>           |                                 |                                                                                                         |
| BFTP                                              | LZ+TFO+DRE                      | 152                                                                                                     |
| FTP-Control <sup>2</sup>                          | Passthrough                     | 21                                                                                                      |
| FTP-Data <sup>2</sup>                             | LZ+TFO+DRE                      | src20                                                                                                   |
| FTPS <sup>2</sup>                                 | TFO                             | 990                                                                                                     |

**Table A-1** Default Traffic Policies (continued)

| Classifier               | WAAS Action     | Destination Ports                                                                                                                                                                                                                          |
|--------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FTP-Control <sup>2</sup> | Passthrough     | src989                                                                                                                                                                                                                                     |
| Simple-FTP               | LZ+TFO+DRE      | 115                                                                                                                                                                                                                                        |
| TFTP                     | LZ+TFO+DRE      | 69                                                                                                                                                                                                                                         |
| TFTPS                    | TFO             | 3713                                                                                                                                                                                                                                       |
| <b>Instant Messaging</b> |                 |                                                                                                                                                                                                                                            |
| AOL                      | Passthrough     | 5190–5193                                                                                                                                                                                                                                  |
| Apple-iChat              | Passthrough     | 5297, 5298                                                                                                                                                                                                                                 |
| IRC                      | Passthrough     | 531, 6660–6669                                                                                                                                                                                                                             |
| Jabber                   | Passthrough     | 5222, 5269                                                                                                                                                                                                                                 |
| Lotus-Sametime-Connect   | Passthrough     | 1533                                                                                                                                                                                                                                       |
| MS-Chat                  | Passthrough     | 6665, 6667                                                                                                                                                                                                                                 |
| MSN-Messenger            | Passthrough     | 1863, 6891–6900                                                                                                                                                                                                                            |
| Yahoo-Messenger          | Passthrough     | 5000, 5001, 5050, 5100                                                                                                                                                                                                                     |
| <b>Name Services</b>     |                 |                                                                                                                                                                                                                                            |
| DNS                      | Passthrough     | 53                                                                                                                                                                                                                                         |
| iSNS                     | Passthrough     | 3205                                                                                                                                                                                                                                       |
| Service-Location         | Passthrough     | 427                                                                                                                                                                                                                                        |
| WINS                     | Passthrough     | 42, 137, 1512                                                                                                                                                                                                                              |
| <b>Other (monitored)</b> |                 |                                                                                                                                                                                                                                            |
| Basic-TCP-services       | Passthrough     | 1–19                                                                                                                                                                                                                                       |
| BGP                      | LZ+TFO+DRE      | 179                                                                                                                                                                                                                                        |
| MS-EndPointMapper        | EPM accelerator | 135                                                                                                                                                                                                                                        |
| MS-Message-Queuing       | LZ+TFO+DRE      | 1801, 2101, 2103, 2105                                                                                                                                                                                                                     |
| NTP                      | Passthrough     | 123                                                                                                                                                                                                                                        |
| Other-Secure             | Passthrough     | 261, 448, 684, 695, 994, 2252, 2478, 2479, 2482, 2484, 2679, 2762, 2998, 3077, 3078, 3183, 3191, 3220, 3410, 3424, 3471, 3496, 3509, 3529, 3539, 3660, 3661, 3747, 3864, 3885, 3896, 3897, 3995, 4031, 5007, 5989, 5990, 7674, 9802, 12109 |
| SOAP                     | LZ+TFO+DRE      | 7627                                                                                                                                                                                                                                       |
| Symantec-AntiVirus       | LZ+TFO+DRE      | 2847, 2848, 2967, 2968, 38037, 38292                                                                                                                                                                                                       |
| <b>P2P (monitored)</b>   |                 |                                                                                                                                                                                                                                            |
| BitTorrent               | Passthrough     | 6881–6889, 6969                                                                                                                                                                                                                            |
| eDonkey                  | Passthrough     | 4661, 4662                                                                                                                                                                                                                                 |
| Gnutella                 | Passthrough     | 6346–6349, 6355, 5634                                                                                                                                                                                                                      |
| Grouper                  | Passthrough     | 8038                                                                                                                                                                                                                                       |

**Table A-1** *Default Traffic Policies (continued)*

| <b>Classifier</b>                          | <b>WAAS Action</b>             | <b>Destination Ports</b>                      |
|--------------------------------------------|--------------------------------|-----------------------------------------------|
| HotLine                                    | Passthrough                    | 5500–5503                                     |
| Kazaa                                      | Passthrough                    | 1214                                          |
| Laplink-ShareDirect                        | Passthrough                    | 2705                                          |
| Napster                                    | Passthrough                    | 8875, 7777, 6700, 6666, 6677, 6688            |
| Qnext                                      | Passthrough                    | 44, 5555                                      |
| SoulSeek                                   | Passthrough                    | 2234, 5534                                    |
| WASTE                                      | Passthrough                    | 1337                                          |
| WinMX                                      | Passthrough                    | 6699                                          |
| <b>Printing</b> ( <i>monitored</i> )       |                                |                                               |
| AppSocket                                  | LZ+TFO+DRE                     | 9100                                          |
| IPP                                        | LZ+TFO+DRE                     | 631                                           |
| SUN-Xprint                                 | LZ+TFO+DRE                     | 8100                                          |
| Unix-Printing                              | LZ+TFO+DRE                     | 515, 170                                      |
| <b>Remote-Desktop</b> ( <i>monitored</i> ) |                                |                                               |
| Altiris-CarbonCopy                         | Passthrough                    | 1680                                          |
| Apple-NetAssistant                         | Passthrough                    | 3283                                          |
| Citrix-ICA                                 | LZ+TFO+DRE                     | 1494, 2598                                    |
| ControlIT                                  | TFO                            | 799                                           |
| Danware-NetOp                              | TFO                            | 6502                                          |
| Laplink-Host                               | TFO                            | 1547                                          |
| Laplink-PCSync                             | TFO                            | 8444                                          |
| Laplink-PCSync-secure                      | TFO                            | 8443                                          |
| MS-Terminal-Services                       | TFO                            | 3389                                          |
| Netopia-Timbuku                            | TFO                            | 407, 1417–1420                                |
| PCAnywhere                                 | TFO                            | 73, 5631, 5632, 65301                         |
| RAdmin                                     | TFO                            | 4899                                          |
| Remote-Anything                            | TFO                            | 3999, 4000                                    |
| Vmware-VMConsole                           | TFO                            | 902                                           |
| VNC                                        | TFO                            | 5801–5809, 6900–6909                          |
| XWindows                                   | TFO                            | 6000–6063                                     |
| <b>Replication</b> ( <i>monitored</i> )    |                                |                                               |
| Double-Take                                | LZ+TFO+DRE                     | 1100, 1105                                    |
| EMC-Celerra-Replicator                     | LZ+TFO+DRE                     | 8888                                          |
| MS-AD-Replication <sup>1</sup>             | LZ+TFO+DRE+<br>EPM accelerator | UUID:e3514235-4b06-11d1-ab04-00c04fc2<br>dcd2 |
| MS-Content-Replication-Service             | TFO                            | 560, 507                                      |

**Table A-1** Default Traffic Policies (continued)

| <b>Classifier</b>                     | <b>WAAS Action</b>               | <b>Destination Ports</b>                      |
|---------------------------------------|----------------------------------|-----------------------------------------------|
| MS-FRS <sup>1</sup>                   | LZ+TFO+DRE+<br>EPM accelerator   | UUID:f5cc59b4-4264-101a-8c59-08002b2f<br>8426 |
| Netapp-SnapMirror                     | LZ+TFO+DRE                       | 10565-10569                                   |
| Remote-Replication-Agent              | TFO                              | 5678                                          |
| Rsync                                 | TFO                              | 873                                           |
| <b>SQL (monitored)</b>                |                                  |                                               |
| Borland-Interbase                     | LZ+TFO+DRE                       | 3050                                          |
| IBM-DB2                               | LZ+TFO+DRE                       | 523                                           |
| InterSystems-Cache                    | LZ+TFO+DRE                       | 1972                                          |
| MS-SQL                                | LZ+TFO+DRE                       | 1433                                          |
| MS-SQL-RPC <sup>1</sup>               | LZ+TFO+DRE+<br>EPM accelerator   | UUID:3f99b900-4d87-101b-99b7-aa000400<br>7f07 |
| MySQL                                 | LZ+TFO+DRE                       | 3306                                          |
| Oracle                                | LZ+TFO+DRE                       | 66, 1525, 1521                                |
| Pervasive-SQL                         | LZ+TFO+DRE                       | 1583                                          |
| PostgreSQL                            | LZ+TFO+DRE                       | 5432                                          |
| Scalable-SQL                          | LZ+TFO+DRE                       | 3352                                          |
| SQL-Service                           | LZ+TFO+DRE                       | 156                                           |
| Sybase-SQL                            | LZ+TFO+DRE                       | 1498, 2638, 2439, 3968                        |
| UniSQL                                | LZ+TFO+DRE                       | 1978, 1979                                    |
| <b>SSH</b>                            |                                  |                                               |
| SSH                                   | TFO                              | 22                                            |
| <b>Storage (monitored)</b>            |                                  |                                               |
| EMC-SRDF-A-IP                         | LZ+TFO+DRE                       | 1748                                          |
| FCIP                                  | LZ+TFO+DRE                       | 3225                                          |
| iFCP                                  | LZ+TFO+DRE                       | 3420                                          |
| iSCSI                                 | LZ+TFO+DRE                       | 3260                                          |
| <b>Streaming (monitored)</b>          |                                  |                                               |
| Liquid-Audio                          | LZ+TFO+DRE                       | 18888                                         |
| MS-NetShow                            | LZ+TFO+DRE                       | 1755                                          |
| RTSP                                  | LZ+TFO+DRE+<br>Video accelerator | 554, 8554                                     |
| VDOLive                               | LZ+TFO+DRE                       | 7000                                          |
| <b>Systems-Management (monitored)</b> |                                  |                                               |
| BMC-Patrol                            | Passthrough                      | 6161, 6162, 8160, 8161, 6767, 6768, 10128     |
| HP-OpenView                           | Passthrough                      | 7426–7431, 7501, 7510                         |
| HP-Radia                              | LZ+TFO+DRE                       | 3460, 3461, 3464, 3466                        |

**Table A-1** *Default Traffic Policies (continued)*

| <b>Classifier</b>                     | <b>WAAS Action</b>                                                | <b>Destination Ports</b>         |
|---------------------------------------|-------------------------------------------------------------------|----------------------------------|
| IBM-NetView                           | Passthrough                                                       | 729–731                          |
| IBM-Tivoli                            | LZ+TFO+DRE                                                        | 94, 627, 1965, 1580, 1581        |
| LANDesk                               | LZ+TFO+DRE                                                        | 9535, 9593–9595                  |
| NetIQ                                 | Passthrough                                                       | 2220, 2735, 10113–10116          |
| Netopia-netOctopus                    | Passthrough                                                       | 1917, 1921                       |
| Novell-ZenWorks                       | LZ+TFO+DRE                                                        | 1761–1763, 517, 2544, 8039, 2037 |
| WAAS-FlowMonitor                      | TFO                                                               | 7878                             |
| WBEM                                  | Passthrough                                                       | 5987, 5988                       |
| <b>Version Management (monitored)</b> |                                                                   |                                  |
| Clearcase                             | LZ+TFO+DRE                                                        | 371                              |
| CVS                                   | LZ+TFO+DRE                                                        | 2401                             |
| <b>VPN</b>                            |                                                                   |                                  |
| L2TP                                  | TFO                                                               | 1701                             |
| OpenVPN                               | TFO                                                               | 1194                             |
| PPTP                                  | TFO                                                               | 1723                             |
| <b>WAFS (monitored)</b>               |                                                                   |                                  |
| CIFS                                  | LZ+TFO+DRE+<br>CIFS accelerator or<br>WAFS legacy<br>acceleration | 139, 445                         |
| <b>Web (monitored)</b>                |                                                                   |                                  |
| HTTP                                  | LZ+TFO+DRE+<br>HTTP accelerator                                   | 80, 8080, 8000, 8001, 3128       |
| HTTPS                                 | TFO                                                               | 443                              |

1. These classifiers use the EPM service in WAAS to accelerate traffic. EPM-based applications do not have predefined ports so the application's UUID must be used to identify the traffic.
2. These classifiers identify the source port instead of the destination port.







## INDEX

### A

- AAA accounting
  - configuring [6-30](#)
- AAA-based management systems [2-25, 6-2](#)
- acceleration
  - about [1-6, 12-1](#)
  - features [1-6](#)
  - TCP adaptive buffering settings [12-21](#)
  - TCP settings [12-19](#)
- accelerators
  - enabling [12-2](#)
- accounts
  - creating [7-4](#)
  - creation process [7-2](#)
  - deleting [7-6](#)
  - local CLI [7-2](#)
  - roles-based [7-2](#)
  - types [7-1](#)
  - viewing [7-8](#)
- ACL
  - See also* IP ACL
- action
  - full optimization [12-14](#)
  - passthrough [12-14](#)
  - TFO only [12-14](#)
  - TFO with DRE [12-14](#)
  - TFO with LZ compression [12-14](#)
  - types [12-14](#)
- activating devices [15-29](#)
- adaptive buffering, TFO [12-21](#)
- adding
  - charts [16-11](#)
  - print clusters [13-14](#)
  - printers [13-12](#)
  - print server to clients [13-23](#)
- administrative login authentication and authorization
  - default [6-4](#)
  - for WAEs [6-3](#)
  - local database
    - description of [6-7](#)
  - overview of [6-1](#)
- RADIUS
  - overview of [6-13](#)
- TACACS+
  - overview of [6-15](#)
- administrative login authentication failover [6-26](#)
- aggregate settings
  - for print servers [13-26](#)
- alarm overload detection, enabling [9-19](#)
- alarm panel
  - system dashboard window [16-3](#)
- alarms
  - device reporting [16-5](#)
- alerts [16-6](#)
- aliases, for file servers [11-23](#)
- allowed protocols [13-30](#)
- application acceleration
  - about [1-6, 12-1](#)
  - enabling [12-2](#)
- application classifiers
  - creating [12-9](#)
  - match condition [12-12](#)
  - restoring [12-16](#)
- application definition
  - creating [12-8](#)

application list, viewing [12-15](#)

application policy

- creating [12-9](#)
- creation process [12-7](#)
- position [12-18](#)
- preparation tasks [12-7](#)
- restoring defaults [12-16](#)
- types [12-11](#)

applications

- monitoring [12-17, 16-2](#)

application traffic mix chart [16-11](#)

assigning

- application to a device [12-9](#)
- application to a device group [12-9](#)
- core cluster to file server [11-19](#)
- devices to a preposition directive [11-30](#)
- devices to device groups [3-5](#)
- devices to more than one device group [3-7](#)

audit trail logs

- viewing [6-32, 16-36](#)

authentication

- default feature values [6-4](#)

authentication databases, types of [6-3](#)

authentication servers

- configuring [6-13, 6-15](#)

authorization

- default feature values [6-4](#)

autodiscover [1-17](#)

autoregistration

- DHCP server requirements [2-8](#)

---

## B

backing up

- configuration files [10-7](#)
- WAAS Central Manager [15-11](#)
- WAE devices [15-13](#)

backup and restore

- cms database [15-11](#)

- virtual blade [14-8](#)

banners

- configuring [6-10](#)

baseline groups

- configuring [3-13](#)
- creation process [3-11](#)
- customizing [3-12](#)
- switching [3-13](#)
- types [3-11](#)
- working with [3-11](#)

BIC TCP [1-5](#)

bootflags [15-19](#)

browser support [2-11](#)

---

## C

caching, about [1-18](#)

CDP

- configuring [5-15](#)

cdp enable command [4-39](#)

cdp run command [4-39](#)

Central Manager. *See* WAAS Central Manager

charts

- adding [16-11](#)
- application traffic mix [16-11](#)
- customizing [16-10](#)
- descriptions [16-11](#)
- settings [16-17](#)
- traffic reduction [16-13](#)

CIFS [11-2](#)

CIFS accelerator

- configuring [11-9](#)
- enabling [12-2](#)
- transparent CIFS and legacy modes [11-3](#)

CifsAO WAE Device Manager option [10-19](#)

Cisco.com

- obtaining software files from [15-3](#)

Cisco Discovery Protocol. *See* CDP

classifier, creating [12-9](#)

- classifier report, viewing [12-16](#)
  - clear ip wccp command [4-1](#)
  - clear statistics all command [6-25](#)
  - clear statistics authentication command [6-25](#)
  - clear statistics windows-domain command [6-25](#)
  - CLI user
    - creating [7-4](#)
  - clock
    - setting [9-5](#)
  - clustering in inline mode [4-48](#)
  - cms database
    - backup and restore procedure [15-11](#)
  - cms database backup command [15-11](#)
  - cms database restore command [15-12](#)
  - coherency
    - age-based validation [11-5](#)
  - compression, about [1-5](#)
  - conditions
    - modifying or deleting from IP ACLs [8-7](#)
  - configuration group [3-3](#)
  - configuration process [11-9](#)
  - congestion windows, about [5-12](#)
  - connections
    - creating for WAFS [11-22](#)
    - viewing TCP connections [16-20](#)
  - controlled shutdown [15-30](#)
  - copy disk ftp command [15-12](#)
  - core cluster
    - assigning to file server [11-19](#)
    - connecting to Edge WAEs [11-22](#)
  - core configuration [11-10](#)
  - corrupted system images
    - recovering from [15-17](#)
  - CPU utilization report [16-21](#)
  - creating
    - accounts [7-4](#)
    - application classifier [12-9](#)
    - application definition [12-8](#)
    - application policy [12-9](#)
    - connections for WAFS [11-22](#)
    - local user [7-4](#)
    - match condition [12-12](#)
    - new software file [15-4](#)
    - preposition directive [11-25](#)
    - preposition schedule [11-31](#)
  - current software version
    - determining [15-3](#)
- 
- ## D
- dashboard
    - customizing [16-10](#)
    - device [16-9](#)
    - system [16-2](#)
  - database backup [15-11](#)
  - data coherency, about [11-5](#)
  - data concurrency, about [11-6](#)
  - data migration [2-28](#)
  - data redundancy elimination, about [1-5](#)
  - debug command [16-39](#)
  - default status, restoring [15-13](#)
  - deleting
    - accounts [7-6](#)
    - device groups [3-6](#)
    - locations [3-15](#)
    - roles [7-13](#)
    - software files [15-10](#)
    - user groups [7-19](#)
  - device
    - alarms [16-5](#)
    - autodiscovery [1-17](#)
    - clock setting [9-5](#)
    - rebooting [15-29](#)
  - Device Dashboard window [16-9](#)
  - device groups
    - about [3-1](#)
    - adding and removing devices [3-5](#)
    - configuring [3-4](#)

- creating [3-3](#)
  - creation process [3-2](#)
  - deleting [3-6](#)
  - enabling overlap [3-7](#)
  - force group settings [3-8](#)
  - list [3-7](#)
  - overriding settings [3-8](#)
  - setting configuration precedence [3-9](#)
  - types [3-2](#)
- Device Home window. See Device Dashboard window
- device locations
- about [3-14](#)
  - creating [3-14](#)
  - deleting [3-15](#)
- device logs, viewing [16-37](#)
- device registration information
- recovering [15-21](#)
- devices
- activating [15-29](#)
  - adding to device groups [3-5](#)
  - adding to multiple device groups [3-7](#)
  - impact of assigning to multiple groups [3-10](#)
  - overriding device group settings [3-9](#)
  - restarting [15-29](#)
  - topology [16-19](#)
  - viewing group assignments [3-6](#)
  - viewing information for [16-7, 16-18, 16-20](#)
- Devices window [16-7](#)
- DFS, request interception method [4-50](#)
- DHCP
- configuring interfaces for [5-9](#)
  - for autoregistration [2-8](#)
  - interface-level [2-10](#)
- DHCP server
- requirements for autoregistration [2-8](#)
- directed mode [5-17](#)
- disabling WCCP flow redirection [4-17](#)
- disconnected mode
- about [11-33](#)
  - configuring [11-34](#)
  - requirements [11-34](#)
- disk-based software, missing
- recovering from [15-20](#)
- disk encryption [15-26](#)
- disk handling
- configuring error-handling methods [15-28](#)
- disks
- monitoring [16-22](#)
- distributing drivers [13-19](#)
- DNS, configuring [5-16](#)
- domains
- about [7-14](#)
  - adding entities [7-15](#)
  - assigning to user accounts [7-15](#)
  - assigning to user groups [7-18](#)
  - creating [7-14](#)
  - deleting [7-16](#)
  - modifying and deleting [7-16](#)
  - viewing [7-16](#)
- double-byte language support [11-14](#)
- downgrading [15-3](#)
- DRE, about [1-5](#)
- drivers
- distributing [13-19](#)
  - installing [13-18](#)
  - repository [13-16](#)
- DSCP [11-12, 11-15, 12-12](#)
- global default [12-17](#)
- dynamic shares, creating [11-20](#)

---

## E

- edge configuration [11-13](#)
- egress methods

  - configuring [4-29](#)

- email server settings for reports [9-20](#)
- enable command [6-16](#)

enabling

- core file services [11-10](#)
- edge file services [11-13](#)
- optimization and accelerators [12-2](#)
- print banners [13-30](#)
- print services [13-11](#)
- SNMP [17-9](#)
- SNMP agent [17-8](#)
- traffic statistic collection [12-8](#)
- virtual blade [14-2](#)
- WCCP flow redirection [4-17](#)

encryption

- disk [15-26](#)
- enabling secure store [9-10](#)

entities

- adding to domains [7-15](#)

EPM accelerator

- enabling [12-2](#)

errors

- disk drives [15-28](#)

EtherChannel

- configuring [5-8](#)

Exec timeout

- configuring [6-11](#)

explicit congestion notification

- about [5-12](#)

---

## F

failover, for administrative login authentication [6-26](#)

fast offline detection

- about [9-18](#)
- configuring [9-18](#)

file locking, about [11-6](#)

file server aliases [11-23](#)

File Server Rename utility [10-18](#)

file servers

- registering [11-16](#)
- supported [11-8](#)

file services [11-9](#)

- about [1-7](#)
- enabling on core [11-10](#)
- enabling on edge [11-13](#)
- features [1-7](#)
- preparing for [11-8](#)

firewall, configuring for [5-17](#)

flash memory

- corrupted [15-17](#)

flow monitoring

- configuring [16-23](#)

force group settings [3-8](#)

full optimization action [12-14](#)

---

## G

generic GRE egress method [4-29](#)

generic routing encapsulation. *See* GRE encapsulation

Gigabit Ethernet interfaces

- modifying [5-6](#)

GRE encapsulation [4-14, 4-16](#)

GRE packet forwarding [4-16](#)

GRE tunnel, configuring on router [4-31](#)

groups. *See* user groups

---

## H

hardware clock [9-6](#)

HTTP accelerator

- configuring [12-4](#)
- enabling [12-2](#)

---

## I

increased buffering [1-5](#)

inline mode [4-41](#)

- configuring IP address [4-45](#)
- interface settings [4-43](#)

- serial clustering [4-48](#)
- VLAN configuration [4-47](#)
- VLAN ID check [4-45](#)
- inline network adapter card [4-41](#)
- intelligent message prediction [1-6](#)
- interface-level DHCP
  - description [2-10](#)
  - note [2-8](#)
- interfaces
  - manually configuring for DHCP [5-9](#)
- IP access control lists. *See* IP ACL
- IP ACL
  - adding conditions to [8-4](#)
  - applying to interface [8-7](#)
  - associating with application [8-7](#)
  - conditions, modifying or deleting [8-7](#)
  - configuration constraints [8-3](#)
  - creating new [8-4](#)
  - deleting [8-8](#)
  - on routers [2-24](#)
  - on WAEs [2-24](#)
  - overview [8-1](#)
- IP addresses
  - multiple, configuring on single interface [5-6](#)
  - static [2-10](#)
- IP routes
  - configuring [5-15](#)
- ip wccp command [4-11](#)
- ip wccp redirect-list command [4-11](#)
- ip web-cache redirect command [4-1, 4-11](#)

---

## K

- kernel debugger
  - enabling [16-37](#)

---

## L

- Layer 2 redirection [4-16](#)
- LDAP server signing [10-11, 10-13](#)
  - configuring on a Microsoft server [6-23](#)
  - configuring on a WAE [6-24](#)
  - disabling on a WAE [6-25](#)
  - overview of [6-23](#)
- legacy mode, CIFS [11-3](#)
- licenses [9-3](#)
- line console carrier detection
  - configuring [6-12](#)
- load balancing [1-20, 4-13, 5-10](#)
- local CLI accounts, about [7-2](#)
- local user, creating [7-4](#)
- locations
  - about [3-14](#)
  - creating [3-14](#)
  - deleting [3-15](#)
- location tree
  - viewing [3-15](#)
- logging
  - configuring system logging [16-29](#)
  - message priority levels [16-31](#)
  - transaction logging [16-32](#)
  - viewing audit trail log [16-36](#)
  - viewing device logs [16-37](#)
  - viewing system messages [16-35](#)
- login
  - WAE Device Manager [10-2](#)
- login access
  - controlling [6-7](#)
- login authentication
  - about [2-25, 6-1](#)
- logs
  - severity levels in the WAE Device Manager [10-32](#)
  - viewing in the WAE Device Manager [10-31](#)
- lost administrator passwords
  - recovering [15-19](#)

LZ compression, about [1-5](#)

## M

management IP address [9-2](#)

MAPI accelerator

    configuring [12-5](#)

    enabling [12-2](#)

match condition, creating [12-12](#)

maximum segment size [12-20](#)

message logs

    viewing [16-35](#)

message of the day settings

    configuring [6-10](#)

MIBs

    supported [17-4](#)

MIB traps

    configuring using the WAE Device Manager [10-9](#)

Microsoft DFS, request interception method [4-50](#)

migration, data [2-28](#)

missing disk-based software

    recovering from [15-20](#)

modifying configuration [13-28](#)

monitoring

    applications [12-17, 16-2](#)

    chart descriptions [16-11](#)

    chart settings [16-17](#)

    CPU utilization [16-21](#)

    creating custom reports [16-25](#)

    disk information [16-22](#)

    flows with NetQoS [16-23](#)

    predefined reports [16-18](#)

    system status [16-6](#)

    using the WAE Device Manager [10-23](#)

    with SNMP [17-1](#)

multiple IP addresses

    configuring on single interfaces [5-6](#)

## N

namespace support [1-20](#)

NAS appliances [1-18](#)

NAT address [9-2](#)

NAT configuration [9-2](#)

NetBIOS [9-2, 11-14](#)

NetQoS monitoring [16-23](#)

network

    viewing information for [16-2](#)

Network Time Protocol. *See* NTP

network traffic analyzer tool [16-39](#)

NFS accelerator

    enabling [12-2](#)

notification settings

    for alerts [10-15](#)

    for reports [9-20](#)

NTP, configuring [9-5](#)

## O

obtaining software files [15-3](#)

operation prediction and batching [1-6](#)

optimization, enabling [12-2](#)

## P

packet forwarding method [4-14](#)

    Layer 2 redirection [4-16](#)

    Layer 3 GRE [4-16](#)

packet return [4-15](#)

passthrough action [12-14](#)

passwords

    changing account [7-7, 7-8](#)

    recovering administrator [15-19](#)

PBR, about [1-19](#)

policy-based routing

    about [1-19](#)

    configuration of [4-32](#)

- overview of [2-20](#)
- verifying next-hop availability [4-38](#)
- policy report, viewing [12-16](#)
- port channel interfaces
  - configuring [5-8](#)
  - load balancing [5-10](#)
- ports
  - 139 [2-7](#)
    - bypassing [2-7](#)
    - disabling [11-14](#)
    - enabling [11-14](#)
  - 4050 [2-7](#)
  - 445 [2-7](#)
    - disabling [11-14](#)
    - enabling [11-14](#)
  - 50139 [2-7](#)
  - used in WAFS [2-7](#)
- position, application policy [12-18](#)
- power failure [15-17](#)
- preposition
  - about [11-4](#)
  - checking status of [11-32](#)
  - creating directive [11-25](#)
  - scheduling [11-31](#)
  - viewing in the WAE Device Manager [10-19](#)
- print accelerator [1-8](#)
- print banners, enabling and disabling [13-30](#)
- print clusters
  - about [13-4](#)
  - adding [13-14](#)
- print drivers
  - distributing [13-19](#)
  - installing [13-18](#)
  - support issues [13-3](#)
  - verifying distribution [13-21](#)
- printer [13-28](#)
  - adding to a WAAS print server [13-12](#)
- printer misconfiguration, PostScript error [13-31](#)
- printing a test page [13-29](#)

- print servers
  - adding to clients [13-23](#)
  - details, viewing [13-25](#)
- print services
  - about [1-8, 13-1](#)
  - configuration process [13-7](#)
  - enabling [13-11](#)
  - planning [13-5](#)
- Print Services Administration GUI, about [13-27](#)
- priority levels [16-31](#)

---

## R

- RADIUS
  - authentication overview [6-13](#)
  - configuring server [6-13](#)
  - database [6-3](#)
  - default configuration [6-4](#)
- RAID [1-21](#)
- RCP services, enabling [9-4](#)
- rebooting devices [15-29](#)
- receive buffer size [12-20](#)
- recovering
  - device registration information [15-21](#)
  - from missing disk-based software [15-20](#)
  - lost administrator passwords [15-19](#)
  - system software [15-17](#)
- redirection methods [4-1](#)
- registering
  - file servers [11-16](#)
  - WAEs in the WAE Device Manager [10-6](#)
- remote login
  - controlling access [6-7](#)
- reports
  - configuring email server settings [9-20](#)
  - CPU utilization [16-21](#)
  - creating custom [16-25](#)
  - customizing [16-10](#)
  - editing [16-27](#)



- managing [16-25](#)
  - predefined [16-18](#)
  - scheduling [16-27](#)
  - viewing custom [16-27](#)
  - repository, driver [13-16](#)
  - request redirection methods [4-1](#)
  - rescue system image [15-17](#)
  - restarting devices [15-29](#)
  - restoring
    - application classifiers [12-16](#)
    - application policies [12-16](#)
    - configuration files [10-7](#)
    - WAAS Central Manager [15-11](#)
    - WAE devices [15-13](#)
    - WAE to default condition [15-13](#)
  - retransmit time multiplier
    - about [5-13](#)
  - roles
    - about [7-10](#)
    - assigning to user accounts [7-12](#)
    - assigning to user groups [7-18](#)
    - creating and managing [7-10](#)
    - deleting [7-13](#)
    - modifying and deleting [7-13](#)
    - read-only access to services [7-10](#)
    - viewing [7-13](#)
    - viewing settings [7-13](#)
  - roles-based accounts
    - about [7-2, 7-3](#)
  - router
    - configuring WCCP transparent redirection on [4-7](#)
  - router lists, defining for WCCP services [4-25](#)
- 
- S**
- SACK, about [1-5](#)
  - scheduling
    - preposition [11-31](#)
    - reports [16-27](#)
  - secure shell
    - configuring [6-8](#)
    - host keys [6-9](#)
  - secure store
    - changing key and password [9-14](#)
    - configuring [9-10](#)
    - disabling [9-15](#)
    - enabling on Central Manager [9-12](#)
    - enabling on standby Central Manager [9-13](#)
    - enabling on WAE [9-13](#)
  - security
    - disk encryption [15-26](#)
    - enabling secure store [9-10](#)
  - selective acknowledgement [1-5](#)
  - send buffer size [12-20](#)
  - send TCP keepalive [12-20](#)
  - serial clustering in inline mode [4-48](#)
  - service password
    - configuring [4-11](#)
  - set ip next-hop verify-availability command [4-39](#)
  - shadow copy for shared folders [11-7](#)
  - shares, request redirection using explicit naming of [4-49](#)
  - show cdp neighbors command [4-38](#)
  - show command utility
    - for troubleshooting [16-39](#)
  - show version command [15-19](#)
  - shutting down WCCP [4-27](#)
  - Simple Network Management Protocol. *See* SNMP
  - site and network planning [2-4](#)
  - SNMP [1-21](#)
    - asset tag setting [17-19](#)
    - community settings [17-14](#)
    - configuration process [17-8](#)
    - configuring using the WAE Device Manager [10-8](#)
    - contact settings [17-20](#)
    - defining custom traps [17-12](#)
    - enabling [17-9](#)
    - enabling SNMP agent [17-8](#)
    - enabling traps [17-10](#)

- group settings [17-17](#)
- host settings [17-13](#)
- manager
  - creating [17-3](#)
- monitoring with [17-1](#)
- preparation [17-9](#)
- security models and security levels [17-4](#)
- supported MIBs [17-4](#)
- user settings [17-18](#)
- versions supported [17-3](#)
- view settings [17-16](#)
- software
  - recovering [15-17](#)
- software clock [9-6](#)
- software files
  - obtaining from Cisco.com [15-3](#)
- software licenses [9-3](#)
- software recovery
  - using the CD-ROM [15-13](#)
- software upgrades [15-4](#)
  - for multiple devices [15-10](#)
  - process [15-1](#)
- software version
  - determining [15-3](#)
- spooling space, default [13-14](#)
- standby Central Manager
  - switching to primary [15-25](#)
- standby groups
  - of interfaces [5-2](#)
- standby interfaces
  - configuring [5-2](#)
  - priority settings [5-4](#)
- starting WAE components [10-5](#)
- static IP addresses [2-10](#)
- static IP routes
  - configuring [5-15](#)
- statistics, collecting [12-8](#)
- stopping WAE components [10-5](#)
- switching baseline group [3-13](#)

- system configuration settings [9-16](#)
- system dashboard
  - viewing system-wide information [16-2](#)
- system event logging
  - configuring [16-29](#)
  - message priority levels [16-31](#)
  - viewing log [16-35](#)
- system image
  - recovering [15-17](#)
- system message log
  - using [16-29](#)
  - viewing [16-35](#)
- system software
  - recovering [15-17](#)
- system status
  - monitoring [16-6](#)

---

## T

- TACACS+
  - authentication and authorization, overview of [6-15](#)
  - database [6-3](#)
  - default configuration [6-4](#)
  - enable password attribute [6-16](#)
- TACACS+ server
  - configuring [6-15](#)
- taskbar icons [1-12](#)
- TCP
  - congestion windows [5-12](#)
  - explicit congestion notification [5-12](#)
  - parameter settings [5-10](#)
  - retransmit timer [5-13](#)
  - slow start [5-13](#)
  - viewing connections [16-20](#)
- tcpdump command [16-39](#)
- TCP initial window size, about [1-4](#)
- TCP promiscuous mode service
  - overview of [2-23](#)

- Telnet services
    - enabling [6-10](#)
  - test command for troubleshooting [16-38](#)
  - tethereal command [16-39](#)
  - TFO
    - about [1-4](#)
  - TFO adaptive buffering [12-21](#)
  - TFO and LZ compression action [12-14](#)
  - TFO features [1-4](#)
    - BIC TCP [1-5](#)
    - compression [1-5](#)
    - increased buffering [1-5](#)
    - selective acknowledgement [1-5](#)
    - TCP initial window size maximization [1-4](#)
    - Windows scaling [1-4](#)
  - TFO only action [12-14](#)
  - TFO with DRE action [12-14](#)
  - time zones
    - location abbreviations [9-7](#)
    - parameter settings for [9-5](#)
  - topology [16-19](#)
  - track command [4-40](#)
  - traffic reduction chart [16-13](#)
  - traffic statistics collection, enabling [12-8](#)
  - traffic statistics report [16-2](#)
    - chart descriptions [16-11](#)
  - transaction logging [16-32](#)
    - configuring [16-32](#)
  - transparent redirection, configuring on a router [4-7](#)
  - traps
    - defining SNMP [17-12](#)
    - enabling [17-10](#)
  - triggers
    - defining SNMP [17-12](#)
  - troubleshooting
    - CLI commands [16-38](#)
    - using show command utility [16-39](#)
    - with Central Manager diagnostic tests [16-38](#)
    - with TCPdump [16-39](#)
      - with Tethereal [16-39](#)
  - Troubleshooting Devices window [16-6](#)
  - types of application policies [12-11](#)
- 
- U**
  - Unicode support [2-11](#)
  - upgrading
    - device groups [15-10](#)
    - process [15-1](#)
    - WAAS Central Manager device [15-8](#)
  - user accounts
    - adding domain entities [7-15](#)
    - assigning to domains [7-15](#)
    - audit trail logs
      - viewing [6-32, 16-36](#)
    - changing passwords [7-7, 7-8](#)
    - creating [7-4](#)
    - creation process [7-2](#)
    - deleting [7-6](#)
    - deleting domains [7-16](#)
    - domains [7-14](#)
    - managing [7-7, 7-8](#)
    - modifying and deleting [7-6](#)
    - roles
      - assigning to [7-12](#)
      - creating [7-10](#)
      - modifying and deleting [7-13](#)
      - viewing [7-13](#)
    - viewing [7-8](#)
    - viewing domains [7-16](#)
  - user authentication. *See* login authentication
  - user groups
    - about [7-17](#)
    - assigning roles to [7-18](#)
    - assigning to domains [7-18](#)
    - creating [7-17](#)
    - deleting [7-19](#)
    - viewing [7-19](#)

UTC offsets [9-8](#)

*See also* GMT offsets

## V

version of software [15-3](#)

video accelerator

configuring [12-5](#)

enabling [12-2](#)

viewing

application list [12-15](#)

classifier report [12-16](#)

logs in the WAE device manager [10-31](#)

policy report [12-16](#)

print server details [13-25](#)

role settings [7-13](#)

virtual blade

backing up and restoring [14-8](#)

configuring [14-1, 14-4](#)

copying disk image to [14-8](#)

enabling [14-2](#)

starting and stopping [14-7](#)

virtualization. *See* virtual blade

VLAN ID check [4-45](#)

VLAN support [4-42](#)

## W

WAAS

benefits [1-16](#)

interfaces [1-8](#)

WAAS Central Manager

backing up [15-11](#)

configuring as driver repository [13-16](#)

restoring [15-11](#)

upgrading [15-8](#)

WAAS Central Manager GUI

about [1-9](#)

accessing [1-9](#)

components [1-9](#)

taskbar icons [1-12](#)

WAAS CLI, about [1-16](#)

WAAS interfaces

CLI [1-16](#)

Print Services Administration GUI [1-15](#)

WAAS Central Manager GUI [1-9](#)

WAE Device Manager GUI [1-14](#)

WAAS networks

and IOP interoperability [2-12](#)

network planning for [2-1](#)

traffic redirection methods [2-18](#)

WAAS Print Services Administration GUI, about [1-15](#)

WAAS services, about [1-4](#)

WAE Device Manager

about [1-14, 10-1](#)

Configuration option [10-8](#)

Control option for the WAE [10-4](#)

logging out [10-3](#)

Notifier tab [10-15](#)

quick tour [10-2](#)

Utilities option [10-17](#)

workflow [10-3](#)

WAE devices

backing up [15-13](#)

controlled shutdown [15-30](#)

modifying configuration properties [9-1](#)

restoring [15-13](#)

supported [2-11](#)

WAE packet return [4-15](#)

WAFS

about [1-18](#)

configuration process [11-9](#)

preparing for [11-8](#)

WAFS Cache Cleanup utility [10-18](#)

WAFS Core cluster [3-3](#)

WAN failures, preparing for [11-33](#)

WAN utilization setting [11-24](#)

## WCCP

about [1-19](#)

Cisco Express Forwarding (CEF) [4-16](#)

default values

    for WAE general settings [4-17](#)

defining router lists [4-25](#)

flow redirection

    enabling and disabling [4-17](#)

GRE packet return [4-29](#)

ports used [2-7](#)

request interception method [4-4](#)

shutting down [4-27](#)

## WCCP-based routing

advanced configuration

    for a router [4-7](#)

configuration guidelines [4-5](#)

overview of [2-19](#)

wccp command [4-5](#)

## WCCP general settings

WAE default values [4-17](#)

## WCCP service masks

deleting [4-22, 4-23](#)

modifying [4-22, 4-23](#)

## WCCP services

displaying list of [4-5](#)

web browser support [2-11](#)

## Windows Authentication

checking the status in the WAE Device  
Manager [10-14](#)

configuring using the WAE Device Manager [10-10](#)

Windows name services [5-17](#)

Windows print accelerator, about [1-8](#)

Windows scaling, about [1-4](#)

