Cisco IOS Security Command Reference

Release 12.2

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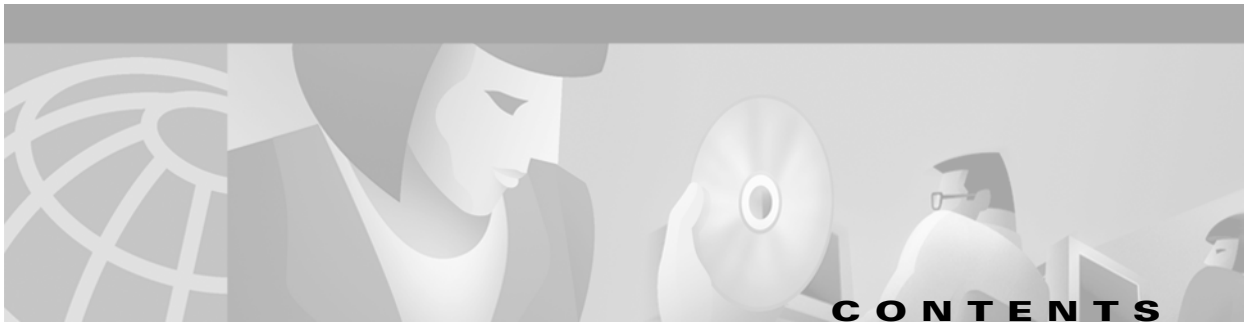

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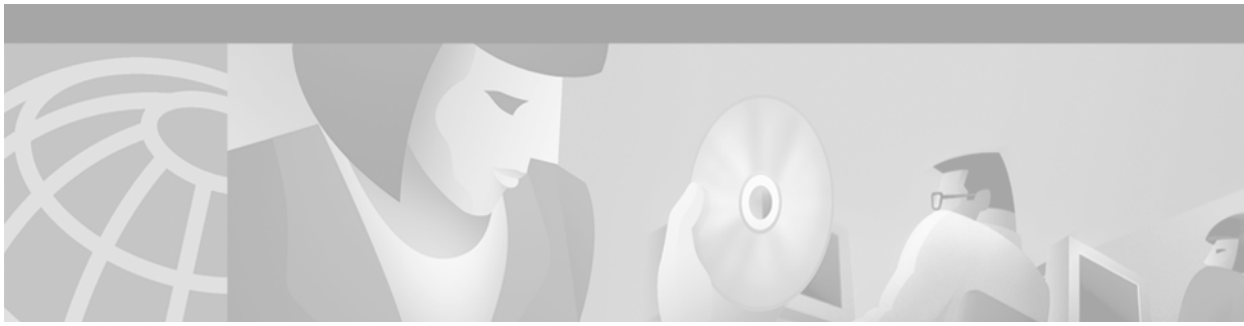


About Cisco IOS Software Documentation

This chapter discusses the objectives, audience, organization, and conventions of Cisco IOS software documentation. It also provides sources for obtaining documentation from Cisco Systems.

Documentation Objectives

Cisco IOS software documentation describes the tasks and commands necessary to configure and maintain Cisco networking devices.

Audience

The Cisco IOS software documentation set is intended primarily for users who configure and maintain Cisco networking devices (such as routers and switches) but who may not be familiar with the tasks, the relationship between tasks, or the Cisco IOS software commands necessary to perform particular tasks. The Cisco IOS software documentation set is also intended for those users experienced with Cisco IOS software who need to know about new features, new configuration options, and new software characteristics in the current Cisco IOS software release.

Documentation Organization

The Cisco IOS software documentation set consists of documentation modules and master indexes. In addition to the main documentation set, there are supporting documents and resources.

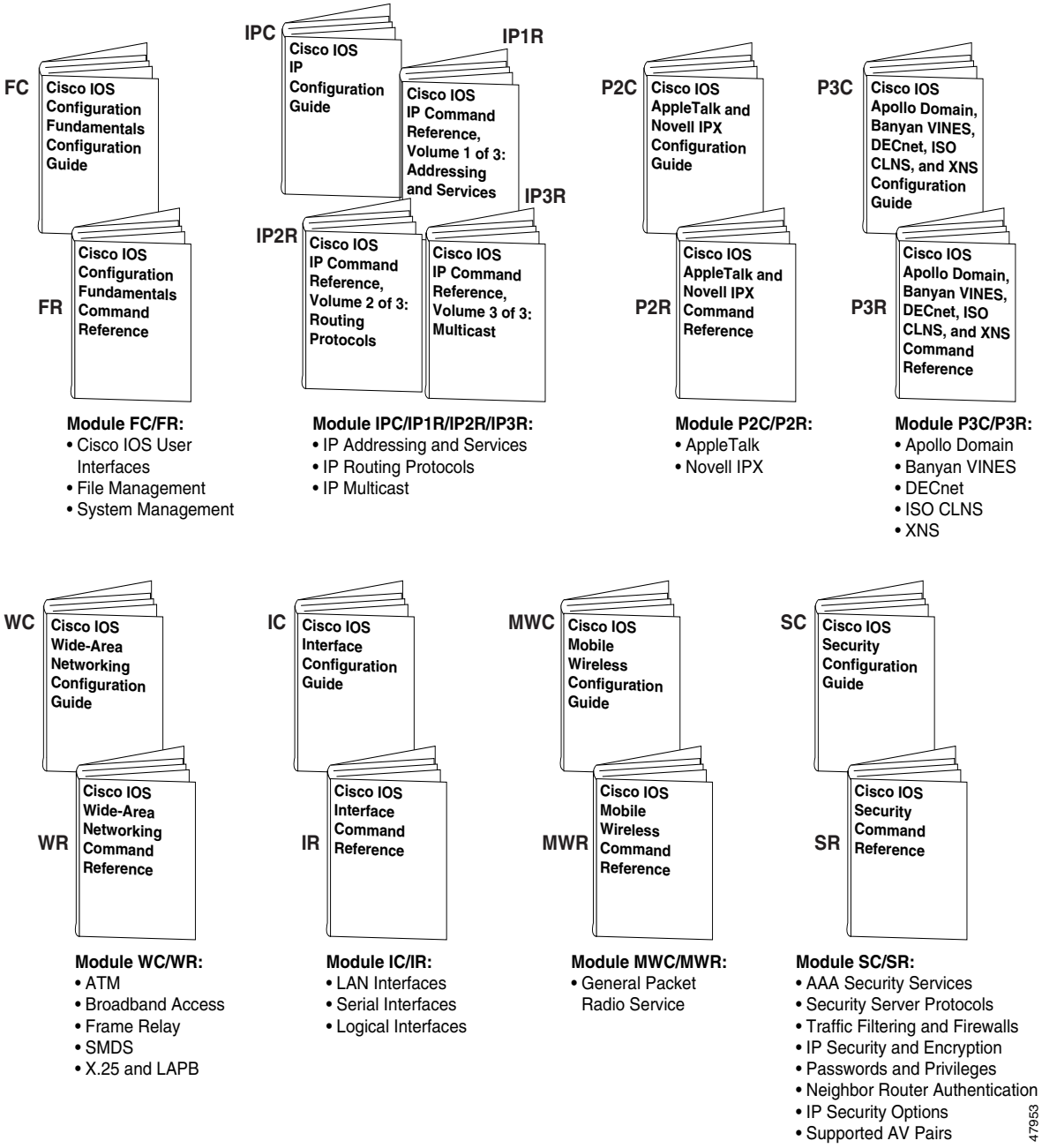
Documentation Modules

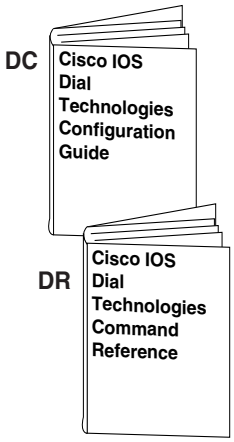
The Cisco IOS documentation modules consist of configuration guides and corresponding command reference publications. Chapters in a configuration guide describe protocols, configuration tasks, and Cisco IOS software functionality and contain comprehensive configuration examples. Chapters in a command reference publication provide complete Cisco IOS command syntax information. Use each configuration guide in conjunction with its corresponding command reference publication.

Figure 1 shows the Cisco IOS software documentation modules.

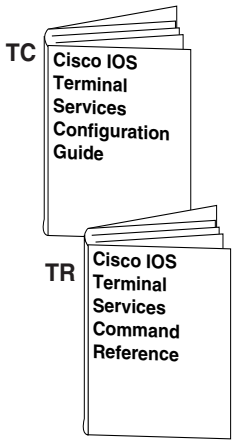
Note The abbreviations (for example, FC and FR) next to the book icons are page designators, which are defined in a key in the index of each document to help you with navigation. The bullets under each module list the major technology areas discussed in the corresponding books.

Figure 1 Cisco IOS Software Documentation Modules

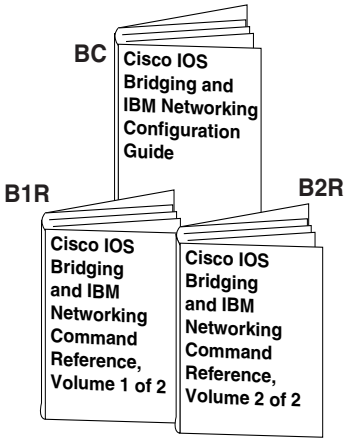




Module DC/DR:
- Preparing for Dial Access
- Modem and Dial Shelf Configuration and Management
- ISDN Configuration
- Signalling Configuration
- Dial-on-Demand Routing Configuration
- Dial-Backup Configuration
- Dial-Related Addressing Services
- Virtual Templates, Profiles, and Networks
- PPP Configuration
- Callback and Bandwidth Allocation Configuration
- Dial Access Specialized Features
- Dial Access Scenarios

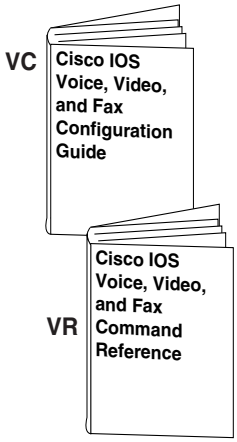


Module TC/TR:
- ARA
- LAT
- NASI
- Telnet
- TN3270
- XRemote
- X.28 PAD
- Protocol Translation

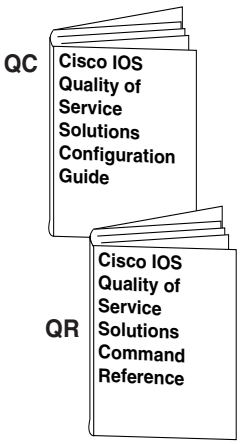


Module BC/B1R:
- Transparent Bridging
- SRB
- Token Ring Inter-Switch Link
- Token Ring Route Switch Module
- RSRB
- DLSw+
- Serial Tunnel and Block Serial Tunnel
- LLC2 and SDLC
- IBM Network Media Translation
- SNA Frame Relay Access
- NCIA Client/Server
- Airline Product Set

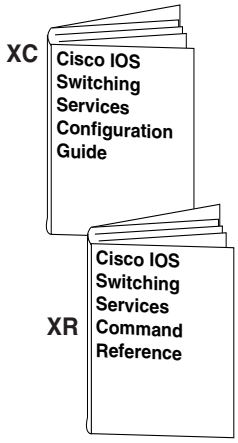
Module BC/B2R:
- DSPU and SNA Service Point
- SNA Switching Services
- Cisco Transaction Connection
- Cisco Mainframe Channel Connection
- CLAW and TCP/IP Offload
- CSNA, CMPC, and CMPC+
- TN3270 Server



Module VC/VR:
- Voice over IP
- Call Control Signalling
- Voice over Frame Relay
- Voice over ATM
- Telephony Applications
- Trunk Management
- Fax, Video, and Modem Support



Module QC/QR:
- Packet Classification
- Congestion Management
- Congestion Avoidance
- Policing and Shaping
- Signalling
- Link Efficiency Mechanisms



Module XC/XR:
- Cisco IOS Switching Paths
- NetFlow Switching
- Multiprotocol Label Switching
- Multilayer Switching
- Multicast Distributed Switching
- Virtual LANs
- LAN Emulation

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Master Indexes

Two master indexes provide indexing information for the Cisco IOS software documentation set: an index for the configuration guides and an index for the command references. Individual books also contain a book-specific index.

The master indexes provide a quick way for you to find a command when you know the command name but not which module contains the command. When you use the online master indexes, you can click the page number for an index entry and go to that page in the online document.

Supporting Documents and Resources

The following documents and resources support the Cisco IOS software documentation set:

- *Cisco IOS Command Summary* (three volumes)—This publication explains the function and syntax of the Cisco IOS software commands. For more information about defaults and usage guidelines, refer to the Cisco IOS command reference publications.
- *Cisco IOS System Error Messages*—This publication lists and describes Cisco IOS system error messages. Not all system error messages indicate problems with your system. Some are purely informational, and others may help diagnose problems with communications lines, internal hardware, or the system software.
- *Cisco IOS Debug Command Reference*—This publication contains an alphabetical listing of the **debug** commands and their descriptions. Documentation for each command includes a brief description of its use, command syntax, usage guidelines, and sample output.
- *Dictionary of Internetworking Terms and Acronyms*—This Cisco publication compiles and defines the terms and acronyms used in the internetworking industry.
- New feature documentation—The Cisco IOS software documentation set documents the mainline release of Cisco IOS software (for example, Cisco IOS Release 12.2). New software features are introduced in early deployment releases (for example, the Cisco IOS "T" release train for 12.2, 12.2(x)T). Documentation for these new features can be found in standalone documents called "feature modules." Feature module documentation describes new Cisco IOS software and hardware networking functionality and is available on Cisco.com and the Documentation CD-ROM.
- Release notes—This documentation describes system requirements, provides information about new and changed features, and includes other useful information about specific software releases. See the section "Using Software Release Notes" in the chapter "Using Cisco IOS Software" for more information.
- Caveats documentation—This documentation provides information about Cisco IOS software defects in specific software releases.
- RFCs—RFCs are standards documents maintained by the Internet Engineering Task Force (IETF). Cisco IOS software documentation references supported RFCs when applicable. The full text of referenced RFCs may be obtained on the World Wide Web at http://www.rfc-editor.org/.
- MIBs—MIBs are used for network monitoring. For lists of supported MIBs by platform and release, and to download MIB files, see the Cisco MIB website on Cisco.com at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

New and Changed Information

The following is new information since the last release of the *Cisco IOS Security Command Reference*:

- A new chapter titled "Secure Shell Commands" has been added to the section "Other Security Features." This chapter describes the SSH commands.
- The chapter titled “Cisco Encryption Technology Commands” has been deleted from the section “IP Security and Encryption.” This functionality is no longer supported. For information regarding CET commands, refer to *Cisco IOS Security Command Reference*, Release 12.1 or earlier.

Document Conventions

Within Cisco IOS software documentation, the term *router* is generally used to refer to a variety of Cisco products (for example, routers, access servers, and switches). Routers, access servers, and other networking devices that support Cisco IOS software are shown interchangeably within examples. These products are used only for illustrative purposes; that is, an example that shows one product does not necessarily indicate that other products are not supported.

The Cisco IOS documentation set uses the following conventions:

Convention	Description
^ or Ctrl	The ^ and Ctrl symbols represent the Control key. For example, the key combination ^D or Ctrl-D means hold down the Control key while you press the D key. Keys are indicated in capital letters but are not case sensitive.
string	A string is a nonquoted set of characters shown in italics. For example, when setting an SNMP community string to public, do not use quotation marks around the string or the string will include the quotation marks.

Command syntax descriptions use the following conventions:

Convention	Description
boldface	Boldface text indicates commands and keywords that you enter literally as shown.
italics	Italic text indicates arguments for which you supply values.
[x]	Square brackets enclose an optional element (keyword or argument).
|	A vertical line indicates a choice within an optional or required set of keywords or arguments.
[x | y]	Square brackets enclosing keywords or arguments separated by a vertical line indicate an optional choice.
{x | y}	Braces enclosing keywords or arguments separated by a vertical line indicate a required choice.

Nested sets of square brackets or braces indicate optional or required choices within optional or required elements. For example:

Convention	Description
[x {y | z}]	Braces and a vertical line within square brackets indicate a required choice within an optional element.

Examples use the following conventions:

Convention	Description
`screen`	Examples of information displayed on the screen are set in Courier font.
`boldface screen`	Examples of text that you must enter are set in Courier bold font.
< >	Angle brackets enclose text that is not printed to the screen, such as passwords.
!	An exclamation point at the beginning of a line indicates a comment line. (Exclamation points are also displayed by the Cisco IOS software for certain processes.)
[ ]	Square brackets enclose default responses to system prompts.

The following conventions are used to attract the attention of the reader:

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

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means the *described action saves time*. You can save time by performing the action described in the paragraph.

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

The most current Cisco documentation is available on the World Wide Web at the following website:

http://www.cisco.com

Translated documentation is available at the following website:

http://www.cisco.com/public/countries_languages.html

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

Ordering Documentation

Cisco documentation can be ordered in the following ways:

- Registered Cisco Direct Customers can order Cisco product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/cgi-bin/order/order_root.pl

- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

  http://www.cisco.com/go/subscription

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco corporate headquarters (California, USA) at 408 526-7208 or, in North America, by calling 800 553-NETS(6387).

Documentation Feedback

If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

You can e-mail your comments to bug-doc@cisco.com.

To submit your comments by mail, use the response card behind the front cover of your document, or write to the following address:

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Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

Cisco.com

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Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

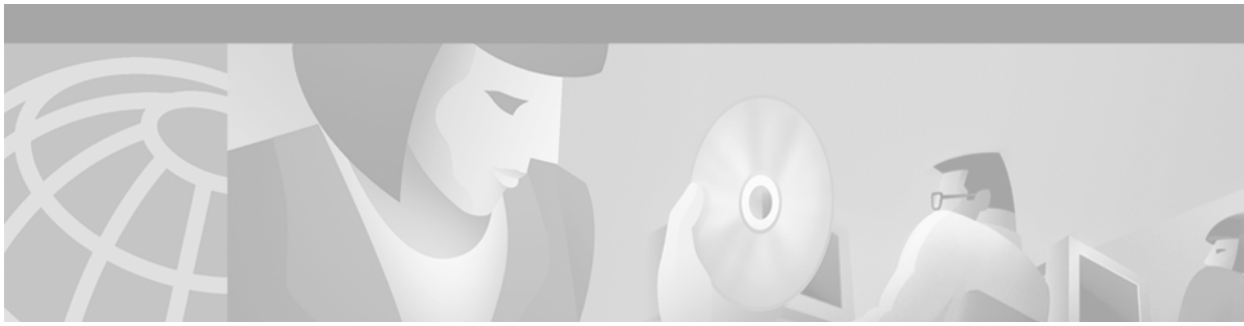
Contacting TAC by Telephone

If you have a priority level 1 (P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.



Using Cisco IOS Software

This chapter provides helpful tips for understanding and configuring Cisco IOS software using the command-line interface (CLI). It contains the following sections:

- Understanding Command Modes
- Getting Help
- Using the no and default Forms of Commands
- Saving Configuration Changes
- Filtering Output from the show and more Commands
- Identifying Supported Platforms

For an overview of Cisco IOS software configuration, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide*.

For information on the conventions used in the Cisco IOS software documentation set, see the chapter "About Cisco IOS Software Documentation" located at the beginning of this book.

Understanding Command Modes

You use the CLI to access Cisco IOS software. Because the CLI is divided into many different modes, the commands available to you at any given time depend on the mode you are currently in. Entering a question mark (**?**) at the CLI prompt allows you to obtain a list of commands available for each command mode.

When you log in to the CLI, you are in user EXEC mode. User EXEC mode contains only a limited subset of commands. To have access to all commands, you must enter privileged EXEC mode, normally by using a password. From privileged EXEC mode you can issue any EXEC command—user or privileged mode—or you can enter global configuration mode. Most EXEC commands are one-time commands. For example, **show** commands show important status information, and **clear** commands clear counters or interfaces. The EXEC commands are not saved when the software reboots.

Configuration modes allow you to make changes to the running configuration. If you later save the running configuration to the startup configuration, these changed commands are stored when the software is rebooted. To enter specific configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and a variety of other modes, such as protocol-specific modes.

ROM monitor mode is a separate mode used when the Cisco IOS software cannot load properly. If a valid software image is not found when the software boots or if the configuration file is corrupted at startup, the software might enter ROM monitor mode.

Table 1 describes how to access and exit various common command modes of the Cisco IOS software. It also shows examples of the prompts displayed for each mode.

Table 1 Accessing and Exiting Command Modes

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Log in.	`Router>`	Use the **logout** command.
Privileged EXEC	From user EXEC mode, use the **enable** EXEC command.	`Router#`	To return to user EXEC mode, use the **disable** command.
Global configuration	From privileged EXEC mode, use the **configure terminal** privileged EXEC command.	`Router(config)#`	To return to privileged EXEC mode from global configuration mode, use the **exit** or **end** command, or press **Ctrl-Z**.
Interface configuration	From global configuration mode, specify an interface using an **interface** command.	`Router(config-if)#`	To return to global configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command, or press **Ctrl-Z**.
ROM monitor	From privileged EXEC mode, use the **reload** EXEC command. Press the **Break** key during the first 60 seconds while the system is booting.	`>`	To exit ROM monitor mode, use the **continue** command.

For more information on command modes, refer to the "Using the Command-Line Interface" chapter in the *Cisco IOS Configuration Fundamentals Configuration Guide*.

Getting Help

Entering a question mark (**?**) at the CLI prompt displays a list of commands available for each command mode. You can also get a list of keywords and arguments associated with any command by using the context-sensitive help feature.

To get help specific to a command mode, a command, a keyword, or an argument, use one of the following commands:

Command	Purpose
help	Provides a brief description of the help system in any command mode.
*abbreviated-command-entry***?**	Provides a list of commands that begin with a particular character string. (No space between command and question mark.)
abbreviated-command-entry<**Tab**>	Completes a partial command name.
?	Lists all commands available for a particular command mode.
command **?**	Lists the keywords or arguments that you must enter next on the command line. (Space between command and question mark.)

Example: How to Find Command Options

This section provides an example of how to display syntax for a command. The syntax can consist of optional or required keywords and arguments. To display keywords and arguments for a command, enter a question mark (**?**) at the configuration prompt or after entering part of a command followed by a space. The Cisco IOS software displays a list and brief description of available keywords and arguments. For example, if you were in global configuration mode and wanted to see all the keywords or arguments for the **arap** command, you would type **arap ?**.

The <cr> symbol in command help output stands for "carriage return." On older keyboards, the carriage return key is the Return key. On most modern keyboards, the carriage return key is the Enter key. The <cr> symbol at the end of command help output indicates that you have the option to press **Enter** to complete the command and that the arguments and keywords in the list preceding the <cr> symbol are optional. The <cr> symbol by itself indicates that no more arguments or keywords are available and that you must press **Enter** to complete the command.

Table 2 shows examples of how you can use the question mark (**?**) to assist you in entering commands. The table steps you through configuring an IP address on a serial interface on a Cisco 7206 router that is running Cisco IOS Release 12.0(3).

Table 2 How to Find Command Options

Command	Comment

`Router> enable`
`Password: <password>`
`Router#`
	Enter the **enable** command and password to access privileged EXEC commands. You are in privileged EXEC mode when the prompt changes to `Router#`.

`Router# configure terminal`
`Enter configuration commands, one per line. End with CNTL/Z.`
`Router(config)#`
	Enter the **configure terminal** privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to `Router(config)#`.

`Router(config)# interface serial ?`
`  <0-6>  Serial interface number`
`Router(config)# interface serial 4 ?`
`  /`
`Router(config)# interface serial 4/ ?`
`  <0-3>  Serial interface number`
`Router(config)# interface serial 4/0`
`Router(config-if)#`
	Enter interface configuration mode by specifying the serial interface that you want to configure using the **interface serial** global configuration command.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter the serial interface slot number and port number, separated by a forward slash.
	You are in interface configuration mode when the prompt changes to `Router(config-if)#`.

Table 2 How to Find Command Options (continued)

Command	Comment

`Router(config-if)# ?`
`Interface configuration commands:`
`  .`
`  .`
`  .`
`  ip  Interface Internet Protocol config commands`
`  keepalive  Enable keepalive`
`  lan-name  LAN Name command`
`  llc2  LLC2 Interface Subcommands`
`  load-interval  Specify interval for load calculation for an interface`
`  locaddr-priority  Assign a priority group`
`  logging  Configure logging for interface`
`  loopback  Configure internal loopback on an interface`
`  mac-address  Manually set interface MAC address`
`  mls  mls router sub/interface commands`
`  mpoa  MPOA interface configuration commands`
`  mtu  Set the interface Maximum Transmission Unit (MTU)`
`  netbios  Use a defined NETBIOS access list or enable name-caching`
`  no  Negate a command or set its defaults`
`  nrzi-encoding  Enable use of NRZI encoding`
`  ntp  Configure NTP`
`  .`
`  .`
`  .`
`Router(config-if)#`
	Enter **?** to display a list of all the interface configuration commands available for the serial interface. This example shows only some of the available interface configuration commands.

`Router(config-if)# ip ?`
`Interface IP configuration subcommands:`
`  access-group  Specify access control for packets`
`  accounting  Enable IP accounting on this interface`
`  address  Set the IP address of an interface`
`  authentication  authentication subcommands`
`  bandwidth-percent  Set EIGRP bandwidth limit`
`  broadcast-address  Set the broadcast address of an interface`
`  cgmp  Enable/disable CGMP`
`  directed-broadcast  Enable forwarding of directed broadcasts`
`  dvmrp  DVMRP interface commands`
`  hello-interval  Configures IP-EIGRP hello interval`
`  helper-address  Specify a destination address for UDP broadcasts`
`  hold-time  Configures IP-EIGRP hold time`
`  .`
`  .`
`  .`
`Router(config-if)# ip`
	Enter the command that you want to configure for the interface. This example uses the **ip** command.
	Enter **?** to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands.

Table 2 How to Find Command Options (continued)

Command	Comment

`Router(config-if)# ip address ?`
`  A.B.C.D  IP address`
`  negotiated  IP Address negotiated over PPP`
`Router(config-if)# ip address`
	Enter the command that you want to configure for the interface. This example uses the **ip address** command.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP address or the **negotiated** keyword.
	A carriage return (<cr>) is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 ?`
`  A.B.C.D  IP subnet mask`
`Router(config-if)# ip address 172.16.0.1`
	Enter the keyword or argument you want to use. This example uses the 172.16.0.1 IP address.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.
	A <cr> is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0 ?`
`  secondary  Make this IP address a secondary address`
`  <cr>`
`Router(config-if)# ip address 172.16.0.1 255.255.255.0`
	Enter the IP subnet mask. This example uses the 255.255.255.0 IP subnet mask.
	Enter **?** to display what you must enter next on the command line. In this example, you can enter the **secondary** keyword, or you can press **Enter**.
	A <cr> is displayed; you can press **Enter** to complete the command, or you can enter another keyword.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0` `Router(config-if)#`	In this example, Enter is pressed to complete the command.

Using the no and default Forms of Commands

Almost every configuration command has a **no** form. In general, use the **no** form to disable a function. Use the command without the **no** keyword to reenable a disabled function or to enable a function that is disabled by default. For example, IP routing is enabled by default. To disable IP routing, use the **no ip routing** command; to reenable IP routing, use the **ip routing** command. The Cisco IOS software command reference publications provide the complete syntax for the configuration commands and describe what the **no** form of a command does.

Configuration commands also can have a **default** form, which returns the command settings to the default values. Most commands are disabled by default, so in such cases using the **default** form has the same result as using the **no** form of the command. However, some commands are enabled by default and

have variables set to certain default values. In these cases, the **default** form of the command enables the command and sets the variables to their default values. The Cisco IOS software command reference publications describe the effect of the **default** form of a command if the command functions differently than the **no** form.

Saving Configuration Changes

Use the **copy system:running-config nvram:startup-config** command to save your configuration changes to the startup configuration so that the changes will not be lost if the software reloads or a power outage occurs. For example:

```
Router# copy system:running-config nvram:startup-config
Building configuration...
```

It might take a minute or two to save the configuration. After the configuration has been saved, the following output appears:

```
[OK]
Router#
```

On most platforms, this task saves the configuration to NVRAM. On the Class A Flash file system platforms, this task saves the configuration to the location specified by the CONFIG_FILE environment variable. The CONFIG_FILE variable defaults to NVRAM.

Filtering Output from the show and more Commands

In Cisco IOS Release 12.0(1)T and later releases, you can search and filter the output of **show** and **more** commands. This functionality is useful if you need to sort through large amounts of output or if you want to exclude output that you need not see.

To use this functionality, enter a **show** or **more** command followed by the "pipe" character (|); one of the keywords **begin**, **include**, or **exclude**; and a regular expression on which you want to search or filter (the expression is case-sensitive):

command | {**begin** | **include** | **exclude**} *regular-expression*

The output matches certain lines of information in the configuration file. The following example illustrates how to use output modifiers with the **show interface** command when you want the output to include only lines in which the expression "protocol" appears:

```
Router# show interface | include protocol

FastEthernet0/0 is up, line protocol is up
Serial4/0 is up, line protocol is up
Serial4/1 is up, line protocol is up
Serial4/2 is administratively down, line protocol is down
Serial4/3 is administratively down, line protocol is down
```

For more information on the search and filter functionality, refer to the "Using the Command-Line Interface" chapter in the *Cisco IOS Configuration Fundamentals Configuration Guide*.

Identifying Supported Platforms

Cisco IOS software is packaged in feature sets consisting of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco IOS software images are included in a release. To identify the set of software images available in a specific release or to find out if a feature is available in a given Cisco IOS software image, see the following sections:

- Using Feature Navigator
- Using Software Release Notes

Using Feature Navigator

Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a particular set of features and which features are supported in a particular Cisco IOS image.

Feature Navigator is available 24 hours a day, 7 days a week. To access Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, e-mail the Contact Database Administration group at cdbadmin@cisco.com. If you do not have an account on Cisco.com, go to http://www.cisco.com/register and follow the directions to establish an account.

To use Feature Navigator, you must have a JavaScript-enabled web browser such as Netscape 3.0 or later, or Internet Explorer 4.0 or later. Internet Explorer 4.0 always has JavaScript enabled. To enable JavaScript for Netscape 3.x or Netscape 4.x, follow the instructions provided with the web browser. For JavaScript support and enabling instructions for other browsers, check with the browser vendor.

Feature Navigator is updated when major Cisco IOS software releases and technology releases occur. You can access Feature Navigator at the following URL:

http://www.cisco.com/go/fn

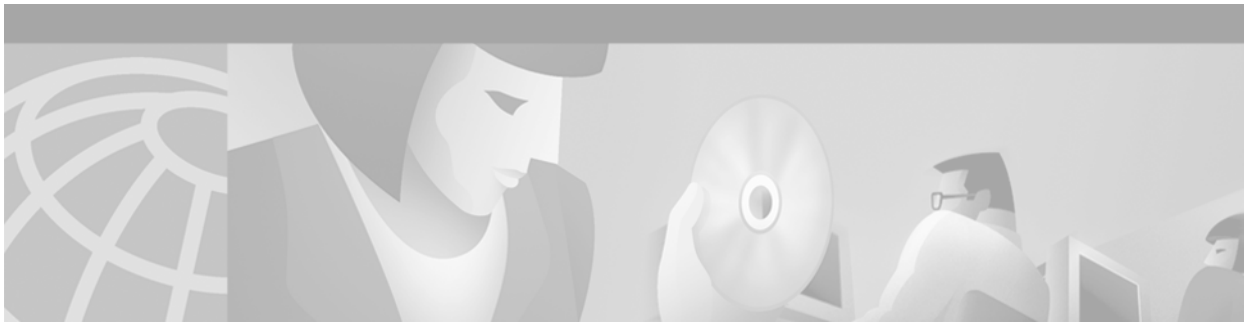
Using Software Release Notes

Cisco IOS software releases include release notes that provide the following information:

- Platform support information
- Memory recommendations
- Microcode support information
- Feature set tables
- Feature descriptions
- Open and resolved severity 1 and 2 caveats for all platforms

Release notes are intended to be release-specific for the most current release, and the information provided in these documents may not be cumulative in providing information about features that first appeared in previous releases.

Authentication, Authorization, and Accounting



Authentication Commands

This chapter describes the commands used to configure both AAA and non-AAA authentication methods. Authentication identifies users before they are allowed access to the network and network services. Basically, the Cisco IOS software implementation of authentication is divided into two main categories:

- AAA Authentication Methods
- Non-AAA Authentication Methods

Authentication, for the most part, is implemented through the AAA security services. We recommend that, whenever possible, AAA be used to implement authentication.

For information on how to configure authentication using either AAA or non-AAA methods, refer to the chapter "Configuring Authentication" in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the section "Authentication Examples" located at the end of the chapter "Configuring Authentication" in the *Cisco IOS Security Configuration Guide*.

aaa authentication arap

To enable an authentication, authorization, and accounting (AAA) authentication method for AppleTalk Remote Access (ARA), use the **aaa authentication arap** command in global configuration mode. To disable this authentication, use the **no** form of this command.

aaa authentication arap {**default** | *list-name*} *method1* [*method2*...]

no aaa authentication arap {**default** | *list-name*} *method1* [*method2*...]

Syntax Description

default	Uses the listed methods that follow this argument as the default list of methods when a user logs in.
list-name	Character string used to name the following list of authentication methods tried when a user logs in.
method1 [*method2*...]	At least one of the keywords described in Table 3.

Defaults

If the **default** list is not set, only the local user database is checked. This has the same effect as the following command:

```
aaa authentication arap default local
```

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.
12.0(5)T	Group server and local-case support were added as method keywords for this command.

Usage Guidelines

The list names and default that you set with the **aaa authentication arap** command are used with the **arap authentication** command. Note that ARAP guest logins are disabled by default when you enable AAA. To allow guest logins, you must use either the **guest** or **auth-guest** method listed in Table 3. You can only use one of these methods; they are mutually exclusive.

Create a list by entering the **aaa authentication arap** *list-name method* command, where *list-name* is any character string used to name this list (such as *MIS-access*). The *method* argument identifies the list of methods the authentication algorithm tries in the given sequence. See Table 3 for descriptions of method keywords.

To create a default list that is used if no list is specified in the **arap authentication** command, use the **default** keyword followed by the methods you want to be used in default situations.

The additional methods of authentication are used only if the previous method returns an error, not if it fails.

Use the **more system:running-config** command to view currently configured lists of authentication methods.

Note In Table 3, the **group radius**, **group tacacs+**, and **group** *group-name* methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs+-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Table 3 aaa authentication arap Methods

Keyword	Description
guest	Allows guest logins. This method must be the first method listed, but it can be followed by other methods if it does not succeed.
auth-guest	Allows guest logins only if the user has already logged in to EXEC. This method must be the first method listed, but can be followed by other methods if it does not succeed.
line	Uses the line password for authentication.
local	Uses the local username database for authentication.
local-case	Uses case-sensitive local username authentication.
group radius	Uses the list of all RADIUS servers for authentication.
group tacacs+	Uses the list of all TACACS+ servers for authentication.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for authentication as defined by the **aaa group server radius** or **aaa group server tacacs+** command.

Examples

The following example creates a list called *MIS-access*, which first tries TACACS+ authentication and then none:

```
aaa authentication arap MIS-access group tacacs+ none
```

The following example creates the same list, but sets it as the default list that is used for all ARA protocol authentications if no other list is specified:

```
aaa authentication arap default group tacacs+ none
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.

aaa authentication banner

To configure a personalized banner that will be displayed at user login, use the **aaa authentication banner** command in global configuration mode. To remove the banner, use the **no** form of this command.

aaa authentication banner *dstringd*

no aaa authentication banner

Syntax Description

d	Any delimiting character at the beginning and end of the *string* that notifies the system that the *string* is to be displayed as the banner. The delimiting character can be any character in the extended ASCII character set, but once defined as the delimiter, that character cannot be used in the text string making up the banner.
string	Any group of characters, excluding the one used as the delimiter. The maximum number of characters that you can display is 2996.

Defaults

Not enabled

Command Modes

Global configuration

Command History

Release	Modification
11.3(4)T	This command was introduced.

Usage Guidelines

Use the **aaa authentication banner** command to create a personalized message that appears when a user logs in to the system. This message or banner will replace the default message for user login.

To create a login banner, you need to configure a delimiting character, which notifies the system that the following text string is to be displayed as the banner, and then the text string itself. The delimiting character is repeated at the end of the text string to signify the end of the banner. The delimiting character can be any character in the extended ASCII character set, but once defined as the delimiter, that character cannot be used in the text string making up the banner.

Note The AAA authentication banner message is not displayed if TACACS+ is the first method in the method list.

Examples

The following example shows the default login message if **aaa authentication banner** is not configured. (RADIUS is specified as the default login authentication method.)

```
aaa new-model
aaa authentication login default group radius
```

This configuration produces the following standard output:

```
User Verification Access
Username:
Password:
```

The following example configures a login banner (in this case, the phrase "Unauthorized use is prohibited.") that will be displayed when a user logs in to the system. In this case, the asterisk (*) symbol is used as the delimiter. (RADIUS is specified as the default login authentication method.)

```
aaa new-model
aaa authentication banner *Unauthorized use is prohibited.*
aaa authentication login default group radius
```

This configuration produces the following login banner:

```
Unauthorized use is prohibited.
Username:
```

Related Commands

Command	Description
aaa authentication fail-message	Configures a personalized banner that will be displayed when a user fails login.

aaa authentication enable default

To enable authentication, authorization, and accounting (AAA) authentication to determine if a user can access the privileged command level, use the **aaa authentication enable default** command in global configuration mode. To disable this authorization method, use the **no** form of this command.

aaa authentication enable default *method1* [*method2*...]

no aaa authentication enable default *method1* [*method2*...]

Syntax Description

method1 [*method2*...]	At least one of the keywords described in Table 3.

Defaults

If the **default** list is not set, only the enable password is checked. This has the same effect as the following command:

```
aaa authentication enable default enable
```

On the console, the enable password is used if it exists. If no password is set, the process will succeed anyway.

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.
12.0(5)T	Group server support was added as various method keywords for this command.

Usage Guidelines

Use the **aaa authentication enable default** command to create a series of authentication methods that are used to determine whether a user can access the privileged command level. Method keywords are described in Table 3. The additional methods of authentication are used only if the previous method returns an error, not if it fails. To specify that the authentication should succeed even if all methods return an error, specify **none** as the final method in the command line.

All **aaa authentication enable default** requests sent by the router to a RADIUS or TACACS+ server include the username "$enab15$."

If a default authentication routine is not set for a function, the default is **none** and no authentication is performed. Use the **more system:running-config** command to view currently configured lists of authentication methods.

Note In Table 3, the **group radius**, **group tacacs+**, and **group** *group-name* methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs+-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Table 4 aaa authentication enable default Methods

Keyword	Description
enable	Uses the enable password for authentication.
line	Uses the line password for authentication.
none	Uses no authentication.
group radius	Uses the list of all RADIUS servers for authentication. **Note** The RADIUS method does not work on a per-username basis.
group tacacs+	Uses the list of all TACACS+ servers for authentication.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for authentication as defined by the **aaa group server radius** or **aaa group server tacacs+** command.

Examples

The following example creates an authentication list that first tries to contact a TACACS+ server. If no server can be found, AAA tries to use the enable password. If this attempt also returns an error (because no enable password is configured on the server), the user is allowed access with no authentication.

```
aaa authentication enable default group tacacs+ enable none
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict network access to a user.
aaa new-model	Enables the AAA access control model.
enable password	Sets a local password to control access to various privilege levels.

aaa authentication fail-message

To configure a personalized banner that will be displayed when a user fails login, use the **aaa authentication fail-message** command in global configuration mode. To remove the failed login message, use the **no** form of this command.

aaa authentication fail-message *dstringd*

no aaa authentication fail-message

Syntax Description

d	The delimiting character at the beginning and end of the *string* that notifies the system that the *string* is to be displayed as the banner. The delimiting character can be any character in the extended ASCII character set, but once defined as the delimiter, that character cannot be used in the text string making up the banner.
string	Any group of characters, excluding the one used as the delimiter. The maximum number of characters that you can display is 2996.

Defaults

Not enabled

Command Modes

Global configuration

Command History

Release	Modification
11.3(4)T	This command was introduced.

Usage Guidelines

Use the **aaa authentication fail-message** command to create a personalized message that appears when a user fails login. This message will replace the default message for failed login.

To create a failed-login banner, you need to configure a delimiting character, which notifies the system that the following text string is to be displayed as the banner, and then the text string itself. The delimiting character is repeated at the end of the text string to signify the end of the banner. The delimiting character can be any character in the extended ASCII character set, but once defined as the delimiter, that character cannot be used in the text string making up the banner.

Examples

The following example shows the default login message and failed login message that is displayed if **aaa authentication banner** and **aaa authentication fail-message** are not configured. (RADIUS is specified as the default login authentication method.)

```
aaa new-model
aaa authentication login default group radius
```

This configuration produces the following standard output:

```
User Verification Access
Username:
Password:
```

```
% Authentication failed.
```

The following example configures both a login banner (“Unauthorized use is prohibited.”) and a login-fail message (“Failed login. Try again.”). The login message will be displayed when a user logs in to the system. The failed-login message will display when a user tries to log in to the system and fails. (RADIUS is specified as the default login authentication method.) In this example, the asterisk (*) is used as the delimiting character.

```
aaa new-model
aaa authentication banner *Unauthorized use is prohibited.*
aaa authentication fail-message *Failed login. Try again.*
aaa authentication login default group radius
```

This configuration produces the following login and failed login banner:

```
Unauthorized use is prohibited.
Username:
Password:
Failed login. Try again.
```

Related Commands

Command	Description
aaa authentication banner	Configures a personalized banner that will be displayed at user login.

aaa authentication login

To set authentication, authorization, and accounting (AAA) authentication at login, use the **aaa authentication login** command in global configuration mode. To disable AAA authentication, use the **no** form of this command.

aaa authentication login {**default** | *list-name*} *method1* [*method2*...]

no aaa authentication login {**default** | *list-name*} *method1* [*method2*...]

Syntax Description

default	Uses the listed authentication methods that follow this argument as the default list of methods when a user logs in.
list-name	Character string used to name the list of authentication methods activated when a user logs in.
method1 [*method2*...]	At least one of the keywords described in Table 5.

Defaults

If the **default** list is not set, only the local user database is checked. This has the same effect as the following command:

```
aaa authentication login default local
```

Note On the console, login will succeed without any authentication checks if **default** is not set.

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.
12.0(5)T	Group server and local-case support were added as method keywords for this command.

Usage Guidelines

The default and optional list names that you create with the **aaa authentication login** command are used with the **login authentication** command.

Create a list by entering the **aaa authentication login** *list-name method* command for a particular protocol, where *list-name* is any character string used to name this list (such as *MIS-access*). The *method* argument identifies the list of methods that the authentication algorithm tries, in the given sequence. Method keywords are described in Table 5.

To create a default list that is used if no list is assigned to a line, use the **login authentication** command with the default argument followed by the methods you want to use in default situations.

The additional methods of authentication are used only if the previous method returns an error, not if it fails. To ensure that the authentication succeeds even if all methods return an error, specify **none** as the final method in the command line.

If authentication is not specifically set for a line, the default is to deny access and no authentication is performed. Use the **more system:running-config** command to display currently configured lists of authentication methods.

Note In Table 5, the **group radius**, **group tacacs+**, and **group** *group-name* methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs+-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Table 5 aaa authentication login Methods

Keyword	Description
enable	Uses the enable password for authentication.
krb5	Uses Kerberos 5 for authentication.
krb5-telnet	Uses Kerberos 5 telnet authentication protocol when using Telnet to connect to the router.
line	Uses the line password for authentication.
local	Uses the local username database for authentication.
local-case	Uses case-sensitive local username authentication.
none	Uses no authentication.
group radius	Uses the list of all RADIUS servers for authentication.
group tacacs+	Uses the list of all TACACS+ servers for authentication.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for authentication as defined by the **aaa group server radius** or **aaa group server tacacs+** command.

Examples

The following example creates an AAA authentication list called *MIS-access*. This authentication first tries to contact a TACACS+ server. If no server is found, TACACS+ returns an error and AAA tries to use the enable password. If this attempt also returns an error (because no enable password is configured on the server), the user is allowed access with no authentication.

```
aaa authentication login MIS-access group tacacs+ enable none
```

The following example creates the same list, but it sets it as the default list that is used for all login authentications if no other list is specified:

```
aaa authentication login default group tacacs+ enable none
```

The following example sets authentication at login to use the Kerberos 5 Telnet authentication protocol when using Telnet to connect to the router:

```
aaa authentication login default krb5
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.
login authentication	Enables AAA authentication for logins.

aaa authentication nasi

To specify authentication, authorization, and accounting (AAA) authentication for Netware Asynchronous Services Interface (NASI) clients connecting through the access server, use the **aaa authentication nasi** command in global configuration mode. To disable authentication for NASI clients, use the **no** form of this command.

aaa authentication nasi {**default** | *list-name*} *method1* [*method2*...]

no aaa authentication nasi {**default** | *list-name*} *method1* [*method2*...]

Syntax Description

default	Makes the listed authentication methods that follow this argument the default list of methods used when a user logs in.
list-name	Character string used to name the list of authentication methods activated when a user logs in.
method1 [*method2*...]	At least one of the methods described in Table 6.

Defaults

If the **default** list is not set, only the local user database is selected. This has the same effect as the following command:

```
aaa authentication nasi default local
```

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.0(5)T	Group server support and **local-case** were added as method keywords for this command.

Usage Guidelines

The default and optional list names that you create with the **aaa authentication nasi** command are used with the **nasi authentication** command.

Create a list by entering the **aaa authentication nasi** command, where *list-name* is any character string that names the list (such as *MIS-access*). The *method* argument identifies the list of methods the authentication algorithm tries in the given sequence. Method keywords are described in Table 6.

To create a default list that is used if no list is assigned to a line with the **nasi authentication** command, use the default argument followed by the methods that you want to use in default situations.

The remaining methods of authentication are used only if the previous method returns an error, not if it fails. To ensure that the authentication succeeds even if all methods return an error, specify **none** as the final method in the command line.

If authentication is not specifically set for a line, the default is to deny access and no authentication is performed. Use the **more system:running-config** command to display currently configured lists of authentication methods.

Note In Table 6, the **group radius**, **group tacacs+**, and **group** *group-name* methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs+-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Table 6 aaa authentication nasi Methods

Keyword	Description
enable	Uses the enable password for authentication.
line	Uses the line password for authentication.
local	Uses the local username database for authentication.
local-case	Uses case-sensitive local username authentication.
none	Uses no authentication.
group radius	Uses the list of all RADIUS servers for authentication.
group tacacs+	Uses the list of all TACACS+ servers for authentication.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for authentication as defined by the **aaa group server radius** or **aaa group server tacacs+** command.

Examples

The following example creates an AAA authentication list called *list1*. This authentication first tries to contact a TACACS+ server. If no server is found, TACACS+ returns an error and AAA tries to use the enable password. If this attempt also returns an error (because no enable password is configured on the server), the user is allowed access with no authentication.

```
aaa authentication nasi list1 group tacacs+ enable none
```

The following example creates the same list, but sets it as the default list that is used for all login authentications if no other list is specified:

```
aaa authentication nasi default group tacacs+ enable none
```

Related Commands

Command	Description
ip trigger-authentication (global)	Enables the automated part of double authentication at a device.
ipx nasi-server enable	Enables NASI clients to connect to asynchronous devices attached to a router.
nasi authentication	Enables AAA authentication for NASI clients connecting to a router.
show ipx nasi connections	Displays the status of NASI connections.
show ipx spx-protocol	Displays the status of the SPX protocol stack and related counters.

aaa authentication password-prompt

To change the text displayed when users are prompted for a password, use the **aaa authentication password-prompt** command in global configuration mode. To return to the default password prompt text, use the **no** form of this command.

aaa authentication password-prompt *text-string*

no aaa authentication password-prompt *text-string*

Syntax Description

text-string	String of text that will be displayed when the user is prompted to enter a password. If this text-string contains spaces or unusual characters, it must be enclosed in double-quotes (for example, “Enter your password:”).

Defaults

There is no user-defined *text-string*, and the password prompt appears as “Password.”

Command Modes

Global configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

Use the **aaa authentication password-prompt** command to change the default text that the Cisco IOS software displays when prompting a user to enter a password. This command changes the password prompt for the enable password as well as for login passwords that are not supplied by remote security servers. The **no** form of this command returns the password prompt to the default value:

```
Password:
```

The **aaa authentication password-prompt** command does not change any dialog that is supplied by a remote TACACS+ server.

The **aaa authentication password-prompt** command works when RADIUS is used as the login method. The password prompt that is defined in the command will be shown even when the RADIUS server is unreachable. The **aaa authentication password-prompt** command does not work with TACACS+. TACACS+ supplies the network access server (NAS) with the password prompt to display to the users. If the TACACS+ server is reachable, the NAS gets the password prompt from the server and uses that prompt instead of the one defined in the **aaa authentication password-prompt** command. If the TACACS+ server is not reachable, the password prompt that is defined in the **aaa authentication password-prompt** command may be used.

Examples

The following example changes the text for the password prompt:

```
aaa authentication password-prompt “Enter your password now:”
```

Related Commands

Command	Description
aaa authentication username-prompt	Changes the text displayed when users are prompted to enter a username.
aaa new-model	Enables the AAA access control model.
enable password	Sets a local password to control access to various privilege levels.

aaa authentication ppp

To specify one or more authentication, authorization, and accounting (AAA) authentication methods for use on serial interfaces that are running PPP, use the **aaa authentication ppp** command in global configuration mode. To disable authentication, use the **no** form of this command.

aaa authentication ppp {**default** | *list-name*} *method1* [*method2*...]

no aaa authentication ppp {**default** | *list-name*} *method1* [*method2*...]

Syntax Description

default	Uses the listed authentication methods that follow this keyword as the default list of methods when a user logs in.
list-name	Character string used to name the list of authentication methods tried when a user logs in.
method1 [*method2*...]	Identifies the list of methods that the authentication algorithm tries in the given sequence. You must enter at least one method; you may enter up to four methods. Method keywords are described in Table 7.

Defaults

If the **default** list is not set, only the local user database is checked. This has the same effect as that created by the following command:

```
aaa authentication ppp default local
```

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.
12.0(5)T	Group server support and **local-case** were added as method keywords.

Usage Guidelines

The lists that you create with the **aaa authentication ppp** command are used with the **ppp authentication** command. These lists contain up to four authentication methods that are used when a user tries to log in to the serial interface.

Create a list by entering the **aaa authentication ppp** *list-name method* command, where *list-name* is any character string used to name this list (such as *MIS-access*). The *method* argument identifies the list of methods that the authentication algorithm tries in the given sequence. You can enter up to four methods. Method keywords are described in Table 7.

The additional methods of authentication are used only if the previous method returns an error, not if it fails. Specify **none** as the final method in the command line to have authentication succeed even if all methods return an error.

If authentication is not specifically set for a function, the default is **none** and no authentication is performed. Use the **more system:running-config** command to display currently configured lists of authentication methods.

Note In Table 7, the **group radius**, **group tacacs+**, and **group** *group-name* methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs+-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Table 7 aaa authentication ppp Methods

Keyword	Description
if-needed	Does not authenticate if the user has already been authenticated on a tty line.
krb5	Uses Kerberos 5 for authentication (can be used only for Password Authentication Protocol [PAP] authentication).
local	Uses the local username database for authentication.
local-case	Uses case-sensitive local username authentication.
none	Uses no authentication.
group radius	Uses the list of all RADIUS servers for authentication.
group tacacs+	Uses the list of all TACACS+ servers for authentication.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for authentication as defined by the **aaa group server radius** or **aaa group server tacacs+** command.

Examples

The following example creates a AAA authentication list called *MIS-access* for serial lines that use PPP. This authentication first tries to contact a TACACS+ server. If this action returns an error, the user is allowed access with no authentication.

```
aaa authentication ppp MIS-access group tacacs+ none
```

Related Commands

Command	Description
aaa group server radius	Groups different RADIUS server hosts into distinct lists and distinct methods.
aaa group server tacacs+	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
more system:running-config	Displays the contents of the currently running configuration file, the configuration for a specific interface, or map class information.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
radius-server host	Specifies a RADIUS server host.
tacacs+-server host	Specifies a TACACS host.

aaa authentication username-prompt

To change the text displayed when users are prompted to enter a username, use the **aaa authentication username-prompt** command in global configuration mode. To return to the default username prompt text, use the **no** form of this command.

aaa authentication username-prompt *text-string*

no aaa authentication username-prompt *text-string*

Syntax Description

text-string	String of text that will be displayed when the user is prompted to enter a username. If this text-string contains spaces or unusual characters, it must be enclosed in double-quotes (for example, “Enter your name:”).

Defaults

There is no user-defined *text-string*, and the username prompt appears as “Username.”

Command Modes

Global configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

Use the **aaa authentication username-prompt** command to change the default text that the Cisco IOS software displays when prompting a user to enter a username. The **no** form of this command returns the username prompt to the default value:

```
Username:
```

Some protocols (for example, TACACS+) have the ability to override the use of local username prompt information. Using the **aaa authentication username-prompt** command will not change the username prompt text in these instances.

Note The **aaa authentication username-prompt** command does not change any dialog that is supplied by a remote TACACS+ server.

Examples

The following example changes the text for the username prompt:

```
aaa authentication username-prompt "Enter your name here:"
```

Related Commands

Command	Description
aaa authentication password-prompt	Changes the text that is displayed when users are prompted for a password.
aaa new-model	Enables the AAA access control model.
enable password	Sets a local password to control access to various privilege levels.

aaa dnis map authentication login group

To map a Dialed Number Information Service (DNIS) number to a particular authentication, authorization, and accounting (AAA) server group for the login service (this server group will be used for AAA authentication), use the **aaa dnis map authentication login group** command in global configuration mode. To unmap this DNIS number from the defined server group, use the **no** form of this command.

aaa dnis map *dnis-number* **authentication login group** *server-group-name*

no aaa dnis map *dnis-number* **authentication login group** *server-group-name*

Syntax Description

dnis-number	Number of the DNIS.
server-group-name	Character string used to name a group of security servers associated in a server group.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

This command lets you assign a DNIS number to a particular AAA server group; thus, the server group can process the AAA authentication requests for login service for users dialing into the network using that particular DNIS.

To use this command, you must first enable AAA, define an AAA server group, and enable DNIS mapping.

Examples

The following example shows how to map DNIS number 7777 to the RADIUS server group called group1. group1 will use RADIUS server 172.30.0.0 for AAA authentication requests for login service for users dialing in with DNIS 7777.

```
aaa new-model
radius-server host 172.30.0.0 auth-port 1645 key cisco1
aaa group server radius group1
 server 172.30.0.0
 exit
aaa dnis map enable
aaa dnis map 7777 authentication login group group1
```

Related Commands

Command	Description
aaa dnis map accounting network group	Maps a DNIS number to a particular accounting server group.
aaa dnis map enable	Enables AAA server selection based on DNIS.
aaa group server	Groups different server hosts into distinct lists and methods.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.

aaa dnis map authentication ppp group

To map a Dialed Number Information Service (DNIS) number to a particular authentication server group (this server group will be used for authentication, authorization, and accounting (AAA) authentication), use the **aaa dnis map authentication ppp group** command in global configuration mode. To remove the DNIS number from the defined server group, use the **no** form of this command.

aaa dnis map *dnis-number* **authentication ppp group** *server-group-name*

no aaa dnis map *dnis-number* **authentication ppp group** *server-group-name*

Syntax Description

dnis-number	Number of the DNIS.
server-group-name	Character string used to name a group of security servers associated in a server group.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

This command lets you assign a DNIS number to a particular AAA server group, so that the server group can process authentication requests for users dialing in to the network using that particular DNIS. To use this command, you must first enable AAA, define an AAA server group, and enable DNIS mapping.

Examples

The following example maps DNIS number 7777 to the RADIUS server group called group1. Server group group1 will use RADIUS server 172.30.0.0 for authentication requests for users dialing in with DNIS 7777.

```
aaa new-model
radius-server host 172.30.0.0 auth-port 1645 key cisco1
aaa group server radius group1
 server 172.30.0.0
aaa dnis map enable
aaa dnis map 7777 authentication ppp group group1
```

Related Commands

Command	Description
aaa dnis map accounting network group	Maps a DNIS number to a particular accounting server group.
aaa dnis map enable	Enables AAA server selection based on DNIS.
aaa group server	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.

aaa nas redirected-station

To include the original number in the information sent to the authentication server when the number dialed by a device is redirected to another number for authentication, use the **aaa nas redirected-station** command in global configuration mode. To leave the original number out of the information sent to the authentication server, use the **no** form of this command.

aaa nas redirected-station

no aaa nas redirected-station

Syntax Description

This command has no arguments or keywords.

Defaults

The original number is not included in the information sent to the authentication server.

Command Modes

Global configuration

Command History

Release	Modification
12.1 T	This command was introduced.

Usage Guidelines

If a customer is being authenticated by a RADIUS or TACACS+ server and the number dialed by the cable modem (or other device) is redirected to another number for authentication, the **aaa nas redirected-station** command will enable the original number to be included in the information sent to the authentication server.

This functionality allows the service provider to determine whether the customer dialed a number that requires special billing arrangements, such as a toll-free number.

The original number can be sent as a Cisco Vendor Specific Attribute (VSA) for TACACS+ servers and as RADIUS Attribute 93 (Ascend-Redirect-Number) for RADIUS servers. The RADIUS Attribute 93 is sent by default; to also send a VSA attribute for TACACS+ servers, use the **radius-server vsa send accounting** and **radius-server vsa send authentication** commands. To configure the RADIUS server to use RADIUS Attribute 93, add the non-standard option to the **radius-server host** command.

Note This feature is valid only when using port adapters that are configured for a T1 or E1 ISDN PRI or BRI interface. In addition, the telco switch performing the number redirection must be able to provide the redirected number in the Q.931 Digital Subscriber Signaling System Network Layer.

Examples

The following example enables the original number to be forwarded to the authentication server:

```
!
aaa authorization config-commands
aaa accounting exec default start-stop group radius
aaa accounting system default start-stop broadcast group apn23
aaa nas redirected-station
```

```
aaa session-id common
ip subnet-zero
!
```

Related Commands

Command	Description
radius-server host	Specifies a RADIUS server host.
radius-server vsa	Configures the network access server to recognize and use vendor-specific attributes.

aaa new-model

To enable the authentication, authorization, and accounting (AAA) access control model, issue the **aaa new-model** command in global configuration mode. To disable the AAA access control model, use the **no** form of this command.

aaa new-model

no aaa new-model

Syntax Description

This command has no arguments or keywords.

Defaults

AAA is not enabled.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command enables the AAA access control system.

Examples

The following example initializes AAA:

```
aaa new-model
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
aaa authentication arap	Enables an AAA authentication method for ARAP using TACACS+.
aaa authentication enable default	Enables AAA authentication to determine if a user can access the privileged command level.
aaa authentication login	Sets AAA authentication at login.
aaa authentication ppp	Specifies one or more AAA authentication method for use on serial interfaces running PPP.
aaa authorization	Sets parameters that restrict user access to a network.

aaa pod server

To enable inbound user sessions to be disconnected when specific session attributes are presented, use the **aaa pod server** global configuration command. To disable this feature, use the **no** form of this command.

aaa pod server [**port** *port-number*] [**auth-type** {**any** | **all** | **session-key**}] **server-key** *string*

no aaa pod server

Syntax Description

port *port-number*	(Optional) The network access server port to use for packet of disconnect requests. If no port is specified, port 1700 is used.
auth-type	(Optional) The type of authorization required for disconnecting sessions. If no authentication type is specified, **auth-type** is the default.
any	(Optional) Specifies that the session that matches all attributes sent in the POD packet is disconnected. The POD packet can contain one or more of four key attributes (user-name, framed-IP-address, session-ID, and session-key).
all	(Optional) Only a session that matches all four key attributes is disconnected. **All** is the default.
session-key	(Optional) Specifies that the session that has a matching session-key attribute is disconnected. All other attributes are ignored.
server-key *string*	The secret text string that is shared between the network access server and the client workstation. This secret string must be the same on both systems.

Defaults

The POD server function is disabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

For a session to be disconnected, the values in one or more of the key fields in the POD request must match the values for a session on one of the network access server ports. Which values must match depends on the **auth-type** attribute defined in the command. If no **auth-type** is specified, all four values must match. If no match is found, all connections remain intact and an error response is returned. The key fields are as follows:

- User-Name
- Framed-IP-Address
- Session-Id
- Server-Key

Examples

The following example enables POD and sets the secret key to "ab9123."

```
aaa pod server server-key ab9123
```

Related Commands

Command	Description
aaa authentication	Enables authentication.
aaa accounting	Enables accounting records.
aaa accounting delay-start	Delays generation of the start accounting record until the user IP address is established.
debug aaa pod	Displays debug messages related to POD packets.
radius-server host	Identifies a RADIUS host.

aaa preauth

To enter authentication, authorization, and accounting (AAA) preauthentication configuration mode, use the **aaa preauth** command in global configuration mode. To disable preauthentication, use the **no** form of this command.

aaa preauth

no aaa preauth

Syntax Description

This command has no arguments or keywords.

Defaults

Preauthentication is not enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

To enter AAA preauthentication configuration mode, use the **aaa preauth** command. To configure preauthentication, use a combination of the **aaa preauth** commands: **group**, **clid**, **ctype**, **dnis**, and **dnis bypass**. You must configure the **group** command. You must also configure one or more of the **clid**, **ctype**, **dnis**, or **dnis bypass** commands.

In addition to using the preauthentication commands to configure preauthentication on the Cisco router, you must set up the preauthentication profiles on the RADIUS server.

You can use the **clid**, **ctype**, or **dnis** commands to define the list of the preauthentication elements. For each preauthentication element, you can also define options such as password (for all the elements, the default password is cisco). If you specify multiple elements, the preauthentication process will be performed on each element according to the order of the elements that you configure with the preauthentication commands. In this case, more than one RADIUS preauthentication profile is returned, but only the last preauthentication profile will be applied to the authentication and authorization later on, if applicable.

Examples

The following example enables DNIS preauthentication using a RADIUS server and the password Ascend-DNIS:

```
aaa preauth
 dnis password Ascend-DNIS
```

Related Commands

Command	Description
dnis (AAA preauthentication)	Enables AAA preauthentication using DNIS.
group	Selects the security server to use for AAA preauthentication.
isdn guard-timer	Sets a guard timer to accept or reject a call in the event that the RADIUS server fails to respond to a preauthentication request.

aaa processes

To allocate a specific number of background processes to be used to process authentication, authorization, and accounting (AAA) authentication and authorization requests for PPP, use the **aaa processes** command in global configuration mode. To restore the default value for this command, use the **no** form of this command.

aaa processes *number*

no aaa processes *number*

Syntax Description

number	Specifies the number of background processes allocated for AAA requests for PPP. Valid entries are 1 to 2147483647.

Defaults

The default for this command is one allocated background process.

Command Modes

Global configuration

Command History

Release	Modification
11.3(2)AA	This command was introduced.

Usage Guidelines

Use the **aaa processes** command to allocate a specific number of background processes to simultaneously handle multiple AAA authentication and authorization requests for PPP. Previously, only one background process handled all AAA requests for PPP, so only one new user could be authenticated or authorized at a time. This command configures the number of processes used to handle AAA requests for PPP, increasing the number of users that can be simultaneously authenticated or authorized.

The argument *number* defines the number of background processes earmarked to process AAA authentication and authorization requests for PPP. This argument also defines the number of new users that can be simultaneously authenticated and can be increased or decreased at any time.

Examples

The following examples shows the **aaa processes** command within a standard AAA configuration. The authentication method list “dialins” specifies RADIUS as the method of authentication, then (if the RADIUS server does not respond) local authentication will be used on serial lines using PPP. Ten background processes have been allocated to handle AAA requests for PPP.

```
aaa new-model
aaa authentication ppp dialins group radius local
aaa processes 10
interface 5
encap ppp
ppp authentication pap dialins
```

Related Commands

Command	Description
show ppp queues	Monitors the number of requests processed by each AAA background process.

access-profile

To apply your per-user authorization attributes to an interface during a PPP session, use the **access-profile** command in privileged EXEC mode. Use the default form of the command (no keywords) to cause existing access control lists (ACLs) to be removed and ACLs defined in your per-user configuration to be installed.

access-profile [**merge** | **replace**] [**ignore-sanity-checks**]

Syntax Description

merge	(Optional) Like the default form of the command, this option removes existing ACLs while retaining other existing authorization attributes for the interface. However, using this option also installs per-user authorization attributes in addition to the existing attributes. (The default form of the command installs only new ACLs.) The per-user authorization attributes come from all attribute-value pairs defined in the authentication, authorization, and accounting (AAA) per-user configuration (the user's authorization profile). The resulting authorization attributes of the interface are a combination of the previous and new configurations.
replace	(Optional) This option removes existing ACLs *and* all other existing authorization attributes for the interface. A complete new authorization configuration is then installed, using all AV pairs defined in the AAA per-user configuration. This option is not normally recommended because it initially deletes *all* existing configurations, including static routes. This could be detrimental if the new user profile does not reinstall appropriate static routes and other critical information.
ignore-sanity-checks	(Optional) Enables you to use any AV pairs, whether or not they are valid.

Command Modes

User EXEC

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

Remote users can use this command to activate double authentication for a PPP session. Double authentication must be correctly configured for this command to have the desired effect.

You should use this command when remote users establish a PPP link to gain local network access.

After you have been authenticated with CHAP (Challenge Handshake Authentication Protocol) or PAP (Password Authentication Protocol), you will have limited authorization. To activate double authentication and gain your appropriate user network authorization, you must open a Telnet session to the network access server and execute the **access-profile** command. (This command could also be set up as an autocommand, which would eliminate the need to enter the command manually.)

This command causes all subsequent network authorizations to be made in *your* username instead of in the remote *host's* username.

Any changes to the interface caused by this command will stay in effect for as long as the interface stays up. These changes will be removed when the interface goes down. This command does not affect the normal operation of the router or the interface.

The default form of the command, **access-profile**, causes existing ACLs to be unconfigured (removed), and new ACLs to be installed. The new ACLs come from your per-user configuration on an AAA server (such as a TACACS+ server). The ACL replacement constitutes a reauthorization of your network privileges.

The default form of the command can fail if your per-user configuration contains statements other than ACL AV pairs. Any protocols with non-ACL statements will be deconfigured, and no traffic for that protocol can pass over the PPP link.

The **access-profile merge** form of the command causes existing ACLs to be unconfigured (removed) and new authorization information (including new ACLs) to be added to the interface. This new authorization information consists of your complete per-user configuration on an AAA server. If any of the new authorization statements conflict with existing statements, the new statements could "override" the old statements or be ignored, depending on the statement and applicable parser rules. The resulting interface configuration is a combination of the original configuration and the newly installed per-user configuration.

Caution The new user authorization profile (per-user configuration) must *not* contain any invalid mandatory AV pairs, otherwise the command will fail and the PPP protocol (containing the invalid pair) will be dropped. If invalid AV pairs are included as *optional* in the user profile, the command will succeed, but the invalid AV pair will be ignored. Invalid AV pair types are listed later in this section.

The **access-profile replace** form of the command causes the entire existing authorization configuration to be removed from the interface, and the complete per-user authorization configuration to be added. This per-user authorization consists of your complete per-user configuration on an AAA server.

Caution Use extreme caution when using the **access-profile replace** form of the command. It might have detrimental and unexpected results, because this option deletes *all* authorization configuration information (including static routes) before reinstalling the new authorization configuration.

Invalid AV pair types

- addr
- addr-pool
- zonelist
- tunnel-id
- ip-addresses
- x25-addresses
- frame-relay
- source-ip

Note These AV pair types are "invalid" only when used with double authentication, in the user-specific authorization profile; they cause the **access-profile** command to fail. However, these AV pair types can be appropriate when used in other contexts.

Examples

The following example activates double authentication for a remote user. This example assumes that the **access-profile** command was *not* configured as an autocommand.

The remote user connects to the corporate headquarters network as shown in Figure 2.

Figure 2 Network Topology for Activating Double Authentication (Example)

The remote user runs a terminal emulation application to Telnet to the corporate network access server, a Cisco AS5200 universal access server local host named "hqnas." The remote user, named Bob, has the username "BobUser."

The following example replaces ACLs on the local host PPP interface. The ACLs previously applied to the interface during PPP authorization are replaced with ACLs defined in the per-user configuration AV pairs.

The remote user establishes a Telnet session to the local host and logs in:

```
login: BobUser
Password: <welcome>
hqnas> access-profile
```

Bob is reauthenticated when he logs in to hqnas, because hqnas is configured for login AAA authentication using the corporate RADIUS server. When Bob enters the **access-profile** command, he is reauthorized with his per-user configuration privileges. This causes the access lists and filters in his per-user configuration to be applied to the network access server interface.

After the reauthorization is complete, Bob is automatically logged out of the Cisco AS5200 local host.

Related Commands

Command	Description
connect	Logs in to a host that supports Telnet, rlogin, or LAT.
telnet	Logs in to a host that supports Telnet.

arap authentication

To enable authentication, authorization, and accounting (AAA) authentication for AppleTalk Remote Access Protocol (ARAP) on a line, use the **arap authentication** command in line configuration mode. To disable authentication for an ARAP line, use the **no** form of the command

arap authentication {**default** | *list-name*} [**one-time**]

no arap authentication {**default** | *list-name*}

Caution If you use a *list-name* value that was not configured with the **aaa authentication arap** command, ARAP will be disabled on this line.

Syntax Description

default	Default list created with the **aaa authentication arap** command.
list-name	Indicated list created with the **aaa authentication arap** command.
one-time	(Optional) Accepts the username and password in the username field.

Defaults

ARAP authentication uses the default set with **aaa authentication arap** command. If no default is set, the local user database is checked.

Command Modes

Line configuration

Command History

Release	Modification
10.3	This command was introduced.
11.0	The **one-time** keyword was added.

Usage Guidelines

This command is a per-line command that specifies the name of a list of AAA authentication methods to try at login. If no list is specified, the default list is used (whether or not it is specified in the command line). You create defaults and lists with the **aaa authentication arap** command. Entering the **no** version of **arap authentication** has the same effect as entering the command with the **default** keyword. Before issuing this command, create a list of authentication processes by using the **aaa authentication arap** global configuration command.

Examples

The following example specifies that the TACACS+ authentication list called *MIS-access* is used on ARAP line 7:

```
line 7
 arap authentication MIS-access
```

Related Commands

Command	Description
aaa authentication arap	Enables an AAA authentication method for ARAP using TACACS+.

clear ip trigger-authentication

To clear the list of remote hosts for which automated double authentication has been attempted, use the **clear ip trigger-authentication** command in privileged EXEC mode.

clear ip trigger-authentication

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command when troubleshooting automated double authentication. This command clears the entries in the list of remote hosts displayed by the **show ip trigger-authentication** command.

Examples

The following example clears the remote host table:

```
Router# show ip trigger-authentication

Trigger-authentication Host Table:
Remote Host          Time Stamp
172.21.127.114       2940514234
router# clear ip trigger-authentication
router# show ip trigger-authentication
router#
```

Related Commands

Command	Description
show ip trigger-authentication	Displays the list of remote hosts for which automated double authentication has been attempted.

dnis (AAA preauthentication)

To preauthenticate calls on the basis of the Dialed Number Identification Service (DNIS) number, use the **dnis** authentication, authorization, and accounting (AAA) preauthentication configuration command. To remove the **dnis** command from your configuration, use the **no** form of this command.

dnis [**if-avail** | **required**] [**accept-stop**] [**password** *string*]

no dnis [**if-avail** | **required**] [**accept-stop**] [**password** *string*]

Syntax Description

if-avail	(Optional) Implies that if the switch provides the data, RADIUS must be reachable and must accept the string in order for preauthentication to pass. If the switch does not provide the data, preauthentication passes.
required	(Optional) Implies that the switch must provide the associated data, that RADIUS must be reachable, and that RADIUS must accept the string in order for preauthentication to pass. If these three conditions are not met, preauthentication fails.
accept-stop	(Optional) Prevents subsequent preauthentication elements from being tried once preauthentication has succeeded for a call element.
password *string*	(Optional) Password to use in the Access-Request packet. The default is cisco.

Defaults

The **if-avail** and **required** keywords are mutually exclusive. If the **if-avail** keyword is not configured, the preauthentication setting defaults to **required**.

The default password string is cisco.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You may configure more than one of the AAA preauthentication commands (**clid**, **ctype**, **dnis**) to set conditions for preauthentication. The sequence of the command configuration decides the sequence of the preauthentication conditions. For example, if you configure **dnis**, then **clid**, then **ctype**, then this is the order of the conditions considered in the preauthentication process.

In addition to using the preauthentication commands to configure preauthentication on the Cisco router, you must set up the preauthentication profiles on the RADIUS server.

Examples

The following example enables DNIS preauthentication using a RADIUS server and the password Ascend-DNIS:

```
aaa preauth
 group radius
 dnis password Ascend-DNIS
```

Related Commands

Command	Description
aaa preauth	Enters AAA preauthentication mode.
group	Selects the security server to use for AAA preauthentication.
isdn guard-timer	Sets a guard timer to accept or reject a call in the event that the RADIUS server fails to respond to a preauthentication request.

group

To specify the authentication, authorization, and accounting (AAA) TACACS+ server group to use for preauthentication, use the **group** command in AAA preauthentication configuration mode. To remove the **group** command from your configuration, use the **no** form of this command.

group {**tacacs+** *server-group*}

no group {**tacacs+** *server-group*}

Syntax Description

tacacs+	Uses a TACACS+ server for authentication.
server-group	Name of the server group to use for authentication.

Defaults

No method list is configured.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must configure the **group** command before you configure any other AAA preauthentication command (**clid**, **ctype**, **dnis**, or **dnis bypass**).

Examples

The following example enables Dialed Number Identification Service (DNIS) preauthentication using the abc123 server group and the password aaa-DNIS:

```
aaa preauth
 group abc123
 dnis password aaa-DNIS
```

Related Commands

Command	Description
aaa preauth	Enters AAA preauthentication mode.
dnis (AAA preauthentication)	Enables AAA preauthentication using DNIS.

ip trigger-authentication (global)

To enable the automated part of double authentication at a device, use the **ip trigger-authentication** command in global configuration mode. To disable the automated part of double authentication, use the **no** form of this command.

ip trigger-authentication [**timeout** *seconds*] [**port** *number*]

no ip trigger-authentication

Syntax Description

timeout *seconds*	(Optional) Specifies how frequently the local device sends a User Datagram Protocol (UDP) packet to the remote host to request the user's username and password (or PIN). The default is 90 seconds. See "The Timeout Keyword" in the Usage Guidelines section for details.
port *number*	(Optional) Specifies the UDP port to which the local router should send the UPD packet requesting the user's username and password (or PIN). The default is port 7500. See "The Port Keyword" in the Usage Guidelines section for details.

Defaults

The default timeout is 90 seconds, and the default port number is 7500.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Configure this command on the local device (router or network access server) that remote users dial in to. Use this command only if the local device has already been configured to provide double authentication; this command enables automation of the second authentication of double authentication.

The Timeout Keyword

During the second authentication stage of double authentication—when the remote user is authenticated—the remote user must send a username and password (or PIN) to the local device. With automated double authentication, the local device sends a UDP packet to the remote user's host during the second user-authentication stage. This UDP packet triggers the remote host to launch a dialog box requesting a username and password (or PIN).

If the local device does not receive a valid response to the UDP packet within a timeout period, the local device will send another UDP packet. The device will continue to send UDP packets at the timeout intervals until it receives a response and can authenticate the user.

By default, the UDP packet timeout interval is 90 seconds. Use the **timeout** keyword to specify a different interval.

(This timeout also applies to how long entries will remain in the remote host table; see the **show ip trigger-authentication** command for details.)

The Port Keyword

As described in the previous section, the local device sends a UDP packet to the remote user's host to request the user's username and password (or PIN). This UDP packet is sent to UDP port 7500 by default. (The remote host client software listens to UDP port 7500 by default.) If you need to change the port number because port 7500 is used by another application, you should change the port number using the **port** keyword. If you change the port number you need to change it in both places—both on the local device and in the remote host client software.

Examples

The following example globally enables automated double authentication and sets the timeout to 120 seconds:

```
ip trigger-authentication timeout 120
```

Related Commands

Command	Description
ip trigger-authentication (interface)	Specifies automated double authentication at an interface.
show ip trigger-authentication	Displays the list of remote hosts for which automated double authentication has been attempted.

ip trigger-authentication (interface)

To specify automated double authentication at an interface, use the **ip trigger-authentication** command in interface configuration mode. To turn off automated double authentication at an interface, use the **no** form of this command.

ip trigger-authentication

no ip trigger-authentication

Syntax Description

This command has no arguments or keywords.

Defaults

Automated double authentication is not enabled for specific interfaces.

Command Modes

Interface configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Configure this command on the local router or network access server that remote users dial into. Use this command only if the local device has already been configured to provide double authentication and if automated double authentication has been enabled with the **ip trigger-authentication** (global) command.

This command causes double authentication to occur automatically when users dial into the interface.

Examples

The following example turns on automated double authentication at the ISDN BRI interface BRI0:

```
interface BRI0
 ip trigger-authentication
 encapsulation ppp
 ppp authentication chap
```

Related Commands

Command	Description
ip trigger-authentication (global)	Enables the automated part of double authentication at a device.

login authentication

To enable authentication, authorization, and accounting (AAA) authentication for logins, use the **login authentication** command in line configuration mode. To return to the default specified by the **aaa authentication login** command, use the **no** form of this command.

login authentication {**default** | *list-name*}

no login authentication {**default** | *list-name*}

Syntax Description

default	Uses the default list created with the **aaa authentication login** command.
list-name	Uses the indicated list created with the **aaa authentication login** command.

Defaults

Uses the default set with **aaa authentication login**.

Command Modes

Line configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is a per-line command used with AAA that specifies the name of a list of AAA authentication methods to try at login. If no list is specified, the default list is used (whether or not it is specified in the command line).

Caution If you use a *list-name* value that was not configured with the **aaa authentication login** command, you will disable login on this line.

Entering the **no** version of **login authentication** has the same effect as entering the command with the **default** keyword.

Before issuing this command, create a list of authentication processes by using the global configuration **aaa authentication login** command.

Examples

The following example specifies that the default AAA authentication is to be used on line 4:

```
line 4
 login authentication default
```

The following example specifies that the AAA authentication list called *list1* is to be used on line 7:

```
line 7
 login authentication list1
```

Related Commands

Command	Description
aaa authentication login	Sets AAA authentication at login.

nasi authentication

To enable authentication, authorization, and accounting (AAA) authentication for NetWare Asynchronous Services Interface (NASI) clients connecting to a router, use the **nasi authentication** command in line configuration mode. To return to the default, as specified by the **aaa authentication nasi** command, use the **no** form of the command.

nasi authentication {**default** | *list-name*}

no nasi authentication {**default** | *list-name*}

Syntax Description

default	Uses the default list created with the **aaa authentication nasi** command.
list-name	Uses the list created with the **aaa authentication nasi** command.

Defaults

Uses the default set with the **aaa authentication nasi** command.

Command Modes

Line configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command is a per-line command used with AAA authentication that specifies the name of a list of authentication methods to try at login. If no list is specified, the default list is used, even if it is not specified in the command line. (You create defaults and lists with the **aaa authentication nasi** command.) Entering the **no** form of this command has the same effect as entering the command with the **default** argument.

Caution If you use a *list-name* value that was not configured with the **aaa authentication nasi** command, you will disable login on this line.

Before issuing this command, create a list of authentication processes by using the **aaa authentication nasi** global configuration command.

Examples

The following example specifies that the default AAA authentication be used on line 4:

```
line 4
 nasi authentication default
```

The following example specifies that the AAA authentication list called *list1* be used on line 7:

```
line 7
 nasi authentication list1
```

Related Commands

Command	Description
aaa authentication nasi	Specifies AAA authentication for NASI clients connecting through the access server.
ipx nasi-server enable	Enables NASI clients to connect to asynchronous devices attached to a router.
show ipx nasi connections	Displays the status of NASI connections.
show ipx spx-protocol	Displays the status of the SPX protocol stack and related counters.

ppp authentication

To enable Challenge Handshake Authentication Protocol (CHAP) or Password Authentication Protocol (PAP) or both and to specify the order in which CHAP and PAP authentication are selected on the interface, use the **ppp authentication** command in interface configuration mode. To disable this authentication, use the **no** form of this command.

ppp authentication {*protocol1* [*protocol2...*]} [**if-needed**] [*list-name* | **default**] [**callin**] [**one-time**] [**optional**]

no ppp authentication

Syntax Description

protocol1 [*protocol2...*]	Specify at least one of the keywords described in Table 8.
if-needed	(Optional) Used with TACACS and extended TACACS. Does not perform CHAP or PAP authentication if the user has already provided authentication. This option is available only on asynchronous interfaces.
list-name	(Optional) Used with AAA. Specifies the name of a list of methods of authentication to use. If no list name is specified, the system uses the default. The list is created with the **aaa authentication ppp** command.
default	(Optional) The name of the method list is created with the **aaa authentication ppp** command.
callin	(Optional) Specifies authentication on incoming (received) calls only.
one-time	(Optional) Accepts the username and password in the username field.
optional	(Optional) Accepts the connection even if the peer refuses to accept the authentication methods that the router has requested.

Defaults

PPP authentication is not enabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.1(0.1)	The **optional** keyword was added.

Usage Guidelines

When you enable CHAP or PAP authentication (or both), the local router requires the remote device to prove its identity before allowing data traffic to flow. PAP authentication requires the remote device to send a name and a password, which is checked against a matching entry in the local username database or in the remote security server database. CHAP authentication sends a challenge message to the remote device. The remote device encrypts the challenge value with a shared secret and returns the encrypted value and its name to the local router in a Response message. The local router attempts to match the

remote device's name with an associated secret stored in the local username or remote security server database; it uses the stored secret to encrypt the original challenge and verify that the encrypted values match.

You can enable CHAP, MS-CHAP, or PAP in any order. If you enable all three methods, the first method specified is requested during link negotiation. If the peer suggests using the second method, or refuses the first method, the second method is tried. Some remote devices support only one method. Base the order in which you specify methods on the remote device's ability to correctly negotiate the appropriate method, and on the level of data line security you require. PAP usernames and passwords are sent as clear text strings, which can be intercepted and reused.

Caution If you use a *list-name* value that was not configured with the **aaa authentication ppp** command, you will disable PPP on this interface.

Table 8 lists the protocols used to negotiate PPP authentication.

Table 8 ppp authentication Protocols

chap	Enables CHAP on a serial interface.
ms-chap	Enables Microsoft's version of CHAP (MS-CHAP) on a serial interface.
pap	Enables PAP on a serial interface.

Enabling or disabling PPP authentication does not affect the local router's ability to authenticate itself to the remote device.

If you are using autoselect on a tty line, you can use the **ppp authentication** command to turn on PPP authentication for the corresponding interface.

MS-CHAP is the Microsoft version of CHAP. Like the standard version of CHAP, MS-CHAP is used for PPP authentication; in this case, authentication occurs between a personal computer using Microsoft Windows NT or Microsoft Windows 95 and a Cisco router or access server acting as a network access server.

Enabling or disabling PPP authentication does not affect the local router's willingness to authenticate itself to the remote device.

If you are using autoselect on a tty line, you probably want to use the **ppp authentication** command to turn on PPP authentication for the corresponding interface.

Examples

The following example enables CHAP on asynchronous interface 4 and uses the authentication list MIS-access:

```
interface async 4
 encapsulation ppp
 ppp authentication chap MIS-access
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication method for use on serial interfaces running PPP.
aaa new-model	Enables the AAA access control model.

Command	Description
autoselect	Configures a line to start an ARAP, PPP, or SLIP session.
encapsulation	Sets the encapsulation method used by the interface.
username	Establishes a username-based authentication system, such as PPP CHAP and PAP.

ppp chap hostname

To create a pool of dialup routers that all appear to be the same host when authenticating with Challenge Handshake Authentication Protocol (CHAP), use the **ppp chap hostname** command in interface configuration mode. To disable this function, use the **no** form of the command.

ppp chap hostname *hostname*

no ppp chap hostname *hostname*

Syntax Description

hostname	The name sent in the CHAP challenge.

Defaults

Disabled. The router name is sent in any CHAP challenges.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The **ppp chap hostname** command allows you to specify a common alias for all routers in a rotary group to use so that only one username must be configured on the dialing routers.

This command is normally used with local CHAP authentication (when the router authenticates to the peer), but it can also be used for remote CHAP authentication.

Examples

The following example identifies dialer interface 0 as the dialer rotary group leader and specifies “ppp” as the encapsulation method used by all member interfaces. This example shows that CHAP authentication is used on received calls only and the username ISPCorp will be sent in all CHAP challenges and responses.

```
interface dialer 0
 encapsulation ppp
 ppp authentication chap callin
 ppp chap hostname ISPCorp
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
ppp chap password	Enables a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common CHAP secret password to use in response to challenges from an unknown peer.
ppp chap refuse	Refuses CHAP authentication from peers requesting it.
ppp chap wait	Specifies that the router will not authenticate to a peer requesting CHAP authentication until after the peer has authenticated itself to the router.

ppp chap password

To enable a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common Challenge Handshake Authentication Protocol (CHAP) secret password to use in response to challenges from an unknown peer, use the **ppp chap password** command in interface configuration mode. To disable the PPP CHAP password, use the **no** form of this command.

ppp chap password *secret*

no ppp chap password *secret*

Syntax Description

secret	The secret used to compute the response value for any CHAP challenge from an unknown peer.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command allows you to replace several username and password configuration commands with a single copy of this command on any dialer interface or asynchronous group interface.

This command is used for remote CHAP authentication only (when routers authenticate to the peer) and does not affect local CHAP authentication.

Examples

The commands in the following example specify ISDN BRI number 0. The method of encapsulation on the interface is PPP. If a CHAP challenge is received from a peer whose name is not found in the global list of usernames, the encrypted secret 7 1267234591 is decrypted and used to create a CHAP response value.

```
interface bri 0
 encapsulation ppp
 ppp chap password 7 1234567891
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.

Command	Description
ppp chap hostname	Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP.
ppp chap refuse	Refuses CHAP authentication from peers requesting it.
ppp chap wait	Specifies that the router will not authenticate to a peer requesting CHAP authentication until after the peer has authenticated itself to the router.

ppp chap refuse

To refuse Challenge Handshake Authentication Protocol (CHAP) authentication from peers requesting it, use the **ppp chap refuse** command in interface configuration mode. To allow CHAP authentication, use the **no** form of this command.

ppp chap refuse [**callin**]

no ppp chap refuse [**callin**]

Syntax Description

callin	(Optional) This keyword specifies that the router will refuse to answer CHAP authentication challenges received from the peer, but will still require the peer to answer any CHAP challenges the router sends.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command specifies that CHAP authentication is disabled for all calls, meaning that all attempts by the peer to force the user to authenticate using CHAP will be refused. If the **callin** keyword is used, CHAP authentication is disabled for incoming calls from the peer, but will still be performed on outgoing calls to the peer.

If outbound Password Authentication Protocol (PAP) has been enabled (using the **ppp pap sent-username** command), PAP will be suggested as the authentication method in the refusal packet.

Examples

The following example specifies ISDN BRI number 0. The method of encapsulation on the interface is PPP. This example disables CHAP authentication from occurring if a peer calls in requesting CHAP authentication.

```
interface bri 0
 encapsulation ppp
 ppp chap refuse
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.

Command	Description
ppp chap hostname	Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP.
ppp chap password	Enables a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common CHAP secret password to use in response to challenges from an unknown peer.
ppp chap wait	Specifies that the router will not authenticate to a peer requesting CHAP authentication until after the peer has authenticated itself to the router.

ppp chap wait

To specify that the router will not authenticate to a peer requesting Challenge Handshake Authentication Protocol (CHAP) authentication until after the peer has authenticated itself to the router, use the **ppp chap wait** command in interface configuration mode. To allow the router to respond immediately to an authentication challenge, use the **no** form of this command.

ppp chap wait *secret*

no ppp chap wait *secret*

Syntax Description

secret	The secret used to compute the response value for any CHAP challenge from an unknown peer.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command (which is enabled by default) specifies that the router will not authenticate to a peer requesting CHAP authentication until the peer has authenticated itself to the router. The **no** form of this command specifies that the router will respond immediately to an authentication challenge.

Examples

The following example specifies ISDN BRI number 0. The method of encapsulation on the interface is PPP. This example disables the default, meaning that users do not have to wait for peers to complete CHAP authentication before authenticating themselves.

```
interface bri 0
 encapsulation ppp
 no ppp chap wait
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
ppp chap hostname	Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP.

Command	Description
ppp chap password	Enables a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common CHAP secret password to use in response to challenges from an unknown peer.
ppp chap refuse	Refuses CHAP authentication from peers requesting it.

ppp pap refuse

To refuse a peer request to authenticate remotely with PPP using Password Authentication Protocol, use the **ppp pap refuse** interface configuration command. To disable the refusal, use the **no** form of this command.

ppp pap refuse

no ppp pap refuse

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

Use this command to refuse remote PAP support; for example, to respond to the peer request to authenticate with PAP.

This is a per-interface command.

Examples

The following example shows how to enable the **ppp pap** command to refuse a peer request for remote authentication:

```
interface dialer 0
 encapsulation ppp
 ppp pap refuse
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP and TACACS+.
encapsulation ppp	Sets PPP as the encapsulation method used by a serial or ISDN interface.
ppp authentication	Enables CHAP or PAP or both, and specifies the order in which CHAP and PAP authentication are selected on the interface.
ppp pap sent-username	Reenables remote PAP support for an interface and uses the **sent-username** and **password** in the PAP authentication request packet to the peer.

ppp pap sent-username

To reenable remote Password Authentication Protocol (PAP) support for an interface and use the **sent-username** and **password** in the PAP authentication request packet to the peer, use the **ppp pap sent-username** command in interface configuration mode. To disable remote PAP support, use the **no** form of this command.

ppp pap sent-username *username* **password** *password*

no ppp pap sent-username

Syntax Description

username	Username sent in the PAP authentication request.
password	Password sent in the PAP authentication request.
password	Must contain from 1 to 25 uppercase and lowercase alphanumeric characters.

Defaults

Remote PAP support disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to reenable remote PAP support (for example, to respond to the peer's request to authenticate with PAP) and to specify the parameters to be used when sending the PAP authentication request.

This is a per-interface command. You must configure this command for each interface.

Examples

The following example identifies dialer interface 0 as the dialer rotary group leader and specify PPP as the method of encapsulation used by the interface. Authentication is by CHAP or PAP on received calls only. ISPCorp is the username sent to the peer if the peer requires the router to authenticate with PAP.

```
interface dialer0
 encapsulation ppp
 ppp authentication chap pap callin
 ppp chap hostname ISPCorp
 ppp pap sent username ISPCorp password 7 fjhfeu
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
ppp chap hostname	Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP.
ppp chap password	Enables a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common CHAP secret password to use in response to challenges from an unknown peer.

show ip trigger-authentication

To view the list of remote hosts for which automated double authentication has been attempted, use the **show ip trigger-authentication** command in privileged EXEC mode.

show ip trigger-authentication

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Whenever a remote user needs to be user-authenticated in the second stage of automated double authentication, the local device sends a User Datagram Protocol (UDP) packet to the remote user's host. When the UDP packet is sent, the user's host IP address is added to a table. If additional UDP packets are sent to the same remote host, a new table entry is not created; instead, the existing entry is updated with a new time stamp. This remote host table contains a cumulative list of host entries; entries are deleted after a timeout period or after you manually clear the table using the **clear ip trigger-authentication** command. You can change the timeout period with the **ip trigger-authentication** (global) command.

Use this command to view the list of remote hosts for which automated double authentication has been attempted.

Examples

The following example shows output from the **show ip trigger-authentication** command:

```
Router# show ip trigger-authentication

Trigger-authentication Host Table:
Remote Host          Time Stamp
172.21.127.114       2940514234
```

This output shows that automated double authentication was attempted for a remote user; the remote user's host has the IP address 172.21.127.114. The attempt to automatically double authenticate occurred when the local host (myfirewall) sent the remote host (172.21.127.114) a packet to UDP port 7500. (The default port was not changed in this example.)

Related Commands

Command	Description
clear ip trigger-authentication	Clears the list of remote hosts for which automated double authentication has been attempted.

show ppp queues

To monitor the number of requests processed by each authentication, authorization, and accounting (AAA) background process, use the **show ppp queues** command in privileged EXEC mode.

show ppp queues

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3(2)AA	This command was introduced.

Usage Guidelines

Use the **show ppp queues** command to display the number of requests handled by each AAA background process, the average amount of time it takes to complete each request, and the requests still pending in the work queue. This information can help you balance the data load between the network access server and the AAA server.

This command displays information about the background processes configured by the **aaa processes** global configuration command. Each line in the display contains information about one of the background processes. If there are AAA requests in the queue when you enter this command, the requests will be printed as well as the background process data.

Examples

The following example shows output from the **show ppp queues** command:

```
Router# show ppp queues

Proc #0   pid=73  authens=59   avg. rtt=118s. authors=160  avg. rtt=94s.
Proc #1   pid=74  authens=52   avg. rtt=119s. authors=127  avg. rtt=115s.
Proc #2   pid=75  authens=69   avg. rtt=130s. authors=80   avg. rtt=122s.
Proc #3   pid=76  authens=44   avg. rtt=114s. authors=55   avg. rtt=106s.
Proc #4   pid=77  authens=70   avg. rtt=141s. authors=76   avg. rtt=118s.
Proc #5   pid=78  authens=64   avg. rtt=131s. authors=97   avg. rtt=113s.
Proc #6   pid=79  authens=56   avg. rtt=121s. authors=57   avg. rtt=117s.
Proc #7   pid=80  authens=43   avg. rtt=126s. authors=54   avg. rtt=105s.
Proc #8   pid=81  authens=139  avg. rtt=141s. authors=120  avg. rtt=122s.
Proc #9   pid=82  authens=63   avg. rtt=128s. authors=199  avg. rtt=80s.
queue len=0 max len=499
```

Table 9 describes the fields shown in the example.

Table 9 show ppp queues Field Descriptions

Field	Description
Proc #	Identifies the background process allocated by the **aaa processes** command to handle AAA requests for PPP. All of the data in this row relates to this process.
pid=	Identification number of the background process.
authens=	Number of authentication requests the process has performed.
avg. rtt=	Average delay (in seconds) until the authentication request was completed.
authors=	Number of authorization requests the process has performed.
avg. rtt=	Average delay (in seconds) until the authorization request was completed.
queue len=	Current queue length.
max len=	Maximum length the queue ever reached.

Related Commands

Command	Description
aaa processes	Allocates a specific number of background processes to be used to process AAA authentication and authorization requests for PPP.

timeout login response

To specify how long the system will wait for login input (such as username and password) before timing out, use the **timeout login response** command in line configuration mode. To set the timeout value to 0 seconds, use the **no** form of this command.

timeout login response *seconds*

no timeout login response *seconds*

Syntax Description

seconds	Integer that determines the number of seconds the system will wait for login input before timing out. Available settings are from 1 to 300 seconds.

Defaults

The default login timeout value is 30 seconds.

Command Modes

Line configuration

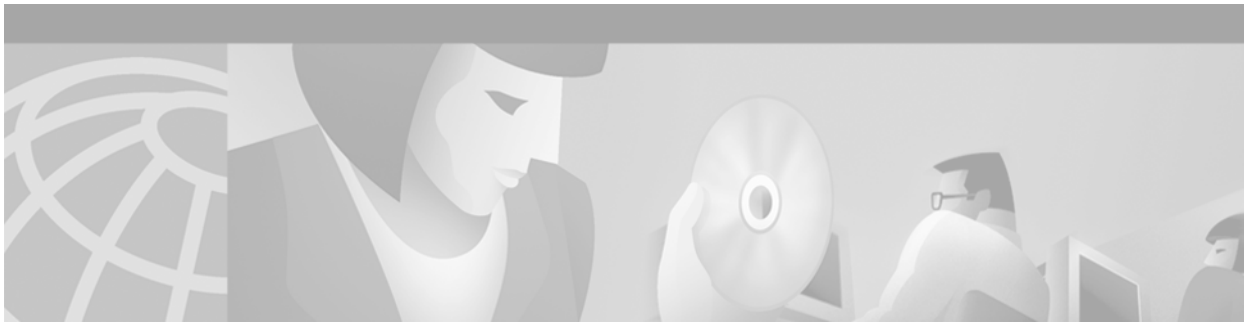
Command History

Release	Modification
11.3	This command was introduced.

Examples

The following example changes the login timeout value to 60 seconds:

```
line 10
 timeout login response 60
```



Authorization Commands

This chapter describes the commands used to configure authentication, authorization, and accounting (AAA) authorization. AAA authorization enables you to limit the services available to a user. When AAA authorization is enabled, the network access server uses information retrieved from the user profile, which is located either in the local user database or on the security server, to configure the user's session. Once this is done, the user will be granted access to a requested service only if the information in the user profile allows it.

For information on how to configure authorization using AAA, refer to the chapter "Configuring Authorization" in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the section "Authorization Configuration Examples" located at the end of the chapter "Configuring Authorization" in the *Cisco IOS Security Configuration Guide*.

aaa authorization

To set parameters that restrict user access to a network, use the **aaa authorization** command in global configuration mode. To disable authorization for a function, use the **no** form of this command.

aaa authorization {**network** | **exec** | **commands** *level* | **reverse-access** | **configuration**} {**default** | *list-name*} *method1* [*method2...*]

no aaa authorization {**network** | **exec** | **commands** *level* | **reverse-access** | **configuration** | **default** | *list-name*}

Syntax Description

network	Runs authorization for all network-related service requests, including SLIP[1], PPP[2], PPP NCPs[3], and ARA[4].
exec	Runs authorization to determine if the user is allowed to run an EXEC shell. This facility might return user profile information such as **autocommand** information.
commands	Runs authorization for all commands at the specified privilege level.
level	Specific command level that should be authorized. Valid entries are 0 through 15.
reverse-access	Runs authorization for reverse access connections, such as reverse Telnet.
configuration	Downloads the configuration from the AAA server.
default	Uses the listed authorization methods that follow this argument as the default list of methods for authorization.
list-name	Character string used to name the list of authorization methods.
method1 [*method2...*]	One of the keywords listed in Table 10.

1. Serial Line Internet Protocol
2. Point-to-Point Protocol
3. Point-to-Point Protocol Network Control Programs
4. AppleTalk Remote Access

Defaults

Authorization is disabled for all actions (equivalent to the method keyword **none**).

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	Group server support was added as a method keyword for this command.

Usage Guidelines

Use the **aaa authorization** command to enable authorization and to create named methods lists, defining authorization methods that can be used when a user accesses the specified function. Method lists for authorization define the ways authorization will be performed and the sequence in which these methods

will be performed. A method list is simply a named list describing the authorization methods to be used (such as RADIUS or TACACS+), in sequence. Method lists enable you to designate one or more security protocols to be used for authorization, thus ensuring a backup system in case the initial method fails. Cisco IOS software uses the first method listed to authorize users for specific network services; if that method fails to respond, the Cisco IOS software selects the next method listed in the method list. This process continues until there is successful communication with a listed authorization method, or all methods defined are exhausted.

Note The Cisco IOS software attempts authorization with the next listed method only when there is no response from the previous method. If authorization fails at any point in this cycle—meaning that the security server or local username database responds by denying the user services—the authorization process stops and no other authorization methods are attempted.

If the **aaa authorization** command for a particular authorization type is issued without a named method list specified, the default method list is automatically applied to all interfaces or lines (where this authorization type applies) except those that have a named method list explicitly defined. (A defined method list overrides the default method list.) If no default method list is defined, then no authorization takes place.

Use the **aaa authorization** command to create a list by entering the *list-name* and the *method*, where *list-name* is any character string used to name this list (excluding all method names) and *method* identifies the list of authorization method(s) tried in the given sequence.

Note In Table 10, the **group radius**, **group tacacs+**, and **group** *group-name* methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Method keywords are described in Table 10.

Table 10 aaa authorization Methods

Keyword	Description
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for authentication as defined by the **aaa group server radius** or **aaa group server tacacs+** command.
if-authenticated	Allows the user to access the requested function if the user is authenticated.
krb5-instance	Uses the instance defined by the **kerberos instance map** command.
local	Uses the local database for authorization.
none	No authorization is performed.

Cisco IOS software supports the following six methods for authorization:

- RADIUS—The network access server requests authorization information from the RADIUS security server group. RADIUS authorization defines specific rights for users by associating attributes, which are stored in a database on the RADIUS server, with the appropriate user.
- TACACS+—The network access server exchanges authorization information with the TACACS+ security daemon. TACACS+ authorization defines specific rights for users by associating attribute-value (AV) pairs, which are stored in a database on the TACACS+ security server, with the appropriate user.

- If-Authenticated—The user is allowed to access the requested function provided the user has been authenticated successfully.
- None—The network access server does not request authorization information; authorization is not performed over this line/interface.
- Local—The router or access server consults its local database, as defined by the **username** command, to authorize specific rights for users. Only a limited set of functions can be controlled via the local database.
- Kerberos Instance Map—The network access server uses the instance defined by the **kerberos** instance map command for authorization.

Method lists are specific to the type of authorization being requested. AAA supports five different types of authorization:

- Network—Applies to network connections. This can include a PPP, SLIP, or ARA connection.
- EXEC—Applies to the attributes associated with a user EXEC terminal session.
- Commands—Applies to the EXEC mode commands a user issues. Command authorization attempts authorization for all EXEC mode commands, including global configuration commands, associated with a specific privilege level.
- Reverse Access—Applies to reverse Telnet sessions.
- Configuration—Applies to the configuration downloaded from the AAA server.

When you create a named method list, you are defining a particular list of authorization methods for the indicated authorization type.

Once defined, method lists must be applied to specific lines or interfaces before any of the defined methods will be performed.

The authorization command causes a request packet containing a series of AV pairs to be sent to the RADIUS or TACACS daemon as part of the authorization process. The daemon can do one of the following:

- Accept the request as is.
- Make changes to the request.
- Refuse the request and refuse authorization.

For a list of supported RADIUS attributes, refer to the appendix "RADIUS Attributes" in the *Cisco IOS Security Configuration Guide*. For a list of supported TACACS+ AV pairs, refer to the appendix "TACACS+ Attribute-Value Pairs" in the *Cisco IOS Security Configuration Guide*.

Note There are five commands associated with privilege level 0: **disable**, **enable**, **exit**, **help**, and **logout**. If you configure AAA authorization for a privilege level greater than 0, these five commands will not be included in the privilege level command set.

Examples

The following example defines the network authorization method list named "scoobee", which specifies that RADIUS authorization will be used on serial lines using PPP. If the RADIUS server fails to respond, then local network authorization will be performed.

```
aaa authorization network scoobee group radius local
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
aaa new-model	Enables the AAA access control model.

aaa authorization config-commands

To reestablish the default created when the **aaa authorization commands** command was issued, use the **aaa authorization config-commands** command in global configuration mode. To disable authentication, authorization, and accounting (AAA) configuration command authorization, use the **no** form of this command.

aaa authorization config-commands

no aaa authorization config-commands

Syntax Description

This command has no arguments or keywords.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.
12.0(6.02)T	This command was changed from being enabled by default to being disabled by default.

Usage Guidelines

If **aaa authorization commands** *level method* command is enabled, all commands, including configuration commands, are authorized by AAA using the method specified. Because there are configuration commands that are identical to some EXEC-level commands, there can be some confusion in the authorization process. Using the **no aaa authorization config-commands** command stops the network access server from attempting configuration command authorization.

After the **no** form of this command has been entered, AAA authorization of configuration commands is completely disabled. Care should be taken before entering the **no** form of this command because it potentially reduces the amount of administrative control on configuration commands.

Use the **aaa authorization config-commands** command if, after using the **no** form of this command, you need to reestablish the default set by the **aaa authorization commands** *level method* command.

Note You will get the same result if you (1) do not configure this command, or (2) configure **no aaa authorization config-commands**.

Examples

The following example specifies that TACACS+ authorization is run for level 15 commands and that AAA authorization of configuration commands is disabled:

```
aaa new-model
aaa authorization command 15 group tacacs+ none
no aaa authorization config-commands
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict user access to a network.

aaa authorization console

To apply authorization to a console, use the **aaa authorization console** command in global configuration mode. To disable the authorization, use the **no** form of this command.

aaa authorization console

no aaa authorization console

Syntax Description

This command has no arguments or keywords.

Defaults

Authentication, authorization, and accounting (AAA) authorization is disabled on the console.

Command Modes

Global configuration

Command History

Release	Modification
12.0(6)T	This command was introduced.

Usage Guidelines

If the **aaa new-model** command has been configured to enable the AAA access control model, the **no aaa authorization console** command is the default, and the authorization that is configured on the console line will always succeed. If you do not want the default, you need to configure the **aaa authorization console** command.

Note This command by itself does not turn on authorization of the console line. It needs to be used in conjunction with the **authorization** command under console line configurations.

If you are trying to enable authorization and the **no aaa authorization console** command is configured by default, you will see the following message:

```
%Authorization without the global command aaa authorization console is useless.
```

Examples

The following example shows that the default authorization that is configured on the console line is being disabled:

```
Router (config)# aaa authorization console
```

Related Commands

Command	Description
authorization	Enables AAA authorization for a specific line or group of lines.

aaa authorization reverse-access

To configure a network access server to request authorization information from a security server before allowing a user to establish a reverse Telnet session, use the **aaa authorization reverse-access** command in global configuration mode. To restore the default value for this command, use the **no** form of this command.

aaa authorization reverse-access {**group radius** | **group tacacs+**}

no aaa authorization reverse-access {**group radius** | **group tacacs+**}

Syntax Description

group radius	Specifies that the network access server will request authorization from a RADIUS security server before allowing a user to establish a reverse Telnet session.
group tacacs+	Specifies that the network access server will request authorization from a TACACS+ security server before allowing a user to establish a reverse Telnet session.

Defaults

This command is disabled by default, meaning that authorization for reverse Telnet is not requested.

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.
12.0(5)T	Group server support was added as various method keywords for this command.

Usage Guidelines

Telnet is a standard terminal emulation protocol used for remote terminal connection. Normally, you log in to a network access server (typically through a dialup connection) and then use Telnet to access other network devices from that network access server. There are times, however, when it is necessary to establish a reverse Telnet session. In reverse Telnet sessions, the Telnet connection is established in the opposite direction—from inside a network to a network access server on the network periphery to gain access to modems or other devices connected to that network access server. Reverse Telnet is used to provide users with dialout capability by allowing them to open Telnet sessions to modem ports attached to a network access server.

It is important to control access to ports accessible through reverse Telnet. Failure to do so could, for example, allow unauthorized users free access to modems where they can trap and divert incoming calls or make outgoing calls to unauthorized destinations.

Authentication during reverse Telnet is performed through the standard AAA login procedure for Telnet. Typically the user has to provide a username and password to establish either a Telnet or reverse Telnet session. This command provides an additional (optional) level of security by requiring authorization in addition to authentication. When this command is enabled, reverse Telnet authorization can use RADIUS or TACACS+ to authorize whether or not this user is allowed reverse Telnet access to specific asynchronous ports, after the user successfully authenticates through the standard Telnet login procedure.

Examples

The following example causes the network access server to request authorization information from a TACACS+ security server before allowing a user to establish a reverse Telnet session:

```
aaa new-model
aaa authentication login default group tacacs+
aaa authorization reverse-access default group tacacs+
!
tacacs-server host 172.31.255.0
tacacs-server timeout 90
tacacs-server key goaway
```

The lines in this sample TACACS+ reverse Telnet authorization configuration are defined as follows:

- The **aaa new-model** command enables AAA.
- The **aaa authentication login default group tacacs+** command specifies TACACS+ as the default method for user authentication during login.
- The **aaa authorization reverse-access default group tacacs+** command specifies TACACS+ as the method for user authorization when trying to establish a reverse Telnet session.
- The **tacacs-server host** command identifies the TACACS+ server.
- The **tacacs-server timeout** command sets the interval of time that the network access server waits for the TACACS+ server to reply.
- The **tacacs-server key** command defines the encryption key used for all TACACS+ communications between the network access server and the TACACS+ daemon.

The following example configures a generic TACACS+ server to grant a user, "jim," reverse Telnet access to port tty2 on the network access server named "site1" and to port tty5 on the network access server named site2:

```
user = jim
  login = cleartext lab
  service = raccess {
    port#1 = site1/tty2
    port#2 = site2/tty5
}
```

Note In this example, "site1" and "site2" are the configured host names of network access servers, not DNS names or alias.

The following example configures the TACACS+ server (CiscoSecure) to authorize a user named Jim for reverse Telnet:

```
user = jim
 profile_id = 90
 profile_cycle = 1
 member = Tacacs_Users
 service=shell {
 default cmd=permit
 }
 service=raccess {
 allow "c2511e0" "tty1" ".*"
 refuse ".*" ".*" ".*"
 password = clear "goaway"
```

Note CiscoSecure only supports reverse Telnet using the command line interface in versions 2.1(*x*) through version 2.2(1).

An empty “service=raccess {}” clause permits a user to have unconditional access to network access server ports for reverse Telnet. If no “service=raccess” clause exists, the user is denied access to any port for reverse Telnet.

For more information about configuring TACACS+, refer to the chapter “Configuring TACACS+” in the *Cisco IOS Security Configuration Guide*. For more information about configuring CiscoSecure, refer to the *CiscoSecure Access Control Server User Guide*, version 2.1(2) or later.

The following example causes the network access server to request authorization from a RADIUS security server before allowing a user to establish a reverse Telnet session:

```
aaa new-model
aaa authentication login default group radius
aaa authorization reverse-access default group radius
!
radius-server host 172.31.255.0
radius-server key goaway
```

The lines in this sample RADIUS reverse Telnet authorization configuration are defined as follows:

- The **aaa new-model** command enables AAA.
- The **aaa authentication login default group radius** command specifies RADIUS as the default method for user authentication during login.
- The **aaa authorization reverse-access default group radius** command specifies RADIUS as the method for user authorization when trying to establish a reverse Telnet session.
- The **radius-server host** command identifies the RADIUS server.
- The **radius-server key** command defines the encryption key used for all RADIUS communications between the network access server and the RADIUS daemon.

The following example configures the RADIUS server to grant a user named “jim” reverse Telnet access at port tty2 on network access server site1:

```
Password = “goaway”
User-Service-Type = Shell-User
cisco-avpair = “raccess:port#1=site1/tty2”
```

The syntax "raccess:port=any/any" permits a user to have unconditional access to network access server ports for reverse Telnet. If no "raccess:port={*nasname*}/{*tty number*}" clause exists in the user profile, the user is denied access to reverse Telnet on all ports..

For more information about configuring RADIUS, refer to the chapter “Configuring RADIUS” in the *Cisco IOS Security Configuration Guide*.

aaa dnis map authorization network group

To map a Dialed Number Identification Service (DNIS) number to a particular authentication, authorization, and accounting (AAA) server group (the server group that will be used for AAA authorization), use the **aaa dnis map authorization network group** global configuration command. To unmap this DNIS number from the defined server group, use the **no** form of this command.

aaa dnis map *dnis-number* **authorization network group** *server-group-name*

no aaa dnis map *dnis-number* **authorization network group** *server-group-name*

Syntax Description

dnis-number	Number of the DNIS.
server-group-name	Character string used to name a group of security servers functioning within a server group.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

This command lets you assign a DNIS number to a particular AAA server group so that the server group can process authorization requests for users dialing in to the network using that particular DNIS number. To use this command, you must first enable AAA, define a AAA server group, and enable DNIS mapping.

Examples

The following example maps DNIS number 7777 to the RADIUS server group called group1. Server group group1 will use RADIUS server 172.30.0.0 for authorization requests for users dialing in with DNIS 7777:

```
aaa new-model
radius-server host 172.30.0.0 auth-port 1645 key cisco1
aaa group server radius group1
server 172.30.0.0
aaa dnis map enable
aaa dnis map 7777 authorization network group group1
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.
aaa dnis map accounting network group	Maps a DNIS number to a AAA server group used for accounting services.

Command	Description
aaa dnis map authentication ppp group	Maps a DNIS number to a AAA server used for authentication services.
aaa dnis map enable	Enables AAA server selection based on DNIS number.
aaa group server	Groups different server hosts into distinct lists and methods.
radius-server host	Specifies and defines the IP address of the RADIUS server host.

authorization

To enable authentication, authorization, and accounting (AAA) authorization for a specific line or group of lines, use the **authorization** command in line configuration mode. To disable authorization, use the **no** form of this command.

authorization {**arap** | **commands** *level* | **exec** | **reverse-access**} [**default** | *list-name*]

no authorization {**arap** | **commands** *level* | **exec** | **reverse-access**} [**default** | *list-name*]

Syntax Description

arap	Enables authorization for lines configured for AppleTalk Remote Access (ARA) protocol.
commands	Enables authorization on the selected lines for all commands at the specified privilege level.
level	Specific command level to be authorized. Valid entries are 0 through 15.
exec	Enables authorization to determine if the user is allowed to run an EXEC shell on the selected lines.
reverse-access	Enables authorization to determine if the user is allowed reverse access privileges.
default	(Optional) The name of the default method list, created with the **aaa authorization** command.
list-name	(Optional) Specifies the name of a list of authorization methods to use. If no list name is specified, the system uses the default. The list is created with the **aaa authorization** command.

Defaults

Authorization is not enabled.

Command Modes

Line configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

After you enable the **aaa authorization** command and define a named authorization method list (or use the default method list) for a particular type of authorization, you must apply the defined lists to the appropriate lines for authorization to take place. Use the **authorization** command to apply the specified method lists (or if none is specified, the default method list) to the selected line or group of lines.

Examples

The following example enables command authorization (for level 15) using the method list named charlie on line 10:

```
line 10
 authorization commands 15 charlie
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict user access to a network.

ppp authorization

To enable authentication, authorization, and accounting (AAA) authorization on the selected interface, use the **ppp authorization** command in interface configuration mode. To disable authorization, use the **no** form of this command.

ppp authorization [**default** | *list-name*]

no ppp authorization

Syntax Description

default	(Optional) The name of the method list is created with the **aaa authorization** command.
list-name	(Optional) Specifies the name of a list of authorization methods to use. If no list name is specified, the system uses the default. The list is created with the **aaa authorization** command.

Defaults

Authorization is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

After you enable the **aaa authorization** command and define a named authorization method list (or use the default method list), you must apply the defined lists to the appropriate interfaces for authorization to take place. Use the **ppp authorization** command to apply the specified method lists (or if none is specified, the default method list) to the selected interface.

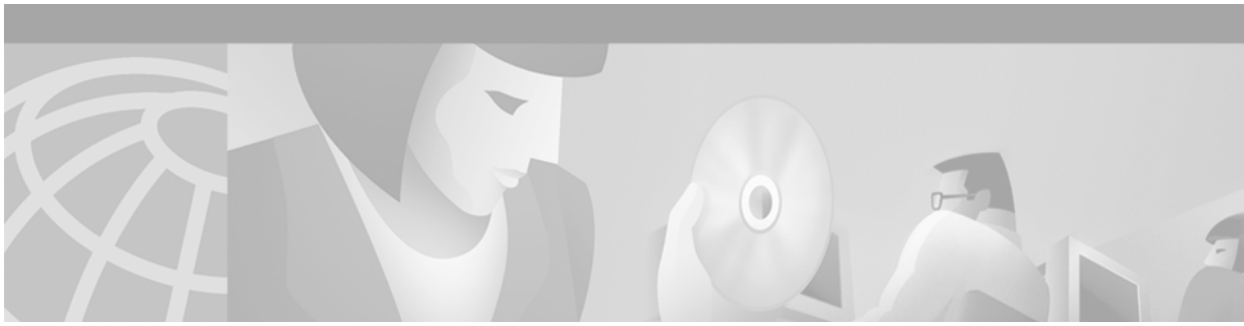
Examples

The following example enables authorization on asynchronous interface 4 and uses the method list named charlie:

```
interface async 4
 encapsulation ppp
 ppp authorization charlie
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict user access to a network.



Accounting Commands

This chapter describes the commands used to manage accounting on the network. Accounting management allows you to track individual and group usage of network resources. The authentication, authorization, and accounting (AAA) accounting feature enables you to track the services users are accessing as well as the amount of network resources they are consuming. When AAA accounting is activated, the network access server reports user activity to the TACACS+ or RADIUS security server (depending on which security method you have implemented) in the form of accounting records. Each accounting record contains accounting attribute-value (AV) pairs and is stored on the security server. This data can then be analyzed for network management, client billing or auditing.

For information on how to configure accounting using AAA, refer to the chapter "Configuring Accounting" in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the section "Accounting Configuration Examples" located at the end of the chapter "Configuring Accounting" in the *Cisco IOS Security Configuration Guide*.

Refer also to the IP accounting feature in the chapter "Configuring IP Services" of the *Cisco IOS IP Configuration Guide*.

aaa accounting

To enable authentication, authorization, and accounting (AAA) accounting of requested services for billing or security purposes when you use RADIUS or TACACS+, use the **aaa accounting** command in global configuration mode. To disable AAA accounting, use the **no** form of this command.

aaa accounting {**auth-proxy** | **system** | **network** | **exec** | **connection** | **commands** *level*} {**default** | *list-name*} {**start-stop** | **stop-only** | **none**} [**broadcast**] **group** *groupname*

no aaa accounting {**auth-proxy** | **system** | **network** | **exec** | **connection** | **commands** *level*} {**default** | *list-name*} [**broadcast**] **group** *groupname*

Syntax Description

auth-proxy	Provides information about all authenticated-proxy user events.
system	Performs accounting for all system-level events not associated with users, such as reloads.
network	Runs accounting for all network-related service requests, including SLIP[1], PPP[2], PPP NCPs[3], and ARAP[4].
exec	Runs accounting for EXEC shell session. This keyword might return user profile information such as what is generated by the **autocommand** command.
connection	Provides information about all outbound connections made from the network access server, such as Telnet, LAT[5], TN3270, PAD[6], and rlogin.
commands *level*	Runs accounting for all commands at the specified privilege level. Valid privilege level entries are integers from 0 through 15.
default	Uses the listed accounting methods that follow this argument as the default list of methods for accounting services.
list-name	Character string used to name the list of at least one of the accounting methods decribed in Table 12.
start-stop	Sends a “start” accounting notice at the beginning of a process and a “stop” accounting notice at the end of a process. The “start” accounting record is sent in the background. The requested user process begins regardless of whether the “start” accounting notice was received by the accounting server.
stop-only	Sends a “stop” accounting notice at the end of the requested user process.
none	Disables accounting services on this line or interface.
broadcast	(Optional) Enables sending accounting records to multiple AAA servers. Simultaneously sends accounting records to the first server in each group. If the first server is unavailable, fail over occurs using the backup servers defined within that group.
group *groupname*	At least one of the keywords described in Table 11.

1. SLIP = Serial Line Internet Protocol
2. PPP = Point-to-Point Protocol
3. PPP NCPs = Point-to-Point Protocol Network Control Protocols
4. ARAP = AppleTalk Remote Access Protocol
5. LAT = local-area transport
6. PAD = packet assembler/disassembler

Defaults

AAA accounting is disabled.

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.
12.0(5)T	Group server support was added.
12.1(1)T	The **broadcast** keyword was added on the Cisco AS5300 and Cisco AS5800 universal access servers.
12.1(5)T	The **auth-proxy** keyword was added.

Usage Guidelines

Use the **aaa accounting** command to enable accounting and to create named method lists defining specific accounting methods on a per-line or per-interface basis.

Table 11 contains descriptions of accounting method keywords.

Table 11 aaa accounting Methods

Keyword	Description
group radius	Uses the list of all RADIUS servers for authentication as defined by the **aaa group server radius** command.
group tacacs+	Uses the list of all TACACS+ servers for authentication as defined by the **aaa group server tacacs+** command.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for accounting as defined by the server group *group-name*.

In Table 11, the **group radius** and **group tacacs+** methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Cisco IOS software supports the following two methods of accounting:

- RADIUS—The network access server reports user activity to the RADIUS security server in the form of accounting records. Each accounting record contains accounting attribute-value (AV) pairs and is stored on the security server.
- TACACS+—The network access server reports user activity to the TACACS+ security server in the form of accounting records. Each accounting record contains accounting attribute-value (AV) pairs and is stored on the security server.

Method lists for accounting define the way accounting will be performed. Named accounting method lists enable you to designate a particular security protocol to be used on specific lines or interfaces for particular types of accounting services. Create a list by entering the *list-name* and the *method*, where *list-name* is any character string used to name this list (excluding the names of methods, such as radius or tacacs+) and *method* identifies the methods to be tried in sequence as given.

If the **aaa accounting** command for a particular accounting type is issued without a named method list specified, the default method list is automatically applied to all interfaces or lines (where this accounting type applies) except those that have a named method list explicitly defined. (A defined method list overrides the default method list.) If no default method list is defined, then no accounting takes place.

Named accounting method lists are specific to the indicated type of accounting. Method list keywords are described in Table 12.

Table 12 aaa accounting Methods Lists

Keyword	Description
auth-proxy	Creates a method list to provide accounting information about all authenticated hosts that use the authentication proxy service.
commands	Creates a method list to provide accounting information about specific, individual EXEC commands associated with a specific privilege level.
connection	Creates a method list to provide accounting information about all outbound connections made from the network access server.
exec	Creates a method list to provide accounting records about user EXEC terminal sessions on the network access server, including username, date, and start and stop times.
network	Creates a method list to provide accounting information for SLIP, PPP, NCPs, and ARA sessions.
resource	Creates a method list to provide accounting records for calls that have passed user authentication or calls that failed to be authenticated.

Note System accounting does not use named accounting lists; you can only define the default list for system accounting.

For minimal accounting, include the **stop-only** keyword to send a "stop" record accounting notice at the end of the requested user process. For more accounting, you can include the **start-stop** keyword, so that RADIUS or TACACS+ sends a "start" accounting notice at the beginning of the requested process and a "stop" accounting notice at the end of the process. Accounting is stored only on the RADIUS or TACACS+ server. The **none** keyword disables accounting services for the specified line or interface.

When AAA accounting is activated, the network access server monitors either RADIUS accounting attributes or TACACS+ AV pairs pertinent to the connection, depending on the security method you have implemented. The network access server reports these attributes as accounting records, which are then stored in an accounting log on the security server. For a list of supported RADIUS accounting attributes, refer to the appendix "RADIUS Attributes" in the *Cisco IOS Security Configuration Guide*. For a list of supported TACACS+ accounting AV pairs, refer to the appendix "TACACS+ Attribute-Value Pairs" in the *Cisco IOS Security Configuration Guide*.

Note This command cannot be used with TACACS or extended TACACS.

Examples

The following example defines a default commands accounting method list, where accounting services are provided by a TACACS+ security server, set for privilege level 15 commands with a stop-only restriction.

```
aaa accounting commands 15 default stop-only group tacacs+
```

The following example defines a default auth-proxy accounting method list, where accounting services are provided by a TACACS+ security server with a stop-only restriction. The **aaa accounting** command activates authentication proxy accounting.

```
aaa new-model
aaa authentication login default group tacacs+
aaa authorization auth-proxy default group tacacs+
aaa accounting auth-proxy default start-stop group tacacs+
```

Related Commands

Command	Description
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
aaa authorization	Sets parameters that restrict user access to a network.
aaa group server radius	Groups different RADIUS server hosts into distinct lists and distinct methods.
aaa group server tacacs	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.
tacacs-server host	Specifies a TACACS+ server host.

aaa accounting connection h323

To define the accounting method list H.323 with RADIUS as a method with either **stop-only** or **start-stop** accounting options, use the **aaa accounting connection h323** command in global configuration mode. To disable the use of this accounting method list, use the **no** form of this command.

aaa accounting connection h323 {**stop-only** | **start-stop** | **none**} [**broadcast**] **group** *groupname*

no aaa accounting connection h323 {**stop-only** | **start-stop** | **none**} [**broadcast**] **group** *groupname*

Syntax Description

stop-only	Sends a "stop" accounting notice at the end of the requested user process.
start-stop	Sends a "start" accounting notice at the beginning of a process and a "stop" accounting notice at the end of a process. The "start" accounting record is sent in the background. The requested user process begins regardless of whether the "start" accounting notice was received by the accounting server.
none	Disables accounting services on this line or interface.
broadcast	(Optional) Enables sending accounting records to multiple AAA servers. Simultaneously sends accounting records to the first server in each group. If the first server is unavailable, failover occurs using the backup servers defined within that group.
group *groupname*	Specifies the server group to be used for accounting services. The following are valid server group names: • *string*: Character string used to name a server group. • **radius**: Uses list of all RADIUS hosts. • **tacacs+**: Uses list of all TACACS+ hosts.

Defaults

No accounting method list

Command Modes

Global configuration

Command History

Release	Modification
11.3(6)NA2	This command was introduced.

Usage Guidelines

This command creates a method list called h323 and is applied by default to all voice interfaces if the **gw-accounting h323** command is also activated.

Examples

The following example enables authentication, authorization, and accounting (AAA) services, gateway accounting services, and defines a connection accounting method list (h323). The h323 accounting method lists specifies that RADIUS is the security protocol that will provide the accounting services, and that the RADIUS service will track start-stop records.

```
aaa new model
gw-accounting h323
aaa accounting connection h323 start-stop radius
```

aaa accounting delay-start

To delay generation of accounting "start" records until the user IP address is established, use the **aaa accounting delay-start** command in global configuration mode. To disable this functionality, use the **no** form of this command.

aaa accounting delay-start

no aaa accounting delay-start

Syntax Description

This command has no arguments or keywords.

Defaults

Accounting records are not delayed.

Command Modes

Global configuration

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

Use the **aaa accounting delay-start** command to delay creation of the PPP network "start" record until the peer IP address is known.

Examples

The following example shows how to delay accounting "start" records until the IP address of the user is established:

```
aaa new-model
aaa authentication ppp default radius
aaa accounting network default start-stop radius
aaa accounting delay-start
radius-server host 172.16.0.0 non-standard
radius-server key rad123
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes when you use RADIUS or TACACS+.
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
aaa authorization	Sets parameters that restrict user access to a network.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.
tacacs-server host	Specifies a TACACS+ server host.

aaa accounting nested

To specify that NETWORK records be generated, or nested, within EXEC "start" and "stop" records for PPP users who start EXEC terminal sessions, use the **aaa accounting nested** command in global configuration mode. To allow the sending of records for users with a NULL username, use the **no** form of this command.

aaa accounting nested

no aaa accounting nested

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command when you want to specify that NETWORK records be nested within EXEC "start" and "stop" records, such as for PPP users who start EXEC terminal sessions. In some cases, such as billing customers for specific services, is can be desirable to keep NETWORK "start" and "stop" records together, essentially nesting them within the framework of the EXEC "start" and "stop" messages. For example, a user dialing in using PPP can create the following records: EXEC-start, NETWORK-start, EXEC-stop, NETWORK-stop. By nesting the accounting records, NETWORK-stop records follow NETWORK-start messages: EXEC-start, NETWORK-start, NETWORK-stop, EXEC-stop.

Examples

The following example enables nesting of NETWORK accounting records for user sessions:

```
aaa accounting nested
```

aaa accounting resource start-stop group

To enable full resource accounting, which will generate both a "start" record at call setup and a "stop" record at call termination, use the **aaa accounting resource start-stop group** command in global configuration mode. To disable full resource accounting, use the **no** form of this command.

aaa accounting resource *method-list* **start-stop** [**broadcast**] **group** *groupname*

no aaa accounting resource *method-list* **start-stop** [**broadcast**] **group** *groupname*

Syntax Description

method-list	Method used for accounting services. Use one of the following options: • **default**: Uses the listed accounting methods that follow this argument as the default list of methods for accounting services. • *string*: Character string used to name the list of accounting methods.
broadcast	(Optional) Enables sending accounting records to multiple AAA servers. Simultaneously sends accounting records to the first server in each group. If the first server is unavailable, failover occurs using the backup servers defined within that group.
group *groupname*	Specifies the server group to be used for accounting services. The following are valid server group names: • *string*: Character string used to name a server group. • **radius**: Uses list of all RADIUS hosts. • **tacacs+**: Uses list of all TACACS+ hosts.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

Use the **aaa accounting resource start-stop group** command to send a "start" record at each call setup followed with a corresponding "stop" record at the call disconnect. There is a separate "call setup-call disconnect "start-stop" accounting record tracking the progress of the resource connection to the device, and a separate "user authentication start-stop accounting" record tracking the user management progress. These two sets of accounting records are interlinked by using a unique session ID for the call.

You may want to use this command to manage and monitor wholesale customers from one source of data reporting, such as accounting records.

Note Sending "start-stop" records for resource allocation along with user "start-stop" records during user authentication can lead to serious performance issues and is discouraged unless absolutely required.

All existing AAA accounting method list and server group options are made available to this command.

Examples

The following example shows how to configure resource accounting for "start-stop" records:

```
aaa new-model
aaa authentication login AOL group radius local
aaa authentication ppp default group radius local
aaa authorization exec AOL group radius if-authenticated
aaa authorization network default group radius if-authenticated
aaa accounting exec default start-stop group radius
aaa accounting network default start-stop group radius
aaa accounting resource default start-stop group radius
```

Related Commands

Command	Description
aaa accounting start-stop failure	Enables resource failure stop accounting support, which will only generate a stop record at any point prior to user authentication if a call is terminated.

aaa accounting resource stop-failure group

To enable resource failure stop accounting support, which will generate a "stop" record at any point prior to user authentication only if a call is terminated, use the **aaa accounting resource stop-failure group** command in global configuration mode. To disable resource failure stop accounting, use the **no** form of this command.

aaa accounting resource *method-list* **stop-failure** [**broadcast**] **group** *groupname*

no aaa accounting resource *method-list* **stop-failure** [**broadcast**] **group** *groupname*

Syntax Description

method-list	Method used for accounting services. Use one of the following options: • **default**: Uses the listed accounting methods that follow this argument as the default list of methods for accounting services. • *string*: Character string used to name the list of accounting methods.
broadcast	(Optional) Enables sending accounting records to multiple AAA servers. Simultaneously sends accounting records to the first server in each group. If the first server is unavailable, failover occurs using the backup servers defined within that group.
group *groupname*	Group to be used for accounting services. Use one of the following options: • *string*: Character string used to name a server group. • **radius**: Uses list of all RADIUS hosts. • **tacacs+**: Uses list of all TACACS+ hosts.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

Use the **aaa accounting resource stop-failure group** command to generate a "stop" record for any calls that do not reach user authentication; this function creates "stop" accounting records for the moment of call setup. All calls that pass user authentication will behave as before; that is, no additional accounting records will be seen.

All existing authentication, authorization, and accounting (AAA) accounting method list and server group options are made available to this command.

Examples

The following example shows how to configure "stop" accounting records from the moment of call setup:

```
aaa new-model
aaa authentication login AOL group radius local
aaa authentication ppp default group radius local
aaa authorization exec AOL group radius if-authenticated
aaa authorization network default group radius if-authenticated
aaa accounting exec default start-stop group radius
aaa accounting network default start-stop group radius
aaa accounting resource default stop-failure group radius
```

Related Commands

Command	Description
aaa accounting resource start-stop group	Enables full resource accounting, which will generate both a "start" record at call setup and a "stop" record at call termination.

aaa accounting send stop-record authentication failure

To generate accounting "stop" records for users who fail to authenticate at login or during session negotiation, use the **aaa accounting send stop-record authentication failure** command in global configuration mode. To stop generating records for users who fail to authenticate at login or during session negotiation, use the **no** form of this command.

aaa accounting send stop-record authentication failure

no aaa accounting send stop-record authentication failure

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command to generate accounting "stop" records for users who fail to authenticate at login or during session negotiation. When **aaa accounting** is activated, the Cisco IOS software by default does not generate accounting records for system users who fail login authentication or who succeed in login authentication but fail PPP negotiation for some reason.

Examples

The following example generates "stop" records for users who fail to authenticate at login or during session negotiation:

```
aaa accounting send stop-record authentication failure
```

aaa accounting suppress null-username

To prevent the Cisco IOS software from sending accounting records for users whose username string is NULL, use the **aaa accounting suppress null-username** command in global configuration mode. To allow sending records for users with a NULL username, use the **no** form of this command.

aaa accounting suppress null-username

no aaa accounting suppress null-username

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

When **aaa accounting** is activated, the Cisco IOS software issues accounting records for all users on the system, including users whose username string, because of protocol translation, is NULL. This command prevents accounting records from being generated for those users who do not have usernames associated with them.

Examples

The following example supresses accounting records for users who do not have usernames associated with them:

```
aaa accounting suppress null-username
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.

aaa accounting update

To enable periodic interim accounting records to be sent to the accounting server, use the **aaa accounting update** command in global configuration mode. To disable interim accounting updates, use the **no** form of this command.

aaa accounting update [**newinfo**] [**periodic** *number*]

no aaa accounting update

Syntax Description

newinfo	(Optional) Causes an interim accounting record to be sent to the accounting server whenever there is new accounting information to report relating to the user in question.
periodic	(Optional) Causes an interim accounting record to be sent to the accounting server periodically, as defined by the argument *number*.
number	Integer specifying number of minutes.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

When **aaa accounting update** is activated, the Cisco IOS software issues interim accounting records for all users on the system. If the keyword **newinfo** is used, interim accounting records will be sent to the accounting server every time there is new accounting information to report. An example of this would be when IP Control Protocol (IPCP) completes IP address negotiation with the remote peer. The interim accounting record will include the negotiated IP address used by the remote peer.

When used with the keyword **periodic**, interim accounting records are sent periodically as defined by the argument number. The interim accounting record contains all of the accounting information recorded for that user up to the time the accounting record is sent.

When using both the **newinfo** and **periodic** keywords, interim accounting records are sent to the accounting server every time there is new accounting information to report, and accounting records are sent to the accounting server periodically as defined by the argument number. For example, if you configure **aaa accounting update newinfo periodic** *number*, all users currently logged in will continue to generate periodic interim accounting records while new users will generate accounting records based on the **newinfo** algorithm.

Caution Using the **aaa accounting update periodic** command can cause heavy congestion when many users are logged in to the network.

Examples

The following example sends PPP accounting records to a remote RADIUS server. When IPCP completes negotiation, this command sends an interim accounting record to the RADIUS server that includes the negotiated IP address for this user; it also sends periodic interim accounting records to the RADIUS server at 30 minute intervals.

```
aaa accounting network default start-stop group radius
aaa accounting update newinfo periodic 30
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.

aaa dnis map accounting network

To map a Dialed Number Information Service (DNIS) number to a particular authentication, authorization, and accounting (AAA) server group that will be used for AAA accounting, use the **aaa dnis map accounting network** command in global configuration mode. To remove DNIS mapping from the named server group, use the **no** form of this command.

aaa dnis map *dnis-number* **accounting network** [**start-stop** | **stop-only** | **none**] [**broadcast**] **group** *groupname*

no aaa dnis map *dnis-number* **accounting network**

Syntax Description

dnis-number	Number of the DNIS.
start-stop	(Optional) Indicates that the defined security server group will send a "start accounting" notice at the beginning of a process and a "stop accounting" notice at the end of a process. The "start accounting" record is sent in the background. (The requested user process begins regardless of whether the "start accounting" notice was received by the accounting server.)
stop-only	(Optional) Indicates that the defined security server group will send a "stop accounting" notice at the end of the requested user process.
none	(Optional) Indicates that the defined security server group will not send accounting notices.
broadcast	(Optional) Enables sending accounting records to multiple AAA servers. Simultaneously sends accounting records to the first server in each group. If the first server is unavailable, failover occurs using the backup servers defined within that group.
group *groupname*	At least one of the keywords described in Table 13.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.
12.1(1)T	• The optional **broadcast** keyword was added. • The ability to specify multiple server groups was added. • To accommodate multiple server groups, the name of the command was changed from **aaa dnis map accounting network group** to **aaa dnis map accounting network**.

Usage Guidelines

This command lets you assign a DNIS number to a particular AAA server group so that the server group can process accounting requests for users dialing in to the network using that particular DNIS. To use this command, you must first enable AAA, define an AAA server group, and enable DNIS mapping.

Table 12 contains descriptions of accounting method keywords.

Table 13 AAA Accounting Methods

Keyword	Description
group radius	Uses the list of all RADIUS servers for authentication as defined by the **aaa group server radius** command.
group tacacs+	Uses the list of all TACACS+ servers for authentication as defined by the **aaa group server tacacs+** command.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for accounting as defined by the server group *group-name*.

In Table 13, the **group radius** and **group tacacs+** methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius-server host** and **tacacs+-server host** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Examples

The following example maps DNIS number 7777 to the RADIUS server group called group1. Server group group1 will use RADIUS server 172.30.0.0 for accounting requests for users dialing in with DNIS 7777.

```
aaa new-model
radius-server host 172.30.0.0 acct-port 1646 key cisco1
aaa group server radius group1
 server 172.30.0.0
aaa dnis map enable
aaa dnis map 7777 accounting network group group1
```

Related Commands

Command	Description
aaa dnis map authentication ppp group	Maps a DNIS number to a particular authentication server group.
aaa dnis map enable	Enables AAA server selection based on DNIS.
aaa group server	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.

aaa session-mib

To enable disconnect by using Simple Network Management Protocol (SNMP), use the **aaa session-mib** global configuration mode command. To disable this function, use the **no** form of this command.

aaa session-mib disconnect

no aaa session-mib disconnect

Syntax Description

disconnect	Enables authentication, authorization, and accounting (AAA) session MIB disconnect.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

Use the **aaa session-mib** command to terminate authenticated client connections using SNMP.

You must enable the **disconnect** keyword with this command. Otherwise, the network management station cannot perform set operations and disconnect users; it can only poll the table.

Examples

The following example shows how to enable a AAA session MIB to disconnect authenticated clients using SNMP:

```
aaa session-mib disconnect
```

accounting

To enable authentication, authorization, and accounting (AAA) accounting services to a specific line or group of lines, use the **accounting** command in line configuration mode. To disable AAA accounting services, use the **no** form of this command.

accounting {**arap** | **commands** *level* | **connection** | **exec**} [**default** | *list-name*]

no accounting {**arap** | **commands** *level* | **connection** | **exec**} [**default** | *list-name*]

Syntax Description

arap	Enables accounting on lines configured for AppleTalk Remote Access Protocol (ARAP).
commands *level*	Enables accounting on the selected lines for all commands at the specified privilege level. Valid privilege level entries are 0 through 15.
connection	Enables both CHAP and PAP, and performs PAP authentication before CHAP.
exec	Enables accounting for all system-level events not associated with users, such as reloads on the selected lines.
default	(Optional) The name of the default method list, created with the **aaa accounting** command.
list-name	(Optional) Specifies the name of a list of accounting methods to use. If no list name is specified, the system uses the default. The list is created with the **aaa accounting** command.

Defaults

Accounting is disabled.

Command Modes

Line configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

After you enable the **aaa accounting** command and define a named accounting method list (or use the default method list) for a particular type of accounting, you must apply the defined lists to the appropriate lines for accounting services to take place. Use the **accounting** command to apply the specified method lists (or if none is specified, the default method list) to the selected line or group of lines.

Examples

The following example enables command accounting services (for level 15) using the accounting method list named charlie on line 10:

```
line 10
 accounting commands 15 charlie
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.

accounting (gatekeeper)

To enable the accounting on the gatekeeper, use the **accounting** command in gatekeeper configuration mode. To disable accounting, use the **no** form of this command.

accounting

no accounting

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Gatekeeper configuration

Command History

Release	Modification
11.3(2)NA	This command was introduced.
12.0(3)T	This command was integrated into Cisco IOS release 12.0(3)T.

Usage Guidelines

Specify a RADIUS server before using the **accounting** command.

Examples

The following example enables the gateway to report user activity to the RADIUS server in the form of connection accounting records:

```
aaa accounting connection start-stop group radius
gatekeeper
  accounting
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.
radius-server key	Sets the authentication and encryption key for all RADIUS communications between the router and the RADIUS daemon.

ppp accounting

To enable authentication, authorization, and accounting (AAA) accounting services on the selected interface, use the **ppp accounting** command in interface configuration mode. To disable AAA accounting services, use the **no** form of this command.

ppp accounting default

no ppp accounting

Syntax Description

default	The name of the method list is created with the **aaa accounting** command.

Defaults

Accounting is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

After you enable the **aaa accounting** command and define a named accounting method list (or use the default method list), you must apply the defined lists to the appropriate interfaces for accounting services to take place. Use the **ppp accounting** command to apply the specified method lists (or if none is specified, the default method list) to the selected interface.

Examples

The following example enables accounting on asynchronous interface 4 and uses the accounting method list named charlie:

```
interface async 4
 encapsulation ppp
 ppp accounting charlie
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.

show accounting

To step through all active sessions and to print all the accounting records for actively accounted functions, use the **show accounting** command in EXEC mode. Use the **no** form of this command to disable viewing and printing accounting records.

show accounting

no show accounting

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The **show accounting** command allows you to display the active accountable events on the network. It provides system administrators with a quick look at what is going on, and it also can help collect information in the event of a data loss on the accounting server.

The **show accounting** command displays additional data on the internal state of authentication, authorization, and accounting (AAA) if **debug aaa accounting** is activated.

Examples

The following is sample output from the **show accounting** command.

```
Router# show accounting

Active Accounted actions on Interface Serial0:19, User jdoe Priv 1
 Task ID 15, Network Accounting record, 00:00:18 Elapsed
 task_id=15 timezone=PDT service=ppp mlp-links-max=4 mlp-links-current=4
protocol=ip addr=9.0.0.2 mlp-sess-id=1

Active Accounted actions on Interface Serial0:20, User jdoe Priv 1
 Task ID 13, Network Accounting record, 00:00:49 Elapsed
 task_id=13 timezone=PDT service=ppp mlp-links-max=4 mlp-links-current=4
protocol=ip addr=9.0.0.2 mlp-sess-id=1

Active Accounted actions on Interface Serial0:21, User jdoe Priv 1
 Task ID 11, Network Accounting record, 00:01:19 Elapsed
 task_id=11 timezone=PDT service=ppp mlp-links-max=4 mlp-links-current=4
protocol=ip addr=9.0.0.2 mlp-sess-id=1

Active Accounted actions on Interface Serial0:22, User jdoe Priv 1
 Task ID 9, Network Accounting record, 00:01:20 Elapsed
 task_id=9 timezone=PDT service=ppp mlp-links-max=4 mlp-links-current=4
mlp-sess-id=1 protocol=ip addr=9.0.0.2
```

```
Active Accounted actions on , User (not logged in) Priv 0
 Task ID 1, Resource-management Accounting record, 06:21:47 Elapsed
 task_id=1 timezone=PDT rm-protocol-version=1.0
service=resource-management
protocol=nas-status event=nas-start reason=reload

     Overall Accounting Traffic
          Starts   Stops  Updates  Active  Drops
Exec           0       0        0       0       0
Network        8       4        0       4       0
Connect        0       0        0       0       0
Command        0       0        0       0       0
Rsrc-mgmt      1       0        0       1       0
System         0       0        0       0       0

User creates:21, frees:9, Acctinfo mallocs:15, frees:6
Users freed with accounting unaccounted for:0
Queue length:0
```

Table 14 describes the fields contained in this example.

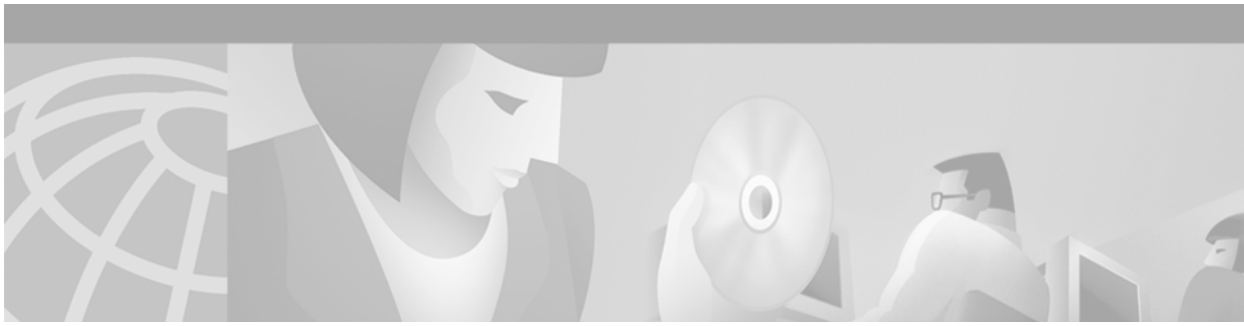
Table 14 show accounting Field Descriptions

Field	Description
Active Accounted actions on	Terminal line or interface name with which the user logged in.
User	ID of the user.
Priv	Privilege level of the user.
Task ID	Unique identifier for each accounting session.
Accounting Record	Type of accounting session.
Elapsed	Length of time (hh:mm:ss) for this session type.

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
show line	Displays the parameters of a terminal line.
show users	Displays information about the active lines on the router.

Security Server Protocols



RADIUS Commands

This chapter describes the commands used to configure RADIUS.

RADIUS is a distributed client/server system that secures networks against unauthorized access. In the Cisco implementation, RADIUS clients run on Cisco routers and send authentication requests to a central RADIUS server that contains all user authentication and network service access information. Cisco supports RADIUS under its authentication, authorization, and accounting (AAA) security paradigm.

For information on how to configure RADIUS, refer to the chapter "Configuring RADIUS" in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the section "RADIUS Configuration Examples" located at the end of the chapter "Configuring RADIUS" in the *Cisco IOS Security Configuration Guide*.

aaa group server radius

To group different RADIUS server hosts into distinct lists and distinct methods, enter the **aaa group server radius** command in global configuration mode. To remove a group server from the configuration list, enter the **no** form of this command.

aaa group server radius *group-name*

no aaa group server radius *group-name*

Syntax Description

group-name	Character string used to name the group of servers.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The authentication, authorization, and accounting (AAA) server-group feature introduces a way to group existing server hosts. The feature enables you to select a subset of the configured server hosts and use them for a particular service.

A group server is a list of server hosts of a particular type. Currently supported server host types are RADIUS server hosts and TACACS+ server hosts. A group server is used in conjunction with a global server host list. The group server lists the IP addresses of the selected server hosts.

Examples

The following example shows the configuration of an AAA group server named radgroup1 that comprises three member servers:

```
aaa group server radius radgroup1
    server 1.1.1.1 auth-port 1700 acct-port 1701
    server 2.2.2.2 auth-port 1702 acct-port 1703
    server 3.3.3.3 auth-port 1705 acct-port 1706
```

Note If auth-port and acct-port are not specified, the default value of auth-port is 1645 and the default value of acct-port is 1646.

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
aaa authentication login	Set AAA authentication at login.

Command	Description
aaa authorization	Sets parameters that restrict user access to a network.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.

aaa nas port extended

To replace the NAS-Port attribute with RADIUS IETF attribute 26 and to display extended field information, use the **aaa nas port extended** command in global configuration mode. To display no extended field information, use the **no** form of this command.

aaa nas port extended

no aaa nas port extended

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

On platforms with multiple interfaces (ports) per slot, the Cisco RADIUS implementation will not provide a unique NAS-Port attribute that permits distinguishing between the interfaces. For example, if a dual PRI interface is in slot 1, calls on both Serial1/0:1 and Serial1/1:1 will appear as NAS-Port = 20101 due to the 16-bit field size limitation associated with RADIUS IETF NAS-Port attribute.

In this case, the solution is to replace the NAS-Port attribute with a vendor-specific attribute (RADIUS IETF Attribute 26). Cisco's vendor ID is 9, and the Cisco-NAS-Port attribute is subtype 2. Vendor-specific attributes (VSAs) can be turned on by entering the **radius-server vsa send** command. The port information in this attribute is provided and configured using the **aaa nas port extended** command.

The standard NAS-Port attribute (RADIUS IETF attribute 5) will continue to be sent. If you do not want this information to be sent, you can suppress it by using the **no radius-server attribute nas-port** command. When this command is configured, the standard NAS-Port attribute will no longer be sent.

Examples

The following example specifies that RADIUS will display extended interface information:

```
radius-server vsa send
aaa nas port extended
```

Related Commands

Command	Description
radius-server extended-portnames	Displays expanded interface information in the NAS-Port attribute.
radius-server vsa send	Configures the network access server to recognize and use vendor-specific attributes.

call guard-timer

To set a guard timer to accept or reject a call in the event that the RADIUS server fails to respond to a preauthentication request, use the **call guard-timer** controller configuration command. To remove the **call guard-timer** command from your configuration file, use the **no** form of this command.

call guard-timer *milliseconds* [**on-expiry** {**accept** | **reject**}]

no call guard-timer *milliseconds* [**on-expiry** {**accept** | **reject**}]

Syntax Description

milliseconds	Specifies the number of milliseconds to wait for a response from the RADIUS server.
on-expiry accept	(Optional) Accepts the call if a response is not received from the RADIUS server within the specified time.
on-expiry reject	(Optional) Rejects the call if a response is not received from the RADIUS server within the specified time.

Defaults

No default behavior or values.

Command Modes

Controller configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Examples

The following example shows a guard timer that is set at 20000 milliseconds. A call will be accepted if the RADIUS server has not responded to a preauthentication request when the timer expires.

```
controller T1 0
 framing esf
 clock source line primary
 linecode b8zs
 ds0-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
 cas-custom 0
    call guard-timer 20000 on-expiry accept

aaa preauth
group radius
    dnis required
```

Related Commands

Command	Description
aaa preauth	Enters AAA preauthentication configuration mode.

clid

To preauthenticate calls on the basis of the Calling Line Identification (CLID) number, use the **clid** authentication, authorization, and accounting (AAA) preauthentication configuration command. To remove the **clid** command from your configuration, use the **no** form of this command.

clid [**if-avail | required**] [**accept-stop**] [**password** *password*]

no clid [**if-avail | required**] [**accept-stop**] [**password** *password*]

Syntax Description

if-avail	(Optional) Implies that if the switch provides the data, RADIUS must be reachable and must accept the string in order for preauthentication to pass. If the switch does not provide the data, preauthentication passes.
required	(Optional) Implies that the switch must provide the associated data, that RADIUS must be reachable, and that RADIUS must accept the string in order for preauthentication to pass. If these three conditions are not met, preauthentication fails.
accept-stop	(Optional) Prevents subsequent preauthentication elements such as **ctype** or **dnis** from being tried once preauthentication has succeeded for a call element.
password *password*	(Optional) Defines the password for the preauthentication element.

Defaults

The **if-avail** and **required** keywords are mutually exclusive. If the **if-avail** keyword is not configured, the preauthentication setting defaults to **required**.

The default password string is cisco.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You may configure more than one of the AAA preauthentication commands (**clid**, **ctype**, **dnis**) to set conditions for preauthentication. The sequence of the command configuration decides the sequence of the preauthentication conditions. For example, if you configure **dnis**, then **clid**, then **ctype**, in this order, then this is the order of the conditions considered in the preauthentication process.

In addition to using the preauthentication commands to configure preauthentication on the Cisco router, you must set up the preauthentication profiles on the RADIUS server.

Examples

The following example specifies that incoming calls be preauthenticated on the basis of the CLID number:

```
aaa preauth
 group radius
```

```
clid required
```

Related Commands

Command	Description
ctype	Preauthenticates calls on the basis of the call type.
dnis (AAA preauthentication configuration)	Preauthenticates calls on the basis of the DNIS number.
dnis bypass (AAA preauthentication configuration)	Specifies a group of DNIS numbers that will be bypassed for preauthentication.
group (AAA preauthentication configuration)	Specifies the AAA RADIUS server group to use for preauthentication.

ctype

To preauthenticate calls on the basis of the call type, use the **ctype** authentication, authorization, and accounting (AAA) preauthentication configuration command. To remove the **ctype** command from your configuration, use the **no** form of this command.

ctype [**if-avail** | **required**] [**accept-stop**] [**password** *password*] [**digital** | **speech** | **v.110** | **v.120**]

no ctype [**if-avail** | **required**] [**accept-stop**] [**password** *password*] [**digital** | **speech** | **v.110** | **v.120**]

Syntax Description

if-avail	(Optional) Implies that if the switch provides the data, RADIUS must be reachable and must accept the string in order for preauthentication to pass. If the switch does not provide the data, preauthentication passes.
required	(Optional) Implies that the switch must provide the associated data, that RADIUS must be reachable, and that RADIUS must accept the string in order for preauthentication to pass. If these three conditions are not met, preauthentication fails.
accept-stop	(Optional) Prevents subsequent preauthentication elements such as **clid** or **dnis** from being tried once preauthentication has succeeded for a call element.
password *password*	(Optional) Defines the password for the preauthentication element.
digital	(Optional) Specifies “digital” as the call type for preauthentication.
speech	(Optional) Specifies “speech” as the call type for preauthentication.
v.110	(Optional) Specifies “v.110” as the call type for preauthentication.
v.120	(Optional) Specifies “v.120” as the call type for preauthentication.

Defaults

The **if-avail** and **required** keywords are mutually exclusive. If the **if-avail** keyword is not configured, the preauthentication setting defaults to **required**.

The default password string is cisco.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You may configure more than one of the AAA preauthentication commands (**clid**, **ctype**, **dnis**) to set conditions for preauthentication. The sequence of the command configuration decides the sequence of the preauthentication conditions. For example, if you configure **dnis**, then **clid**, then **ctype**, in this order, then this is the order of the conditions considered in the preauthentication process.

In addition to using the preauthentication commands to configure preauthentication on the Cisco router, you must set up the preauthentication profiles on the RADIUS server.

Set up the RADIUS preauthentication profile with the call type string as the username and with the password that is defined in the **ctype** command as the password. Table 15 shows the call types that you may use in the preauthentication profile.

Table 15 Preauthentication Call Types

Call Type String	ISDN Bearer Capabilities
digital	Unrestricted digital, restricted digital.
speech	Speech, 3.1 kHz audio, 7 kHz audio.
v.110	Anything with V.110 user information layer.
v.120	Anything with V.120 user information layer.

Examples

The following example specifies that incoming calls be preauthenticated on the basis of the call type:

```
aaa preauth
 group radius
 ctype required
```

Related Commands

Command	Description
clid	Preauthenticates calls on the basis of the CLID number.
dnis (AAA preauthentication configuration)	Preauthenticates calls on the basis of the DNIS number.
dnis bypass (AAA preauthentication configuration)	Specifies a group of DNIS numbers that will be bypassed for preauthentication.
group (AAA preauthentication configuration)	Specifies the AAA RADIUS server group to use for preauthentication.

deadtime (server-group configuration)

To configure deadtime within the context of RADIUS server groups, use the **deadtime** server group configuration command. To set deadtime to 0, use the **no** form of this command.

deadtime *minutes*

no deadtime

Syntax Description

minutes	Length of time, in minutes, for which a RADIUS server is skipped over by transaction requests, up to a maximum of 1440 minutes (24 hours).

Defaults

Deadtime is set to 0.

Command Modes

Server-group configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

Use this command to configure the deadtime value of any RADIUS server group. The value of deadtime set in the server groups will override the server that is configured globally. If deadtime is omitted from the server group configuration, the value will be inherited from the master list. If the server group is not configured, the default value (0) will apply to all servers in the group.

Examples

The following example specifies a one-minute deadtime for RADIUS server group group1 once it has failed to respond to authentication requests:

```
aaa group server radius group1
    server 1.1.1.1 auth-port 1645 acct-port 1646
    server 2.2.2.2 auth-port 2000 acct-port 2001
    deadtime 1
```

Related Commands

Command	Description
radius-server deadtime	Sets the deadtime value globally.

dialer aaa

To allow a dialer to access the authentication, authorization, and accounting (AAA) server for dialing information, use the **dialer aaa** command in interface configuration mode. To disable this function, use the **no** form of this command.

dialer aaa [**password** *string* | **suffix** *string*]

no dialer aaa [**password** *string* | **suffix** *string*]

Syntax Description

password *string*	(Optional) Defines a nondefault password for authentication. The password string can be a maximum of 128 characters.
suffix *string*	(Optional) Defines a suffix for authentication. The suffix string can be a maximum of 64 characters.

Defaults

This feature is not enabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.1(5)T	The **password** and **suffix** keywords were added.

Usage Guidelines

This command is required for large scale dial-out and Layer 2 Tunneling Protocol (L2TP) dial-out functionality. With this command, you can specify a suffix, a password, or both. If you do not specify a password, the default password will be "cisco."

Note Only IP addresses can be specified as usernames for the **dialer aaa suffix** command.

Examples

This example shows a user sending out packets from interface Dialer1 with a destination IP address of 1.1.1.1. The username in the access-request message is "1.1.1.1@ciscoDoD" and the password is "cisco."

```
interface dialer1
 dialer aaa
 dialer aaa suffix @ciscoDoD password cisco
```

Related Commands

Command	Description
accept dialout	Accepts requests to tunnel L2TP dial-out calls and creates an accept-dialout VPDN subgroup.

dialer congestion-threshold	Specifies congestion threshold in connected links.
dialer vpdn	Enables a Dialer Profile or DDR dialer to use L2TP dial-out.

dnis (AAA preauthentication configuration)

To preauthenticate calls on the basis of the DNIS (Dialed Number Identification Service) number, use the **dnis** AAA preauthentication configuration command. To remove the **dnis** command from your configuration, use the **no** form of this command.

dnis [**if-avail | required**] [**accept-stop**] [**password** *password*]

no dnis [**if-avail | required**] [**accept-stop**] [**password** *password*]

Syntax Description

if-avail	(Optional) Implies that if the switch provides the data, RADIUS must be reachable and must accept the string in order for preauthentication to pass. If the switch does not provide the data, preauthentication passes.
required	(Optional) Implies that the switch must provide the associated data, that RADIUS must be reachable, and that RADIUS must accept the string in order for preauthentication to pass. If these three conditions are not met, preauthentication fails.
accept-stop	(Optional) Prevents subsequent preauthentication elements such as **clid** or **ctype** from being tried once preauthentication has succeeded for a call element.
password *password*	(Optional) Defines the password for the preauthentication element.

Defaults

The **if-avail** and **required** keywords are mutually exclusive. If the **if-avail** keyword is not configured, the preauthentication setting defaults to **required**.

The default password string is cisco.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You may configure more than one of the authentication, authorization, and accounting (AAA) preauthentication commands (**clid**, **ctype**, **dnis**) to set conditions for preauthentication. The sequence of the command configuration decides the sequence of the preauthentication conditions. For example, if you configure **dnis**, then **clid**, then **ctype**, in this order, then this is the order of the conditions considered in the preauthentication process.

In addition to using the preauthentication commands to configure preauthentication on the Cisco router, you must set up the preauthentication profiles on the RADIUS server.

Examples

The following example specifies that incoming calls be preauthenticated on the basis of the DNIS number:

```
aaa preauth
 group radius
 dnis required
```

Related Commands

Command	Description
clid	Preauthenticates calls on the basis of the CLID number.
ctype	Preauthenticates calls on the basis of the call type.
dnis bypass (AAA preauthentication configuration)	Specifies a group of DNIS numbers that will be bypassed for preauthentication.
group (AAA preauthentication configuration)	Specifies the AAA RADIUS server group to use for preauthentication.

dnis bypass (AAA preauthentication configuration)

To specify a group of DNIS (Dialed Number Identification Service) numbers that will be bypassed for preauthentication, use the **dnis bypass** AAA preauthentication configuration command. To remove the **dnis bypass** command from your configuration, use the **no** form of this command.

dnis bypass {*dnis-group-name*}

no dnis bypass {*dnis-group-name*}

Syntax Description

dnis-group-name	Name of the defined DNIS group.

Defaults

No DNIS numbers are bypassed for preauthentication.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

Before using this command, you must first create a DNIS group with the **dialer dnis group** command.

Examples

The following example specifies that preauthentication be performed on all DNIS numbers except for two DNIS numbers (12345 and 12346), which have been defined in the DNIS group called hawaii:

```
aaa preauth
 group radius
 dnis required
 dnis bypass hawaii

dialer dnis group hawaii
 number 12345
 number 12346
```

Related Commands

Command	Description
dialer dnis group	Creates a DNIS group.
dnis (AAA preauthentication configuration)	Preauthenticates calls on the basis of the DNIS number.

group (AAA preauthentication configuration)

To specify the authentication, authorization, and accounting (AAA) RADIUS server group to use for preauthentication, use the **group** AAA preauthentication configuration command. To remove the **group** command from your configuration, use the **no** form of this command.

group *server-group*

no group *server-group*

Syntax Description

server-group	Specifies a AAA RADIUS server group.

Defaults

No default behavior or values.

Command Modes

AAA preauthentication configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must configure a RADIUS server group with the **aaa group server radius** command in global configuration mode before using the **group** command in AAA preauthentication configuration mode.

You must configure the **group** command before you configure any other AAA preauthentication command (**clid**, **ctype**, **dnis**, or **dnis bypass**).

Examples

The following example shows the creation of a RADIUS server group called “maestro” and then specifies that DNIS preauthentication be performed using this server group:

```
aaa group server radius maestro
 server 1.1.1.1
 server 2.2.2.2
 server 3.3.3.3

aaa preauth
 group maestro
 dnis required
```

Related Commands

Command	Description
aaa group server radius	Groups different RADIUS server hosts into distinct lists and distinct methods.
clid	Preauthenticates calls on the basis of the CLID number.
ctype	Preauthenticates calls on the basis of the call type.
dnis (AAA preauthentication configuration)	Preauthenticates calls on the basis of the DNIS number.
dnis bypass (AAA preauthentication configuration)	Specifies a group of DNIS numbers that will be bypassed for preauthentication.

ip radius source-interface

To force RADIUS to use the IP address of a specified interface for all outgoing RADIUS packets, use the **ip radius source-interface** command in global configuration mode. To prevent RADIUS from using the IP address of a specified interface for all outgoing RADIUS packets, use the **no** form of this command.

ip radius source-interface *subinterface-name*

no ip radius source-interface

Syntax Description

subinterface-name	Name of the interface that RADIUS uses for all of its outgoing packets.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

Use this command to set a subinterface's IP address to be used as the source address for all outgoing RADIUS packets. This address is used as long as the interface is in the *up* state. In this way, the RADIUS server can use one IP address entry for every network access client instead of maintaining a list of IP addresses.

This command is especially useful in cases where the router has many interfaces and you want to ensure that all RADIUS packets from a particular router have the same IP address.

The specified interface must have an IP address associated with it. If the specified subinterface does not have an IP address or is in the *down* state, then RADIUS reverts to the default. To avoid this, add an IP address to the subinterface or bring the interface to the *up* state.

Examples

The following example makes RADIUS use the IP address of subinterface s2 for all outgoing RADIUS packets:

```
ip radius source-interface s2
```

Related Commands

Command	Description
ip tacacs source-interface	Uses the IP address of a specified interface for all outgoing TACACS packets.
ip telnet source-interface	Allows a user to select an address of an interface as the source address for Telnet connections.
ip tftp source-interface	Allows a user to select the interface whose address will be used as the source address for TFTP connections.

radius-server attribute 32 include-in-access-req

To send RADIUS attribute 32 (NAS-Identifier) in an access-request or accounting-request, use the **radius-server attribute 32 include-in-access-req** global configuration command. To disable sending RADIUS attribute 32, use the **no** form of this command.

radius-server attribute 32 include-in-access-req [*format*]

no radius-server attribute 32 include-in-access-req

Syntax Description

format	(Optional) A string sent in attribute 32 containing an IP address (%i), a hostname (%h), or a domain name (%d).

Defaults

RADIUS attribute 32 is not sent in access-request or accounting-request packets.

Command Modes

Global configuration mode

Command History

Release	Modification
12.1T	This command was introduced.

Usage Guidelines

Using the **radius-server attribute 32 include-in-access-req** makes it possible to identify the network access server (NAS) manufacturer to the RADIUS server by sending RADIUS attribute 32 (NAS-Identifier) in an access-request or accounting-request. If you configure the *format* argument, the string sent in attribute 32 will include an IP address, a hostname, or a domain name; otherwise, the Fully Qualified Domain Name (FQDN) is sent by default.

Examples

The following example shows a configuration that sends RADIUS attribute 32 in the access-request with the format configured to identify a Cisco NAS:

```
radius-server attribute 32 include-in-access-req format cisco %h.%d %i
! The following string will be sent in attribute 32 (NAS-Identifier).
"cisco router.nlab.cisco.com 10.0.1.67"
```

radius-server attribute 44 include-in-access-req

To send RADIUS attribute 44 (Accounting Session ID) in access request packets before user authentication (including requests for preauthentication), use the **radius-server attribute 44 include-in-access-req** global configuration command. To remove this command from your configuration, use the **no** form of this command.

radius-server attribute 44 include-in-access-req

no radius-server attribute 44 include-in-access-req

Syntax Description

This command has no arguments or keywords.

Defaults

RADIUS attribute 44 is not sent in access request packets.

Command Modes

Global configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

There is no guarantee that the Accounting Session IDs will increment uniformly and consistently. In other words, between two calls, the Accounting Session ID can increase by more than one.

Examples

The following example shows a configuration that sends RADIUS attribute 44 in access-request packets:

```
aaa new-model
aaa authentication ppp default group radius
radius-server host 10.100.1.34
radius-server attribute 44 include-in-access-req
```

radius-server attribute 55 include-in-acct-req

To send the RADIUS attribute 55 (Event-Timestamp) in accounting packets, use the **radius-server attribute 55 include-in-acct-req** command in global configuration mode. To remove this command from your configuration, use the **no** form of this command.

radius-server attribute 55 include-in-acct-req

no radius-server attribute 55 include-in-acct-req

Syntax Description

This command has no arguments or keywords.

Defaults

RADIUS attribute 55 is not sent in accounting packets.

Command Modes

Global configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

Use the **radius-server attribute 55 include-in-acct-req** command to send RADIUS attribute 55 (Event-Timestamp) in accounting packets. The Event-Timestamp attribute records the time that the event occurred on the NAS; the timestamp sent in attribute 55 is in seconds since January 1, 1970 00:00 UTC.

Note Before the Event-Timestamp attribute can be sent in accounting packets, you *must* configure the clock on the router. (For information on setting the clock on your router, refer to section "Performing Basic System Management" in the chapter "System Management" of the *Cisco IOS Configuration Fundamentals Configuration Guide*.)

To avoid configuring the clock on the router every time the router is reloaded, you can enable the **clock calendar-valid** command. (For information on this command, refer to the chapter "Basic System Management Commands" in the *Cisco IOS Configuration Fundamentals Command Reference.*

Examples

The following example shows how to enable your router to send the Event-Timestamp attribute in accounting packets. (To see whether the Event-Timestamp was successfully enabled, use the **debug radius** command.)

```
radius-server attribute 55 include-in-acct-req
```

Related Commands

Command	Description
clock calendar-valid	Configures a system as an authoritative time source for a network based on its hardware clock (calendar).
clock set	Manually sets the system software clock.

radius-server attribute 69 clear

To receive nonencrypted tunnel passwords in attribute 69 (Tunnel-Password), use the **radius-server attribute 69 clear** global configuration command. To disable this feature and receive encrypted tunnel passwords, use the **no** form of this command.

radius-server attribute 69 clear

no radius-server attribute 69 clear

Syntax Description

This command has no arguments or keywords.

Defaults

RADIUS attribute 69 is not sent and encrypted tunnel passwords are sent.

Command Modes

Global configuration mode

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

Use the **radius-server attribute 69 clear** command to receive nonencrypted tunnel passwords, which are sent in RADIUS attribute 69 (Tunnel-Password). This command allows tunnel passwords to be sent in a "string" encapsulated format, rather than the standard tag/salt/string format, which enables the encrypted tunnel password.

Some RADIUS servers do not encrypt Tunnel-Password; however the current NAS (network access server) implementation will decrypt a non-encrypted password that causes authorization failures. Because nonencrypted tunnel passwords can be sent in attribute 69, the NAS will no longer decrypt tunnel passwords.

Note Once this command is enabled, all tunnel passwords received will be nonencrypted until the command is manually disabled.

Examples

The following example shows how to enable attribute 69 to receive nonencrypted tunnel passwords. (To see whether the Tunnel-Password process is successful, use the **debug radius** command.)

```
radius-server attribute 69 clear
```

radius-server attribute 188 format non-standard

To send the number of remaining links in the multilink bundle in the accounting-request packet, use the **radius-server attribute 188 format non-standard** global configuration command. To disable the sending of the number of links in the multilink bundle in the accounting-request packet, use the **no** form of this command.

radius-server attribute 188 format non-standard

no radius-server attribute 188 format non-standard

Syntax Description

This command has no arguments or keywords.

Defaults

RADIUS attribute 188 is not sent in accounting "start" and "stop" records.

Command Modes

Global configuration mode

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

Use this command to send attribute 188 in accounting "start" and "stop" records.

Examples

The following example shows a configuration that sends RADIUS attribute 188 in accounting-request packets:

```
radius-server attribute 188 format non-standard
```

radius-server attribute nas-port extended

The **radius-server attribute nas-port extended** command is replaced by the **radius-server attribute nas-port format** command. See the description of the **radius-server attribute nas-port format** command in this chapter for more information.

radius-server attribute nas-port format

To select the NAS-Port format used for RADIUS accounting features, and to restore the default NAS-Port format, use the **radius-server attribute nas-port format** global configuration command. If the **no** form of this command is used, attribute 5 (NAS-Port) will no longer be sent to the RADIUS server.

radius-server attribute nas-port format *format*

no radius-server attribute nas-port format *format*

Syntax Description

format	NAS-Port format. Possible values for the format argument are as follows: **a**—Standard NAS-Port format **b**—Extended NAS-Port format **c**—Shelf-slot NAS-Port format **d**—PPP extended NAS-Port format

Defaults

Standard NAS-Port format

Command Modes

Global configuration

Command History

Release	Modification
11.3(7)T	This command was introduced.
11.3(9)DB	The PPP extended NAS-Port format was added.
12.1(5)T	The PPP extended NAS-Port format was expanded to support PPPoE over ATM and PPPoE over IEEE 802.1Q VLANs.

Usage Guidelines

The **radius-server attribute nas-port format** command configures RADIUS to change the size and format of the NAS-Port attribute field (RADIUS IETF attribute 5).

The following NAS-Port formats are supported:

- Standard NAS-Port format—This 16-bit NAS-Port format indicates the type, port, and channel of the controlling interface. This is the default format used by Cisco IOS software.
- Extended NAS-Port format—The standard NAS-Port attribute field is expanded to 32 bits. The upper 16 bits of the NAS-Port attribute display the type and number of the controlling interface; the lower 16 bits indicate the interface that is undergoing authentication.
- Shelf-slot NAS-Port format—This 16-bit NAS-Port format supports expanded hardware models requiring shelf and slot entries.
- PPP extended NAS-Port format—This NAS-Port format uses 32 bits to indicate the interface, VPI, and VCI for PPP over ATM and PPPoE over ATM, and the interface and VLAN ID for PPPoE over IEEE 802.1Q VLANs.

Note This command replaces the **radius-server attribute nas-port extended** command.

Examples

In the following example, a RADIUS server is identified, and the NAS-Port field is set to the PPP extended format:

```
radius-server host 172.31.5.96 auth-port 1645 acct-port 1646
radius-server attribute nas-port format d
```

Related Commands

Command	Description
vpdn aaa attribute	Enables reporting of NAS AAA attributes related to a VPDN to the AAA server.

radius-server challenge-noecho

To prevent user responses to Access-Challenge packets from being displayed on the screen, use the **radius-server challenge-noecho** global configuration command. To return to the default condition, use the **no** form of this command.

radius-server challenge-noecho

no radius-server challenge-noecho

Syntax Description

This command has no arguments or keywords.

Defaults

All user responses to Access-Challenge packets are echoed to the screen.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

This command applies to all users. When the **radius-server challenge-noecho** command is configured, user responses to Access-Challenge packets are not displayed unless the Prompt attribute in the user profile is set to *echo* on the RADIUS server. The Prompt attribute in a user profile overrides the **radius-server challenge-noecho** command for the individual user. For more information, see the chapter "Configuring RADIUS" in the *Cisco IOS Security Configuration Guide*, Release 12.2.

Examples

The following example stops all user responses from displaying on the screen:

```
radius-server challenge-noecho
```

radius-server configure-nas

To have the Cisco router or access server query the vendor-proprietary RADIUS server for the static routes and IP pool definitions used throughout its domain when the device starts up, use the **radius-server configure-nas** command in global configuration mode. To discontinue the query of the RADIUS server, use the **no** form of this command.

radius-server configure-nas

no radius-server configure-nas

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

Use the **radius-server configure-nas** command to have the Cisco router query the vendor-proprietary RADIUS server for static routes and IP pool definitions when the router first starts up. Some vendor-proprietary implementations of RADIUS let the user define static routes and IP pool definitions on the RADIUS server instead of on each individual network access server in the network. As each network access server starts up, it queries the RADIUS server for static route and IP pool information. This command enables the Cisco router to obtain static routes and IP pool definition information from the RADIUS server.

Note Because the **radius-server configure-nas** command is performed when the Cisco router starts up, it will not take effect until you issue a **copy system:running-config nvram:startup-config** command.

Examples

The following example shows how to tell the Cisco router or access server to query the vendor-proprietary RADIUS server for already-defined static routes and IP pool definitions when the device first starts up:

```
radius-server configure-nas
```

Related Commands

Command	Description
radius-server host non-standard	Identifies that the security server is using a vendor-proprietary implementation of RADIUS.

radius-server deadtime

To improve RADIUS response times when some servers might be unavailable, use the **radius-server deadtime** command in global configuration mode to cause the unavailable servers to be skipped immediately. To set dead-time to 0, use the **no** form of this command.

radius-server deadtime *minutes*

no radius-server deadtime

Syntax Description

minutes	Length of time, in minutes, for which a RADIUS server is skipped over by transaction requests, up to a maximum of 1440 minutes (24 hours).

Defaults

Dead time is set to 0.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Use this command to cause the Cisco IOS software to mark as "dead" any RADIUS servers that fail to respond to authentication requests, thus avoiding the wait for the request to time out before trying the next configured server. A RADIUS server marked as "dead" is skipped by additional requests for the duration of *minutes* or unless there are no servers not marked "dead."

Examples

The following example specifies five minutes deadtime for RADIUS servers that fail to respond to authentication requests:

```
radius-server deadtime 5
```

Related Commands

Command	Description
deadtime (server-group configuration)	Configures deadtime within the context of RADIUS server groups.
radius-server host	Specifies a RADIUS server host.
radius-server retransmit	Specifies the number of times the Cisco IOS software searches the list of RADIUS server hosts before giving up.
radius-server timeout	Sets the interval for which a router waits for a server host to reply.

radius-server directed-request

To allow users logging into a Cisco netword access server (NAS) to select a RADIUS server for authentication, use the **radius-server directed-request** command in global configuration mode. To disable the directed-request feature, use the **no** form of this command.

radius-server directed-request [**restricted**]

no radius-server directed-request [**restricted**]

Syntax Description

restricted	(Optional) Prevents the user from being sent to a secondary server if the specified server is not available.

Defaults

User cannot log into a Cisco NAS to select a RADIUS server for authentication.

Command Modes

Global configuration mode

Command History

Release	Modification
12.0(2)T	This command was introduced.

Usage Guidelines

The **radius-server directed-request** command sends only the portion of the username before the "@" symbol to the host specified after the "@" symbol. In other words, with this command enabled, you can direct a request to any of the configured servers, and only the username is sent to the specified server.

Disabling the **radius-server directed-request** command causes the whole string, both before and after the "@" symbol, to be sent to the default RADIUS server. The router queries the list of servers, starting with the first one in the list. It sends the whole string, and accepts the first response that it gets from the server.

Use the **radius-server directed-request restricted** command to limit the user to the RADIUS server identified as part of the username.

The **no radius-server directed-request** command causes the entire username string to be passed to the default RADIUS server.

Note When **no radius-server directed-request restricted** is entered, only the "restricted" flag is removed, and the "directed-request" flag is retained. To disable the directed-request feature, you must also issue the **no radius-server directed-request** command.

Examples

The following example verifies that the RADIUS server is selected based on the directed request:

```
aaa new-model
aaa authentication login default radius
radius-server host 192.168.1.1
radius-server host 172.16.56.103
```

```
radius-server host 172.31.40.1
radius-server directed-request
```

radius-server extended-portnames

The **radius-server extended-portnames** command is replaced by the **radius-server attribute nas-port format** command. See the description of the **radius-server attribute nas-port format** command in this chapter for more information.

radius-server host

To specify a RADIUS server host, use the **radius-server host** command in global configuration mode. To delete the specified RADIUS host, use the **no** form of this command.

radius-server host {*hostname* | *ip-address*} [**auth-port** *port-number*] [**acct-port** *port-number*] [**timeout** *seconds*] [**retransmit** *retries*] [**key** *string*] [**alias**{*hostname* | *ip-address*}]

no radius-server host {*hostname* | *ip-address*}

Syntax Description

hostname	Domain Name System (DNS) name of the RADIUS server host.
ip-address	IP address of the RADIUS server host.
auth-port	(Optional) Specifies the UDP destination port for authentication requests.
port-number	(Optional) Port number for authentication requests; the host is not used for authentication if set to 0. If unspecified, the port number defaults to 1645.
acct-port	(Optional) Specifies the UDP destination port for accounting requests.
port-number	(Optional) Port number for accounting requests; the host is not used for accounting if set to 0. If unspecified, the port number defaults to 1646.
timeout	(Optional) The time interval (in seconds) that the router waits for the RADIUS server to reply before retransmitting. This setting overrides the global value of the **radius-server timeout** command. If no timeout value is specified, the global value is used. Enter a value in the range 1 to 1000.
seconds	(Optional) Specifies the **timeout** value. Enter a value in the range 1 to 1000. If no **timeout** value is specified, the global value is used.
retransmit	(Optional) The number of times a RADIUS request is re-sent to a server, if that server is not responding or responding slowly. This setting overrides the global setting of the **radius-server retransmit** command.
retries	(Optional) Specifies the retransmit value. Enter a value in the range 1 to 100. If no retransmit value is specified, the global value is used.
key	(Optional) Specifies the authentication and encryption key used between the router and the RADIUS daemon running on this RADIUS server. This key overrides the global setting of the **radius-server key** command. If no key string is specified, the global value is used. The key is a text string that must match the encryption key used on the RADIUS server. Always configure the key as the last item in the **radius-server host** command syntax. This is because the leading spaces are ignored, but spaces within and at the end of the key are used. If you use spaces in the key, do not enclose the key in quotation marks unless the quotation marks themselves are part of the key.
string	(Optional) Specifies the authentication and encryption key for all RADIUS communications between the router and the RADIUS server. This key must match the encryption used on the RADIUS daemon. All leading spaces are ignored, but spaces within and at the end of the key are used. If you use spaces in your key, do not enclose the key in quotation marks unless the quotation marks themselves are part of the key.
alias	(Optional) Allows up to eight aliases per line for any given RADIUS server.

Defaults No RADIUS host is specified; use global **radius-server** command values.

Command Modes Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.0(5)T	This command was modified to add options for configuring timeout, retransmission, and key values per RADIUS server.
12.1(3)T	The **alias** keyword was added on the Cisco AS5300 and AS5800 universal access servers.

Usage Guidelines You can use multiple **radius-server host** commands to specify multiple hosts. The software searches for hosts in the order in which you specify them.

If no host-specific timeout, retransmit, or key values are specified, the global values apply to each host.

Examples The following example specifies *host1* as the RADIUS server and uses default ports for both accounting and authentication:

```
radius-server host host1
```

The following example specifies port 1612 as the destination port for authentication requests and port 1616 as the destination port for accounting requests on the RADIUS host named host1:

```
radius-server host host1 auth-port 1612 acct-port 1616
```

Because entering a line resets all the port numbers, you must specify a host and configure accounting and authentication ports on a single line.

The following example specifies the host with IP address 172.29.39.46 as the RADIUS server, uses ports 1612 and 1616 as the authorization and accounting ports, sets the timeout value to 6, sets the retransmit value to 5, and sets “rad123” as the encryption key, matching the key on the RADIUS server:

```
radius-server host 172.29.39.46 auth-port 1612 acct-port 1616 timeout 6 retransmit 5 key
rad123
```

To use separate servers for accounting and authentication, use the zero port value as appropriate.

The following example specifies that RADIUS server host1 be used for accounting but not for authentication, and that RADIUS server host2 be used for authentication but not for accounting:

```
radius-server host host1.example.com auth-port 0
radius-server host host2.example.com acct-port 0
```

The following example specifies four aliases on the RADIUS server with IP address 172.1.1.1:

```
radius-server host 172.1.1.1 acct-port 1645 auth-port 1646
radius-server host 172.1.1.1 alias 172.16.2.1 172.17.3.1 172.16.4.1
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
aaa authentication ppp	Specifies one or more AAA authentication method for use on serial interfaces running PPP.
aaa authorization	Sets parameters that restrict network access to a user.
ppp	Starts an asynchronous connection using PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
radius-server key	Sets the authentication and encryption key for all RADIUS communications between the router and the RADIUS daemon.
radius-server retransmit	Specifies how many times the Cisco IOS software searches the list of RADIUS server hosts before giving up.
radius-server timeout	Sets the interval a router waits for a server host to reply.
username	Establishes a username-based authentication system, such as PPP CHAP and PAP.

radius-server host non-standard

To identify that the security server is using a vendor-proprietary implementation of RADIUS, use the **radius-server host non-standard** command in global configuration mode. This command tells the Cisco IOS software to support nonstandard RADIUS attributes. To delete the specified vendor-proprietary RADIUS host, use the **no** form of this command.

radius-server host {*hostname* | *ip-address*} **non-standard**

no radius-server host {*hostname* | *ip-address*} **non-standard**

Syntax Description

hostname	DNS name of the RADIUS server host.
ip-address	IP address of the RADIUS server host.

Defaults

No RADIUS host is specified.

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

The **radius-server host non-standard** command enables you to identify that the RADIUS server is using a vendor-proprietary implementation of RADIUS. Although an IETF draft standard for RADIUS specifies a method for communicating information between the network access server and the RADIUS server, some vendors have extended the RADIUS attribute set in a unique way. This command enables the Cisco IOS software to support the most common vendor-proprietary RADIUS attributes. Vendor-proprietary attributes will not be supported unless you use the **radius-server host non-standard** command.

For a list of supported vendor-specific RADIUS attributes, refer to the appendix "RADIUS Attributes" in the *Cisco IOS Security Configuration Guide*.

Examples

The following example specifies a vendor-proprietary RADIUS server host named *alcatraz*:

```
radius-server host alcatraz non-standard
```

Related Commands

Command	Description
radius-server configure-nas	Allows the Cisco router or access server to query the vendor-proprietary RADIUS server for the static routes and IP pool definitions used throughout its domain when the device starts up.
radius-server host	Specifies a RADIUS server host.

radius-server key

To set the authentication and encryption key for all RADIUS communications between the router and the RADIUS daemon, use the **radius-server key** command in global configuration mode. To disable the key, use the **no** form of this command.

radius-server key {**0** *string* | **7** *string* | *string*}

no radius-server key

Syntax Description

0	Specifies that an unencrypted key will follow.
string	The unencrypted (cleartext) shared key.
7	Specifies that a hidden key will follow.
string	The hidden shared key.
string	The unencrypted (cleartext) shared key.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.1(3)T	The *string* argument was modified as follows: • **0** *string* • **7** *string* • *string*

Usage Guidelines

After enabling authentication, authorization, and accounting (AAA) authentication with the **aaa new-model** command, you must set the authentication and encryption key using the **radius-server key** command.

Note Specify a RADIUS key after you issue the **aaa new-model** command.

The key entered must match the key used on the RADIUS daemon. All leading spaces are ignored, but spaces within and at the end of the key are used. If you use spaces in your key, do not enclose the key in quotation marks unless the quotation marks themselves are part of the key.

Examples

The following example sets the authentication and encryption key to “dare to go”:

```
radius-server key dare to go
```

The following example sets the authentication and encryption key to “anykey.” The 7 specifies that a hidden key will follow.

```
service password-encryption
radius-server key 7 anykey
```

After you save your configuration and use the **show-running config** command, an encrypted key will be displayed as follows:

```
show running-config
!
!
  radius-server key 7 19283103834782sda
!The leading 7 indicates that the following text is encrypted.
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
aaa authentication ppp	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.
aaa authorization	Sets parameters that restrict user access to a network.
ppp	Starts an asynchronous connection using PPP.
ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
radius-server host	Specifies a RADIUS server host.
service password-encryption	Encrypt passwords.
username	Establishes a username-based authentication system, such as PPP CHAP and PAP.

radius-server optional passwords

To specify that the first RADIUS request to a RADIUS server be made *without* password verification, use the **radius-server optional-passwords** command in global configuration mode. To restore the default, use the **no** form of this command.

radius-server optional-passwords

no radius-server optional-passwords

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

When the user enters the login name, the login request is transmitted with the name and a zero-length password. If accepted, the login procedure completes. If the RADIUS server refuses this request, the server software prompts for a password and tries again when the user supplies a password. The RADIUS server must support authentication for users without passwords to make use of this feature.

Examples

The following example configures the first login to not require RADIUS verification:

```
radius-server optional-passwords
```

radius-server retransmit

To specify the number of times the Cisco IOS software searches the list of RADIUS server hosts before giving up, use the **radius-server retransmit** command in global configuration mode. To disable retransmission, use the **no** form of this command.

radius-server retransmit *retries*

no radius-server retransmit

Syntax Description

retries	Maximum number of retransmission attempts. The default is 3 attempts.

Defaults

3 attempts

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The Cisco IOS software tries all servers, allowing each one to time out before increasing the retransmit count.

Examples

The following example specifies a retransmit counter value of five times:

```
radius-server retransmit 5
```

radius-server timeout

To set the interval for which a router waits for a server host to reply, use the **radius-server timeout** command in global configuration mode. To restore the default, use the **no** form of this command.

radius-server timeout *seconds*

no radius-server timeout

Syntax Description

seconds	Number that specifies the timeout interval, in seconds. The default is 5 seconds.

Defaults

5 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Use this command to set the number of seconds a router waits for a server host to reply before timing out.

Examples

The following example changes the interval timer to 10 seconds:

```
radius-server timeout 10
```

Related Commands

Command	Description
radius-server host	Specifies a RADIUS server host.
radius-server key	Sets the authentication and encryption key for all RADIUS communications between the router and the RADIUS daemon.

radius-server unique-ident

To assign a unique accounting session identification (Acct-Session-Id), use the **radius-server unique-ident** command in global configuration mode. To disable this command, use the **no** form of this command.

radius-server unique-ident *number*

no radius-server unique-ident *number+1*

Syntax Description

number	Acct-Session-Id string.

Defaults

This command is not enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.2	This command was introduced.

Usage Guidelines

Use the **radius-server unique-ident** command to ensure that RADIUS Acct-Session-IDs are unique across Cisco IOS boots. After the router parses this command, **radius-server unique-ident** *n+1* is written to RAM; thereafter, the Acct-Session-ID attribute will have its higher order eight bits set to n+1 in all accounting records.

After the router is reloaded, it will parse the **radius-server unique-ident** *n+1* command, and the **radius-server unique-ident** *n+2* will be written to NVRAM. Thus, the Cisco IOS configuration is automatically written to NVRAM after the router reboots.

Note **radius-server unique-ident** *255* has the same functionality as **radius-server unique-ident** 0; thus, **radius-server unique-ident** *1* is written to NVRAM when either number (255 or 0) is used.

Examples

The following example shows how to define the Acct-Session-Id to 1. In this example, the Acct-Session-ID begins as "acct-session-id = 01000008," but after enabling this command and rebooting the router, the Acct-Session-ID becomes "acct-session-id = 02000008" because the value increments by one and is updated in the system configuration.

```
radius-server unique-ident 1
```

radius-server vsa send

To configure the network access server to recognize and use vendor-specific attributes, use the **radius-server vsa send** command in global configuration mode. To restore the default, use the **no** form of this command.

radius-server vsa send [**accounting** | **authentication**]

no radius-server vsa send [**accounting** | **authentication**]

Syntax Description

accounting	(Optional) Limits the set of recognized vendor-specific attributes to only accounting attributes.
authentication	(Optional) Limits the set of recognized vendor-specific attributes to only authentication attributes.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.3T	This command was introduced.

Usage Guidelines

The Internet Engineering Task Force (IETF) draft standard specifies a method for communicating vendor-specific information between the network access server and the RADIUS server by using the vendor-specific attribute (attribute 26). Vendor-specific attributes (VSAs) allow vendors to support their own extended attributes not suitable for general use. The **radius-server vsa send** command enables the network access server to recognize and use both accounting and authentication vendor-specific attributes. Use the **accounting** keyword with the **radius-server vsa send** command to limit the set of recognized vendor-specific attributes to just accounting attributes. Use the **authentication** keyword with the **radius-server vsa send** command to limit the set of recognized vendor-specific attributes to just authentication attributes.

The Cisco RADIUS implementation supports one vendor-specific option using the format recommended in the specification. Cisco's vendor-ID is 9, and the supported option has vendor-type 1, which is named "cisco-avpair." The value is a string with the following format:

```
protocol : attribute sep value *
```

"Protocol" is a value of the Cisco "protocol" attribute for a particular type of authorization. "Attribute" and "value" are an appropriate attribute-value (AV) pair defined in the Cisco TACACS+ specification, and "sep" is "=" for mandatory attributes and "*" for optional attributes. This allows the full set of features available for TACACS+ authorization to also be used for RADIUS.

For example, the following AV pair causes Cisco's "multiple named ip address pools" feature to be activated during IP authorization (during PPP's IPCP address assignment):

```
cisco-avpair= "ip:addr-pool=first"
```

The following example causes a “NAS Prompt” user to have immediate access to EXEC commands.

```
cisco-avpair= "shell:priv-lvl=15"
```

Other vendors have their own unique vendor-IDs, options, and associated VSAs. For more information about vendor-IDs and VSAs, refer to RFC 2138, *Remote Authentication Dial-In User Service (RADIUS)*.

Examples

The following example configures the network access server to recognize and use vendor-specific accounting attributes:

```
radius-server vsa send accounting
```

Related Commands

Command	Description
aaa nas port extended	Replaces the NAS-Port attribute with RADIUS IETF attribute 26 and displays extended field information.

server (RADIUS)

To configure the IP address of the RADIUS server for the group server, use the **server** command in server-group configuration mode. To remove the associated server from the authentication, authorization, and accounting (AAA) group server, use the **no** form of this command.

server *ip-address* [**auth-port** *port-number*] [**acct-port** *port-number*]

no server *ip-address* [**auth-port** *port-number*] [**acct-port** *port-number*]

Syntax Description

ip-address	IP address of the RADIUS server host.
auth-port *port-number*	(Optional) Specifies the User Datagram Protocol (UDP) destination port for authentication requests. The port-number argument specifies the port number for authentication requests. The host is not used for authentication if this value is set to 0.
acct-port *port-number*	(Optional) Specifies the UDP destination port for accounting requests. The port number argument specifies the port number for accounting requests. The host is not used for accounting services if this value is set to 0.

Defaults

If no port attributes are defined, the defaults are as follows:

- Authentication port: 1645
- Accounting port: 1646

Command Modes

Server-group configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(7)T	The following new keywords/arguments were added: • **auth-port** *port-number* • **acct-port** *port-number*

Usage Guidelines

Use the **server** command to associate a particular server with a defined group server. There are two different ways in which you can identify a server, depending on the way you want to offer AAA services. You can identify the server simply by using its IP address, or you can identify multiple host instances or entries using the optional **auth-port** and **acct-port** keywords.

When you use the optional keywords, the network access server identifies RADIUS security servers and host instances associated with a group server on the basis of their IP address and specific UDP port numbers. The combination of the IP address and UDP port number creates a unique identifier, allowing different ports to be individually defined as RADIUS host entries providing a specific AAA service. If two different host entries on the same RADIUS server are configured for the same service—for example, accounting—the second host entry configured acts as failover backup to the first one. Using this

example, if the first host entry fails to provide accounting services, the network access server will try the second host entry configured on the same device for accounting services. (The RADIUS host entries will be tried in the order they are configured.)

Examples

Configuring Multiple Entries for the Same Server IP Address

The following example shows the network access server configured to recognize several RADIUS host entries with the same IP address. Two different host entries on the same RADIUS server are configured for the same services—authentication and accounting. The second host entry configured acts as fail-over backup to the first one. (The RADIUS host entries are tried in the order in which they are configured.)

```
! This command enables AAA.
aaa new-model
! The next command configures default RADIUS parameters.
aaa authentication ppp default radius
! The next set of commands configures multiple host entries for the same IP address.
radius-server host 172.20.0.1 auth-port 1000 acct-port 1001
radius-server host 172.20.0.1 auth-port 2000 acct-port 2000
```

Configuring Multiple Entries Using AAA Group Servers

In this example, the network access server is configured to recognize two different RADIUS group servers. One of these groups, group1, has two different host entries on the same RADIUS server configured for the same services. The second host entry configured acts as failover backup to the first one.

```
! This command enables AAA.
aaa new-model
! The next command configures default RADIUS parameters.
aaa authentication ppp default group group1
! The following commands define the group1 RADIUS group server and associates servers
! with it.
aaa group server radius group1
   server 172.20.0.1 auth-port 1000 acct-port 1001
! The following commands define the group2 RADIUS group server and associates servers
! with it.
aaa group server radius group2
   server 172.20.0.1 auth-port 2000 acct-port 2001
! The following set of commands configures the RADIUS attributes for each host entry
! associated with one of the defined group servers.
radius-server host 172.20.0.1 auth-port 1000 acct-port 1001
radius-server host 172.20.0.1 auth-port 1000 acct-port 1001
radius-server host 172.10.0.1 auth-port 1645 acct-port 1646
```

Related Commands

Command	Description
aaa group server	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
radius-server host	Specifies a RADIUS server host.

show radius statistics

To display the RADIUS statistics for accounting and authentication packets, use the **show radius statistics** EXEC command.

show radius statistics

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.1(3)T	This command was introduced.

Examples

The following example is sample output for the **show radius statistics** command:

```
Router# show radius statistics
                                  Auth.       Acct.        Both
          Maximum inQ length:       NA          NA           1
        Maximum waitQ length:       NA          NA           1
        Maximum doneQ length:       NA          NA           1
        Total responses seen:        3           0           3
      Packets with responses:        3           0           3
   Packets without responses:        0           0           0
  Average response delay(ms):     5006           0        5006
  Maximum response delay(ms):    15008           0       15008
   Number of Radius timeouts:        3           0           3
        Duplicate ID detects:        0           0           0
```

Table 16 describes significant fields shown in the display.

Table 16 show radius statistics Field Descriptions

Auth.	Statistics for authentication packets.
Acct.	Statistics for accounting packets.
Both	Combined statistics for authentication and accounting packets.
Maximum inQ length	Maximum number of entries allowed in the queue, that holds the RADIUS messages not yet sent.
Maximum waitQ length	Maximum number of entries allowed in the queue, that holds the RADIUS messages that have been sent and are waiting for a response.
Maximum doneQ length	Maximum number of entries allowed in the queue, that holds the messages that have received a response and will be forwarded to the code that is waiting for the messages.

Table 16 show radius statistics Field Descriptions (continued)

Total responses seen	Number of RADIUS responses seen from the server. In addition to the expected packets, this includes repeated packets and packets that do not have a matching message in the waitQ.
Packets with responses	Number of packets that received a response from the RADIUS server.
Packets without responses	Number of packets that never received a response from any RADIUS server.
Average response delay	Average time from when the packet was first transmitted to when it received a response. If the response timed out and the packet was sent again, this value includes the timeout. If the packet never received a response, this is not included in the average.
Maximum response delay	Maximum delay observed while gathering average response delay information.
Number of RADIUS timeouts	Number of times a server did not respond, and the RADIUS server re-sent the packet.
Duplicate ID detects	RADIUS has a maximum of 255 unique IDs. In some instances there can be more than 255 outstanding packets. When a packet is received, the doneQ is searched from the oldest entry to the youngest. If the IDs are the same, further techniques are used to see if this response matches this entry. If it is determined that this does not match, the duplicate ID detect counter is increased.

Related Commands

Command	Description
radius-server host	Specifies a RADIUS server host.
radius-server retransmit	Specifies how many times the Cisco IOS software searches the list of RADIUS server hosts before giving up.
radius-server timeout	Sets the interval for which a router waits for a server host to reply.

vpdn aaa attribute

To enable reporting of network access server (NAS) authentication, authorization, and accounting (AAA) attributes related to a virtual private dialup network (VPDN) to the AAA server, use the **vpdn aaa attribute** command in global configuration mode. To disable reporting of AAA attributes related to VPDN, use the **no** form of this command.

vpdn aaa attribute {**nas-ip-address vpdn-nas** | **nas-port vpdn-nas**}

no vpdn aaa attribute {**nas-ip-address vpdn-nas** | **nas-port**}

Syntax Description

nas-ip-address vpdn-nas	Enable reporting of the VPDN NAS IP address to the AAA server.
nas-port vpdn-nas	Enable reporting of the VPDN NAS port to the AAA server.

Command Default

AAA attributes are not reported to the AAA server.

Command Modes

Global configuration

Command History

Release	Modification
11.3 NA	This command was introduced.
11.3(8.1)T	This command was integrated into Cisco IOS Release 11.3(8.1)T.
12.1(5)T	This command was modified to support the PPP extended NAS-Port format.

Usage Guidelines

This command can be used with RADIUS or TACACS+, and is applicable only on the VPDN tunnel server.

The PPP extended NAS-Port format enables the NAS-Port and NAS-Port-Type attributes to provide port details to a RADIUS server when one of the following protocols is configured:

- PPP over ATM
- PPP over Ethernet (PPPoE) over ATM
- PPPoE over 802.1Q VLANs

Before PPP extended NAS-Port format attributes can be reported to the RADIUS server, the **radius-server attribute nas-port format** command with the **d** keyword must be configured on both the tunnel server and the NAS, and the tunnel server and the NAS must both be Cisco routers.

Examples

The following example configures VPDN on a tunnel server and enables reporting of VPDN AAA attributes to the AAA server:

```
vpdn enable
vpdn-group 1
 accept-dialin
```

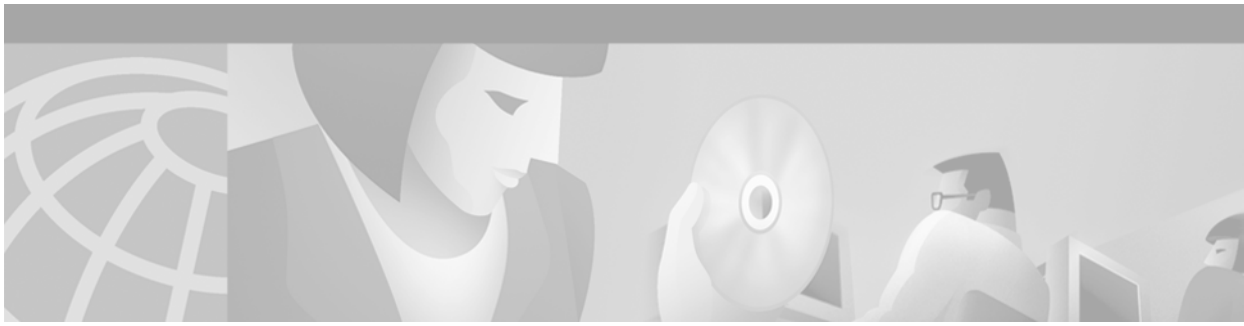
```
  protocol any
  virtual-template 1
!
 terminate-from hostname nas1
 local name ts1
!
vpdn aaa attribute nas-ip-address vpdn-nas
vpdn aaa attribute nas-port vpdn-nas
```

The following example configures the tunnel server for VPDN, enables AAA, configures a RADIUS AAA server, and enables reporting of PPP extended NAS-Port format values to the RADIUS server. PPP extended NAS-Port format must also be configured on the NAS for this configuration to be effective.

```
vpdn enable
vpdn-group L2TP-tunnel
 accept-dialin
  protocol l2tp
  virtual-template 1
!
 terminate-from hostname nas1
 local name ts1
!
aaa new-model
aaa authentication ppp default local group radius
aaa authorization network default local group radius
aaa accounting network default start-stop group radius
!
radius-server host 171.79.79.76 auth-port 1645 acct-port 1646
radius-server retransmit 3
radius-server attribute nas-port format d
radius-server key ts123
!
vpdn aaa attribute nas-port vpdn-nas
```

Related Commands

Command	Description
radius-server attribute nas-port format	Selects the NAS-Port format used for RADIUS accounting features.



TACACS+ Commands

This chapter describes the commands used to configure TACACS+. TACACS+ provides detailed accounting information and flexible administrative control over authentication and authorization processes. TACACS+ is facilitated through authentication, authorization, and accounting (AAA) and can be enabled only through AAA commands.

Note Refer to the chapter "Authentication Commands", the chapter "Authorization Commands", and the chapter "Accounting Commands" for information about commands specific to AAA.

For information on how to configure TACACS+, refer to the chapter "Configuring TACACS+" in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the section "TACACS+ Configuration Examples" located at the end of the chapter "Configuring TACACS+" in the *Cisco IOS Security Configuration Guide*.

Note TACACS and Extended TACACS commands are included in Cisco IOS Release 12.2 software for backward compatibility with earlier Cisco IOS releases; however, these commands are no longer supported and are not documented for this release.

Cisco recommends using only the TACACS+ security protocol with Release 12.1 and later of Cisco IOS software. For a description of TACACS and Extended TACACS commands, refer to the chapter "TACACS, Extended TACACS, and TACACS+ Commands" in Cisco IOS Release 12.0 *Security Command Reference* at Cisco.com.

Table 17 identifies Cisco IOS software commands available to the different versions of TACACS. Although TACACS+ is enabled through AAA and uses commands specific to AAA, there are some commands that are common to TACACS, Extended TACACS, and TACACS+. TACACS and Extended TACACS commands that are not common to TACACS+ are not documented in this release.

Table 17 TACACS Command Comparison

Cisco IOS Command	TACACS	Extended TACACS	TACACS+
aaa accounting[1]	–	–	yes
aaa authentication arap[1]	–	–	yes
aaa authentication enable default[1]	–	–	yes
aaa authentication login[1]	–	–	yes
aaa authentication ppp[1]	–	–	yes

Table 17 TACACS Command Comparison (continued)

Cisco IOS Command	TACACS	Extended TACACS	TACACS+
aaa authorization[1]	–	–	yes
aaa group server tacacs+			yes
aaa new-model[1]	–	–	yes
arap authentication[1]	–	–	yes
arap use-tacacs	yes	yes	–
enable last-resort	yes	yes	–
enable use-tacacs	yes	yes	–
ip tacacs source-interface	yes	yes	yes
login authentication[1]	–	–	yes
login tacacs	yes	yes	–
ppp authentication[1]	yes	yes	yes
ppp use-tacacs[1]	yes	yes	no
server	–	–	yes
tacacs-server administration	–	–	yes
tacacs-server directed-request	yes	yes	yes
tacacs-server dns-alias-lookup	–	–	yes
tacacs-server host	yes	yes	yes
tacacs-server key	–	–	yes
tacacs-server packet	–	–	yes
tacacs-server timeout	yes	yes	yes

1. These commands are documented in separate chapters. Refer to the appropriate authentication, authorization, or accounting section of the *Cisco IOS Security Command Reference,* or use the index to locate a command.

aaa group server tacacs+

To group different server hosts into distinct lists and distinct methods, use the **aaa group server tacacs+** command in global configuration mode. To remove a server group from the configuration list, use the **no** form of this command.

aaa group server tacacs+ *group-name*

no aaa group server tacacs+ *group-name*

Syntax Description

tacacs+	Uses only the TACACS+ server hosts.
group-name	Character string used to name the group of servers.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The authentication, authorization, and accounting (AAA) server-group feature introduces a way to group existing server hosts. The feature enables you to select a subset of the configured server hosts and use them for a particular service.

A server group is a list of server hosts of a particular type. Currently supported server host types are RADIUS server hosts and TACACS+ server hosts. A server group is used in conjunction with a global server host list. The server group lists the IP addresses of the selected server hosts.

Examples

The following example shows the configuration of an AAA group server named tacgroup1 that comprises three member servers:

```
aaa group server tacacs+ tacgroup1
    server 1.1.1.1
    server 2.2.2.2
    server 3.3.3.3
```

Related Commands

Command	Description
aaa accounting	Enables AAA accounting of requested services for billing or security.
aaa authentication login	Enables AAA accounting of requested services for billing or security purposes.
aaa authorization	Sets parameters that restrict user access to a network.

Command	Description
aaa new-model	Enables the AAA access control model.
tacacs-server host	Specifies a TACACS+ host.

ip tacacs source-interface

To use the IP address of a specified interface for all outgoing TACACS+ packets, use the **ip tacacs source-interface** command in global configuration mode. To disable use of the specified interface IP address, use the **no** form of this command.

ip tacacs source-interface *subinterface-name*

no ip tacacs source-interface

Syntax Description

subinterface-name	Name of the interface that TACACS+ uses for all of its outgoing packets.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use this command to set a subinterface's IP address for all outgoing TACACS+ packets. This address is used as long as the interface is in the *up* state. In this way, the TACACS+ server can use one IP address entry associated with the network access client instead of maintaining a list of all IP addresses.

This command is especially useful in cases where the router has many interfaces and you want to ensure that all TACACS+ packets from a particular router have the same IP address.

The specified interface must have an IP address associated with it. If the specified subinterface does not have an IP address or is in a *down* state, TACACS+ reverts to the default. To avoid this, add an IP address to the subinterface or bring the interface to the *up* state.

Examples

The following example makes TACACS+ use the IP address of subinterface s2 for all outgoing TACACS+ packets:

```
ip tacacs source-interface s2
```

Related Commands

Command	Description
ip radius source-interface	Forces RADIUS to use the IP address of a specified interface for all outgoing RADIUS packets.
ip telnet source-interface	Allows a user to select an address of an interface as the source address for Telnet connections.
ip tftp source-interface	Allows a user to select the interface whose address will be used as the source address for TFTP connections.

server (TACACS+)

To configure the IP address of the TACACS+ server for the group server, use the **server** command in TACACS+ group server configuration mode. To remove the IP address of the RADIUS server, use the **no** form of this command.

server *ip-address*

no server *ip-address*

Syntax Description

ip-address	IP address of the selected server.

Defaults

No default behavior or values.

Command Modes

TACACS+ group server configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

You must configure the **aaa group server tacacs** command before configuring this command.

Enter the **server** command to specify the IP address of the TACACS+ server. Also configure a matching **tacacs-server host** entry in the global list. If there is no response from the first host entry, the next host entry is tried.

Examples

The following example shows server host entries configured for the RADIUS server:

```
aaa new-model
aaa authentication ppp default group g1
aaa group server tacacs+ g1
    server 1.0.0.1
    server 2.0.0.1
tacacs-server host 1.0.0.1
tacacs-server host 2.0.0.1
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.
aaa server group	Groups different server hosts into distinct lists and distinct methods.
tacacs-server host	Specifies a RADIUS server host.

show tacacs

To display statistics for a TACACS+ server, use the **show tacacs** command in EXEC configuration mode.

show tacacs

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following example is sample output for the **show tacacs** command:

```
Router# show tacacs

Tacacs+ Server            : 172.19.192.80/49
              Socket opens:          3
             Socket closes:          3
             Socket aborts:          0
             Socket errors:          0
          Socket Timeouts:           0
   Failed Connect Attempts:          0
        Total Packets Sent:          7
        Total Packets Recv:          7
          Expected Replies:          0
  No current connection
```

Table 18 describes the significant fields shown in the display.

Table 18 show tacacs Field Descriptions

Field	Description
Tacacs+ Server	IP address of the TACACS+ server.
Socket opens	Number of successful TCP socket connections to the TACACS+ server.
Socket closes	Number of successfully closed TCP socket attempts.
Socket aborts	Number of premature TCP socket closures to the TACACS+ server; that is, the peer did not wait for a reply from the server after a the peer sent its request.
Socket errors	Any other socket read or write errors, such as incorrect packet format and length.

Table 18 show tacacs Field Descriptions (continued)

Field	Description
Failed Connect Attempts	Number of failed TCP socket connections to the TACACS+ server.
Total Packets Sent	Number of packets sent to the TACACS+ server.
Total Packets Recv	Number of packets received from the TACACS+ server.
Expected replies	Number of outstanding replies from the TACACS+ server.

Related Commands

Command	Description
tacacs-server host	Specifies a TACACS+ host.

tacacs-server administration

To enable the handling of administrative messages by the TACACS+ daemon, use the **tacacs-server administration** command in global configuration mode. To disable the handling of administrative messages by the TACACS+ daemon, use the **no** form of this command.

tacacs-server administration

no tacacs-server administration

Syntax Description

This command has no arguments or keywords.

Command Default

None

Command Modes

Global configuration

Command History

Release	Modification
Prior to 12.0	This command was introduced.

Examples

The following example shows that the TACACS+ daemon is enabled to handle administrative messages:

```
tacacs-server administration
```

tacacs-server directed-request

To send only a username to a specified server when a direct request is issued, use the **tacacs-server directed-request** command in global configuration mode. To send the entire string to the TACACS+ server, use the **no** form of this command.

tacacs-server directed-request [**restricted**] [**no-truncate**]

no tacacs-server directed-request

Syntax Description

restricted	(Optional) Restrict queries to directed request servers only.
no-truncate	(Optional) Do not truncate the @hostname from the username.

Defaults

Enabled

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command sends only the portion of the username before the "@" symbol to the host specified after the "@" symbol. In other words, with the directed-request feature enabled, you can direct a request to any of the configured servers, and only the username is sent to the specified server.

Disabling **tacacs-server directed-request** causes the whole string, both before and after the "@" symbol, to be sent to the default TACACS+ server. When the directed-request feature is disabled, the router queries the list of servers, starting with the first one in the list, sending the whole string, and accepting the first response that it gets from the server. The **tacacs-server directed-request** command is useful for sites that have developed their own TACACS+ server software that parses the whole string and makes decisions based on it.

With **tacacs-server directed-request** enabled, only configured TACACS+ servers can be specified by the user after the "@" symbol. If the host name specified by the user does not match the IP address of a TACACS+ server configured by the administrator, the user input is rejected.

Use **no tacacs-server directed-request** to disable the ability of the user to choose between configured TACACS+ servers and to cause the entire string to be passed to the default server.

Examples

The following example enables **tacacs-server directed-request** so that the entire user input is passed to the default TACACS+ server:

```
no tacacs-server directed-request
```

tacacs-server dns-alias-lookup

To enable IP Domain Name System (DNS) alias lookup for TACACS+ servers, use the command in global configuration mode. To disable IP DNS alias lookup, use the **no** form of this command.

tacacs-server dns-alias-lookup

no tacacs-server dns-alias-lookup

Syntax Description

This command has no arguments or keywords.

Command Default

IP DNS alias lookup is disabled.

Command Modes

global configuration

Command History

Release	Modification
Prior to 12.0	This command was introduced.

Examples

The following example shows that IP DNS alias lookup has been enabled:

```
tacacs-server dns-alias-lookup
```

tacacs-server host

To specify a TACACS+ host, use the **tacacs-server host** command in global configuration mode. To delete the specified name or address, use the **no** form of this command.

tacacs-server host *host-name* [**port** *integer*] [**timeout** *integer*] [**key** *string*] [**single-connection**] [**nat**]

no tacacs-server host *host-name*

Syntax Description

host-name	Name or IP address of the host.
port	(Optional) Specifies a server port number. This option overrides the default, which is port 49.
integer	(Optional) Port number of the server. Valid port numbers range from 1 to 65535.
timeout	(Optional) Specifies a timeout value. This overrides the global timeout value set with the **tacacs-server timeout** command for this server only.
integer	(Optional) Integer value, in seconds, of the timeout interval.
key	(Optional) Specifies an authentication and encryption key. This must match the key used by the TACACS+ daemon. Specifying this key overrides the key set by the global command **tacacs-server key** for this server only.
string	(Optional) Character string specifying authentication and encryption key.
single-connection	(Optional) Maintains a single open connection between the router and the TACACS+ server.
nat	(Optional) Port Network Address Translation (NAT) address of the client is sent to the TACACS+ server.

Defaults

No TACACS+ host is specified.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.1(11), 12.2(6)	The **nat** keyword was added.
12.2(8)T	The **nat** keyword was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

You can use multiple **tacacs-server host** commands to specify additional hosts. The Cisco IOS software searches for hosts in the order in which you specify them. Use the **port**, **timeout**, **key,** **single-connection**, and **nat** keywords only when running a AAA/TACACS+ server.

Because some of the parameters of the **tacacs-server host** command override global settings made by the **tacacs-server timeout** and **tacacs-server key** commands, you can use this command to enhance security on your network by uniquely configuring individual routers.

The **single-connection** keyword specifies a single connection (only valid with CiscoSecure Release 1.0.1 or later). Rather than have the router open and close a TCP connection to the server each time it must communicate, the single-connection option maintains a single open connection between the router and the server. The single connection is more efficient because it allows the server to handle a higher number of TACACS operations.

Examples

The following example specifies a TACACS+ host named Sea_Change:

```
tacacs-server host Sea_Change
```

The following example specifies that, for authentication, authorization, and accounting (AAA) confirmation, the router consults the TACACS+ server host named Sea_Cure on port number 51. The timeout value for requests on this connection is three seconds; the encryption key is a_secret.

```
tacacs-server host Sea_Cure port 51 timeout 3 key a_secret
```

Related Commands

Command	Description
aaa authentication	Specifies or enables AAA authentication.
aaa authorization	Sets parameters that restrict user access to a network.
aaa accounting	Enables AAA accounting of requested services for billing or security.
ppp	Starts an asynchronous connection using PPP.
slip	Starts a serial connection to a remote host using SLIP.
tacacs-server key	Sets the authentication encryption key used for all TACACS+ communications between the access server and the TACACS+ daemon.

tacacs-server key

To set the authentication encryption key used for all TACACS+ communications between the access server and the TACACS+ daemon, use the **tacacs-server key** command in global configuration mode. To disable the key, use the **no** form of this command.

tacacs-server key *key*

no tacacs-server key [*key*]

Syntax Description

key	Key used to set authentication and encryption. This key must match the key used on the TACACS+ daemon.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

After enabling authentication, authorization, and accounting (AAA) with the **aaa new-model** command, you must set the authentication and encryption key using the **tacacs-server key** command.

The key entered must match the key used on the TACACS+ daemon. All leading spaces are ignored; spaces within and at the end of the key are not. If you use spaces in your key, do not enclose the key in quotation marks unless the quotation marks themselves are part of the key.

Examples

The following example sets the authentication and encryption key to “dare to go”:

```
tacacs-server key dare to go
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.
tacacs-server host	Specifies a TACACS+ host.

tacacs-server packet

To modify TACACS+ packet options, use the **tacacs-server packet** command in global configuration mode. To disable the modified packet options, use the **no** form of this command.

tacacs-server packet *maxsize*

no tacacs-server packet

Syntax Description

maxsize	Maximum TACACS+ packet size that is acceptable. The value is from 10240 through 65536.

Command Default

None

Command Modes

Global configuration

Command History

Release	Modification
Prior to 12.0	This command was introduced.

Examples

The following example shows that the TACACS+ packet size has been set to the minimum value of 10240:

```
tacacs-server packet 10240
```

tacacs-server timeout

To set the interval for which the server waits for a server host to reply, use the **tacacs-server timeout** command in global configuration mode. To restore the default, use the **no** form of this command.

tacacs-server timeout *seconds*

no tacacs-server timeout *seconds*

Syntax Description

seconds	Timeout interval in seconds. The value is from 1 through 1000. The default is 5.

Command Default

If the command is not configured, the timeout interval is 5.

Command Modes

Global configuration

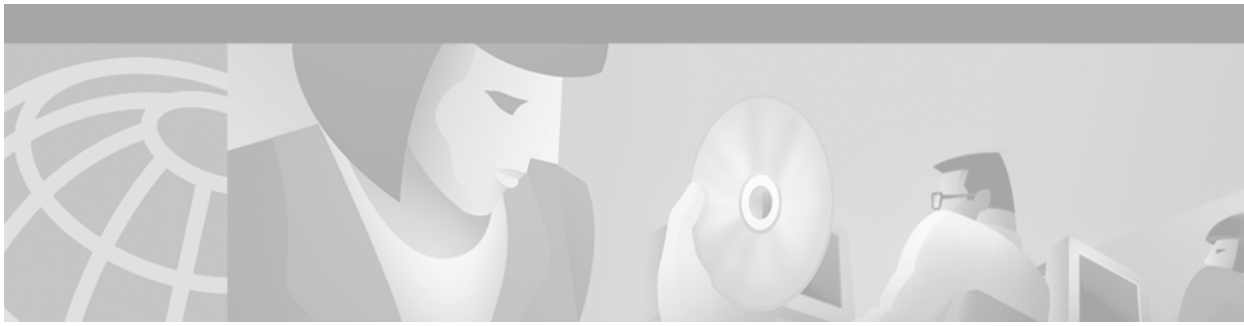
Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example changes the interval timeout to 10 seconds:

```
Router (config)# tacacs-server timeout 10
```



Kerberos Commands

This chapter describes the commands used to configure Kerberos. Kerberos is a secret-key network authentication protocol, developed at Massachusetts Institute of Technology (MIT), that uses the Data Encryption Standard (DES) cryptographic algorithm for encryption and authentication. Kerberos was designed to authenticate requests for network resources. Kerberos, like other secret-key systems, is based on the concept of a trusted third party that performs secure verification of users and services. In the Kerberos protocol, this trusted third party is called the key distribution center (KDC).

For information on how to configure Kerberos, refer to the chapter "Configuring Kerberos" in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the section "Kerberos Configuration Examples" located at the end of the chapter "Configuring Kerberos" in the *Cisco IOS Security Configuration Guide*.

clear kerberos creds

To delete the contents of the credentials cache, use the **clear kerberos creds** command in privileged EXEC mode.

clear kerberos creds

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Credentials are deleted when this command is issued.

Cisco supports Kerberos 5.

Examples

The following example illustrates the **clear kerberos creds** command:

```
cisco-2500 > show kerberos creds
Default Principal: chet@cisco.com
Valid Starting          Expires                 Service Principal
18-Dec-1995 16:21:07    19-Dec-1995 00:22:24    krbtgt/CISCO.COM@CISCO.COM

cisco-2500 > clear kerberos creds
cisco-2500 > show kerberos creds
No Kerberos credentials.

cisco-2500 >
```

Related Commands

Command	Description
show kerberos creds	Displays the contents of your credentials cache.

kerberos clients mandatory

To cause the **rsh**, **rcp**, **rlogin**, and **telnet** commands to fail if they cannot negotiate the Kerberos protocol with the remote server, use the **kerberos clients mandatory** command in global configuration mode. To make Kerberos optional, use the **no** form of this command.

kerberos clients mandatory

no kerberos clients mandatory

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

If this command is not configured and the user has Kerberos credentials stored locally, the **rsh**, **rcp**, **rlogin**, and **telnet** commands attempt to negotiate the Kerberos protocol with the remote server and will use the non-Kerberized protocols if unsuccessful.

If this command is not configured and the user has no Kerberos credentials, the standard protocols for **rcp** and **rsh** are used to negotiate.

Examples

The following example causes the **rsh**, **rcp**, **rlogin**, and **telnet** commands to fail if they cannot negotiate the Kerberos protocol with the remote server:

```
kerberos clients mandatory
```

Related Commands

Command	Description
connect	Logs in to a host that supports Telnet, rlogin, or LAT.
kerberos credentials forward	Forces all network application clients on the router to forward the Kerberos credentials of users upon successful Kerberos authentication.
rlogin	Logs in to a UNIX host using rlogin.
rsh	Executes a command remotely on a remote rsh host.
telnet	Logs in to a host that supports Telnet.

kerberos credentials forward

To force all network application clients on the router to forward users' Kerberos credentials upon successful Kerberos authentication, use the **kerberos credentials forward** command in global configuration mode. To turn off forwarding of Kerberos credentials, use the **no** form of this command.

kerberos credentials forward

no kerberos credentials forward

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Enable credentials forwarding to have users' ticket granting tickets (TGTs) forwarded to the host on which they authenticate. In this way, users can connect to multiple hosts in the Kerberos realm without running the KINIT program each time they need to get a TGT.

Examples

The following example forces all network application clients on the router to forward users' Kerberos credentials upon successful Kerberos authentication:

```
kerberos credentials forward
```

Related Commands

Command	Description
connect	Logs in to a host that supports Telnet, rlogin, or LAT.
rlogin	Logs in to a UNIX host using rlogin.
rsh	Executes a command remotely on a remote rsh host.
telnet	Logs in to a host that supports Telnet.

kerberos instance map

To map Kerberos instances to Cisco IOS privilege levels, use the **kerberos instance map** command in global configuration mode. To remove a Kerberos instance map, use the **no** form of this command.

kerberos instance map *instance privilege-level*

no kerberos instance map *instance*

Syntax Description

instance	Name of a Kerberos instance.
privilege-level	The privilege level at which a user is set if the user's Kerberos principal contains the matching Kerberos instance. You can specify up to 16 privilege levels, using numbers 0 through 15. Level 1 is normal EXEC-mode user privileges.

Defaults

Privilege level 1.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to create user instances with access to administrative commands.

Examples

The following example sets the privilege level to 15 for authenticated Kerberos users with the *admin* instance in Kerberos realm:

```
kerberos instance map admin 15
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict user access to a network.

kerberos local-realm

To specify the Kerberos realm in which the router is located, use the **kerberos local-realm** command in global configuration mode. To remove the specified Kerberos realm from this router, use the **no** form of this command.

kerberos local-realm *kerberos-realm*

no kerberos local-realm

Syntax Description

kerberos-realm	The name of the default Kerberos realm. A Kerberos realm consists of users, hosts, and network services that are registered to a Kerberos server. The Kerberos realm must be in uppercase characters.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The router can be located in more than one realm at a time. However, there can only be one instance of Kerberos local-realm. The realm specified with this command is the default realm.

Examples

The following example specify the Kerberos realm in which the router is located as EXAMPLE.COM:

```
kerberos local-realm EXAMPLE.COM
```

Related Commands

Command	Description
kerberos preauth	Specifies a preauthentication method to use to communicate with the KDC.
kerberos realm	Maps a host name or DNS domain to a Kerberos realm.
kerberos server	Specifies the location of the Kerberos server for a given Kerberos realm.
kerberos srvtab entry	Specifies a krb5 SRVTAB entry.
kerberos srvtab remote	Retrieves a SRVTAB file from a remote host and automatically generate a Kerberos SRVTAB entry configuration.

kerberos preauth

To specify a preauthentication method to use to communicate with the key distribution center (KDC), use the **kerberos preauth** command in global configuration mode. To disable Kerberos preauthentication, use the **no** form of this command.

kerberos preauth [**encrypted-unix-timestamp** | **encrypted-kerberos-timestamp** | **none**]

no kerberos preauth

Syntax Description

encrypted-unix-timestamp	(Optional) Use an encrypted UNIX timestamp as a quick authentication method when communicating with the KDC.
encrypted-kerberos-timestamp	(Optional) Use the RFC1510 kerberos timestamp as a quick authentication method when communicating with the KDC.
none	(Optional) Do not use Kerberos preauthentication.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

It is more secure to use a preauthentication for communications with the KDC. However, communication with the KDC will fail if the KDC does not support this particular version of **kerberos preauth.** If that happens, turn off the preauthentication with the **none** option.

The **no** form of this command is equivalent to using the **none** keyword.

Examples

The following example enables Kerberos preauthentication:

```
kerberos preauth encrypted-unix-timestamp
```

The following example disables Kerberos preauthentication:

```
kerberos preauth none
```

Related Commands

Command	Description
kerberos local-realm	Specifies the Kerberos realm in which the router is located.
kerberos server	Specifies the location of the Kerberos server for a given Kerberos realm.
kerberos srvtab entry	Specifies a krb5 SRVTAB entry.
kerberos srvtab remote	Retrieves a SRVTAB file from a remote host and automatically generate a Kerberos SRVTAB entry configuration.

kerberos realm

To map a host name or Domain Name System (DNS) domain to a Kerberos realm, use the **kerberos realm** command in global configuration mode. To remove a Kerberos realm map, use the **no** form of this command.

kerberos realm {*dns-domain* | *host*} *kerberos-realm*

no kerberos realm {*dns-domain* | *host*} *kerberos-realm*

Syntax Description

dns-domain	Name of a DNS domain or host.
host	Name of a DNS host.
kerberos-realm	Name of the Kerberos realm to which the specified domain or host belongs.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

DNS domains are specified with a leading dot (.) character; host names cannot begin with a dot (.) character. There can be multiple entries of this line.

A Kerberos realm consists of users, hosts, and network services that are registered to a Kerberos server. The Kerberos realm must be in uppercase characters. The router can be located in more than one realm at a time. Kerberos realm names must be in all uppercase characters.

Examples

The following example maps the domain name “example.com” to the Kerberos realm, EXAMPLE.COM:

```
kerberos realm .example.com EXAMPLE.COM
```

Related Commands

Command	Description
kerberos local-realm	Specifies the Kerberos realm in which the router is located.
kerberos server	Specifies the location of the Kerberos server for a given Kerberos realm.
kerberos srvtab entry	Specifies a krb5 SRVTAB entry.
kerberos srvtab remote	Retrieves a SRVTAB file from a remote host and automatically generates a Kerberos SRVTAB entry configuration.

kerberos server

To specify the location of the Kerberos server for a given Kerberos realm, use the **kerberos server** command in global configuration mode. To remove a Kerberos server for a specified Kerberos realm, use the **no** form of this command.

kerberos server *kerberos-realm* {*hostname* | *ip-address*} [*port-number*]

no kerberos server *kerberos-realm* {*hostname* | *ip-address*}

Syntax Description

kerberos-realm	Name of the Kerberos realm. A Kerberos realm consists of users, hosts, and network services that are registered to a Kerberos server. The Kerberos realm must be in uppercase letters.
hostname	Name of the host functioning as a Kerberos server for the specified Kerberos realm (translated into an IP address at the time of entry).
ip-address	IP address of the host functioning as the Kerberos server for the specified Kerberos realm.
port-number	(Optional) Port that the key distribution center (KDC) monitors (defaults to 88).

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Use the **kerberos server** command to specify the location of the Kerberos server for a given realm.

Examples

The following example specifies 192.168.47.66 as the Kerberos server for the Kerberos realm EXAMPLE.COM:

```
kerberos server EXAMPLE.COM 192.168.47.66
```

Related Commands

Command	Description
kerberos local-realm	Specifies the Kerberos realm in which the router is located.
kerberos realm	Maps a host name or DNS domain to a Kerberos realm.
kerberos srvtab entry	Specifies a krb5 SRVTAB entry.
kerberos srvtab remote	Retrieves a SRVTAB file from a remote host and automatically generates a Kerberos SRVTAB entry configuration.

kerberos srvtab entry

To retrieve a SRVTAB file from a remote host and automatically generate a Kerberos SRVTAB entry configuration, use the **kerberos srvtab entry** command in global configuration mode. To remove a SRVTAB entry from the router's configuration, use the **no** form of this command.

kerberos srvtab entry *kerberos-principal principal-type timestamp key-version number key-type key-length encrypted-keytab*

no kerberos srvtab entry *kerberos-principal principal-type*

Syntax Description

kerberos-principal	A service on the router.
principal-type	Version of the Kerberos SRVTAB.
timestamp	Number representing the date and time the SRVTAB entry was created.
key-version number	Version of the encryption key format.
key-type	Type of encryption used.
key-length	Length, in bytes, of the encryption key.
encrypted-keytab	Secret key the router shares with the key distribution center (KDC). It is encrypted with the private Data Encryption Standard (DES) key (if available) when you write out your configuration.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

When you use the **kerberos srvtab remote** command to copy the SRVTAB file from a remote host (generally the KDC), it parses the information in this file and stores it in the router's running configuration in the **kerberos srvtab entry** format. The key for each SRVTAB entry is encrypted with a private DES key if one is defined on the router. To ensure that the SRVTAB is available (that is, that it does not need to be acquired from the KDC) when you reboot the router, use the **write memory** router configuration command to write the router's running configuration to NVRAM.

If you reload a configuration, with a SRVTAB encrypted with a private DES key, on to a router that does not have a private DES key defined, the router displays a message informing you that the SRVTAB entry has been corrupted, and discards the entry.

If you change the private DES key and reload an old version of the router's configuration that contains SRVTAB entries encrypted with the old private DES keys, the router will restore your Kerberos SRVTAB entries, but the SRVTAB keys will be corrupted. In this case, you must delete your old Kerberos SRVTAB entries and reload your Kerberos SRVTABs on to the router using the **kerberos srvtab remote** command.

Although you can configure **kerberos srvtab entry** on the router manually, generally you would not do this because the keytab is encrypted automatically by the router when you copy the SRVTAB using the **kerberos srvtab remote** command.

Examples

In the following example, host/new-router.example.com@EXAMPLE.COM is the host, 0 is the type, 817680774 is the timestamp, 1 is the version of the key, 1 indicates the DES is the encryption type, 8 is the number of bytes, and .cCN.YoU.okK is the encrypted key:

```
kerberos srvtab entry host/new-router.example.com@EXAMPLE.COM 0 817680774 1 1 8
.cCN.YoU.okK
```

Related Commands

Command	Description
kerberos srvtab remote	Retrieves a krb5 SRVTAB file from the specified host.
key config-key	Defines a private DES key for the router.

kerberos srvtab remote

To retrieve a SRVTAB file from a remote host and automatically generate a Kerberos SRVTAB entry configuration, use the **kerberos srvtab remote** command in global configuration mode.

kerberos srvtab remote {boot_device:*URL*}

Syntax Description

URL	Machine that has the Kerberos SRVTAB file.
ip-address	IP address of the machine that has the Kerberos SRVTAB file.
filename	Name of the SRVTAB file.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

When you use the **kerberos srvtab remote** command to copy the SRVTAB file from the remote host (generally the key distribution center [KDC]), it parses the information in this file and stores it in the router's running configuration in the **kerberos srvtab entry** format. The key for each SRVTAB entry is encrypted with the private Data Encryption Standard (DES) key if one is defined on the router. To ensure that the SRVTAB is available (that is, that it does not need to be acquired from the KDC) when you reboot the router, use the **write memory** configuration command to write the router's running configuration to NVRAM.

Examples

The following example copies the SRVTAB file residing on b1.example.com to a router named s1.example.com:

```
kerberos srvtab remote tftp://b1.example.com/s1.example.com-new-srvtab
```

Related Commands

Command	Description
kerberos srvtab entry	Retrieves a SRVTAB file from a remote host and automatically generate a Kerberos SRVTAB entry configuration.
key config-key	Defines a private DES key for the router.

key config-key

To define a private DES key for the router, use the **key config-key** command in global configuration mode. To delete a private Data Encryption Standard (DES) key from the router, use the **no** form of this command.

key config-key 1 *string*

no key config-key 1 *string*

Syntax Description

1	Key number. This number is always 1.
string	Private DES key (can be up to eight alphanumeric characters).

Defaults

No DES-key defined.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was released.

Usage Guidelines

This command defines a private DES key for the router that will not show up in the router configuration. This private DES key can be used to DES-encrypt certain parts of the router's configuration.

Caution The private DES key is unrecoverable. If you encrypt part of your configuration with the private DES key and lose or forget the key, you will not be able to recover the encrypted data.

Examples

The following example sets *keyxx* as the private DES key on the router:

```
key config-key 1 keyxx
```

Related Commands

Command	Description
kerberos srvtab entry	Specifies a krb5 SRVTAB entry.
kerberos srvtab remote	Retrieves a SRVTAB file from a remote host and automatically generates a Kerberos SRVTAB entry configuration.

show kerberos creds

To display the contents of your credentials cache, use the **show kerberos creds** command in privileged EXEC mode.

show kerberos creds

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The **show kerberos creds** command is equivalent to the UNIX klist command.

When users authenticate themselves with Kerberos, they are issued an authentication ticket called a *credential*. The credential is stored in a credential cache.

Examples

The following example displays entries in the credentials cache:

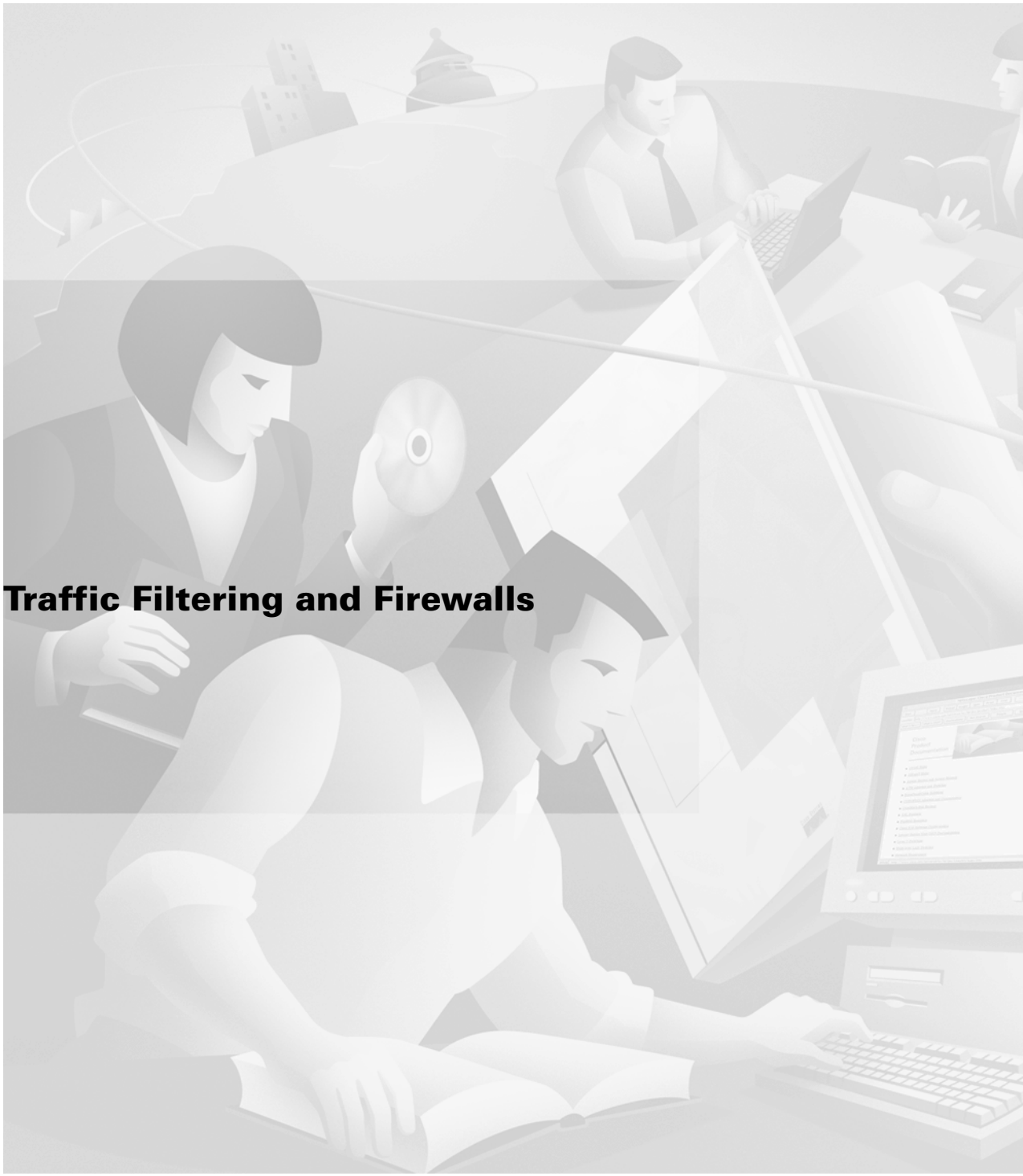
```
Router > show kerberos creds

 Default Principal: user@example.com
 Valid Starting          Expires                 Service Principal
 18-Dec-1995 16:21:07    19-Dec-1995 00:22:24    krbtgt/EXAMPLE.COM@EXAMPLE.COM
```

The following example returns output that acknowledges that credentials do *not* exist in the credentials cache:

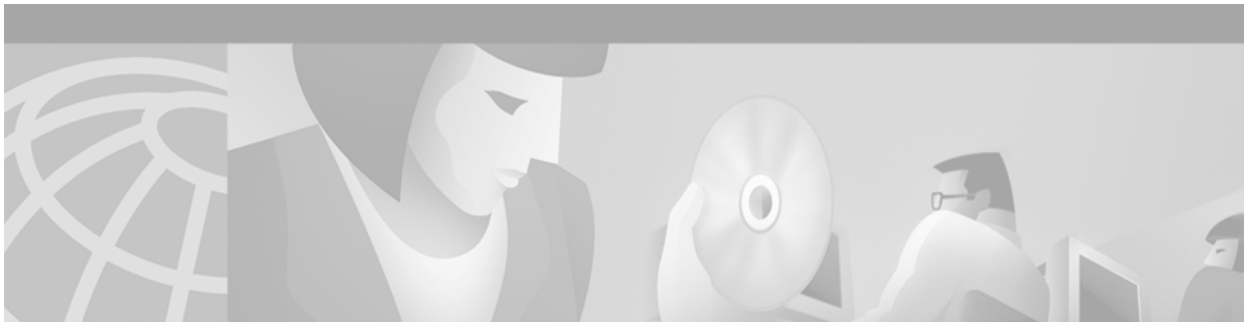
```
Router > show kerberos creds

 No Kerberos credentials
```

Related Commands

Command	Description
clear kerberos creds	Deletes the contents of the credentials cache.



Traffic Filtering and Firewalls



Lock-and-Key Commands

This chapter describes lock-and-key commands. Lock-and-key security is a traffic filtering security feature that uses dynamic access lists. Lock-and-key is available for IP traffic only.

To find complete descriptions of other commands used when configuring lock-and-key, refer to the *Cisco IOS Command Reference Master Index* or search online.

For lock-and-key configuration information, refer to the "Configuring Lock-and-Key Security (Dynamic Access Lists)" chapter in the *Cisco IOS Security Configuration Guide*.

access-enable

To enable the router to create a temporary access list entry in a dynamic access list, use the **access-enable** EXEC command.

access-enable [**host**] [**timeout** *minutes*]

Syntax Description

host	(Optional) Tells the software to enable access only for the host from which the Telnet session originated. If not specified, the software allows all hosts on the defined network to gain access. The dynamic access list contains the network mask to use for enabling the new network.
timeout *minutes*	(Optional) Specifies an idle timeout for the temporary access list entry. If the access list entry is not accessed within this period, it is automatically deleted and requires the user to authenticate again. The default is for the entries to remain permanently. We recommend that this value equal the idle timeout set for the WAN connection.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command enables the lock-and-key access feature.

You should always define either an idle timeout (with the **timeout** keyword in this command) or an absolute timeout (with the **timeout** keyword in the **access-list** command). Otherwise, the temporary access list entry will remain, even after the user terminates the session.

Use the **autocommand** command with the **access-enable** command to cause the **access-enable** command to execute when a user opens a Telnet session into the router.

Examples

The following example causes the software to create a temporary access list entry and tells the software to enable access only for the host from which the Telnet session originated. If the access list entry is not accessed within 2 minutes, it is deleted.

```
autocommand access-enable host timeout 2
```

Related Commands

Command	Description
access-list (IP extended)	Defines an extended IP access list.
autocommand	Configures the Cisco IOS software to automatically execute a command when a user connects to a particular line.
show ip accounting	Displays the active accounting or checkpointed database or displays access list violations.

access-list dynamic-extend

To allow the absolute timer of the dynamic access control list (ACL) to be extended an additional six minutes, use the **access-list dynamic-extend** command in global configuration mode. To disable this functionality, use the **no** form of this command.

access-list dynamic-extend

no access-list dynamic-extend

Syntax Description

This command has no arguments or keywords.

Defaults

6 minutes

Command Modes

Global configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

When you try to create a Telnet session to the router to re-authenticate yourself by using the lock-and-key function, use the **access-list dynamic-extend** command to extend the absolute timer of the dynamic ACL by six minutes.

The router must already be configured with the lock-and-key feature, and you must configure the extension *before* the ACL expires.

Examples

The following example shows how to extend the absolute timer of the dynamic ACL:

```
! The router is configured with the lock-and-key feature as follows
access-list 132 dynamic tactik timeout 6 permit ip any any
! The absolute timer will extended another six minutes.
access-list dynamic-extend
```

access-template

To manually place a temporary access list entry on a router to which you are connected, use the **access-template** EXEC command.

access-template [*access-list-number* | *name*] [*dynamic-name*] [*source*] [*destination*] [**timeout** *minutes*]

Syntax Description

access-list-number	(Optional) Number of the dynamic access list.
name	(Optional) Name of an IP access list. The name cannot contain a space or quotation mark, and must begin with an alphabetic character to avoid ambiguity with numbered access lists.
dynamic-name	(Optional) Name of a dynamic access list.
source	(Optional) Source address in a dynamic access list. The keywords host and any are allowed. All other attributes are inherited from the original access-list entry.
destination	(Optional) Destination address in a dynamic access list. The keywords host and any are allowed. All other attributes are inherited from the original access-list entry.
timeout *minutes*	(Optional) Specifies a maximum time limit for each entry within this dynamic list. This is an absolute time, from creation, that an entry can reside in the list. The default is an infinite time limit and allows an entry to remain permanently.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command provides a way to enable the lock-and-key access feature.

You should always define either an idle timeout (with the **timeout** keyword in this command) or an absolute timeout (with the **timeout** keyword in the **access-list** command). Otherwise, the dynamic access list will remain, even after the user has terminated the session.

Examples

The following example enables IP access on incoming packets in which the source address is 172.29.1.129 and the destination address is 192.168.52.12. All other source and destination pairs are discarded.

```
access-template 101 payroll host 172.29.1.129 host 192.168.52.12 timeout 2
```

Related Commands

Command	Description
access-list (IP extended)	Defines an extended IP access list.
autocommand	Configures the Cisco IOS software to automatically execute a command when a user connects to a particular line.
clear access-template	Clears a temporary access list entry from a dynamic access list manually.
show ip accounting	Displays the active accounting or checkpointed database or displays access list violations.

clear access-template

To manually clear a temporary access list entry from a dynamic access list, use the **clear access-template** EXEC command.

clear access-template [*access-list-number* | *name*] [*dynamic-name*] [*source*] [*destination*]

Syntax Description

access-list-number	(Optional) Number of the dynamic access list from which the entry is to be deleted.
name	(Optional) Name of an IP access list from which the entry is to be deleted. The name cannot contain a space or quotation mark, and must begin with an alphabetic character to avoid ambiguity with numbered access lists.
dynamic-name	(Optional) Name of the dynamic access list from which the entry is to be deleted.
source	(Optional) Source address in a temporary access list entry to be deleted.
destination	(Optional) Destination address in a temporary access list entry to be deleted.

Command Modes

EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command is related to the lock-and-key access feature. It clears any temporary access list entries that match the parameters you define.

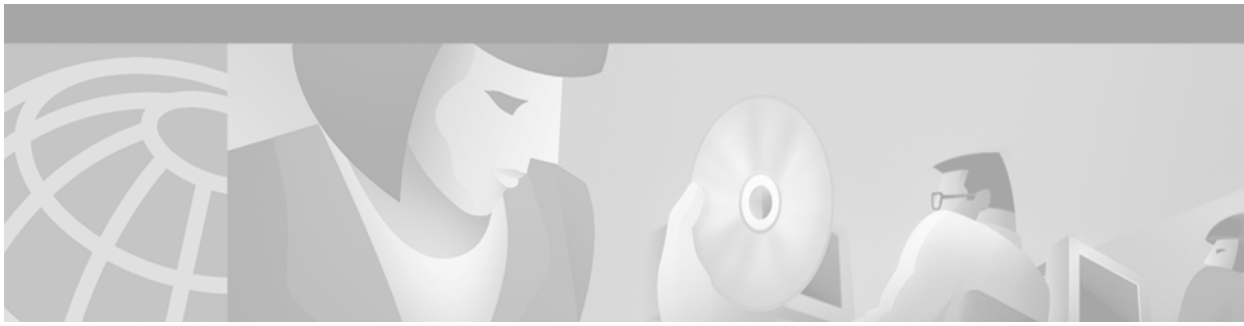
Examples

The following example clears any temporary access list entries with a source of 172.20.1.12 from the dynamic access list named vendor:

```
clear access-template vendor 172.20.1.12
```

Related Commands

Command	Description
access-list (IP extended)	Defines an extended IP access list.
access-template	Places a temporary access list entry on a router to which you are connected manually.
show ip accounting	Displays the active accounting or checkpointed database or displays access list violations.



Reflexive Access List Commands

This chapter describes reflexive access list commands, which are used to configure IP session filtering. IP session filtering provides the ability to filter IP packets based on upper-layer protocol "session" information.

To find complete descriptions of other commands used when configuring reflexive access lists, refer to the *Cisco IOS Command Reference Master Index* or search online.

For reflexive access list configuration information, refer to the "Configuring IP Session Filtering (Reflexive Access Lists)" chapter in the *Cisco IOS Security Configuration Guide*.

evaluate

To nest a reflexive access list within an access list, use the **evaluate** command in access-list configuration mode. To remove a nested reflexive access list from the access list, use the **no** form of this command.

evaluate *name*

no evaluate *name*

Syntax Description

name	The name of the reflexive access list that you want evaluated for IP traffic entering your internal network. This is the name defined in the **permit** (reflexive) command.

Defaults

Reflexive access lists are not evaluated.

Command Modes

Access-list configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

This command is used to achieve reflexive filtering, a form of session filtering.

Before this command will work, you must define the reflexive access list using the **permit** (reflexive) command.

This command nests a reflexive access list within an extended named IP access list.

If you are configuring reflexive access lists for an external interface, the extended named IP access list should be one which is applied to inbound traffic. If you are configuring reflexive access lists for an internal interface, the extended named IP access list should be one which is applied to outbound traffic. (In other words, use the access list opposite of the one used to define the reflexive access list.)

This command allows IP traffic entering your internal network to be evaluated against the reflexive access list. Use this command as an entry (condition statement) in the IP access list; the entry "points" to the reflexive access list to be evaluated.

As with all access list entries, the order of entries is important. Normally, when a packet is evaluated against entries in an access list, the entries are evaluated in sequential order, and when a match occurs, no more entries are evaluated. With a reflexive access list nested in an extended access list, the extended access list entries are evaluated sequentially up to the nested entry, then the reflexive access list entries are evaluated sequentially, and then the remaining entries in the extended access list are evaluated sequentially. As usual, after a packet matches *any* of these entries, no more entries will be evaluated.

Examples

The following example shows reflexive filtering at an external interface. This example defines an extended named IP access list *inboundfilters*, and applies it to inbound traffic at the interface. The access list definition permits all Border Gateway Protocol and Enhanced Interior Gateway Routing Protocol traffic, denies all Internet Control Message Protocol traffic, and causes all Transmission Control Protocol traffic to be evaluated against the reflexive access list *tcptraffic*.

If the reflexive access list *tcptraffic* has an entry that matches an inbound packet, the packet will be permitted into the network. *tcptraffic* only has entries that permit inbound traffic for existing TCP sessions.

```
interface Serial 1
 description Access to the Internet via this interface
 ip access-group inboundfilters in
!
ip access-list extended inboundfilters
 permit 190 any any
 permit eigrp any any
 deny icmp any any
 evaluate tcptraffic
```

Related Commands

Command	Description
ip access-list	Defines an IP access list by name.
ip reflexive-list timeout	Specifies the length of time that reflexive access list entries will continue to exist when no packets in the session are detected.
permit (reflexive)	Creates a reflexive access list and enables its temporary entries to be automatically generated.

ip reflexive-list timeout

To specify the length of time that reflexive access list entries will continue to exist when no packets in the session are detected, use the **ip reflexive-list timeout** command in global configuration mode. To reset the timeout period to the default timeout, use the **no** form of this command.

ip reflexive-list timeout *seconds*

no ip reflexive-list timeout

Syntax Description

seconds	Specifies the number of seconds to wait (when no session traffic is being detected) before temporary access list entries expire. Use a positive integer from 0 to 2,147,483. The default is 300 seconds.

Defaults

300 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

This command is used with reflexive filtering, a form of session filtering.

This command specifies when a reflexive access list entry will be removed after a period of no traffic for the session (the timeout period).

With reflexive filtering, when an IP upper-layer session begins from within your network, a temporary entry is created within the reflexive access list, and a timer is set. Whenever a packet belonging to this session is forwarded (inbound or outbound) the timer is reset. When this timer counts down to zero without being reset, the temporary reflexive access list entry is removed.

The timer is set to the *timeout period*. Individual timeout periods can be defined for specific reflexive access lists, but for reflexive access lists that do not have individually defined timeout periods, the global timeout period is used. The global timeout value is 300 seconds by default; however, you can change the global timeout to a different value at any time using this command.

This command does not take effect for reflexive access list entries that were already created when the command is entered; this command only changes the timeout period for entries created after the command is entered.

Examples

The following example sets the global timeout period for reflexive access list entries to 120 seconds:

```
ip reflexive-list timeout 120
```

The following example returns the global timeout period to the default of 300 seconds:

```
no ip reflexive-list timeout
```

Related Commands

Command	Description
evaluate	Nests a reflexive access list within an access list.
ip access-list	Defines an IP access list by name.
permit (reflexive)	Creates a reflexive access list and enables its temporary entries to be automatically generated.

permit (reflexive)

To create a reflexive access list and to enable its temporary entries to be automatically generated, use the **permit** command in access-list configuration mode. To delete the reflexive access list (if only one protocol was defined) or to delete protocol entries from the reflexive access list (if multiple protocols are defined), use the **no** form of this command.

permit *protocol source source-wildcard destination destination-wildcard* **reflect** *name* [**timeout** *seconds*]

no permit *protocol source-wildcard destination destination-wildcard* **reflect** *name*

Syntax Description

protocol	Name or number of an IP protocol. It can be one of the keywords **gre**, **icmp**, **ip**, **ipinip**, **nos**, **tcp**, or **udp**, or an integer in the range 0 to 255 representing an IP protocol number. To match any Internet protocol (including Internet Control Message Protocol, Transmission Control Protocol, and User Datagram Protocol), use the keyword **ip**.
source	Number of the network or host from which the packet is being sent. There are three other ways to specify the source: • Use a 32-bit quantity in four-part, dotted-decimal format. • Use the keyword **any** as an abbreviation for a *source* and *source-wildcard* of 0.0.0.0 255.255.255.255. This keyword is normally not recommended (see the section "Usage Guidelines"). • Use **host** *source* as an abbreviation for a *source* and *source-wildcard* of *source* 0.0.0.0.
source-wildcard	Wildcard bits (mask) to be applied to source. There are three other ways to specify the source wildcard: • Use a 32-bit quantity in four-part, dotted-decimal format. Place ones in the bit positions you want to ignore. • Use the keyword **any** as an abbreviation for a *source* and *source-wildcard* of 0.0.0.0 255.255.255.255. This keyword is normally not recommended (see the section "Usage Guidelines"). • Use **host** *source* as an abbreviation for a *source* and *source-wildcard* of *source* 0.0.0.0.
destination	Number of the network or host to which the packet is being sent. There are three other ways to specify the destination: • Use a 32-bit quantity in four-part, dotted-decimal format. • Use the keyword **any** as an abbreviation for the *destination* and *destination-wildcard* of 0.0.0.0 255.255.255.255. This keyword is normally *not* recommended (see the section "Usage Guidelines"). • Use **host** *destination* as an abbreviation for a *destination* and *destination-wildcard* of destination 0.0.0.0.

destination-wildcard	Wildcard bits to be applied to the destination. There are three other ways to specify the destination wildcard: • Use a 32-bit quantity in four-part, dotted-decimal format. Place ones in the bit positions you want to ignore. • Use the keyword **any** as an abbreviation for a *destination* and *destination-wildcard* of 0.0.0.0 255.255.255.255. This keyword is normally *not* recommended (see the section "Usage Guidelines"). • Use **host** *destination* as an abbreviation for a *destination* and *destination-wildcard* of *destination* 0.0.0.0.
reflect	Identifies this access list as a reflexive access list.
name	Specifies the name of the reflexive access list. Names cannot contain a space or quotation mark, and must begin with an alphabetic character to prevent ambiguity with numbered access lists. The name can be up to 64 characters long.
timeout *seconds*	(Optional) Specifies the number of seconds to wait (when no session traffic is being detected) before entries expire in this reflexive access list. Use a positive integer from 0 to 2^{32}–1. If not specified, the number of seconds defaults to the global timeout value.

Defaults

If this command is not configured, no reflexive access lists will exist, and no session filtering will occur.

If this command is configured without specifying a **timeout** value, entries in this reflexive access list will expire after the global timeout period.

Command Modes

Access-list configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

This command is used to achieve reflexive filtering, a form of session filtering.

For this command to work, you must also nest the reflexive access list using the **evaluate** command.

This command creates a reflexive access list and triggers the creation of entries in the same reflexive access list. This command must be an entry (condition statement) in an extended named IP access list.

If you are configuring reflexive access lists for an external interface, the extended named IP access list should be one which is applied to outbound traffic.

If you are configuring reflexive access lists for an internal interface, the extended named IP access list should be one which is applied to inbound traffic.

IP sessions that originate from within your network are initiated with a packet exiting your network. When such a packet is evaluated against the statements in the extended named IP access list, the packet is also evaluated against this reflexive **permit** entry.

As with all access list entries, the order of entries is important, because they are evaluated in sequential order. When an IP packet reaches the interface, it will be evaluated sequentially by each entry in the access list until a match occurs.

If the packet matches an entry prior to the reflexive **permit** entry, the packet will not be evaluated by the reflexive **permit** entry, and no temporary entry will be created for the reflexive access list (session filtering will not be triggered).

The packet will be evaluated by the reflexive **permit** entry if no other match occurs first. Then, if the packet matches the protocol specified in the reflexive **permit** entry, the packet is forwarded and a corresponding temporary entry is created in the reflexive access list (unless the corresponding entry already exists, indicating the packet belongs to a session in progress). The temporary entry specifies criteria that permits traffic into your network only for the same session.

Characteristics of Reflexive Access List Entries

This command enables the creation of temporary entries in the same reflexive access list that was defined by this command. The temporary entries are created when a packet exiting your network matches the protocol specified in this command. (The packet "triggers" the creation of a temporary entry.) These entries have the following characteristics:

- The entry is a **permit** entry.
- The entry specifies the same IP upper-layer protocol as the original triggering packet.
- The entry specifies the same source and destination addresses as the original triggering packet, except the addresses are swapped.
- If the original triggering packet is TCP or UDP, the entry specifies the same source and destination port numbers as the original packet, except the port numbers are swapped.

  If the original triggering packet is a protocol other than TCP or UDP, port numbers do not apply, and other criteria are specified. For example, for ICMP, type numbers are used: the temporary entry specifies the same type number as the original packet (with only one exception: if the original ICMP packet is type 8, the returning ICMP packet must be type 0 to be matched).
- The entry inherits all the values of the original triggering packet, with exceptions only as noted in the previous four bullets.
- IP traffic entering your internal network will be evaluated against the entry, until the entry expires. If an IP packet matches the entry, the packet will be forwarded into your network.
- The entry will expire (be removed) after the last packet of the session is matched.
- If no packets belonging to the session are detected for a configurable length of time (the timeout period), the entry will expire.

Examples

The following example defines a reflexive access list *tcptraffic*, in an outbound access list that permits all Border Gateway Protocol and Enhanced Interior Gateway Routing Protocol traffic and denies all ICMP traffic. This example is for an external interface (an interface connecting to an external network).

First, the interface is defined and the access list is applied to the interface for outbound traffic.

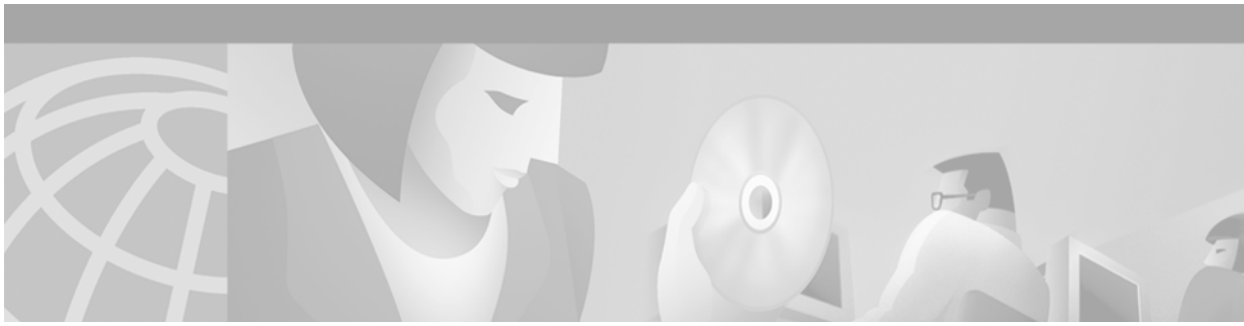
```
interface Serial 1
 description Access to the Internet via this interface
 ip access-group outboundfilters out
```

Next, the outbound access list is defined and the reflexive access list *tcptraffic* is created with a reflexive **permit** entry.

```
ip access-list extended outboundfilters
 permit tcp any any reflect tcptraffic
```

Related Commands

Command	Description
evaluate	Nests a reflexive access list within an access list.
ip access-list	Defines an IP access list by name.
ip reflexive-list timeout	Specifies the length of time that reflexive access list entries will continue to exist when no packets in the session are detected.



TCP Intercept Commands

This chapter describes TCP Intercept commands. TCP Intercept is a traffic filtering security feature that protects TCP servers from TCP SYN-flooding attacks, which are a type of denial-of-service attack. TCP Intercept is available for IP traffic only.

To find complete descriptions of other commands used when configuring TCP Intercept, refer to the *Cisco IOS Command Reference Master Index* or search online.

For TCP Intercept configuration information, refer to the chapter "Configuring TCP Intercept (Preventing Denial-of-Service Attacks)" in the *Cisco IOS Security Configuration Guide*.

ip tcp intercept connection-timeout

To change how long a TCP connection will be managed by the TCP intercept after no activity, use the **ip tcp intercept connection-timeout** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept connection-timeout *seconds*

no ip tcp intercept connection-timeout [*seconds*]

Syntax Description

seconds	Time (in seconds) that the software will still manage the connection after no activity. The minimum value is 1 second. The default is 86,400 seconds (24 hours).

Defaults

86,400 seconds (24 hours)

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

Use the **ip tcp intercept connection-timeout** command to change how long a TCP connection will be managed by the TCP intercept after a period of inactivity.

Examples

The following example sets the software to manage the connection for 12 hours (43,200 seconds) after no activity:

```
ip tcp intercept connection-timeout 43200
```

ip tcp intercept drop-mode

To set the TCP intercept drop mode, use the **ip tcp intercept drop-mode** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept drop-mode [**oldest** | **random**]

no ip tcp intercept drop-mode [**oldest** | **random**]

Syntax Description

oldest	(Optional) Software drops the oldest partial connection. This is the default.
random	(Optional) Software drops a randomly selected partial connection.

Defaults

oldest

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

If the number of incomplete connections exceeds 1100 or the number of connections arriving in the last 1 minute exceeds 1100, the TCP intercept feature becomes more aggressive. When this happens, each new arriving connection causes the oldest partial connection to be deleted, and the initial retransmission timeout is reduced by half to 0.5 seconds (and so the total time trying to establish the connection will be cut in half).

Note that the 1100 thresholds can be configured with the **ip tcp intercept max-incomplete high** and **ip tcp intercept one-minute high** commands.

Use the **ip tcp intercept drop-mode** command to change the dropping strategy from oldest to a random drop.

Examples

The following example sets the drop mode to random:

```
ip tcp intercept drop-mode random
```

Related Commands

Command	Description
ip tcp intercept max-incomplete high	Defines the maximum number of incomplete connections allowed before the software enters aggressive mode.
ip tcp intercept max-incomplete low	Defines the number of incomplete connections below which the software leaves aggressive mode.

Command	Description
ip tcp intercept one-minute high	Defines the number of connection requests received in the last one-minutes sample period before the software enters aggressive mode.
ip tcp intercept one-minute low	Defines the number of connection requests below which the software leaves aggressive mode.

ip tcp intercept finrst-timeout

To change how long after receipt of a reset or FIN-exchange the software ceases to manage the connection, use the **ip tcp intercept finrst-timeout** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept finrst-timeout *seconds*

no ip tcp intercept finrst-timeout [*seconds*]

Syntax Description

seconds	Time (in seconds) after receiving a reset or FIN-exchange that the software ceases to manage the connection. The minimum value is 1 second. The default is 5 seconds.

Defaults

5 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

Even after the two ends of the connection are joined, the software intercepts packets being sent back and forth. Use this command if you need to adjust how soon after receiving a reset or FIN-exchange the software stops intercepting packets.

Examples

The following example sets the software to wait for 10 seconds before it leaves intercept mode:

```
ip tcp intercept finrst-timeout 10
```

ip tcp intercept list

To enable TCP intercept, use the **ip tcp intercept list** global configuration command. To disable TCP intercept, use the **no** form of this command.

ip tcp intercept list *access-list-number*

no ip tcp intercept list *access-list-number*

Syntax Description

access-list-number	Extended access list number in the range from 100 to 199.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

The TCP intercept feature intercepts TCP connection attempts and shields servers from TCP SYN-flood attacks, also known as denial-of-service attacks.

TCP packets matching the access list are presented to the TCP intercept code for processing, as determined by the **ip tcp intercept mode** command. The TCP intercept code either intercepts or watches the connections.

To have all TCP connection attempts submitted to the TCP intercept code, have the access list match everything.

Examples

The following example configuration defines access list 101, causing the software to intercept packets for all TCP servers on the 192.168.1.0/24 subnet:

```
ip tcp intercept list 101
!
access-list 101 permit tcp any 192.168.1.0 0.0.0.255
```

Related Commands

Command	Description
access-list (IP extended)	Defines an extended IP access list.
ip tcp intercept mode	Changes the TCP intercept mode.
show tcp intercept connections	Displays TCP incomplete and established connections.
show tcp intercept statistics	Displays TCP intercept statistics.

ip tcp intercept max-incomplete high

To define the maximum number of incomplete connections allowed before the software enters aggressive mode, use the **ip tcp intercept max-incomplete high** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept max-incomplete high *number*

no ip tcp intercept max-incomplete high [*number*]

Syntax Description

number	Defines the number of incomplete connections allowed, above which the software enters aggressive mode. The range is from 1 to 2147483647. The default is 1100.

Defaults

1100 incomplete connections

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

If the number of incomplete connections exceeds the *number* configured, the TCP intercept feature becomes aggressive. The following are the characteristics of aggressive mode:

- Each new arriving connection causes the oldest partial connection to be deleted.
- The initial retransmission timeout is reduced by half to 0.5 seconds (and so the total time trying to establish the connection is cut in half).
- The watch-timeout is cut in half (from 30 seconds to 15 seconds).

You can change the drop strategy from the oldest connection to a random connection with the **ip tcp intercept drop-mode** command.

Note The two factors that determine aggressive mode (connection requests and incomplete connections) are related and work together. When the value of *either* **ip tcp intercept one-minute high** or **ip tcp intercept max-incomplete high** is exceeded, aggressive mode begins. When *both* connection requests and incomplete connections fall below the values of **ip tcp intercept one-minute low** and **ip tcp intercept max-incomplete low**, aggressive mode ends.

The software will back off from its aggressive mode when the number of incomplete connections falls below the number specified by the **ip tcp intercept max-incomplete low** command.

Examples

The following example allows 1500 incomplete connections before the software enters aggressive mode:

```
ip tcp intercept max-incomplete high 1500
```

Related Commands

Command	Description
ip tcp intercept drop-mode	Sets the TCP intercept drop mode.
ip tcp intercept max-incomplete low	Defines the number of incomplete connections below which the software leaves aggressive mode.
ip tcp intercept one-minute high	Defines the number of connection requests received in the last one-minutes sample period before the software enters aggressive mode.
ip tcp intercept one-minute low	Defines the number of connection requests below which the software leaves aggressive mode.

ip tcp intercept max-incomplete low

To define the number of incomplete connections below which the software leaves aggressive mode, use the **ip tcp intercept max-incomplete low** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept max-incomplete low *number*

no ip tcp intercept max-incomplete low [*number*]

Syntax Description

number	Defines the number of incomplete connections below which the software leaves aggressive mode. The range is 1 to 2147483647. The default is 900.

Defaults

900 incomplete connections

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

When *both* connection requests and incomplete connections fall below the values of **ip tcp intercept one-minute low** and **ip tcp intercept max-incomplete low**, the TCP intercept feature leaves aggressive mode.

Note The two factors that determine aggressive mode (connection requests and incomplete connections) are related and work together. When the value of *either* **ip tcp intercept one-minute high** or **ip tcp intercept max-incomplete high** is exceeded, aggressive mode begins. When *both* connection requests and incomplete connections fall below the values of **ip tcp intercept one-minute low** and **ip tcp intercept max-incomplete low**, aggressive mode ends.

See the **ip tcp intercept max-incomplete high** command for a description of aggressive mode.

Examples

The following example sets the software to leave aggressive mode when the number of incomplete connections falls below 1000:

```
ip tcp intercept max-incomplete low 1000
```

Related Commands

Command	Description
ip tcp intercept drop-mode	Sets the TCP intercept drop mode.
ip tcp intercept max-incomplete high	Defines the maximum number of incomplete connections allowed before the software enters aggressive mode.
ip tcp intercept one-minute high	Defines the number of connection requests received in the last one-minutes sample period before the software enters aggressive mode.
ip tcp intercept one-minute low	Defines the number of connection requests below which the software leaves aggressive mode.

ip tcp intercept mode

To change the TCP intercept mode, use the **ip tcp intercept mode** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept mode {**intercept** | **watch**}

no ip tcp intercept mode [**intercept** | **watch**]

Syntax Description

intercept	Active mode in which the TCP intercept software intercepts TCP packets from clients to servers that match the configured access list and performs intercept duties. This is the default.
watch	Monitoring mode in which the software allows connection attempts to pass through the router and watches them until they are established.

Defaults

intercept

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

When TCP intercept is enabled, it operates in intercept mode by default. In intercept mode, the software actively intercepts TCP SYN packets from clients to servers that match the specified access list. For each SYN, the software responds on behalf of the server with an ACK and SYN, and waits for an ACK of the SYN from the client. When that ACK is received, the original SYN is sent to the server, and the code then performs a three-way handshake with the server. Then the two half-connections are joined.

In watch mode, the software allows connection attempts to pass through the router, but watches them until they become established. If they fail to become established in 30 seconds (or the value set by the **ip tcp intercept watch-timeout** command), a Reset is sent to the server to clear its state.

Examples

The following example sets the mode to watch mode:

```
ip tcp intercept mode watch
```

Related Commands

Command	Description
ip tcp intercept watch-timeout	Defines how long the software will wait for a watched TCP intercept connection to reach established state before sending a reset to the server.

ip tcp intercept one-minute high

To define the number of connection requests received in the last one-minutes sample period before the software enters aggressive mode, use the **ip tcp intercept one-minute high** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept one-minute high *number*

no ip tcp intercept one-minute high [*number*]

Syntax Description

number	Specifies the number of connection requests that can be received in the last one-minute sample period before the software enters aggressive mode. The range is 1 to 2147483647. The default is 1100.

Defaults

1100 connection requests

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

If the number of connection requests exceeds the *number* value configured, the TCP intercept feature becomes aggressive. The following are the characteristics of aggressive mode:

- Each new arriving connection causes the oldest partial connection to be deleted.
- The initial retransmission timeout is reduced by half to 0.5 seconds (and so the total time trying to establish the connection is cut in half).
- The watch-timeout is cut in half (from 30 seconds to 15 seconds).

You can change the drop strategy from the oldest connection to a random connection with the **ip tcp intercept drop-mode** command.

Note The two factors that determine aggressive mode (connection requests and incomplete connections) are related and work together. When the value of *either* **ip tcp intercept one-minute high** or **ip tcp intercept max-incomplete high** is exceeded, aggressive mode begins. When *both* connection requests and incomplete connections fall below the values of **ip tcp intercept one-minute low** and **ip tcp intercept max-incomplete low**, aggressive mode ends.

Examples

The following example allows 1400 connection requests before the software enters aggressive mode:

```
ip tcp intercept one-minute high 1400
```

Related Commands

Command	Description
ip tcp intercept drop-mode	Sets the TCP intercept drop mode.
ip tcp intercept max-incomplete high	Defines the maximum number of incomplete connections allowed before the software enters aggressive mode.
ip tcp intercept max-incomplete low	Defines the number of incomplete connections below which the software leaves aggressive mode.
ip tcp intercept one-minute low	Defines the number of connection requests below which the software leaves aggressive mode.

ip tcp intercept one-minute low

To define the number of connection requests below which the software leaves aggressive mode, use the **ip tcp intercept one-minute low** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept one-minute low *number*

no ip tcp intercept one-minute low [*number*]

Syntax Description

number	Defines the number of connection requests in the last one-minute sample period below which the software leaves aggressive mode. The range is from 1 to 2147483647. The default is 900.

Defaults

900 connection requests

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

When *both* connection requests and incomplete connections fall below the values of **ip tcp intercept one-minute low** and **ip tcp intercept max-incomplete low**, the TCP intercept feature leaves aggressive mode.

Note The two factors that determine aggressive mode (connection requests and incomplete connections) are related and work together. When the value of *either* **ip tcp intercept one-minute high** or **ip tcp intercept max-incomplete high** is exceeded, aggressive mode begins. When *both* connection requests and incomplete connections fall below the values of **ip tcp intercept one-minute low** and **ip tcp intercept max-incomplete low**, aggressive mode ends.

See the **ip tcp intercept one-minute high** command for a description of aggressive mode.

Examples

The following example sets the software to leave aggressive mode when the number of connection requests falls below 1000:

```
ip tcp intercept one-minute low 1000
```

Related Commands

Command	Description
ip tcp intercept drop-mode	Sets the TCP intercept drop mode.
ip tcp intercept max-incomplete high	Defines the maximum number of incomplete connections allowed before the software enters aggressive mode.
ip tcp intercept max-incomplete low	Defines the number of incomplete connections below which the software leaves aggressive mode.
ip tcp intercept one-minute high	Defines the number of connection requests received in the last one-minutes sample period before the software enters aggressive mode.

ip tcp intercept watch-timeout

To define how long the software will wait for a watched TCP intercept connection to reach established state before sending a reset to the server, use the **ip tcp intercept watch-timeout** global configuration command. To restore the default, use the **no** form of this command.

ip tcp intercept watch-timeout *seconds*

no ip tcp intercept watch-timeout [*seconds*]

Syntax Description

seconds	Time (in seconds) that the software waits for a watched connection to reach established state before sending a Reset to the server. The minimum value is 1 second. The default is 30 seconds.

Defaults

30 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

Use this command if you have set the TCP intercept to passive watch mode and you want to change the default time the connection is watched. During aggressive mode, the watch timeout time is cut in half.

Examples

The following example sets the software to wait 60 seconds for a watched connection to reach established state before sending a Reset to the server:

```
ip tcp intercept watch-timeout 60
```

Related Commands

Command	Description
ip tcp intercept mode	Changes the TCP intercept mode.

show tcp intercept connections

To display TCP incomplete and established connections, use the **show tcp intercept connections** EXEC command.

show tcp intercept connections

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

Use the **show tcp intercept connections** command to display TCP incomplete and established connections.

Examples

The following is sample output from the **show tcp intercept connections** command:

```
Router# show tcp intercept connections

Incomplete:
Client                Server               State    Create   Timeout  Mode
172.19.160.17:58190   10.1.1.30:23         SYNRCVD  00:00:09 00:00:05 I
172.19.160.17:57934   10.1.1.30:23         SYNRCVD  00:00:09 00:00:05 I

Established:
Client                Server               State    Create   Timeout  Mode
171.69.232.23:1045    10.1.1.30:23         ESTAB    00:00:08 23:59:54 I
```

Table 19 describes significant fields shown in the display.

Table 19 show tcp intercept connections Field Descriptions

Field	Description
Incomplete:	Rows of information under “Incomplete” indicate connections that are not yet established.
Client	IP address and port of the client.
Server	IP address and port of the server being protected by TCP intercept.
State	SYNRCVD—establishing with client. SYNSENT—establishing with server. ESTAB—established with both, passing data.
Create	Hours:minutes:seconds since the connection was created.
Timeout	Hours:minutes:seconds until the retransmission timeout.

Table 19 show tcp intercept connections Field Descriptions (continued)

Field	Description
Mode	I—intercept mode. W—watch mode.
Established:	Rows of information under "Established" indicate connections that are established. The fields are the same as those under "Incomplete" except for the Timeout field described below.
Timeout	Hours:minutes:seconds until the connection will timeout, unless the software sees a FIN exchange, in which case this indicates the hours:minutes:seconds until the FIN or RESET timeout.

Related Commands

Command	Description
ip tcp intercept connection-timeout	Changes how long a TCP connection will be managed by the TCP intercept after no activity.
ip tcp intercept finrst-timeout	Changes how long after receipt of a reset or FIN-exchange the software ceases to manage the connection.
ip tcp intercept list	Enables TCP intercept.
show tcp intercept statistics	Displays TCP intercept statistics.

show tcp intercept statistics

To display TCP intercept statistics, use the **show tcp intercept statistics** EXEC command.

show tcp intercept statistics

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

Use the **show tcp intercept statistics** command to display TCP intercept statistics.

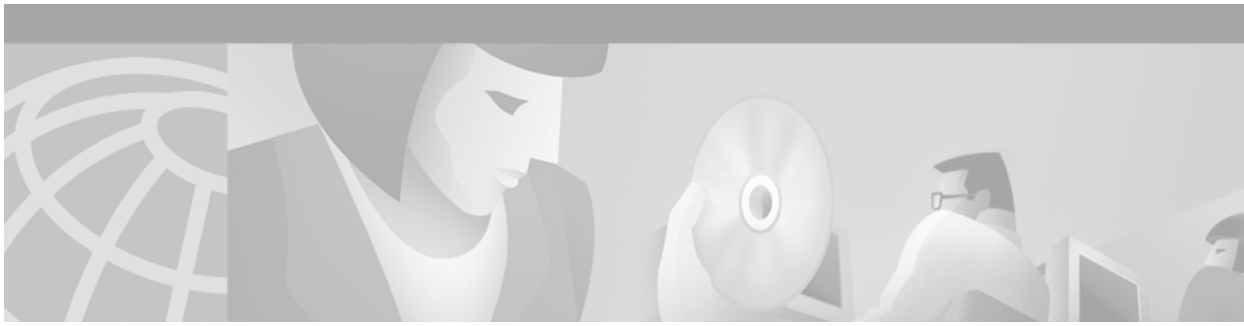
Examples

The following is sample output from the **show tcp intercept statistics** command:

```
Router# show tcp intercept statistics

intercepting new connections using access-list 101
2 incomplete, 1 established connections (total 3)
1 minute connection request rate 2 requests/sec
```

Related Commands

Command	Description
ip tcp intercept connection-timeout	Changes how long a TCP connection will be managed by the TCP intercept after no activity.
ip tcp intercept finrst-timeout	Changes how long after receipt of a reset or FIN-exchange the software ceases to manage the connection.
ip tcp intercept list	Enables TCP intercept.
show tcp intercept connections	Displays TCP incomplete and established connections.



Context-Based Access Control Commands

This chapter describes Context-based Access Control (CBAC) commands. CBAC intelligently filters TCP and User Datagram Protocol packets on the basis of application-layer protocol session information and can be used for intranets, extranets and internets. Without CBAC, traffic filtering is limited to access list implementations that examine packets at the network layer, or at most, the transport layer. CBAC inspects traffic that travels through the firewall to discover and manage state information for TCP and UDP sessions. This state information is used to create temporary openings in the firewall's access lists to allow return traffic and additional data connections for permissible sessions (sessions that originated from within the protected internal network).

To find complete descriptions of other commands used when configuring CBAC, refer to the *Cisco IOS Command Reference Master Index* or search online.

For configuration information, refer to the chapter "Configuring Context-Based Access Control" in the *Cisco IOS Security Configuration Guide.*

ip inspect alert-off

To disable Context-based Access Control (CBAC) alert messages, which are displayed on the console, use the **ip inspect alert-off** command in global configuration mode. To enable CBAC alert messages, use the **no** form of this command.

ip inspect alert-off

no ip inspect alert-off

Syntax Description

This command has no arguments or keywords.

Defaults

Alert messages are displayed.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip inspect alert-off** command to disable alert messages.

Examples

The following example disables CBAC alert messages:

```
ip inspect alert-off
```

ip inspect audit trail

To turn on Context-based Access Control (CBAC) audit trail messages, which will be displayed on the console after each CBAC session closes, use the **ip inspect audit trail** command in global configuration mode. To turn off CBAC audit trail message, use the **no** form of this command.

ip inspect audit trail

no ip inspect audit trail

Syntax Description

This command has no arguments or keywords.

Defaults

Audit trail messages are not displayed.

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

Use this command to turn on CBAC audit trail messages.

Examples

The following example turns on CBAC audit trail messages:

```
ip inspect audit trail
```

Afterward, audit trail messages such as the following are displayed:

```
%FW-6-SESS_AUDIT_TRAIL: tcp session initiator (192.168.1.13:33192) sent 22 bytes --
responder (192.168.129.11:25) sent 208 bytes
%FW-6-SESS_AUDIT_TRAIL: ftp session initiator 192.168.1.13:33194) sent 336 bytes --
responder (192.168.129.11:21) sent 325 bytes
```

These messages are examples of audit trail messages. To determine which protocol was inspected, refer to the responder's port number. The port number follows the responder's IP address.

ip inspect dns-timeout

To specify the Domain Name System (DNS) idle timeout (the length of time during which a DNS name lookup session will still be managed while there is no activity), use the **ip inspect dns-timeout** command in global configuration mode. To reset the timeout to the default of 5 seconds, use the **no** form of this command.

ip inspect dns-timeout *seconds*

no ip inspect dns-timeout

Syntax Description

seconds	Specifies the length of time in seconds, for which a DNS name lookup session will still be managed while there is no activity. The default is 5 seconds.

Defaults

5 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

When the software detects a valid User Datagram Protocol packet for a new DNS name lookup session, if Context-based Access Control (CBAC) inspection is configured for UDP, the software establishes state information for the new DNS session.

If the software detects no packets for the DNS session for a time period defined by the DNS idle timeout, the software will not continue to manage state information for the session.

The DNS idle timeout applies to all DNS name lookup sessions inspected by CBAC.

The DNS idle timeout value overrides the global UDP timeout. The DNS idle timeout value also enters aggressive mode and overrides any timeouts specified for specific interfaces when you define a set of inspection rules with the **ip inspect name** command.

Examples

The following example sets the DNS idle timeout to 30 seconds:

```
ip inspect dns-timeout 30
```

The following example sets the DNS idle timeout back to the default (5 seconds):

```
no ip inspect dns-timeout
```

ip inspect

To apply a set of inspection rules to an interface, use the **ip inspect** command in interface configuration mode. To remove the set of rules from the interface, use the **no** form of this command.

ip inspect *inspection-name* {**in** | **out**}

no ip inspect *inspection-name* {**in** | **out**}

Syntax Description

inspection-name	Identifies which set of inspection rules to apply.
in	Applies the inspection rules to inbound traffic.
out	Applies the inspection rules to outbound traffic.

Defaults

If no set of inspection rules is applied to an interface, no traffic will be inspected by CBAC.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to apply a set of inspection rules to an interface.

Typically, if the interface connects to the external network, you apply the inspection rules to outbound traffic; alternately, if the interface connects to the internal network, you apply the inspection rules to inbound traffic.

If you apply the rules to outbound traffic, then return inbound packets will be permitted if they belong to a valid connection with existing state information. This connection must be initiated with an outbound packet.

If you apply the rules to inbound traffic, then return outbound packets will be permitted if they belong to a valid connection with existing state information. This connection must be initiated with an inbound packet.

Examples

The following example applies a set of inspection rules named “outboundrules” to an external interface’s outbound traffic. This causes inbound IP traffic to be permitted only if the traffic is part of an existing session, and to be denied if the traffic is not part of an existing session.

```
interface serial0
 ip inspect outboundrules out
```

Related Commands

Command	Description
ip inspect name	Defines a set of inspection rules.

ip inspect max-incomplete high

To define the number of existing half-open sessions that will cause the software to start deleting half-open sessions, use the **ip inspect max-incomplete high** command in global configuration mode. To reset the threshold to the default of 500 half-open sessions, use the **no** form of this command.

ip inspect max-incomplete high *number*

no ip inspect max-incomplete high

Syntax Description

number	Specifies the number of existing half-open sessions that will cause the software to start deleting half-open sessions. The default is 500 half-open sessions.

Defaults

500 half-open sessions

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

An unusually high number of half-open sessions (either absolute or measured as the arrival rate) could indicate that a denial-of-service attack is occurring. For TCP, "half-open" means that the session has not reached the established state. For User Datagram Protocol, "half-open" means that the firewall has detected traffic from one direction only.

Context-based Access Control (CBAC) measures both the total number of existing half-open sessions and the rate of session establishment attempts. Both TCP and UDP half-open sessions are counted in the total number and rate measurements. Measurements are made once a minute.

When the number of existing half-open sessions rises above a threshold (the **max-incomplete high** number), the software will delete half-open sessions as required to accommodate new connection requests. The software will continue to delete half-open requests as necessary, until the number of existing half-open sessions drops below another threshold (the **max-incomplete low** number).

The global value specified for this threshold applies to all TCP and UDP connections inspected by CBAC.

Examples

The following example causes the software to start deleting half-open sessions when the number of existing half-open sessions rises above 900, and to stop deleting half-open sessions when the number drops below 800:

```
ip inspect max-incomplete high 900
ip inspect max-incomplete low 800
```

Related Commands

Command	Description
ip inspect max-incomplete low	Defines the number of existing half-open sessions that will cause the software to stop deleting half-open sessions.
ip inspect one-minute high	Defines the rate of new unestablished sessions that will cause the software to start deleting half-open sessions.
ip inspect one-minute low	Defines the rate of new unestablished TCP sessions that will cause the software to stop deleting half-open sessions.
ip inspect tcp max-incomplete host	Specifies the threshold and blocking time values for TCP host-specific denial-of-service detection and prevention.

ip inspect max-incomplete low

To define the number of existing half-open sessions that will cause the software to stop deleting half-open sessions, use the **ip inspect max-incomplete low** command in global configuration mode. To reset the threshold to the default of 400 half-open sessions, use the **no** form of this command.

ip inspect max-incomplete low *number*

no ip inspect max-incomplete low

Syntax Description

number	Specifies the number of existing half-open sessions that will cause the software to stop deleting half-open sessions. The default is 400 half-open sessions.

Defaults

400 half-open sessions.

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

An unusually high number of half-open sessions (either absolute or measured as the arrival rate) could indicate that a denial-of-service attack is occurring. For TCP, "half-open" means that the session has not reached the established state. For User Datagram Protocol, "half-open" means that the firewall has detected traffic from one direction only.

Context-based Access Control (CBAC) measures both the total number of existing half-open sessions and the rate of session establishment attempts. Both TCP and UDP half-open sessions are counted in the total number and rate measurements. Measurements are made once a minute.

When the number of existing half-open sessions rises above a threshold (the **max-incomplete high** number), the software will delete half-open sessions as required to accommodate new connection requests. The software will continue to delete half-open requests as necessary, until the number of existing half-open sessions drops below another threshold (the **max-incomplete low** number).

The global value specified for this threshold applies to all TCP and UDP connections inspected by CBAC.

Examples

The following example causes the software to start deleting half-open sessions when the number of existing half-open sessions rises above 900, and to stop deleting half-open sessions when the number drops below 800:

```
ip inspect max-incomplete high 900
ip inspect max-incomplete low 800
```

Related Commands

Command	Description
ip inspect max-incomplete high	Defines the number of existing half-open sessions that will cause the software to start deleting half-open sessions.
ip inspect one-minute high	Defines the rate of new unestablished sessions that will cause the software to start deleting half-open sessions.
ip inspect one-minute low	Defines the rate of new unestablished TCP sessions that will cause the software to stop deleting half-open sessions.
ip inspect tcp max-incomplete host	Specifies the threshold and blocking time values for TCP host-specific denial-of-service detection and prevention.

ip inspect name

To define a set of inspection rules, use the **ip inspect name** command in global configuration mode. To remove the inspection rule for a protocol or to remove the entire set of inspection rules, use the **no** form of this command.

ip inspect name *inspection-name protocol* [**alert** {**on** | **off**}] [**audit-trail** {**on** | **off**}] [**timeout** *seconds*]

no ip inspect name [*inspection-name protocol*]l

HTTP Inspection Syntax

ip inspect name *inspection-name* **http** [**java-list** *access-list*] [**alert** {**on** | **off**}] [**audit-trail** {**on** | **off**}] [**timeout** *seconds*] (Java protocol only)

no ip inspect name *inspection-name protocol* (removes the inspection rule for a protocol)

RPC Inspection Syntax

ip inspect name *inspection-name* **rpc program-number** *number* [**wait-time** *minutes*] [**alert** {**on** | **off**}] [**audit-trail** {**on** | **off**}] [**timeout** *seconds*] (RPC protocol only)

no ip inspect name *inspection-name protocol* (removes the inspection rule for a protocol)

Fragment Inspection Syntax

ip inspect name *inspection-name* **fragment** [**max** *number* **timeout** *seconds*]

no ip inspect name *inspection-name* **fragment** (removes fragment inspection for a rule)

Syntax Description

inspection-name	Names the set of inspection rules. If you want to add a protocol to an existing set of rules, use the same *inspection-name* as the existing set of rules. **Note** The *inspection-name* cannot exceed 16 characters; otherwise, the name will be truncated to the 16 character limit.
protocol	A protocol keyword listed in Table 20 or Table 21.
alert {**on** | **off**}	(Optional) For each inspected protocol, the generation of alert messages can be set be **on** or **off**. If no option is selected, alerts are generated based on the setting of the **ip inspect alert-off** command.
audit-trail {**on** | **off**}	(Optional) For each inspected protocol, audit trail can be set **on** or **off**. If no option is selected, audit trail message are generated based on the setting of the **ip inspect audit-trail** command.
http	(Optional) Specifies the HTTP protocol for Java applet blocking. This command is used only to enable Java inspection. If you do not configure a numbered standard access list, but use a "placeholder" access list in the **ip inspect name** *inspection-name* **http** command, all Java applets will be blocked.

timeout *seconds*	(Optional) To override the global TCP or User Datagram Protocol idle timeouts for the specified protocol, specify the number of seconds for a different idle timeout. This timeout overrides the global TCP and UPD timeouts but will not override the global Domain Name System timeout.
java-list *access-list*	(Optional) Specifies the numbered standard access list to use to determine "friendly" sites. This keyword is available only for the HTTP protocol, for Java applet blocking. Java blocking only works with numbered standard access lists.
rpc program-number *number*	Specifies the program number to permit. This keyword is available only for the remote-procedure call protocol.
wait-time *minutes*	(Optional) Specifies the number of minutes to keep a small hole in the firewall to allow subsequent connections from the same source address and to the same destination address and port. The default wait-time is zero minutes. This keyword is available only for the RPC protocol.
fragment	Specifies fragment inspection for the named rule.
max *number*	(Optional) Specifies the maximum number of unassembled packets for which state information (structures) is allocated by Cisco IOS software. Unassembled packets are packets that arrive at the router interface before the initial packet for a session. The acceptable range is 50 through 10000. The default is 256 state entries. Memory is allocated for the state structures, and setting this value to a larger number may cause memory resources to be exhausted.
timeout *seconds* (fragmentation)	(Optional) Configures the number of seconds that a packet state structure remains active. When the timeout value expires, the router drops the unassembled packet, freeing that structure for use by another packet. The default timeout value is one second. If this number is set to a value greater that one second, it will be automatically adjusted by the Cisco IOS software when the number of free state structures goes below certain thresholds: when the number of free states is less than 32, the timeout will be divided by 2. When the number of free states is less than 16, the timeout will be set to 1 second.

Table 20 Protocol Keywords—Transport-Layer Protocols

Protocol	Keyword
TCP	**tcp**
UDP	**udp**

Table 21 Protocol Keywords—Application-Layer Protocols

Protocol	Keyword
CU-SeeMe	**cuseeme**
FTP	**ftp**

Table 21 Protocol Keywords—Application-Layer Protocols (continued)

Protocol	Keyword
Java	**http**
H.323	**h323**
Microsoft NetShow	**netshow**
UNIX R commands (rlogin, rexec, rsh)	**rcmd**
RealAudio	**realaudio**
RPC	**rpc**
SMTP	**smtp**
SQL*Net	**sqlnet**
StreamWorks	**streamworks**
TFTP	**tftp**
VDOLive	**vdolive**

Defaults

No inspection rules are defined until you define them using this command.

Command Modes

Global configuration

Command History

Release	Modification
11.2P	This command was introduced.
12.0(5)T	Introduced configurable alert and audit trail, IP fragmentation checking, and NetShow protocol support.

Usage Guidelines

To define a set of inspection rules, enter this command for each protocol that you want Context-based Access Control (CBAC) to inspect, using the same *inspection-name*. Give each set of inspection rules a unique *inspection-name*, which should not exceed the 16 charatcer limit. Define either one or two sets of rules per interface—you can define one set to examine both inbound and outbound traffic; or you can define two sets: one for outbound traffic and one for inbound traffic.

To define a single set of inspection rules, configure inspection for all the desired application-layer protocols, and for TCP or UDP as desired. This combination of TCP, UDP, and application-layer protocols join together to form a single set of inspection rules with a unique name.

To remove the inspection rule for a protocol, use the no form of this command with the specified inspection name and protocol; to remove the entire set of inspection rules, use the no form of this command only; that is, do not list any inspection names or protocols.

In general, when inspection is configured for a protocol, return traffic entering the internal network will be permitted only if the packets are part of a valid, existing session for which state information is being maintained.

TCP and UDP Inspection

You can configure TCP and UDP inspection to permit TCP and UDP packets to enter the internal network through the firewall, even if the application-layer protocol is not configured to be inspected. However, TCP and UDP inspection do not recognize application-specific commands, and therefore might not permit all return packets for an application, particularly if the return packets have a different port number than the previous exiting packet.

Any application-layer protocol that is inspected will take precedence over the TCP or UDP packet inspection. For example, if inspection is configured for File Transfer Protocol, all control channel information will be recorded in the state table, and all FTP traffic will be permitted back through the firewall if the control channel information is valid for the state of the FTP session. The fact that TCP inspection is configured is irrelevant.

With TCP and UDP inspection, packets entering the network must exactly match an existing session: the entering packets must have the same source/destination addresses and source/destination port numbers as the exiting packet (but reversed). Otherwise, the entering packets will be blocked at the interface.

Application-Layer Protocol Inspection

In general, if you configure inspection for an application-layer protocol, packets for that protocol should be permitted to exit the firewall (by configuring the correct access control list), and packets for that protocol will only be allowed back in through the firewall if they belong to a valid existing session. Each protocol packet is inspected to maintain information about the session state.

Java, H.323, RPC, and SMTP, and SQL*Net inspection have additional information, described in the next four sections.

Java Inspection

Java inspection enables Java applet filtering at the firewall. Java applet filtering distinguishes between trusted and untrusted applets by relying on a list of external sites that you designate as "friendly." If an applet is from a friendly site, the firewall allows the applet through. If the applet is not from a friendly site, the applet will be blocked. Alternately, you could permit applets from all sites except sites specifically designated as "hostile."

Note Before you configure Java inspection, you must configure a numbered standard access list that defines "friendly" and "hostile" external sites. You configure this numbered standard access list to permit traffic from friendly sites, and to deny traffic from hostile sites. If you do not configure a numbered standard access list, but use a "placeholder" access list in the **ip inspect name** *inspection-name* **http** command, all Java applets will be blocked.

Note Java blocking forces a strict order on TCP packets. To properly verify that Java applets are not in the response, a firewall will drop any TCP packet that is out of order. Because the network—not the firewall—determines how packets are routed, the firewall cannot control the order of the packets; the firewall can only drop and retransmit all TCP packets that are not in order.

Caution CBAC does not detect or block encapsulated Java applets. Therefore, Java applets that are wrapped or encapsulated, such as applets in .zip or .jar format, are *not* blocked at the firewall. CBAC also does not detect or block applets loaded via FTP, gopher, or HTTP on a nonstandard port.

H.323 Inspection

If you want CBAC inspection to work with NetMeeting 2.0 traffic (an H.323 application-layer protocol), you must also configure inspection for TCP, as described in the chapter "Configuring Context-Based Access Control" in the *Cisco IOS Security Configuration Guide*. This requirement exists because NetMeeting 2.0 uses an additional TCP channel not defined in the H.323 specification.

RPC Inspection

RPC inspection allows the specification of various program numbers. You can define multiple program numbers by creating multiple entries for RPC inspection, each with a different program number. If a program number is specified, all traffic for that program number will be permitted. If a program number is not specified, all traffic for that program number will be blocked. For example, if you created an RPC entry with the NFS program number, all NFS traffic will be allowed through the firewall.

SMTP Inspection

SMTP inspection causes SMTP commands to be inspected for illegal commands. Any packets with illegal commands are dropped, and the SMTP session will hang and eventually time out. An illegal command is any command except for the following legal commands:

- DATA
- EXPN
- HELO
- HELP
- MAIL
- NOOP
- QUIT
- RCPT
- RSET
- SAML
- SEND
- SOML
- VRFY

Use of the timeout Keyword

If you specify a timeout for any of the transport-layer or application-layer protocols, the timeout will override the global idle timeout for the interface that the set of inspection rules is applied to.

If the protocol is TCP or a TCP application-layer protocol, the timeout will override the global TCP idle timeout. If the protocol is UDP or a UDP application-layer protocol, the timeout will override the global UDP idle timeout.

If you do not specify a timeout for a protocol, the timeout value applied to a new session of that protocol will be taken from the corresponding TCP or UDP global timeout value valid at the time of session creation.

IP Fragmentation Inspection

CBAC inspection rules can help protect hosts against certain denial-of-service attacks involving fragmented IP packets. Even though the firewall keeps an attacker from making actual connections to a given host, the attacker may still be able to disrupt services provided by that host. This is done by sending

many non-initial IP fragments or by sending complete fragmented packets through a router with an ACL that filters the first fragment of a fragmented packet. These fragments can tie up resources on the target host as it tries to reassemble the incomplete packets.

Using fragmentation inspection, the firewall maintains an *interfragment state* (structure) for IP traffic. Non-initial fragments are discarded unless the corresponding initial fragment was permitted to pass through the firewall. Non-initial fragments received before the corresponding initial fragments are discarded.

Note Fragmentation inspection can have undesirable effects in certain cases, because it can result in the firewall discarding any packet whose fragments arrive out of order. There are many circumstances that can cause out-of-order delivery of legitimate fragments. Apply fragmentation inspection in situations where legitimate fragments, which are likely to arrive out of order, might have a severe performance impact.

Because routers running Cisco IOS software are used in a very large variety of networks, and because the CBAC feature is often used to isolate parts of internal networks from one another, the fragmentation inspection feature is not enabled by default. Fragmentation detection must be explicitly enabled for an inspection rule using the **ip inspect name** command. Unfragmented traffic is never discarded because it lacks a fragment state. Even when the system is under heavy attack with fragmented packets, legitimate fragmented traffic, if any, will still get some fraction of the firewall's fragment state resources, and legitimate, unfragmented traffic can flow through the firewall unimpeded.

Examples

The following example causes the software to inspect TCP sessions and UDP sessions, and to specifically allow CU-SeeMe, FTP, and RPC traffic back through the firewall for existing sessions only. For UDP traffic, audit-trail is on. For FTP traffic, the idle timeout is set to override the global TCP idle timeout. For RPC traffic, program numbers 100003, 100005, and 100021 are permitted.

```
ip inspect name myrules tcp
ip inspect name myrules udp audit-trail on
ip inspect name myrules cuseeme
ip inspect name myrules ftp timeout 120
ip inspect name myrules rpc program-number 100003
ip inspect name myrules rpc program-number 100005
ip inspect name myrules rpc program-number 100021
```

The following example adds fragment checking to software inspection of TCP and UDP sessions for the rule named *myname*. In this example, the firewall software will allocate 100 state structures, and the timeout value for dropping unassembled packets is set to 4 seconds. If 100 initial fragments for 100 different packets are sent through the router, all of the state structures will be used up. The initial fragment for packet 101 will be dropped. Additionally, if the number of free state structures (structures available for use by unassembled packets) drops below the threshold values, 32 or 16, the timeout value is automatically reduced to 2 or 1, respectively. Changing the timeout value frees up packet state structures more quickly.

```
ip inspect name myrules tcp
ip inspect name myrules udp audit-trail on
ip inspect name myrules cuseeme
ip inspect name myrules ftp timeout 120
ip inspect name myrules rpc program-number 100003
ip inspect name myrules rpc program-number 100005
ip inspect name myrules rpc program-number 100021
ip inspect name myrules fragment max 100 timeout 4
```

Related Commands

Command	Description
ip inspect	Applies a set of inspection rules to an interface.
ip inspect audit trail	Turns on CBAC audit trail messages, which will be displayed on the console after each CBAC session close.
ip inspect alert-off	Disables CBAC alert messages.

ip inspect one-minute high

To define the rate of new unestablished sessions that will cause the software to start deleting half-open sessions, use the **ip inspect one-minute high** command in global configuration mode. To reset the threshold to the default of 500 half-open sessions, use the **no** form of this command.

ip inspect one-minute high *number*

no ip inspect one-minute high

Syntax Description

number	Specifies the rate of new unestablished TCP sessions that will cause the software to start deleting half-open sessions. The default is 500 half-open sessions.

Defaults

500 half-open sessions

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

An unusually high number of half-open sessions (either absolute or measured as the arrival rate) could indicate that a denial-of-service attack is occurring. For TCP, "half-open" means that the session has not reached the established state. For User Datagram Protocol, "half-open" means that the firewall has detected traffic from one direction only.

Context-based Access Control (CBAC) measures both the total number of existing half-open sessions and the rate of session establishment attempts. Both TCP and UDP half-open sessions are included in the total number and rate measurements. Measurements are made once a minute.

When the rate of new connection attempts rises above a threshold (the **one-minute high** number), the software will delete half-open sessions as required to accommodate new connection attempts. The software will continue to delete half-open sessions as necessary, until the rate of new connection attempts drops below another threshold (the **one-minute low** number). The rate thresholds are measured as the number of new session connection attempts detected in the last one-minute sample period. (The rate is calculated as an exponentially-decayed rate.)

The global value specified for this threshold applies to all TCP and UDP connections inspected by CBAC.

Examples

The following example causes the software to start deleting half-open sessions when more than 1000 session establishment attempts have been detected in the last minute, and to stop deleting half-open sessions when fewer than 950 session establishment attempts have been detected in the last minute:

```
ip inspect one-minute high 1000
ip inspect one-minute low 950
```

Related Commands

Command	Description
ip inspect one-minute low	Defines the rate of new unestablished TCP sessions that will cause the software to stop deleting half-open sessions.
ip inspect max-incomplete high	Defines the number of existing half-open sessions that will cause the software to start deleting half-open sessions.
ip inspect max-incomplete low	Defines the number of existing half-open sessions that will cause the software to stop deleting half-open sessions.
ip inspect tcp max-incomplete host	Specifies the threshold and blocking time values for TCP host-specific denial-of-service detection and prevention.

ip inspect one-minute low

To define the rate of new unestablished TCP sessions that will cause the software to stop deleting half-open sessions, use the **ip inspect one-minute low** command in global configuration mode. To reset the threshold to the default of 400 half-open sessions, use the **no** form of this command

ip inspect one-minute low *number*

no ip inspect one-minute low

Syntax Description

number	Specifies the rate of new unestablished TCP sessions that will cause the software to stop deleting half-open sessions. The default is 400 half-open sessions.

Defaults

400 half-open sessions

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

An unusually high number of half-open sessions (either absolute or measured as the arrival rate) could indicate that a denial-of-service attack is occurring. For TCP, "half-open" means that the session has not reached the established state. For User Datagram Protocol, "half-open" means that the firewall has detected traffic from one direction only.

Context-based Access Control (CBAC) measures both the total number of existing half-open sessions and the rate of session establishment attempts. Both TCP and UDP half-open sessions are included in the total number and rate measurements. Measurements are made once a minute.

When the rate of new connection attempts rises above a threshold (the **one-minute high** number), the software will delete half-open sessions as required to accommodate new connection attempts. The software will continue to delete half-open sessions as necessary, until the rate of new connection attempts drops below another threshold (the **one-minute low** number). The rate thresholds are measured as the number of new session connection attempts detected in the last one-minute sample period. (The rate is calculated as an exponentially decayed rate.)

The global value specified for this threshold applies to all TCP and UDP connections inspected by CBAC.

Examples

The following example causes the software to start deleting half-open sessions when more than 1000 session establishment attempts have been detected in the last minute, and to stop deleting half-open sessions when fewer than 950 session establishment attempts have been detected in the last minute:

```
ip inspect one-minute high 1000
ip inspect one-minute low 950
```

Related Commands

Command	Description
ip inspect max-incomplete high	Defines the number of existing half-open sessions that will cause the software to start deleting half-open sessions.
ip inspect max-incomplete low	Defines the number of existing half-open sessions that will cause the software to stop deleting half-open sessions.
ip inspect one-minute high	Defines the rate of new unestablished sessions that will cause the software to start deleting half-open sessions.
ip inspect tcp max-incomplete host	Specifies the threshold and blocking time values for TCP host-specific denial-of-service detection and prevention.

ip inspect tcp finwait-time

To define how long a TCP session will still be managed after the firewall detects a FIN-exchange, use the **ip inspect tcp finwait-time** command in global configuration mode. To reset the timeout to the default of 5 seconds, use the **no** form of this command.

ip inspect tcp finwait-time *seconds*

no ip inspect tcp finwait-time

Syntax Description

seconds	Specifies how long a TCP session will be managed after the firewall detects a FIN-exchange. The default is 5 seconds.

Defaults

5 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

When the software detects a valid TCP packet that is the first in a session, and if Context-based Access Control (CBAC) inspection is configured for the packet's protocol, the software establishes state information for the new session.

Use this command to define how long TCP session state information will be maintained after the firewall detects a FIN-exchange for the session. The FIN-exchange occurs when the TCP session is ready to close.

The global value specified for this timeout applies to all TCP sessions inspected by CBAC.

The timeout set with this command is referred to as the "finwait" timeout.

Note If the -n option is used with rsh, and the commands being executed do not produce output before the "finwait" timeout, the session will be dropped and no further output will be seen.

Examples

The following example changes the "finwait" timeout to 10 seconds:

```
ip inspect tcp finwait-time 10
```

The following example changes the "finwait" timeout back to the default (5 seconds):

```
no ip inspect tcp finwait-time
```

ip inspect tcp idle-time

To specify the TCP idle timeout (the length of time a TCP session will still be managed while there is no activity), use the **ip inspect tcp idle-time** command in global configuration mode. To reset the timeout to the default of 3600 seconds (1 hour), use the **no** form of this command.

ip inspect tcp idle-time *seconds*

no ip inspect tcp idle-time

Syntax Description

seconds	Specifies the length of time, in seconds, for which a TCP session will still be managed while there is no activity. The default is 3600 seconds (1 hour).

Defaults

3600 seconds (1 hour)

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

When the software detects a valid TCP packet that is the first in a session, and if Context-based Access Control (CBAC) inspection is configured for the packet's protocol, the software establishes state information for the new session.

If the software detects no packets for the session for a time period defined by the TCP idle timeout, the software will not continue to manage state information for the session.

The global value specified for this timeout applies to all TCP sessions inspected by CBAC. This global value can be overridden for specific interfaces when you define a set of inspection rules with the **ip inspect name** (global configuration) command.

Note This command does not affect any of the currently defined inspection rules that have explicitly defined timeouts. Sessions created based on these rules still inherit the explicitly defined timeout value. If you change the TCP idle timeout with this command, the new timeout will apply to any new inspection rules you define or to any existing inspection rules that do not have an explicitly defined timeout. That is, new sessions based on these rules (having no explicitly defined timeout) will inherit the global timeout value.

Examples

The following example sets the global TCP idle timeout to 1800 seconds (30 minutes):

```
ip inspect tcp idle-time 1800
```

The following example sets the global TCP idle timeout back to the default of 3600 seconds (one hour):

```
no ip inspect tcp idle-time
```

ip inspect tcp max-incomplete host

To specify threshold and blocking time values for TCP host-specific denial-of-service detection and prevention, use the **ip inspect tcp max-incomplete host** command in global configuration mode. To reset the threshold and blocking time to the default values, use the **no** form of this command.

ip inspect tcp max-incomplete host *number* **block-time** *minutes*

no ip inspect tcp max-incomplete host

Syntax Description

number	Specifies how many half-open TCP sessions with the same host destination address can exist at a time, before the software starts deleting half-open sessions to the host. Use a number from 1 to 250. The default is 50 half-open sessions.
block-time	Specifies blocking of connection initiation to a host.
minutes	Specifies how long the software will continue to delete new connection requests to the host. The default is 0 minutes.

Defaults

50 half-open sessions and 0 minutes

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

An unusually high number of half-open sessions with the same destination host address could indicate that a denial-of-service attack is being launched against the host. For TCP, “half-open” means that the session has not reached the established state.

Whenever the number of half-open sessions with the same destination host address rises above a threshold (the **max-incomplete host** number), the software will delete half-open sessions according to one of the following methods:

- If the **block-time** *minutes* timeout is 0 (the default):

  The software will delete the oldest existing half-open session for the host for every new connection request to the host. This ensures that the number of half-open sessions to a given host will never exceed the threshold.

- If the **block-time** *minutes* timeout is greater than 0:

  The software will delete all existing half-open sessions for the host, and then block all new connection requests to the host. The software will continue to block all new connection requests until the **block-time** expires.

The software also sends syslog messages whenever the **max-incomplete host** number is exceeded and when blocking of connection initiations to a host starts or ends.

The global values specified for the threshold and blocking time apply to all TCP connections inspected by Context-based Access Control (CBAC).

Examples

The following example changes the **max-incomplete host** number to 40 half-open sessions, and changes the **block-time** timeout to 2 minutes:

```
ip inspect tcp max-incomplete host 40 block-time 2
```

The following example resets the defaults (50 half-open sessions and 0 minutes):

```
no ip inspect tcp max-incomplete host
```

Related Commands

Command	Description
ip inspect max-incomplete high	Defines the number of existing half-open sessions that will cause the software to start deleting half-open sessions.
ip inspect max-incomplete low	Defines the number of existing half-open sessions that will cause the software to stop deleting half-open sessions.
ip inspect one-minute high	Defines the rate of new unestablished sessions that will cause the software to start deleting half-open sessions.
ip inspect one-minute low	Defines the rate of new unestablished TCP sessions that will cause the software to stop deleting half-open sessions.

ip inspect tcp synwait-time

To define how long the software will wait for a TCP session to reach the established state before dropping the session, use the **ip inspect tcp synwait-time** command in global configuration mode. To reset the timeout to the default of 30 seconds, use the **no** form of this command.

ip inspect tcp synwait-time *seconds*

no ip inspect tcp synwait-time

Syntax Description

seconds	Specifies how long, in seconds, the software will wait for a TCP session to reach the established state before dropping the session. The default is 30 seconds.

Defaults

30 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

Use this command to define how long Cisco IOS software will wait for a TCP session to reach the established state before dropping the session. The session is considered to have reached the established state after the session's first SYN bit is detected.

The global value specified for this timeout applies to all TCP sessions inspected by Context-based Access Control (CBAC).

Examples

The following example changes the "synwait" timeout to 20 seconds:

```
ip inspect tcp synwait-time 20
```

The following example changes the "synwait" timeout back to the default (30 seconds):

```
no ip inspect tcp synwait-time
```

ip inspect udp idle-time

To specify the User Datagram Protocol idle timeout (the length of time for which a UDP "session" will still be managed while there is no activity), use the **ip inspect udp idle-time** command in global configuration model. To reset the timeout to the default of 30 seconds, use the **no** form of this command.

ip inspect udp idle-time *seconds*

no ip inspect udp idle-time

Syntax Description

seconds	Specifies the length of time a UDP "session" will still be managed while there is no activity. The default is 30 seconds.

Defaults

30 seconds

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

When the software detects a valid UDP packet, if Context-based Access Control (CBAC) inspection is configured for the packet's protocol, the software establishes state information for a new UDP "session." Because UDP is a connectionless service, there are no actual sessions, so the software approximates sessions by examining the information in the packet and determining if the packet is similar to other UDP packets (for example, it has similar source or destination addresses) and if the packet was detected soon after another similar UDP packet.

If the software detects no UDP packets for the UDP session for the a period of time defined by the UDP idle timeout, the software will not continue to manage state information for the session.

The global value specified for this timeout applies to all UDP sessions inspected by CBAC. This global value can be overridden for specific interfaces when you define a set of inspection rules with the **ip inspect name** command.

Note This command does not affect any of the currently defined inspection rules that have explicitly defined timeouts. Sessions created based on these rules still inherit the explicitly defined timeout value. If you change the UDP idle timeout with this command, the new timeout will apply to any new inspection rules you define or to any existing inspection rules that do not have an explicitly defined timeout. That is, new sessions based on these rules (having no explicitly defined timeout) will inherit the global timeout value.

Examples

The following example sets the global UDP idle timeout to 120 seconds (2 minutes):

```
ip inspect udp idle-time 120
```

The following example sets the global UDP idle timeout back to the default of 30 seconds:

```
no ip inspect udp idle-time
```

no ip inspect

To turn off Context-based Access Control (CBAC) completely at a firewall, use the **no ip inspect** command in global configuration mode.

no ip inspect

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

Turn off CBAC with the **no ip inspect** global configuration command.

Note The **no in inspect** command removes all CBAC configuration entries and resets all CBAC global timeouts and thresholds to the defaults. All existing sessions are deleted and their associated access lists are removed.

Examples

The following example turns off CBAC at a firewall:

```
no ip inspect
```

show ip inspect

To view Context-based Access Control (CBAC) configuration and session information, use the **show ip inspect** command in privileged EXEC mode.

show ip inspect {**name** *inspection-name* | **config** | **interfaces** | **session** [**detail**] | **all**}

Syntax Description

name *inspection-name*	Displays the configured inspection rule with the name *inspection-name*.
config	Displays the complete CBAC inspection configuration.
interfaces	Displays interface configuration with respect to applied inspection rules and access lists.
session [**detail**]	Displays existing sessions that are currently being tracked and inspected by CBAC. The optional **detail** keyword causes additional details about these sessions to be shown.
all	Displays all CBAC configuration and all existing sessions that are currently being tracked and inspected by CBAC.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2 P	This command was introduced.

Usage Guidelines

Use this command to view the CBAC configuration and session information.

Examples

The following example shows sample output for the **show ip inspect name myinspectionrule** command, where the inspection rule "myinspectionrule" is configured:

```
Inspection Rule Configuration
 Inspection name myinspectionrule
    tcp timeout 3600
    udp timeout 30
    ftp timeout 3600
```

The output shows the protocols that should be inspected by CBAC and the corresponding idle timeouts for each protocol.

The following is sample output for the **show ip inspect config** command:

```
Session audit trail is disabled
one-minute (sampling period) thresholds are [400:500] connections
max-incomplete sessions thresholds are [400:500]
max-incomplete tcp connections per host is 50. Block-time 0 minute.
tcp synwait-time is 30 sec -- tcp finwait-time is 5 sec
tcp idle-time is 3600 sec -- udp idle-time is 30 sec
dns-timeout is 5 sec
Inspection Rule Configuration
 Inspection name myinspectionrule
    tcp timeout 3600
    udp timeout 30
    ftp timeout 3600
```

The output shows CBAC configuration, including global timeouts, thresholds, and inspection rules.

The following is sample output for the **show ip inspect interfaces** command:

```
Interface Configuration
 Interface Ethernet0
  Inbound inspection rule is myinspectionrule
    tcp timeout 3600
    udp timeout 30
    ftp timeout 3600
  Outgoing inspection rule is not set
  Inbound access list is not set
  Outgoing access list is not set
```

The following is sample output for the **show ip inspect sessions** command:

```
Established Sessions
 Session 25A3318 (10.0.0.1:20)=>(10.1.0.1:46068) ftp-data SIS_OPEN
 Session 25A6E1C (10.1.0.1:46065)=>(10.0.0.1:21) ftp SIS_OPEN
```

The output shows the source and destination addresses and port numbers (separated by colons), and it indicates that the session is an FTP session.

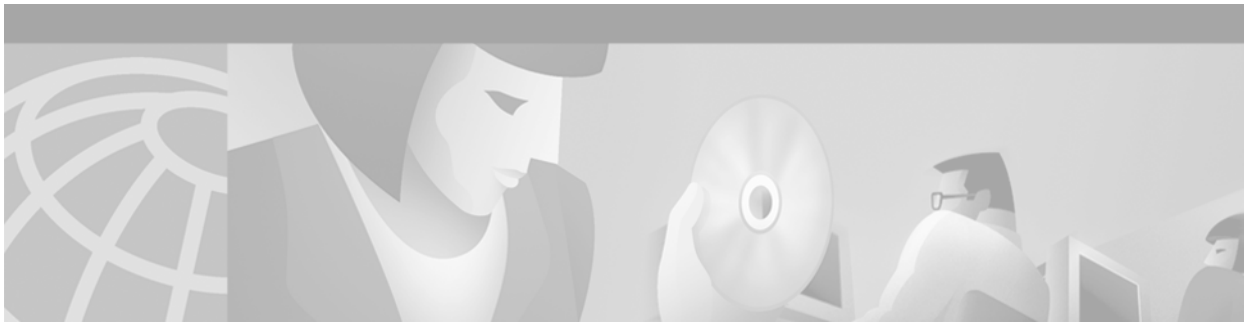
The following is sample output for the **show ip inspect sessions detail** command:

```
Established Sessions
 Session 25A335C (40.0.0.1:20)=>(30.0.0.1:46069) ftp-data SIS_OPEN
   Created 00:00:07, Last heard 00:00:00
   Bytes sent (initiator:responder) [0:3416064] acl created 1
   Inbound access-list 111 applied to interface Ethernet1
 Session 25A6E1C (30.0.0.1:46065)=>(40.0.0.1:21) ftp SIS_OPEN
   Created 00:01:34, Last heard 00:00:07
   Bytes sent (initiator:responder) [196:616] acl created 1
   Inbound access-list 111 applied to interface Ethernet1
```

The output includes times, number of bytes sent, and which access list is applied.

The following is sample output for the **show ip inspect all** command:

```
Session audit trail is disabled
one-minute (sampling period) thresholds are [400:500] connections
max-incomplete sessions thresholds are [400:500]
max-incomplete tcp connections per host is 50. Block-time 0 minute.
tcp synwait-time is 30 sec -- tcp finwait-time is 5 sec
tcp idle-time is 3600 sec -- udp idle-time is 30 sec
dns-timeout is 5 sec
Inspection Rule Configuration
 Inspection name all
    tcp timeout 3600
    udp timeout 30
    ftp timeout 3600
Interface Configuration
 Interface Ethernet0
  Inbound inspection rule is all
    tcp timeout 3600
    udp timeout 30
    ftp timeout 3600
  Outgoing inspection rule is not set
  Inbound access list is not set
  Outgoing access list is not set
 Established Sessions
 Session 25A6E1C (30.0.0.1:46065)=>(40.0.0.1:21) ftp SIS_OPEN
 Session 25A34A0 (40.0.0.1:20)=>(30.0.0.1:46072) ftp-data SIS_OPEN
```



Cisco IOS Firewall Intrusion Detection System Commands

This chapter describes the commands used to configure the integrated Intrusion Detection System (IDS) features in Cisco IOS Firewall. Intrusion detection systems provide a level of protection beyond the firewall by protecting the network from internal and external attacks and threats. The IDS technology enhances perimeter firewall protection by taking appropriate action on packets and flows that violate the security policy or represent malicious network activity.

The Cisco IOS Firewall IDS feature identifies 59 of the most common attacks using "signatures" to detect patterns of misuse in network traffic. For a description of Cisco IOS Firewall IDS signatures, refer to the "Integrated Intrusion Detection System" section in the *Cisco IOS Security Configuration Guide*.

Using Cisco IOS Firewall IDS, the Cisco IOS Firewall acts as an in-line intrusion detection sensor, watching packets and sessions as they flow through the router, scanning each to match any of the Cisco IOS Firewall IDS signatures. When it detects suspicious activity, it responds before network security can be compromised and logs the event through Cisco IOS syslog. The network administrator can configure Cisco IOS Firewall IDS to choose the appropriate response to various threats. When packets in a session match a signature, Cisco IOS Firewall IDS can be configured to perform the following tasks:

- Send an alarm to a syslog server or a NetRanger Director (centralized management interface)
- Drop the packet
- Reset the TCP connection

The IDS feature in Cisco IOS Firewall is compatible with Cisco Secure Intrusion Detection System (formally known as NetRanger). The Cisco Secure IDS is an enterprise-scale, real-time, intrusion detection system designed to detect, report, and terminate unauthorized activity throughout a network.

The Cisco Secure IDS consists of three components: Sensor, Director, and Post Office. Cisco Secure IDS Sensors analyze the content and context of individual packets to determine if traffic is authorized. The Cisco Secure IDS Director is a software-based management system that centrally monitors the activity of multiple Cisco Secure IDS Sensors. The Cisco Secure IDS Post Office is the communication backbone that allows NetRanger services and hosts to communicate with each other.

The IDS feature in Cisco IOS Firewall can be added to the NetRanger Director screen as an icon to provide a consistent view of all intrusion detection sensors throughout a network. It also can be configured to permit logging to the NetRanger Director console in addition to Cisco IOS syslog. For additional information about Cisco Secure IDS (NetRanger), refer to the *NetRanger User Guide*.

For more information on how to configure Cisco IOS Firewall IDS, refer to the "Configuring Integrated Intrusion Detection System" chapter in the *Cisco IOS Security Configuration Guide*. For configuration examples, refer to the Cisco IOS Firewall "IDS Configuration Examples" section in the "Configuring Integrated Intrusion Detection System" chapter of the *Cisco IOS Security Configuration Guide*.

clear ip audit configuration

To disable Cisco IOS Firewall IDS, remove all intrusion detection configuration entries, and release dynamic resources, use the **clear ip audit configuration** EXEC command.

clear ip audit configuration

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **clear ip audit configuration** EXEC command to disable Cisco IOS Firewall IDS, remove all intrusion detection configuration entries, and release dynamic resources.

Examples

The following example clears the existing IP audit configuration:

```
clear ip audit configuration
```

clear ip audit statistics

To reset statistics on packets analyzed and alarms sent, use the **clear ip audit statistics** EXEC command.

clear ip audit statistics

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **clear ip audit statistics** EXEC command to reset statistics on packets analyzed and alarms sent.

Examples

The following example clears all IP audit statistics:

```
clear ip audit statistics
```

ip audit

To apply an audit specification created with the **ip audit** command to a specific interface and for a specific direction, use the **ip audit** interface configuration command. To disable auditing of the interface for the specified direction, use the **no** version of this command.

ip audit *audit-name* {**in** | **out**}

no ip audit *audit-name* {**in** | **out**}

Syntax Description

audit-name	Name of an audit specification.
in	Inbound traffic.
out	Outbound traffic.

Defaults

No audit specifications are applied to an interface or direction.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip audit** interface configuration command to apply an audit specification created with the **ip audit** command to a specific interface and for a specific direction.

Examples

In the following example, the audit specification MARCUS is applied to an interface and direction:

```
interface e0
ip audit MARCUS in
```

In the following example, the audit specification MARCUS is removed from the interface on which it was previously added:

```
interface e0
no ip audit MARCUS in
```

ip audit attack

To specify the default actions for attack signatures, use the **ip audit attack** global configuration command. To set the default action for attack signatures, use the **no** form of this command.

ip audit attack {**action** [**alarm**] [**drop**] [**reset**]}

no ip audit attack

Syntax Description

action	Specifies an action for the attack signature to take in response to a match.
alarm	(Optional) Sends an alarm to the console, NetRanger Director, or to a syslog server. Used with the **action** keyword.
drop	(Optional) Drops the packet. Used with the **action** keyword.
reset	(Optional) Resets the TCP session. Used with the **action** keyword.

Defaults

The default action is **alarm**.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip audit attack** global configuration command to specify the default actions for attack signatures.

Examples

In the following example, the default action for attack signatures is set to all three actions:

```
ip audit attack action alarm drop reset
```

ip audit info

To specify the default actions for info signatures, use the **ip audit info** global configuration command. To set the default action for info signatures, use the **no** form of this command.

ip audit info {**action** [**alarm**] [**drop**] [**reset**]}

no ip audit info

Syntax Description

action	Sets an action for the info signature to take in response to a match.
alarm	(Optional) Sends an alarm to the console, NetRanger Director, or to a syslog server. Used with the **action** keyword.
drop	(Optional) Drops the packet. Used with the **action** keyword.
reset	(Optional) Resets the TCP session. Used with the **action** keyword.

Defaults

The default action is **alarm**.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip audit info** global configuration command. to specify the default actions for info signatures.

Examples

In the following example, the default action for info signatures is set to all three actions:

```
ip audit info action alarm drop reset
```

ip audit name

To create audit rules for info and attack signature types, use the **ip audit name** global configuration command. To delete an audit rule, use the **no** form of this command.

ip audit name *audit-name* {**info** | **attack**} [**list** *standard-acl*] [**action** [**alarm**] [**drop**] [**reset**]]

no ip audit name *audit-name* {**info** | **attack**}

Syntax Description

audit-name	Name for an audit specification.
info	Specifies that the audit rule is for info signatures.
attack	Specifies that the audit rule is for attack signatures.
list	(Optional) Specifies an ACL to attach to the audit rule.
standard-acl	(Optional) Integer representing an access control list. Use with the **list** keyword.
action	(Optional) Specifies an action or actions to take in response to a match.
alarm	(Optional) Sends an alarm to the console, NetRanger Director, or to a syslog server. Use with the **action** keyword.
drop	(Optional) Drops the packet. Use with the **action** keyword.
reset	(Optional) Resets the TCP session. Use with the **action** keyword.

Defaults

If an action is not specified, the default action is **alarm**.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Any signatures disabled with the **ip audit signature** command do not become a part of the audit rule created with the **ip audit name** command.

Examples

In the following example, an audit rule called INFO.2 is created, and configured with all three actions:

```
ip audit name INFO.2 info action alarm drop reset
```

In the following example, an info signature is disabled and an audit rule called INFO.3 is created:

```
ip audit signature 1000 disable
ip audit name INFO.3 info action alarm drop reset
```

In the following example, an audit rule called ATTACK.2 is created with an attached ACL 91, and the ACL is created:

```
ip audit name ATTACK.2 list 91
access-list 91 deny 10.1.0.0 0.0.255.255
access-list 91 permit any
```

ip audit notify

To specify the method of event notification, use the **ip audit notify** global configuration command. To disable event notifications, use the **no** form of this command.

ip audit notify {**nr-director** | **log**}

no ip audit notify {**nr-director** | **log**}

Syntax Description

nr-director	Send messages in NetRanger format to the NetRanger Director or Sensor.
log	Send messages in syslog format.

Defaults

The default is to send messages in syslog format.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

If messages are sent to the NetRanger Director, then you must also configure the NetRanger Director's Post Office transport parameters using the **ip audit po remote** command.

Examples

In the following example, event notifications are specified to be sent in NetRanger format:

```
ip audit notify nr-director
```

Related Commands

Command	Description
ip audit po local	Specifies the local Post Office parameters used when sending event notifications to the NetRanger Director.
ip audit po remote	Specifies one or more sets of Post Office parameters for NetRanger Directors receiving event notifications from the router.

ip audit po local

To specify the local Post Office parameters used when sending event notifications to the NetRanger Director, use the **ip audit po local** global configuration command. To set the local Post Office parameters to their default settings, use the **no** form of this command.

ip audit po local hostid *id-number* **orgid** *id-number*

no ip audit po local [**hostid** *id-number* **orgid** *id-number*]

Syntax Description

hostid	Specifies a NetRanger host ID.
id-number (**hostid**)	Unique integer in the range 1-65535 used in NetRanger communications to identify the local host. Use with the **hostid** keyword.
orgid	Specifies a NetRanger organization ID.
id-number (**orgid**)	Unique integer in the range 1-65535 used in NetRanger communications to identify the group to which the local host belongs. Use with the **orgid** keyword.

Defaults

The default organization ID is 1. The default host ID is 1.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip audit po local** global configuration command to specify the local Post Office parameters used when sending event notifications to the NetRanger Director.

Examples

In the following example, the local host is assigned a host ID of 10 and an organization ID of 500:

```
ip audit po local hostid 10 orgid 500
```

ip audit po max-events

To specify the maximum number of event notifications that are placed in the router's event queue, use the **ip audit po max-events** global configuration command. To set the number of recipients to the default setting, use the **no** version of this command.

ip audit po max-events *number-of-events*

no ip audit po max-events

Syntax Description

number-of-events	Integer in the range from 1 to 65535 that designates the maximum number of events allowable in the event queue. The default is 100 events.

Defaults

The default number of events is 100.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Raising the number of events past 100 may cause memory and performance impacts because each event in the event queue requires 32 KB of memory.

Examples

In the following example, the number of events in the event queue is set to 250:

```
ip audit po max-events 250
```

ip audit po protected

To specify whether an address is on a protected network, use the **ip audit po protected** global configuration command. To remove network addresses from the protected network list, use the **no** form of this command. If you specify an IP address for removal, that address is removed from the list. If you do not specify an address, then all IP addresses are removed from the list.

ip audit po protected *ip-addr* [**to** *ip-addr*]

no ip audit po protected [*ip-addr*]

Syntax Description

to	(Optional) Specifies a range of IP addresses.
ip-addr	IP address of a network host.

Defaults

If no addresses are defined as protected, then all addresses are considered outside the protected network.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

You can enter a single address at a time or a range of addresses at a time. You can also make as many entries to the protected networks list as you want. When an attack is detected, the corresponding event contains a flag that denotes whether the source and/or destination of the packet belongs to a protected network or not.

Examples

In the following example, a range of addresses is added to the protected network list:

```
ip audit po protected 10.1.1.0 to 10.1.1.255
```

In the following example, three individual addresses are added to the protected network list:

```
ip audit po protected 10.4.1.1
ip audit po protected 10.4.1.8
ip audit po protected 10.4.1.25
```

In the following example, an address is removed from the protected network list:

```
no ip audit po protected 10.4.1.1
```

ip audit po remote

To specify one or more set of Post Office parameters for NetRanger Directors receiving event notifications from the router, use the **ip audit po remote** global configuration command. To remove a NetRanger Director's Post Office parameters as defined by host ID, organization ID, and IP address, use the **no** form of this command.

ip audit po remote hostid *host-id* **orgid** *org-id* **rmtaddress** *ip-address* **localaddress** *ip-address* [**port** *port-number*] [**preference** *preference-number*] [**timeout** *seconds*] [**application** {**director** | **logger**}]

no ip audit po remote hostid *host-id* **orgid** *org-id* **rmtaddress** *ip-address*

Syntax Description

host-id	Unique integer in the range from 1 to 65535 used in NetRanger communications to identify the local host. Use with the **hostid** keyword.
hostid	Specifies a NetRanger host ID.
org-id	Unique integer in the range from 1 to 65535 used in NetRanger communications to identify the group in which the local host belongs. Use with the **orgid** keyword.
orgid	Specifies a NetRanger organization ID.
rmtaddress	Specifies the IP address of the NetRanger Director.
localaddress	Specifies the IP address of the Cisco IOS Firewall IDS router.
ip-address	IP address of the NetRanger Director or Cisco IOS Firewall IDS router's interface. Use with the **rmtaddress** and **localaddress** keywords.
port-number	(Optional) Integer representing the UDP port on which the NetRanger Director is listening for event notifications. Use with the **port** keyword.
port	(Optional) Specifies a User Datagram Protocol port through which to send messages.
preference	(Optional) Specifies a route preference for communication.
preference-number	(Optional) Integer representing the relative priority of a route to a NetRanger Director, if more than one route exists. Use with the **preference** keyword.
seconds	(Optional) Integer representing the heartbeat timeout value for Post Office communications. Use with the **timeout** keyword.
timeout	(Optional) Specifies a timeout value for Post Office communications.
application	(Optional) Specifies the type of application that is receiving the Cisco IOS Firewall IDS messages.
director	(Optional) Specifies that the receiving application is the NetRanger Director interface.
logger	(Optional) Specifies that the receiving application is a NetRanger Sensor.

Defaults

The default organization ID is 1.

The default host ID is 1.

The default UDP port number is 45000.

The default preference is 1.

The default heartbeat timeout is 5 seconds.

The default application is **director**.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

A router can report to more than one NetRanger Director. In this case, use the **ip audit po remote** command to add each NetRanger Director to which the router sends notifications.

More than one route can be established to the same NetRanger Director. In this case, you must give each route a preference number that establishes the relative priority of routes. The router always attempts to use the lowest numbered route, switching automatically to the next higher number when a route fails, and then switching back when the route begins functioning again.

A router can also report to a NetRanger Sensor. In this case, use the **ip audit po remote** command and specify **logger** as the application.

Examples

In the following example, two communication routes for the same dual-homed NetRanger Director are defined:

```
ip audit po remote hostid 30 orgid 500 rmtaddress 10.1.99.100 localaddress 10.1.99.1
preference 1
ip audit po remote hostid 30 orgid 500 rmtaddress 10.1.4.30 localaddress 10.1.4.1
preference 2
```

The router uses the first entry to establish communication with the NetRanger Director defined with host ID 30 and organization ID 500. If this route fails, then the router will switch to the secondary communications route. As soon as the first route begins functioning again, the router switches back to the primary route and closes the secondary route.

In the following example, a different Director is assigned a longer heartbeat timeout value because of network congestion, and is designated as a logger application:

```
ip audit po remote hostid 70 orgid 500 rmtaddress 10.1.8.1 localaddress 10.1.8.100 timeout
10 application director
```

ip audit signature

To attach a policy to a signature, use the **ip audit signature** global configuration command. You can set two policies: disable a signature or qualify the audit of a signature with an access list. To remove the policy, use the **no** form of this command. If the policy disabled a signature, then the **no** form of this command reenables the signature. If the policy attached an access list to the signature, the **no** form of this command removes the access list.

ip audit signature *signature-id* {**disable** | **list** *acl-list*}

no ip audit signature *signature-id*

Syntax Description

signature-id	Unique integer specifying a signature as defined in the NetRanger Network Security Database.
disable	Disables the ACL associated with the signature.
list	Specifies an ACL to associate with the signature.
acl-list	Unique integer specifying a configured ACL on the router. Use with the **list** keyword.

Defaults

No policy is attached to a signature.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

This command is mostly used to disable the auditing of a signature or to exclude some hosts or network segments from being audited.

If you are attaching an access control list to a signature, then you also need to create an audit rule with the **ip audit name** command and apply it to an interface with the **ip audit** command.

Examples

In the following example, a signature is disabled, another signature has ACL 99 attached to it, and ACL 99 is defined:

```
ip audit signature 6150 disable
ip audit signature 1000 list 99

access-list 99 deny 10.1.10.0 0.0.0.255
access-list 99 permit any
```

ip audit smtp

To specify the number of recipients in a mail message over which a spam attack is suspected, use the **ip audit smtp** global configuration command. To set the number of recipients to the default setting, use the **no** form of this command.

ip audit smtp spam *number-of-recipients*

no ip audit smtp spam

Syntax Description

spam	Specifies a threshold beyond which the Cisco IOS Firewall IDS alarms on spam e-mail.
number-of-recipients	Integer in the range of 1–65535 that designates the maximum number of recipients in a mail message before a spam attack is suspected. Use with the **spam** keyword. The default is 250 recipients.l

Defaults

The default number of recipients is 250.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip audit smtp** global configuration command to specify the number of recipients in a mail message over which a spam attack is suspected.

Examples

In the following example, the number of recipients is set to 300:

```
ip audit smtp spam 300
```

show ip audit configuration

To display additional configuration information, including default values that may not be displayed using the **show run** command, use the **show ip audit configuration** EXEC command.

show ip audit configuration

Syntax Description

This command has no argument or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **show ip audit configuration** EXEC command to display additional configuration information, including default values that may not be displayed using the **show run** command.

Examples

The following example displays the output of the **show ip audit configuration** command:

```
Event notification through syslog is enabled
Event notification through Net Director is enabled
Default action(s) for info signatures is alarm
Default action(s) for attack signatures is alarm
Default threshold of recipients for spam signature is 25
PostOffice:HostID:5 OrgID:100 Addr:10.2.7.3 Msg dropped:0
HID:1000 OID:100 S:218 A:3 H:14092 HA:7118 DA:0 R:0
    CID:1 IP:172.21.160.20 P:45000 S:ESTAB (Curr Conn)

Audit Rule Configuration
 Audit name AUDIT.1
    info actions alarm
```

Related Commands

Command	Description
clear ip audit statistics	Resets statistics on packets analyzed and alarms sent.

show ip audit interface

To display the interface configuration, use the **show ip audit interface** EXEC command.

show ip audit interface

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **show ip audit interface** EXEC command to display the interface configuration.

Examples

The following example displays the output of the **show ip audit interface** command:

```
Interface Configuration
 Interface Ethernet0
  Inbound IDS audit rule is AUDIT.1
    info actions alarm
  Outgoing IDS audit rule is not set
 Interface Ethernet1
  Inbound IDS audit rule is AUDIT.1
    info actions alarm
  Outgoing IDS audit rule is AUDIT.1
    info actions alarm
```

show ip audit statistics

To display the number of packets audited and the number of alarms sent, among other information, use the **show ip audit statistics** EXEC command.

show ip audit statistics

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **show ip audit statistics** EXEC command to display the number of packets audited and the number of alarms sent, among other information.

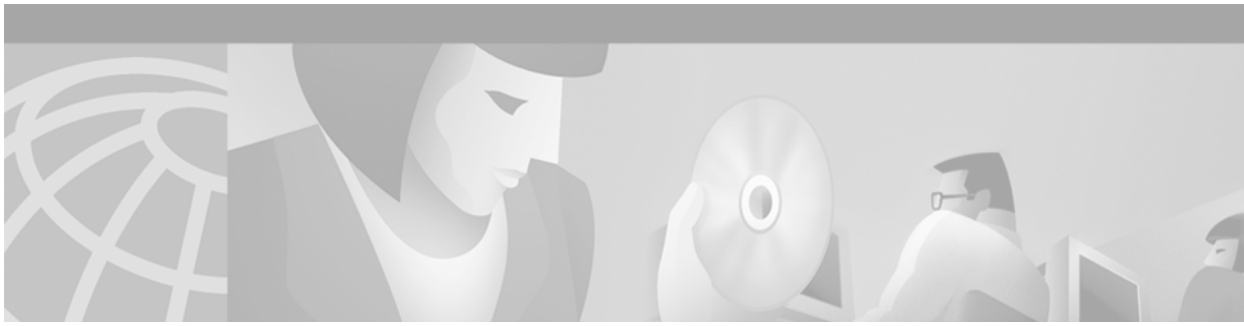
Examples

The following displays the output of the **show ip audit statistics** command:

```
Signature audit statistics [process switch:fast switch]
  signature 2000 packets audited: [0:2]
  signature 2001 packets audited: [9:9]
  signature 2004 packets audited: [0:2]
  signature 3151 packets audited: [0:12]
Interfaces configured for audit 2
Session creations since subsystem startup or last reset 11
Current session counts (estab/half-open/terminating) [0:0:0]
Maxever session counts (estab/half-open/terminating) [2:1:0]
Last session created 19:18:27
Last statistic reset never

HID:1000 OID:100 S:218 A:3 H:14085 HA:7114 DA:0 R:0
```

Related Commands

Command	Description
clear ip audit statistics	Resets statistics on packets analyzed and alarms sent.



Authentication Proxy Commands

This chapter describes the commands used to configure authentication proxy. The Cisco IOS Firewall authentication proxy feature allows network administrators to apply specific security policies on a per-user basis. Without authentication proxy, user identity and related authorized access was associated with a user's IP address, or a single security policy had to be applied to an entire user group or subnet. Configuring authentication proxy enables users to be identified and authorized on the basis of their per-user policy; access privileges tailored on an individual basis are possible, as opposed to general policy applied across multiple users.

With the authentication proxy feature, users can log in to the network or access the Internet via HTTP, and their specific access profiles are automatically retrieved and applied from a CiscoSecure ACS or other RADIUS or TACACS+ authentication server. The user profiles are active only when there is active traffic from the authenticated users.

For information on how to configure authentication proxy, refer to the "Configuring Authentication Proxy" chapter in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the "Authentication Proxy Configuration Examples" section located at the end of the "Configuring Authentication Proxy" chapter in the *Cisco IOS Security Configuration Guide*.

clear ip auth-proxy cache

To clear authentication proxy entries from the router, use the **clear ip auth-proxy cache** command in EXEC mode.

clear ip auth-proxy cache {***** | *host-ip-address*}

Syntax Description

*	Clears all authentication proxy entries, including user profiles and dynamic access lists.
host-ip-address	Clears the authentication proxy entry, including user profiles and dynamic access lists, for the specified host.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command to clear entries from the translation table before they time out.

Examples

The following example deletes all authentication proxy entries:

```
clear ip auth-proxy cache *
```

The following example deletes the authentication proxy entry for the host with IP address 192.168.4.5:

```
clear ip auth-proxy cache 192.168.4.5
```

Related Commands

Command	Description
show ip auth-proxy	Displays the authentication proxy entries or the running authentication proxy configuration.

ip auth-proxy

To set the authentication proxy idle timeout value (the length of time an authentication cache entry, along with its associated dynamic user access control list, is managed after a period of inactivity), use the **ip auth-proxy** command in global configuration mode. To set the default value, use the **no** form of this command.

ip auth-proxy auth-cache-time *min*

no ip auth-proxy auth-cache-time

Syntax Description

auth-cache-time *min*	Specifies the length of time in minutes that an authentication cache entry, along with its associated dynamic user ACL, is managed after a period of inactivity. Enter a value in the range 1 to 2,147,483,647. The default value is 60 minutes.

Defaults

60 minutes

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command to set the global idle timeout value for the authentication proxy. You must set the **auth-cache-time** timeout *min* option to a higher value than the idle timeout of any Context-based Access Control (CBAC) protocols. Otherwise, when the authentication proxy removes the user profile along associated dynamic user ACLs, there might be some idle connections monitored by CBAC. Removing these user-specific ACLs could cause those idle connections to hang. If the CBAC idle timeout value is shorter, CBAC resets these connections when the CBAC idle timeout expires, which is before the authentication proxy removes the user profile.

Examples

The following example sets the authorization cache timeout to 30 minutes:

```
ip auth-proxy auth-cache-time 30
```

Related Commands

Command	Description
ip auth-proxy name	Creates an authentication proxy rule.
show ip auth-proxy	Displays the authentication proxy entries or the running authentication proxy configuration.

ip auth-proxy (interface configuration)

To apply an authentication proxy rule at a firewall interface, use the **ip auth-proxy** command in interface configuration mode. To remove the authentication proxy rules, use the **no** form of this command.

ip auth-proxy *auth-proxy-name*

no ip auth-proxy *auth-proxy-name*

Syntax Description

auth-proxy-name	Specifies the name of the authentication proxy rule to apply to the interface configuration. The authentication proxy rule is established with the **ip auth-proxy name** command.

Defaults

No default behavior or values.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **ip auth-proxy** command to enable the named authentication proxy rule at the firewall interface. Traffic passing through the interface from hosts with an IP address matching the standard access list and protocol type (HTTP) is intercepted for authentication if no corresponding authentication cache entry exists. If no access list is defined, the authentication proxy intercepts traffic from all hosts whose connection initiating packets are received at the configured interface.

Use the **no** form of this command with a rule name to disable the authentication proxy for a given rule on a specific interface. If a rule is not specified, the **no** form of this command disables the authentication proxy on the interface.

Examples

The following example configures interface Ethernet0 with the HQ_users rule:

```
interface e0
    ip address 172.21.127.210 255.255.255.0
    ip access-group 111 in
    ip auth-proxy HQ_users
    ip nat inside
```

Related Commands

Command	Description
ip auth-proxy name	Creates an authentication proxy rule.

ip auth-proxy auth-proxy-banner

To display a banner, such as the router name, in the authentication proxy login page, use the **ip auth-proxy auth-proxy-banner** command in global configuration mode. To disable display of the banner, use the **no** form of this command.

ip auth-proxy auth-proxy-banner [*banner-text*]

no ip auth-proxy auth-proxy-banner [*banner-text*]

Syntax Description

banner-text	(Optional) Specifies a text string to replace the default banner, which is the name of the router. The text string should be written in the following format: "C banner-text C," where "C" is a delimiting character.

Defaults

This command is not enabled, and a banner is not displayed on the authentication proxy login page.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The **ip auth-proxy auth-proxy-banner** command allows users to configure one of two possible options:

- The **ip auth-proxy auth-proxy-banner** command is enabled.

  In this scenario, the administrator has not supplied any text. Thus, a default banner that states the following: "Cisco Systems, <router's hostname> Authentication" will be displayed in the authentication proxy login page. This scenario is most commonly used.

- The **ip auth-proxy auth-proxy-banner** command with the *banner-text* argument is enabled.

  In this scenario, the administrator can supply multiline text that will be converted to HTML by the auth-proxy parser code. Thus, *only* the multiline text will displayed in the authentication proxy login page. You will *not* see the default banner, "Cisco Systems, <router's hostname> Authentication."

Note If the **ip auth-proxy auth-proxy-banner** command is not enabled, there will not be any banner configuration. Thus, nothing will be displayed to the user on the authentication proxy login page except a text box to enter the username and a text box to enter the password.

Examples

The following example causes the router name to be displayed in the authentication proxy login page:

```
ip auth-proxy auth-proxy-banner
```

The following example shows how to specify the custom banner “whozat” to be displayed in the authentication proxy login page:

```
ip auth-proxy auth-proxy-banner ^Cwhozat^C
```

Related Commands

Command	Description
ip auth-proxy name	Creates an authentication proxy rule.

ip auth-proxy name

To create an authentication proxy rule, use the **ip auth-proxy name** command in global configuration mode. To remove the authentication proxy rules, use the **no** form of this command.

ip auth-proxy name *auth-proxy-name* **http** [**list** {*acl* | *acl-name*}] [**auth-cache-time** *min*]

no ip auth-proxy name *auth-proxy-name*

Syntax Description

auth-proxy-name	Associates a name with an authentication proxy rule. Enter a name of up to 16 alphanumeric characters.
http	Specifies the protocol that triggers the authentication proxy. The only supported protocol is HTTP.
list {*acl* | *acl-name*}	(Optional) Specifies a standard (1-99), extended (1-199), or named access list to use with the authentication proxy. With this option, the authentication proxy is applied only to those hosts in the access list. If no list is specified, all connections initiating HTTP traffic arriving at the interface are subject to authentication.
auth-cache-time *min*	(Optional) Overrides the global authentication proxy cache timer for a specific authentication proxy name, offering more control over timeout values. Enter a value in the range 1 to 2,147,483,647. The default value is equal to the value set with the **ip auth-proxy auth-cache-time** command.

Defaults

The default value is equal to the value set with the **ip auth-proxy auth-cache-time** command.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.2	Support for named and extend access lists was introduced.

Usage Guidelines

This command creates a named authentication proxy rule, and it allows you to associate that rule with an access control list (ACL), providing control over which hosts use the authentication proxy. The rule is applied to an interface on a router using the **ip auth-proxy** command.

Use the **auth-cache-time** option to override the global the authentication proxy cache timer. This option provides control over timeout values for specific authentication proxy rules. The authentication proxy cache timer monitors the length of time (in minutes) that an authentication cache entry, along with its associated dynamic user access control list, is managed after a period of inactivity. When that period of inactivity (idle time) expires, the authentication entry and the associated dynamic access lists are deleted.

Use the **list** option to associate a set of specific IP addresses or a named ACL with the **ip auth-proxy name** command.

Use the **no** form of this command with a rule name to remove the authentication proxy rules. If no rule is specified, the **no** form of this command removes all the authentication rules on the router, and disables the proxy at all interfaces.

Note You must use the **aaa authorization auth-proxy** command together with the **ip auth-proxy name** command. Together these commands set up the authorization policy to be retrieved by the firewall. Refer to the **aaa authorization auth-proxy** command for more information.

Examples

The following example creates the HQ_users authentication proxy rule. Because an access list is not specified in the rule, all connection-initiating HTTP traffic is subjected to authentication.

```
ip auth-proxy name HQ_users http
```

The following example creates the Mfg_users authentication proxy rule and applies it to hosts specified in ACL 10:

```
access-list 10 192.168.7.0 0.0.0.255
ip auth-proxy name Mfg_users http list 10
```

The following example sets the timeout value for Mfg_users to 30 minutes:

```
access-list 15 any
ip auth-proxy name Mfg_users http auth-cache-time 30 list 15
```

The following example disables the Mfg_users rule:

```
no ip auth-proxy name Mfg_users
```

The following example disables the authentication proxy at all interfaces and removes all the rules from the router configuration:

```
no ip auth-proxy
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict network access to a user.
ip auth-proxy	Sets the authentication proxy idle timeout value (the length of time an authentication cache entry, along with its associated dynamic user ACL, is managed after a period of inactivity).
ip auth-proxy (interface configuration)	Applies an authentication proxy rule at a firewall interface.
show ip auth-proxy	Displays the authentication proxy entries or the running authentication proxy configuration.

show ip auth-proxy

To display the authentication proxy entries or the running authentication proxy configuration, use the **show ip auth-proxy** command in privileged EXEC mode.

show ip auth-proxy {**cache** | **configuration**}

Syntax Description

cache	Display the current list of the authentication proxy entries.
configuration	Display the running authentication proxy configuration.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use the **show ip auth-proxy** to display either the authentication proxy entries or the running authentication proxy configuration. Use the **cache** keyword to list the host IP address, the source port number, the timeout value for the authentication proxy, and the state for connections using authentication proxy. If authentication proxy state is HTTP_ESTAB, the user authentication was successful.

Use the **configuration** keyword to display all authentication proxy rules configured on the router.

Examples

The following example shows sample output from the **show ip auth-proxy cache** command after one user authentication using the authentication proxy:

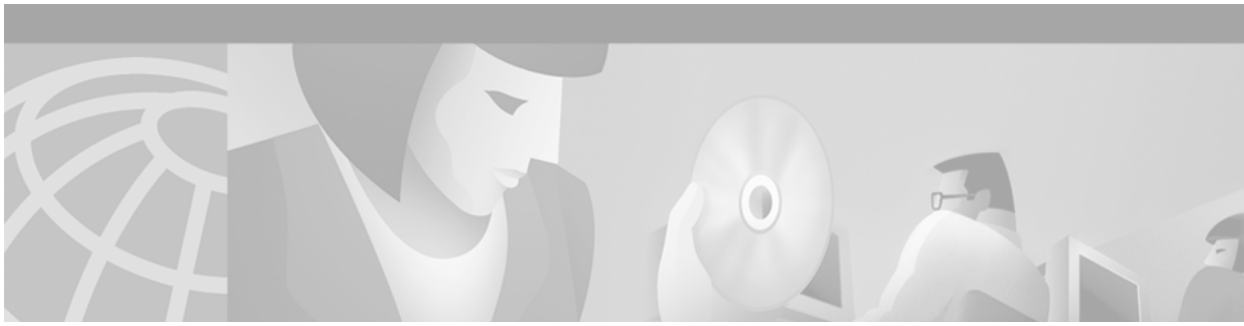
```
Router# show ip auth-proxy cache

Authentication Proxy Cache
    Client IP 192.168.25.215 Port 57882, timeout 1, state HTTP_ESTAB
```

The following example shows how the **show ip auth-proxy configuration** command displays the information about the authentication proxy rule **pxy**. The global idle timeout value is 60 minutes. The idle timeouts value for this named rule is 30 minutes. No host list is specified in the rule, meaning that all connection initiating HTTP traffic at the interface is subject to the authentication proxy rule.

```
Router# show ip auth-proxy configuration

Authentication cache time is 60 minutes
Authentication Proxy Rule Configuration
Auth-proxy name pxy
http list not specified auth-cache-time 30 minutes
```

Related Commands

Command	Description
clear ip auth-proxy cache	Clears authentication proxy entries from the router.
ip auth-proxy	Sets the authentication proxy idle timeout value (the length of time an authentication cache entry, along with its associated dynamic user ACL, is managed after a period of inactivity).
ip auth-proxy (interface configuration)	Applies an authentication proxy rule at a firewall interface.
ip auth-proxy name	Creates an authentication proxy rule.



Port to Application Mapping Commands

This chapter describes the commands used to configure Port to Application Mapping (PAM). PAM allows you to customize TCP or User Datagram Protocol (UDP) port numbers for network services or applications. PAM uses this information to support network environments that run services using ports that are different from the registered or well-known ports associated with an application.

For information on how to configure PAM, refer to the "Configuring Port to Application Mapping" chapter in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the "PAM Configuration Examples" section located at the end of the "Configuring Port to Application Mapping" chapter in the *Cisco IOS Security Configuration Guide*.

ip port-map

To establish Port to Application Mapping (PAM), use the **ip port-map** global configuration command. To delete user-defined PAM entries, use the **no** form of this command.

ip port-map *appl_name* **port** *port_num* [**list** *acl_num*]

no ip port-map *appl_name* **port** *port_num* [**list** *acl_num*]

Syntax Description

appl_name	Specifies the name of the application with which to apply the port mapping.
port	Indicates that a port number maps to the application.
port_num	Identifies a port number in the range 1 to 65535.
list	(Optional) Indicates that the port mapping information applies to a specific host or subnet.
acl_num	(Optional) Identifies the standard access control list (ACL) number used with PAM.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The **ip port-map** command associates TCP or User Datagram Protocol port numbers with applications or services, establishing a table of default port mapping information at the firewall. This information is used to support network environments that run services using ports that are different from the registered or well-known ports associated with a service or application.

The port mapping information in the PAM table is of one of three types:

- System-defined
- User-defined
- Host-specific

System-Defined Port Mapping

Initially, PAM creates a set of system-defined entries in the mapping table using well-known or registered port mapping information set up during the system start-up. The Cisco IOS Firewall Context-based Access Control feature requires the system-defined mapping information to function properly. System-defined mapping information cannot be deleted or changed; that is, you cannot map HTTP services to port 21 (FTP) or FTP services to port 80 (HTTP).

Table 22 lists the default system-defined services and applications in the PAM table.

Table 22 System-Defined Port Mapping

Application Name	Well-Known or Registered Port Number	Protocol Description
cuseeme	7648	CU-SeeMe Protocol
exec	512	Remote Process Execution
ftp	21	File Transfer Protocol (control port)
http	80	Hypertext Transfer Protocol
h323	1720	H.323 Protocol (for example, MS NetMeeting, Intel Video Phone)
login	513	Remote login
msrpc	135	Microsoft Remote Procedure Call
netshow	1755	Microsoft NetShow
real-audio-video	7070	RealAudio and RealVideo
smtp	25	Simple Mail Transfer Protocol
sql-net	1521	SQL-NET
streamworks	1558	StreamWorks Protocol
sunrpc	111	SUN Remote Procedure Call
tftp	69	Trivial File Transfer Protocol
vdolive	7000	VDOLive Protocol

Note You can override the system-defined entries for a specific host or subnet using the **list** option in the **ip port-map** command.

User-Defined Port Mapping

Network applications that use non-standard ports require user-defined entries in the mapping table. Use the **ip port-map** command to create default user-defined entries in the PAM table.

To map a range of port numbers with a service or application, you must create a separate entry for each port number.

Note If you try to map an application to a system-defined port, a message appears warning you of a mapping conflict.

Use the **no** form of the **ip port-map** command to delete user-defined entries from the PAM table.

To overwrite an existing user-defined port mapping, use the **ip port-map** command to associate another service or application with the specific port.

Host-Specific Port Mapping

User-defined entries in the mapping table can include host-specific mapping information, which establishes port mapping information for specific hosts or subnets. In some environments, it might be necessary to override the default port mapping information for a specific host or subnet, including a system-defined default port mapping information. Use the **list** option for the **ip port-map** command to specify an ACL for a host or subnet that uses PAM.

Note If the host-specific port mapping information is the same as existing system-defined or user-defined default entries, host-specific port changes have no effect.

Examples

The following example provides examples for adding and removing user-defined PAM configuration entries at the firewall.

In the following example, non-standard port 8000 is established as the user-defined default port for HTTP services:

```
ip port-map http port 8000
```

The following example shows PAM entries establish a range of non-standard ports for HTTP services:

```
ip port-map http 8001
ip port-map http 8002
ip port-map http 8003
ip port-map http 8004
```

In the following example the command fails because it tries to map port 21, which is the system-defined default port for FTP, with HTTP:

```
ip port-map http port 21
```

In the following example, a specific host uses port 8000 for FTP services. ACL 10 identifies the server address (192.168.32.43), while port 8000 is mapped with FTP services:

```
access-list 10 permit 192.168.32.43
ip port-map ftp port 8000 list 10
```

In the following example, port 21, which is normally reserved for FTP services, is mapped to the RealAudio application for the hosts in list 10. In this configuration, hosts in list 10 do not recognize FTP activity on port 21.

```
ip port-map realaudio port 21 list 10
```

In the following example, the **ip port-map** command fails and generates an error message:

```
ip port-map netshow port 21
Command fail: the port 21 has already been defined for ftp by the system.
              No change can be made to the system defined port mappings.
```

The **no** form of this command deletes user-defined entries from the PAM table. It has no effect on the system-defined port mappings. This command deletes the host-specific port mapping of FTP.

```
no ip port-map ftp port 1022 list 10
```

In the following example, the command fails because it tries to delete the system-defined default port for HTTP:

```
no ip port-map http port 80
```

In the following example, a specific host uses port 8000 for FTP services. ACL 10 identifies the server address (192.168.32.43), while port 8000 is mapped with FTP services.

```
access-list 10 permit 192.168.32.43
ip port-map ftp port 8000 list 10
```

In the following example, a specific subnet runs HTTP services on port 8080. ACL 50 identifies the subnet, while the PAM entry maps port 8080 with HTTP services.

```
access-list 50 permit 192.168.92.0
ip port-map http 8080 list 50
```

In the following example, a specific host runs HTTP services on port 25, which is the system-defined port number for SMTP services. This requires a host-specific PAM entry that overrides the system-defined default port mapping for HTTP, which is port 80. ACL 15 identifies the host address (192.168.33.43), while port 25 is mapped with HTTP services.

```
access-list 15 permit 192.168.33.43
ip port-map http port 25 list 15
```

In the following example, the same port number is required by different services running on different hosts. Port 8000 is required for HTTP services by host 192.168.3.4, while port 8000 is required for Telnet services by host 192.168.5.6. ACL 10 and ACL 20 identify the specific hosts, while PAM maps the ports with the services for each ACL.

```
access-list 10 permit 192.168.3.4
access-list 20 permit 192.168.5.6
ip port-map http port 8000 list 10
ip port-map http ftp 8000 list 20
```

Related Commands

Command	Description
show ip port-map	Displays the PAM information.

show ip port-map

To display the Port to Application Mapping (PAM) information, use the **show ip port-map** privileged EXEC command.

show ip port-map [*appl_name* | **port** *port_num*]

Syntax Description

appl_name	(Optional) Specifies the name of the application to which to apply the port mapping.
port *port_num*	(Optional) Specifies the alternative port number that maps to the application.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command to display the port mapping information at the firewall, including the system-defined and user-defined information. Include the application name to display the list of entries by application. Include the port number to display the entries by port.

Examples

The following is sample output for the **show ip port-map** command, including system-defined mapping information:

```
Router# show ip port-map

Default mapping: vdolive          port 7000               system defined
Default mapping: sunrpc           port 111                system defined
Default mapping: netshow          port 1755               system defined
Default mapping: cuseeme          port 7648               system defined
Default mapping: tftp             port 69                 system defined
Default mapping: real-audio-video port 7070               system defined
Default mapping: streamworks      port 1558               system defined
Default mapping: ftp              port 21                 system defined
Default mapping: h323             port 1720               system defined
Default mapping: smtp             port 25                 system defined
Default mapping: http             port 80                 system defined
Default mapping: msrpc            port 135                system defined
Default mapping: exec             port 512                system defined
Default mapping: login            port 513                system defined
Default mapping: sql-net          port 1521               system defined
Default mapping: tftp             port 70                 user defined
Host specific:   ftp              port 1000   in list 10  user defined
Host specific:   netshow          port 70     in list 10  user defined
Host specific:   smtp             port 70     in list 50  user defined
```

The following example shows the port mapping information for file transfer protocol services:

```
show ip port-map ftp
Default mapping: ftp              port 21                 system defined
Host specific:   ftp              port 1000   in list 10  user defined
```

The following example shows the ports associated with the NetShow application, including both the default and host-specific port mapping information:

```
show ip port-map netshow
Default mapping: netshow          port 1755               system defined
Host specific:   netshow          port 21     in list 10  user defined
```

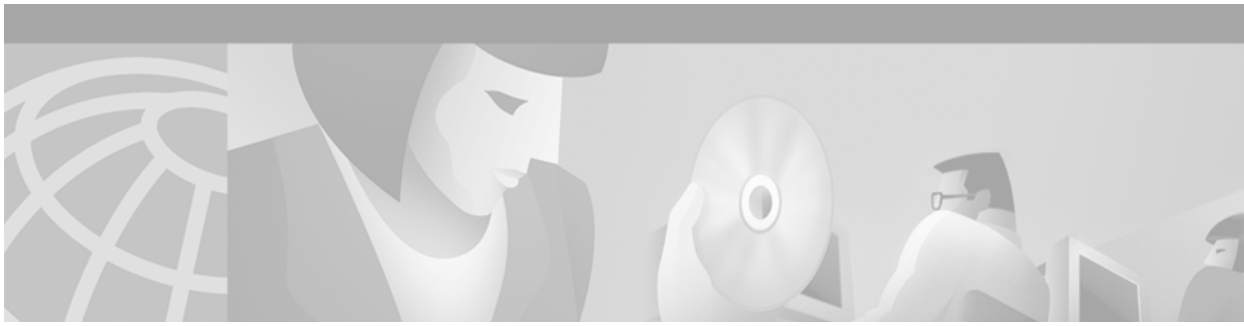
The following example shows the applications associated with port 69, including both the default and host-specific port mapping information:

```
show ip port-map port 69
Default mapping: tftp             port 69                 user defined
Host specific:   netshow          port 69     in list 50  user defined
Host specific:   smtp             port 69     in list 10  user defined
```

Related Commands

Command	Description
ip port-map	Establishes PAM.

IP Security and Encryption



IPSec Network Security Commands

This chapter describes IP Security (IPSec) network security commands. IPSec provides security for transmission of sensitive information over unprotected networks such as the Internet. IPSec provides a robust security solution and is standards-based. IPSec provides data authentication and anti-replay services in addition to data confidentiality services.

For configuration information, refer to the chapter “Configuring IPSec Network Security” in the *Cisco IOS Security Configuration Guide.*

clear crypto sa

To delete IP Security security associations, use the **clear crypto sa** EXEC command.

clear crypto sa

clear crypto sa peer {*ip-address* | *peer-name*}

clear crypto sa map *map-name*

clear crypto sa entry *destination-address protocol spi*

clear crypto sa counters

Syntax Description

peer	Deletes any IPSec security associations for the specified peer.
ip-address	Specifies a remote peer's IP address.
peer-name	Specifies a remote peer's name as the fully qualified domain name, for example remotepeer.example.com.
map	Deletes any IPSec security associations for the named crypto map set.
map-name	Specifies the name of a crypto map set.
entry	Deletes the IPSec security association with the specified address, protocol, and SPI.
destination-address	Specifies the IP address of your peer or the remote peer.
protocol	Specifies either the Encapsulation Security Protocol or Authentication Header.
spi	Specifies an SPI (found by displaying the security association database).
counters	Clears the traffic counters maintained for each security association; **counters** does not clear the security associations themselves.

Defaults

If the **peer**, **map**, **entry**, or **counters** keyword is not used, all IPSec security associations are deleted.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command clears (deletes) IPSec security associations.

If the security associations were established via Internet Key Exchange, they are deleted and future IPSec traffic will require new security associations to be negotiated. (When IKE is used, the IPSec security associations are established only when needed.)

If the security associations are manually established, the security associations are deleted and reinstalled. (When IKE is not used, the IPSec security associations are created as soon as the configuration is completed.)

If **peer**, **map**, **entry**, or **counters** keywords are not used, all IPSec security associations will be deleted.

- The **peer** keyword deletes any IPSec security associations for the specified peer.
- The **map** keyword deletes any IPSec security associations for the named crypto map set.
- The **entry** keyword deletes the IPSec security association with the specified address, protocol, and SPI.

If any of the above commands cause a particular security association to be deleted, all the "sibling" security associations—that were established during the same IKE negotiation—are deleted as well.

The **counters** keyword simply clears the traffic counters maintained for each security association; it does not clear the security associations themselves.

If you make configuration changes that affect security associations, these changes will not apply to existing security associations but to negotiations for subsequent security associations. You can use the **clear crypto sa** command to restart all security associations so they will use the most current configuration settings. In the case of manually established security associations, if you make changes that affect security associations you must use the **clear crypto sa** command before the changes take effect.

If the router is processing active IPSec traffic, it is suggested that you only clear the portion of the security association database that is affected by the changes, to avoid causing active IPSec traffic to temporarily fail.

Note that this command only clears IPSec security associations; to clear IKE state, use the **clear crypto isakmp** command.

Examples

The following example clears (and reinitializes if appropriate) all IPSec security associations at the router:

```
clear crypto sa
```

The following example clears (and reinitializes if appropriate) the inbound and outbound IPSec security associations established along with the security association established for address 10.0.0.1 using the AH protocol with the SPI of 256:

```
clear crypto sa entry 10.0.0.1 AH 256
```

Related Commands

Command	Description
clear crypto isakmp	Clears active IKE connections.

crypto dynamic-map

To create a dynamic crypto map entry and enter the crypto map configuration command mode, use the **crypto dynamic-map** global configuration command. To delete a dynamic crypto map set or entry, use the **no** form of this command.

crypto dynamic-map *dynamic-map-name dynamic-seq-num*

no crypto dynamic-map *dynamic-map-name* [*dynamic-seq-num*]

Syntax Description

dynamic-map-name	Specifies the name of the dynamic crypto map set.
dynamic-seq-num	Specifies the number of the dynamic crypto map entry.

Defaults

No dynamic crypto maps exist.

Command Modes

Global configuration. Using this command puts you into crypto map configuration mode.

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use dynamic crypto maps to create policy templates that can be used when processing negotiation requests for new security associations from a remote IP Security peer, even if you do not know all of the crypto map parameters required to communicate with the remote peer (such as the peer's IP address). For example, if you do not know about all the IPSec remote peers in your network, a dynamic crypto map allows you to accept requests for new security associations from previously unknown peers. (However, these requests are not processed until the Internet Key Exchange authentication has completed successfully.)

When a router receives a negotiation request via IKE from another IPSec peer, the request is examined to see if it matches a crypto map entry. If the negotiation does not match any explicit crypto map entry, it will be rejected unless the crypto map set includes a reference to a dynamic crypto map.

The dynamic crypto map is a policy template; it will accept "wildcard" parameters for any parameters not explicitly stated in the dynamic crypto map entry. This allows you to set up IPSec security associations with a previously unknown IPSec peer. (The peer still must specify matching values for the "non-wildcard" IPSec security association negotiation parameters.)

If the router accepts the peer's request, at the point that it installs the new IPSec security associations it also installs a temporary crypto map entry. This entry is filled in with the results of the negotiation. At this point, the router performs normal processing, using this temporary crypto map entry as a normal entry, even requesting new security associations if the current ones are expiring (based upon the policy specified in the temporary crypto map entry). Once the flow expires (that is, all of the corresponding security associations expire), the temporary crypto map entry is removed.

Dynamic crypto map sets are not used for initiating IPSec security associations. However, they are used for determining whether or not traffic should be protected.

The only configuration required in a dynamic crypto map is the **set transform-set** command. All other configuration is optional.

Dynamic crypto map entries, like regular static crypto map entries, are grouped into sets. After you define a dynamic crypto map set (which commonly contains only one map entry) using this command, you include the dynamic crypto map set in an entry of the "parent" crypto map set using the **crypto map** (IPSec global configuration) command. The parent crypto map set is then applied to an interface.

You should make crypto map entries referencing dynamic maps the lowest priority map entries, so that negotiations for security associations will try to match the static crypto map entries first. Only after the negotiation request does not match any of the static map entries do you want it to be evaluated against the dynamic map.

To make a dynamic crypto map the lowest priority map entry, give the map entry referencing the dynamic crypto map the highest *seq-num* of all the map entries in a crypto map set.

For both static and dynamic crypto maps, if unprotected inbound traffic matches a **permit** statement in an access list, and the corresponding crypto map entry is tagged as "IPSec," then the traffic is dropped because it is not IPSec-protected. (This is because the security policy as specified by the crypto map entry states that this traffic must be IPSec-protected.)

For static crypto map entries, if outbound traffic matches a **permit** statement in an access list and the corresponding security association (SA) is not yet established, the router will initiate new SAs with the remote peer. In the case of dynamic crypto map entries, if no SA existed, the traffic would simply be dropped (because dynamic crypto maps are not used for initiating new SAs).

Note Use care when using the **any** keyword in **permit** entries in dynamic crypto maps. If it is possible for the traffic covered by such a **permit** entry to include multicast or broadcast traffic, the access list should include **deny** entries for the appropriate address range. Access lists should also include **deny** entries for network and subnet broadcast traffic, and for any other traffic that should not be IPSec protected.

Examples

The following example configures an IPSec crypto map set.

Crypto map entry "mymap 30" references the dynamic crypto map set "mydynamicmap," which can be used to process inbound security association negotiation requests that do not match "mymap" entries 10 or 20. In this case, if the peer specifies a transform set that matches one of the transform sets specified in "mydynamicmap," for a flow "permitted" by the access list 103, IPSec will accept the request and set up security associations with the remote peer without previously knowing about the remote peer. If accepted, the resulting security associations (and temporary crypto map entry) are established according to the settings specified by the remote peer.

The access list associated with "mydynamicmap 10" is also used as a filter. Inbound packets that match a **permit** statement in this list are dropped for not being IPSec protected. (The same is true for access lists associated with static crypto maps entries.) Outbound packets that match a **permit** statement without an existing corresponding IPSec SA are also dropped.

```
crypto map mymap 10 ipsec-isakmp
 match address 101
 set transform-set my_t_set1
 set peer 10.0.0.1
 set peer 10.0.0.2
crypto map mymap 20 ipsec-isakmp
 match address 102
 set transform-set my_t_set1 my_t_set2
 set peer 10.0.0.3
```

```
crypto map mymap 30 ipsec-isakmp dynamic mydynamicmap
!
crypto dynamic-map mydynamicmap 10
 match address 103
 set transform-set my_t_set1 my_t_set2 my_t_set3
```

Related Commands

Command	Description
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set pfs	Specifies that IPSec should ask for perfect forward secrecy (PFS) when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations.
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto dynamic-map	Displays a dynamic crypto map set.
show crypto map (IPSec)	Displays the crypto map configuration.

crypto engine accelerator

To enable the IP Security (IPSec) accelerator, use the **crypto engine accelerator** command in global configuration mode. To disable the IPSec accelerator and perform IPSec encryption and decryption in the Cisco IOS software, use the **no** form of this command.

crypto engine accelerator [*slot*]

no crypto engine accelerator [*slot*]

Syntax Description

slot	(Optional) The slot number on the crypto engine.

Defaults

The hardware accelerator for IPSec encryption is enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced on the Cisco 1700 series and any other Cisco router that supports hardware accelerators for IPSec encryption.
12.1(3)XL	This command was implemented on the Cisco uBR905 cable access router.

Usage Guidelines

This command is normally not needed for typical operations because the hardware accelerator for IPSec encryption is enabled by default.

Note The hardware accelerator *should not* be disabled except on instruction from Cisco TAC personnel.

Examples

The following example disables the onboard hardware accelerator of the router. If IPSec encryption is configured, all current connections are brought down. Future encryption will be performed by the Cisco IOS software, which has the same functionality as the hardware accelerator, but performance is significantly slower.

```
Router(config)# no crypto engine accelerator

 Warning! all current connections will be torn down.
 Do you want to continue? [yes/no]: y
 ...Crypto accelerator in slot 0 disabled
 ...switching to SW IPsec crypto engine
```

Related Commands

Command	Description
show crypto engine accelerator sa-database	Displays active (in-use) entries in the platform-specific VPN module database.

crypto ipsec security-association lifetime

To change global lifetime values used when negotiating IPSec security associations, use the **crypto ipsec security-association lifetime** global configuration command. To reset a lifetime to the default value, use the **no** form of this command.

crypto ipsec security-association lifetime {**seconds** *seconds* | **kilobytes** *kilobytes*}

no crypto ipsec security-association lifetime {**seconds** | **kilobytes**}

Syntax Description

seconds *seconds*	Specifies the number of seconds a security association will live before expiring. The default is 3600 seconds (one hour).
kilobytes *kilobytes*	Specifies the volume of traffic (in kilobytes) that can pass between IPSec peers using a given security association before that security association expires. The default is 4,608,000 kilobytes.

Defaults

3600 seconds (one hour) and 4,608,000 kilobytes (10 megabits per second for one hour).

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

IPSec security associations use shared secret keys. These keys and their security associations time out together.

Assuming that the particular crypto map entry does not have lifetime values configured, when the router requests new security associations during security association negotiation, it will specify its global lifetime value in the request to the peer; it will use this value as the lifetime of the new security associations. When the router receives a negotiation request from the peer, it will use the smaller of the lifetime value proposed by the peer or the locally configured lifetime value as the lifetime of the new security associations.

There are two lifetimes: a “timed” lifetime and a “traffic-volume” lifetime. The security association expires after the first of these lifetimes is reached.

If you change a global lifetime, the change is only applied when the crypto map entry does not have a lifetime value specified. The change will not be applied to existing security associations, but will be used in subsequent negotiations to establish new security associations. If you want the new settings to take effect sooner, you can clear all or part of the security association database by using the **clear crypto sa** command. Refer to the **clear crypto sa** command for more details.

To change the global timed lifetime, use the **crypto ipsec security-association lifetime seconds** form of the command. The timed lifetime causes the security association to time out after the specified number of seconds have passed.

To change the global traffic-volume lifetime, use the **crypto ipsec security-association lifetime kilobytes** form of the command. The traffic-volume lifetime causes the security association to time out after the specified amount of traffic (in kilobytes) has been protected by the security associations' key.

Shorter lifetimes can make it harder to mount a successful key recovery attack, since the attacker has less data encrypted under the same key to work with. However, shorter lifetimes require more CPU processing time for establishing new security associations.

The lifetime values are ignored for manually established security associations (security associations installed using an **ipsec-manual** crypto map entry).

How These Lifetimes Work

The security association (and corresponding keys) will expire according to whichever occurs sooner, either after the number of seconds has passed (specified by the **seconds** keyword) or after the amount of traffic in kilobytes has passed (specified by the **kilobytes** keyword).

A new security association is negotiated *before* the lifetime threshold of the existing security association is reached, to ensure that a new security association is ready for use when the old one expires. The new security association is negotiated either 30 seconds before the **seconds** lifetime expires or when the volume of traffic through the tunnel reaches 256 kilobytes less than the **kilobytes** lifetime (whichever occurs first).

If no traffic has passed through the tunnel during the entire life of the security association, a new security association is not negotiated when the lifetime expires. Instead, a new security association will be negotiated only when IPSec sees another packet that should be protected.

Examples

The following example shortens both lifetimes, because the administrator feels there is a higher risk that the keys could be compromised. The timed lifetime is shortened to 2,700 seconds (45 minutes), and the traffic-volume lifetime is shortened to 2,304,000 kilobytes (10 megabits per second for one half hour).

```
crypto ipsec security-association lifetime seconds 2700
crypto ipsec security-association lifetime kilobytes 2304000
```

Related Commands

Command	Description
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.
show crypto ipsec security-association lifetime	Displays the security-association lifetime value configured for a particular crypto map entry.

crypto ipsec transform-set

To define a transform set—an acceptable combination of security protocols and algorithms—use the **crypto ipsec transform-set** global configuration command. To delete a transform set, use the **no** form of the command.

crypto ipsec transform-set *transform-set-name transform1* [*transform2* [*transform3*]]

no crypto ipsec transform-set *transform-set-name*

Syntax Description

transform-set-name	Specifies the name of the transform set to create (or modify).
transform1 *transform2* *transform3*	Specifies up to three "transforms." These transforms define the IPSec security protocols and algorithms. Accepted transform values are described in the "Usage Guidelines" section.

Defaults

No default behavior or values.

Command Modes

Global configuration. This command invokes the crypto transform configuration mode.

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

A transform set is an acceptable combination of security protocols, algorithms and other settings to apply to IP Security protected traffic. During the IPSec security association negotiation, the peers agree to use a particular transform set when protecting a particular data flow.

You can configure multiple transform sets, and then specify one or more of these transform sets in a crypto map entry. The transform set defined in the crypto map entry is used in the IPSec security association negotiation to protect the data flows specified by that crypto map entry's access list. During the negotiation, the peers search for a transform set that is the same at both peers. When such a transform set is found, it is selected and will be applied to the protected traffic as part of both peer's IPSec security associations.

When IKE is not used to establish security associations, a single transform set must be used. The transform set is not negotiated.

Before a transform set can be included in a crypto map entry it must be defined using this command.

A transform set specifies one or two IPSec security protocols (either Encapsulation Security Protocol or Authentication Header or both) and specifies which algorithms to use with the selected security protocol. The ESP and AH IPSec security protocols are described in the section "IPSec Protocols: Encapsulation Security Protocol and Authentication Header."

To define a transform set, you specify one to three "transforms"—each transform represents an IPSec security protocol (ESP or AH) plus the algorithm you want to use. When the particular transform set is used during negotiations for IPSec security associations, the entire transform set (the combination of protocols, algorithms, and other settings) must match a transform set at the remote peer.

In a transform set you could specify the AH protocol, the ESP protocol, or both. If you specify an ESP protocol in a transform set, you can specify just an ESP encryption transform or both an ESP encryption transform and an ESP authentication transform.

Table 23 lists the acceptable transform combination selections for the AH and ESP protocols.

Table 23 Allowed Transform Combinations

Transform type	Transform	Description
AH Transform *(Pick up to one.)*	**ah-md5-hmac**	AH with the MD5 (HMAC variant) authentication algorithm
	a**h-sha-hmac**	AH with the SHA (HMAC variant) authentication algorithm
	ah-sha-hmac	AH with the SHA (HMAC variant) authentication algorithm
ESP Encryption Transform *(Pick up to one.)*	e**sp-des**	ESP with the 56-bit DES encryption algorithm
	esp-3des	ESP with the 168-bit DES encryption algorithm (3DES or Triple DES)
	esp-null	Null encryption algorithm
ESP Authentication Transform *(Pick up to one.)*	**esp-md5-hmac**	ESP with the MD5 (HMAC variant) authentication algorithm
	esp-sha-hmac	ESP with the SHA (HMAC variant) authentication algorithm
IP Compression Transform *(Pick up to one.)*	**comp-lzs**	IP compression with the LZS algorithm.

Examples of acceptable transform combinations are:

- **ah-md5-hmac**
- **esp-des**
- **esp-3des** and **esp-md5-hmac**
- **ah-sha-hmac** and **esp-des** and **esp-sha-hmac**
- **comp-lzs**

The parser will prevent you from entering invalid combinations; for example, once you specify an AH transform it will not allow you to specify another AH transform for the current transform set.

IPSec Protocols: Encapsulation Security Protocol and Authentication Header

Both the Encapsulation Security Protocol (ESP) and Authentication Header (AH) protocols implement security services for IPSec.

ESP provides packet encryption and optional data authentication and anti-replay services.

AH provides data authentication and anti-replay services.

ESP encapsulates the protected data—either a full IP datagram (or only the payload)—with an ESP header and an ESP trailer. AH is embedded in the protected data; it inserts an AH header immediately after the outer IP header and before the inner IP datagram or payload. Traffic that originates and terminates at the IPSec peers can be sent in either tunnel or transport mode; all other traffic is sent in tunnel mode. Tunnel mode encapsulates and protects a full IP datagram, while transport mode encapsulates/protects the payload of an IP datagram. For more information about modes, see the **mode (IPSec)** command description.

Selecting Appropriate Transforms

The following tips may help you select transforms that are appropriate for your situation:

- If you want to provide data confidentiality, include an ESP encryption transform.
- If you want to ensure data authentication for the outer IP header as well as the data, include an AH transform. (Some consider the benefits of outer IP header data integrity to be debatable.)
- If you use an ESP encryption transform, also consider including an ESP authentication transform or an AH transform to provide authentication services for the transform set.
- If you want data authentication (either using ESP or AH) you can choose from the MD5 or SHA (HMAC keyed hash variants) authentication algorithms. The SHA algorithm is generally considered stronger than MD5, but is slower.
- Note that some transforms might not be supported by the IPSec peer.
- In cases where you need to specify an encryption transform but do not actually encrypt packets, you can use the **esp-null** transform.

Suggested transform combinations:

- **esp-des** and **esp-sha-hmac**
- **ah-sha-hmac** and **esp-des** and **esp-sha-hmac**

The Crypto Transform Configuration Mode

After you issue the **crypto ipsec transform-set** command, you are put into the crypto transform configuration mode. While in this mode, you can change the mode to tunnel or transport. (These are optional changes.) After you have made these changes, type **exit** to return to global configuration mode. For more information about these optional changes, see the **match address (IPSec)** and mode (IPSec) command descriptions.

Changing Existing Transforms

If one or more transforms are specified in the **crypto ipsec transform-set** command for an existing transform set, the specified transforms will replace the existing transforms for that transform set.

If you change a transform set definition, the change is only applied to crypto map entries that reference the transform set. The change will not be applied to existing security associations, but will be used in subsequent negotiations to establish new security associations. If you want the new settings to take effect sooner, you can clear all or part of the security association database by using the **clear crypto sa** command.

Examples

The following example defines two transform sets. The first transform set will be used with an IPSec peer that supports the newer ESP and AH protocols. The second transform set will be used with an IPSec peer that only supports the older transforms.

```
crypto ipsec transform-set newer esp-3des esp-sha-hmac
crypto ipsec transform-set older ah-rfc-1828 esp-rfc1829
```

Related Commands

Command	Description
mode (IPSec)	Changes the mode for a transform set.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto ipsec transform-set	Displays the configured transform sets.

crypto map (global IPSec)

To create or modify a crypto map entry and enter the crypto map configuration mode, use the **crypto map** global configuration command. To delete a crypto map entry or set, use the **no** form of this command.

crypto map *map-name seq-num* **ipsec-manual**

crypto map *map-name seq-num* **ipsec-isakmp** [**dynamic** *dynamic-map-name*] [**discover**]

no crypto map *map-name* [*seq-num*]

Note Issue the **crypto map** *map-name seq-num* command without a keyword to modify an existing crypto map entry.

Syntax Description

map-name	The name that identifies the crypto map set. This is the name assigned when the crypto map was created.
seq-num	The number you assign to the crypto map entry. See additional explanation for using this argument in the "Usage Guidelines" section.
ipsec-manual	Indicates that Internet Key Exchange will not be used to establish the IP Security security associations for protecting the traffic specified by this crypto map entry.
ipsec-isakmp	Indicates that IKE will be used to establish the IPSec security associations for protecting the traffic specified by this crypto map entry.
dynamic	(Optional) Specifies that this crypto map entry is to reference a preexisting dynamic crypto map. Dynamic crypto maps are policy templates used in processing negotiation requests from a peer IPSec device. If you use this keyword, none of the crypto map configuration commands will be available.
dynamic-map-name	(Optional) Specifies the name of the dynamic crypto map set that should be used as the policy template.
discover	(Optional) Enables peer discovery. By default, peer discovery is not enabled.

Defaults

No crypto maps exist.

Peer discovery is not enabled.

Command Modes

Global configuration. Using this command puts you into crypto map configuration mode, unless you use the **dynamic** keyword.

Command History

Release	Modification
11.2	This command was introduced.
11.3 T	The following keywords and arguments were added: • **ipsec-manual** • **ipsec-isakmp** • **dynamic** • *dynamic-map-name*
12.0(5)T	The **discover** keyword was added to support Tunnel Endpoint Discovery (TED).

Usage Guidelines

Use this command to create a new crypto map entry or to modify an existing crypto map entry.

Once a crypto map entry has been created, you cannot change the parameters specified at the global configuration level because these parameters determine which of the configuration commands are valid at the crypto map level. For example, once a map entry has been created as **ipsec-isakmp**, you cannot change it to **ipsec-manual** or **cisco**; you must delete and reenter the map entry.

After you define crypto map entries, you can assign the crypto map set to interfaces using the **crypto map (interface IPSec)** command.

What Crypto Maps Are For

Crypto maps provide two functions: (1) filtering and classifying traffic to be protected and (2) defining the policy to be applied to that traffic. The first use affects the flow of traffic on an interface; the second affects the negotiation performed (via IKE) on behalf of that traffic.

IPSec crypto maps link together definitions of the following:

- What traffic should be protected
- Which IPSec peers the protected traffic can be forwarded to—these are the peers with which a security association can be established
- Which transform sets are acceptable for use with the protected traffic
- How keys and security associations should be used or managed (or what the keys are, if IKE is not used)

Multiple Crypto Map Entries with the Same *map-name* Form a Crypto Map Set

A crypto map set is a collection of crypto map entries, each with a different *seq-num* but the same *map-name*. Therefore, for a given interface, you could have certain traffic forwarded to one IPSec peer with specified security applied to that traffic, and other traffic forwarded to the same or a different IPSec peer with different IPSec security applied. To accomplish this you would create two crypto maps, each with the same *map-name*, but each with a different *seq-num*.

The *seq-num* Argument

The number you assign to the *seq-num* argument should not be arbitrary. This number is used to rank multiple crypto map entries within a crypto map set. Within a crypto map set, a crypto map entry with a lower *seq-num* is evaluated before a map entry with a higher *seq-num*; that is, the map entry with the lower number has a higher priority.

For example, imagine that there is a crypto map set that contains three crypto map entries: mymap 10, mymap 20, and mymap 30. The crypto map set named mymap is applied to interface Serial 0. When traffic passes through the Serial 0 interface, the traffic is evaluated first for mymap 10. If the traffic matches a **permit** entry in the extended access list in mymap 10, the traffic will be processed according to the information defined in mymap 10 (including establishing IPSec security associations when necessary). If the traffic does not match the mymap 10 access list, the traffic will be evaluated for mymap 20, and then mymap 30, until the traffic matches a **permit** entry in a map entry. (If the traffic does not match a **permit** entry in any crypto map entry, it will be forwarded without any IPSec security.)

Dynamic Crypto Maps

Refer to the "Usage Guidelines" section of the **crypto dynamic-map** command for a discussion on dynamic crypto maps.

You should make crypto map entries which reference dynamic map sets the lowest priority map entries, so that inbound security association negotiations requests will try to match the static maps first. Only after the request does not match any of the static maps do you want it to be evaluated against the dynamic map set.

To make a crypto map entry referencing a dynamic crypto map set the lowest priority map entry, give the map entry the highest *seq-num* of all the map entries in a crypto map set.

Create dynamic crypto map entries using the **crypto dynamic-map** command. After you create a dynamic crypto map set, add the dynamic crypto map set to a static crypto map set with the **crypto map** (IPSec global configuration) command using the **dynamic** keyword.

Tunnel Endpoint Discovery

Use the **discover** keyword to enable Tunnel Endpoint Discovery (TED), which allows the initiating router to dynamically determine an IPSec peer for secure IPSec communications.

Examples

The following example shows the minimum required crypto map configuration when IKE will be used to establish the security associations:

```
crypto map mymap 10 ipsec-isakmp
 match address 101
 set transform-set my_t_set1
 set peer 10.0.0.1
```

The following example shows the minimum required crypto map configuration when the security associations are manually established:

```
crypto transform-set someset ah-md5-hmac esp-des
crypto map mymap 10 ipsec-manual
 match address 102
 set transform-set someset
 set peer 10.0.0.5
 set session-key inbound ah 256 98765432109876549876543210987654
 set session-key outbound ah 256 fedcbafedcbafedcfedcbafedcbafedc
 set session-key inbound esp 256 cipher 0123456789012345
 set session-key outbound esp 256 cipher abcdefabcdefabcd
```

The following example configures an IPSec crypto map set that includes a reference to a dynamic crypto map set.

Crypto map "mymap 10" allows security associations to be established between the router and either (or both) of two remote IPSec peers for traffic matching access list 101. Crypto map "mymap 20" allows either of two transform sets to be negotiated with the remote peer for traffic matching access list 102.

Crypto map entry “mymap 30” references the dynamic crypto map set “mydynamicmap,” which can be used to process inbound security association negotiation requests that do not match “mymap” entries 10 or 20. In this case, if the peer specifies a transform set that matches one of the transform sets specified in “mydynamicmap,” for a flow “permitted” by the access list 103, IPSec will accept the request and set up security associations with the remote peer without previously knowing about the remote peer. If accepted, the resulting security associations (and temporary crypto map entry) are established according to the settings specified by the remote peer.

The access list associated with “mydynamicmap 10” is also used as a filter. Inbound packets that match a **permit** statement in this list are dropped for not being IPSec protected. (The same is true for access lists associated with static crypto maps entries.) Outbound packets that match a **permit** statement without an existing corresponding IPSec SA are also dropped.

```
crypto map mymap 10 ipsec-isakmp
 match address 101
 set transform-set my_t_set1
 set peer 10.0.0.1
 set peer 10.0.0.2
crypto map mymap 20 ipsec-isakmp
 match address 102
 set transform-set my_t_set1 my_t_set2
 set peer 10.0.0.3
crypto map mymap 30 ipsec-isakmp dynamic mydynamicmap
!
crypto dynamic-map mydynamicmap 10
 match address 103
 set transform-set my_t_set1 my_t_set2 my_t_set3
```

The following example configures Tunnel Endpoint Discovery on a Cisco router:

```
crypto map testtag 10 ipsec-isakmp dynamic dmap discover
```

Related Commands

Command	Description
crypto dynamic-map	Creates a dynamic crypto map entry and enters the crypto map configuration command mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set pfs	Specifies that IPSec should ask for perfect forward secrecy (PFS) when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations.
set security-association level per-host	Specifies that separate IPSec security associations should be requested for each source/destination host pair.
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.

Command	Description
set session-key	Specifies the IPSec session keys within a crypto map entry.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

crypto map (interface IPSec)

To apply a previously defined crypto map set to an interface, use the **crypto map** interface configuration command. To remove the crypto map set from the interface, use the **no** form of this command.

crypto map *map-name*

no crypto map [*map-name*]

Syntax Description

map-name	Name that identifies the crypto map set. This is the name assigned when the crypto map was created. When the **no** form of the command is used, this argument is optional. Any value supplied for the argument is ignored.

Defaults

No crypto maps are assigned to interfaces.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to assign a crypto map set to an interface. You must assign a crypto map set to an interface before that interface can provide IPSec services. Only one crypto map set can be assigned to an interface. If multiple crypto map entries have the same *map-name* but a different *seq-num*, they are considered to be part of the same set and will all be applied to the interface. The crypto map entry with the lowest *seq-num* is considered the highest priority and will be evaluated first. A single crypto map set can contain a combination of **cisco**, **ipsec-isakmp**, and **ipsec-manual** crypto map entries.

Examples

The following example assigns crypto map set "mymap" to the S0 interface. When traffic passes through S0, the traffic will be evaluated against all the crypto map entries in the "mymap" set. When outbound traffic matches an access list in one of the "mymap" crypto map entries, a security association will be established per that crypto map entry's configuration (if no security association or connection already exists).

```
interface S0
 crypto map mymap
```

Related Commands

Command	Description
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
show crypto map (IPSec)	Displays the crypto map configuration.

crypto map local-address

To specify and name an identifying interface to be used by the crypto map for IPSec traffic, use the **crypto map local-address** global configuration command. To remove this command from the configuration, use the **no** form of this command.

crypto map *map-name* **local-address** *interface-id*

no crypto map *map-name* **local-address**

Syntax Description

map-name	Name that identifies the crypto map set. This is the name assigned when the crypto map was created.
interface-id	The identifying interface that should be used by the router to identify itself to remote peers. If Internet Key Exchange is enabled and you are using a certification authority (CA) to obtain certificates, this should be the interface with the address specified in the CA certificates.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

If you apply the same crypto map to two interfaces and do not use this command, two separate security associations (with different local IP addresses) could be established to the same peer for similar traffic. If you are using the second interface as redundant to the first interface, it could be preferable to have a single security association (with a single local IP address) created for traffic sharing the two interfaces. Having a single security association decreases overhead and makes administration simpler.

This command allows a peer to establish a single security association (and use a single local IP address) that is shared by the two redundant interfaces.

If applying the same crypto map set to more than one interface, the default behavior is as follows:

- Each interface will have its own security association database.
- The IP address of the local interface will be used as the local address for IPSec traffic originating from/destined to that interface.

However, if you use a local-address for that crypto map set, it has multiple effects:

- Only one IPSec security association database will be established and shared for traffic through both interfaces.
- The IP address of the specified interface will be used as the local address for IPSec (and IKE) traffic originating from or destined to that interface.

One suggestion is to use a loopback interface as the referenced local address interface, because the loopback interface never goes down.

Examples

The following example assigns crypto map set "mymap" to the S0 interface and to the S1 interface. When traffic passes through either S0 or S1, the traffic will be evaluated against the all the crypto maps in the "mymap" set. When traffic through either interface matches an access list in one of the "mymap" crypto maps, a security association will be established. This same security association will then apply to both S0 and S1 traffic that matches the originally matched IPSec access list. The local address that IPSec will use on both interfaces will be the IP address of interface loopback0.

```
interface S0
 crypto map mymap

interface S1
 crypto map mymap

crypto map mymap local-address loopback0
```

Related Commands

Command	Description
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.

match address (IPSec)

To specify an extended access list for a crypto map entry, use the **match address** crypto map configuration command. To remove the extended access list from a crypto map entry, use the **no** form of this command.

match address [*access-list-id* | *name*]

no match address [*access-list-id* | *name*]

Syntax Description

access-list-id	(Optional) Identifies the extended access list by its name or number. This value should match the *access-list-number* or *name* argument of the extended access list being matched.
name	(Optional) Identifies the named encryption access list. This name should match the *name* argument of the named encryption access list being matched.

Defaults

No access lists are matched to the crypto map entry.

Command Modes

Crypto map configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is required for all static crypto map entries. If you are defining a dynamic crypto map entry (with the **crypto dynamic-map** command), this command is not required but is strongly recommended.

Use this command to assign an extended access list to a crypto map entry. You also need to define this access list using the **access-list** or **ip access-list extended** commands.

The extended access list specified with this command will be used by IPSec to determine which traffic should be protected by crypto and which traffic does not need crypto protection. (Traffic that is permitted by the access list will be protected. Traffic that is denied by the access list will not be protected in the context of the corresponding crypto map entry.)

Note that the crypto access list is *not* used to determine whether to permit or deny traffic through the interface. An access list applied directly to the interface makes that determination.

The crypto access list specified by this command is used when evaluating both inbound and outbound traffic. Outbound traffic is evaluated against the crypto access lists specified by the interface's crypto map entries to determine if it should be protected by crypto and if so (if traffic matches a **permit** entry) which crypto policy applies. (If necessary, in the case of static IPSec crypto maps, new security associations are established using the data flow identity as specified in the **permit** entry; in the case of dynamic crypto map entries, if no SA exists, the packet is dropped.) After passing the regular access lists at the interface, inbound traffic is evaluated against the crypto access lists specified by the entries of the

interface's crypto map set to determine if it should be protected by crypto and, if so, which crypto policy applies. (In the case of IPSec, unprotected traffic is discarded because it should have been protected by IPSec.)

In the case of IPSec, the access list is also used to identify the flow for which the IPSec security associations are established. In the outbound case, the **permit** entry is used as the data flow identity (in general), while in the inbound case the data flow identity specified by the peer must be "permitted" by the crypto access list.

Examples

The following example shows the minimum required crypto map configuration when IKE will be used to establish the security associations. (This example is for a static crypto map.)

```
crypto map mymap 10 ipsec-isakmp
 match address 101
 set transform-set my_t_set1
 set peer 10.0.0.1
```

Related Commands

Command	Description
crypto dynamic-map	Creates a dynamic crypto map entry and enters the crypto map configuration command mode.
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set pfs	Specifies that IPSec should ask for perfect forward secrecy (PFS) when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations.
set security-association level per-host	Specifies that separate IPSec security associations should be requested for each source/destination host pair.
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.
set session-key	Specifies the IPSec session keys within a crypto map entry.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

mode (IPSec)

To change the mode for a transform set, use the **mode** crypto transform configuration command. To reset the mode to the default value of tunnel mode, use the **no** form of the command.

mode [**tunnel** | **transport**]

no mode

Syntax Description

tunnel | **transport**	(Optional) Specifies the mode for a transform set: either tunnel or transport mode. If neither **tunnel** nor **transport** is specified, the default (tunnel mode) is assigned.

Defaults

Tunnel mode

Command Modes

Crypto transform configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to change the mode specified for the transform. This setting is only used when the traffic to be protected has the same IP addresses as the IPSec peers (this traffic can be encapsulated either in tunnel or transport mode). This setting is ignored for all other traffic (all other traffic is encapsulated in tunnel mode).

If the traffic to be protected has the same IP address as the IP Security peers and transport mode is specified, during negotiation the router will request transport mode but will accept either transport or tunnel mode. If tunnel mode is specified, the router will request tunnel mode and will accept only tunnel mode.

After you define a transform set, you are put into the crypto transform configuration mode. While in this mode you can change the mode to either tunnel or transport. This change applies only to the transform set just defined.

If you do not change the mode when you first define the transform set, but later decide you want to change the mode for the transform set, you must re-enter the transform set (specifying the transform name and all its transforms) and then change the mode.

If you use this command to change the mode, the change will only affect the negotiation of subsequent IPSec security associations via crypto map entries which specify this transform set. (If you want the new settings to take effect sooner, you can clear all or part of the security association database. See the **clear crypto sa** command for more details.

Tunnel Mode

With tunnel mode, the entire original IP packet is protected (encrypted, authenticated, or both) and is encapsulated by the IPSec headers and trailers (an Encapsulation Security Protocol header and trailer, an Authentication Header, or both). Then a new IP header is prefixed to the packet, specifying the IPSec endpoints as the source and destination.

Tunnel mode can be used with any IP traffic. Tunnel mode must be used if IPSec is protecting traffic from hosts behind the IPSec peers. For example, tunnel mode is used with Virtual Private Networks (VPNs) where hosts on one protected network send packets to hosts on a different protected network via a pair of IPSec peers. With VPNs, the IPSec peers "tunnel" the protected traffic between the peers while the hosts on their protected networks are the session endpoints.

Transport Mode

With transport mode, only the payload (data) of the original IP packet is protected (encrypted, authenticated, or both). The payload is encapsulated by the IPSec headers and trailers (an ESP header and trailer, an AH header, or both). The original IP headers remain intact and are not protected by IPSec.

Use transport mode only when the IP traffic to be protected has IPSec peers as both the source and destination. For example, you could use transport mode to protect router management traffic. Specifying transport mode allows the router to negotiate with the remote peer whether to use transport or tunnel mode.

Examples

The following example defines a transform set and changes the mode to transport mode. The mode value only applies to IP traffic with the source and destination addresses at the local and remote IPSec peers.

```
crypto ipsec transform-set newer esp-des esp-sha-hmac
  mode transport
  exit
```

Related Commands

Command	Description
crypto ipsec transform-set	Defines a transform set—an acceptable combination of security protocols and algorithms.

set peer (IPSec)

To specify an IP Security peer in a crypto map entry, use the **set peer** crypto map configuration command. To remove an IPSec peer from a crypto map entry, use the **no** form of this command.

set peer {*hostname* | *ip-address*}

no set peer {*hostname* | *ip-address*}

Syntax Description

hostname	Specifies the IPSec peer by its host name. This is the peer's host name concatenated with its domain name (for example, myhost.example.com).
ip-address	Specifies the IPSec peer by its IP address.

Defaults

No peer is defined by default.

Command Modes

Crypto map configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to specify an IPSec peer for a crypto map.

This command is required for all static crypto maps. If you are defining a dynamic crypto map (with the **crypto dynamic-map** command), this command is not required, and in most cases is not used (because, in general, the peer is unknown).

For **ipsec-isakmp** crypto map entries, you can specify multiple peers by repeating this command. The peer that packets are actually sent to is determined by the last peer that the router heard from (received either traffic or a negotiation request from) for a given data flow. If the attempt fails with the first peer, Internet Key Exchange tries the next peer on the crypto map list.

For **ipsec-manual** crypto entries, you can specify only one IPSec peer per crypto map. If you want to change the peer, you must first delete the old peer and then specify the new peer.

You can specify the remote IPSec peer by its host name only if the host name is mapped to the peer's IP address in a Domain Name Server or if you manually map the host name to the IP address with the **ip host** command.

Examples

The following example shows a crypto map configuration when IKE will be used to establish the security associations. In this example, a security association could be set up to either the IPSec peer at 10.0.0.1 or the peer at 10.0.0.2.

```
crypto map mymap 10 ipsec-isakmp
 match address 101
 set transform-set my_t_set1
 set peer 10.0.0.1
```

```
set peer 10.0.0.2
```

Related Commands

Command	Description
crypto dynamic-map	Creates a dynamic crypto map entry and enters the crypto map configuration command mode.
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.
set pfs	Specifies that IPSec should ask for PFS when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations.
set security-association level per-host	Specifies that separate IPSec security associations should be requested for each source/destination host pair.
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.
set session-key	Specifies the IPSec session keys within a crypto map entry.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

set pfs

To specify that IP Security should ask for perfect forward secrecy (PFS) when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations, use the **set pfs** crypto map configuration command. To specify that IPSec should not request PFS, use the **no** form of the command.

set pfs [**group1** | **group2**]

no set pfs

Syntax Description

group1	(Optional) Specifies that IPSec should use the 768-bit Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange.
group2	(Optional) Specifies that IPSec should use the 1024-bit Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange.

Defaults

By default, PFS is not requested. If no group is specified with this command, **group1** is used as the default.

Command Modes

Crypto map configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command is only available for **ipsec-isakmp** crypto map entries and dynamic crypto map entries.

During negotiation, this command causes IPSec to request PFS when requesting new security associations for the crypto map entry. The default (**group1**) is sent if the **set pfs** statement does not specify a group. If the peer initiates the negotiation and the local configuration specifies PFS, the remote peer must perform a PFS exchange or the negotiation will fail. If the local configuration does not specify a group, a default of **group1** will be assumed, and an offer of either **group1** or **group2** will be accepted. If the local configuration specifies **group2**, that group *must* be part of the peer's offer or the negotiation will fail. If the local configuration does not specify PFS it will accept any offer of PFS from the peer.

PFS adds another level of security because if one key is ever cracked by an attacker then only the data sent with that key will be compromised. Without PFS, data sent with other keys could be also compromised.

With PFS, every time a new security association is negotiated, a new Diffie-Hellman exchange occurs. (This exchange requires additional processing time.)

The 1024-bit Diffie-Hellman prime modulus group, **group2**, provides more security than **group1**, but requires more processing time than **group1**.

Examples

The following example specifies that PFS should be used whenever a new security association is negotiated for the crypto map "mymap 10":

```
crypto map mymap 10 ipsec-isakmp
 set pfs group2
```

Related Commands

Command	Description
crypto dynamic-map	Creates a dynamic crypto map entry and enters the crypto map configuration command mode.
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set security-association level per-host	Specifies that separate IPSec security associations should be requested for each source/destination host pair.
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

set security-association level per-host

To specify that separate IP Security security associations should be requested for each source/destination host pair, use the **set security-association level per-host** crypto map configuration command. To specify that one security association should be requested for each crypto map access list **permit** entry, use the **no** form of this command.

set security-association level per-host

no set security-association level per-host

Syntax Description

This command has no arguments or keywords.

Defaults

For a given crypto map, all traffic between two IPSec peers matching a single crypto map access list **permit** entry will share the same security association.

Command Modes

Crypto map configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command is only available for **ipsec-isakmp** crypto map entries and is not supported for dynamic crypto map entries.

When you use this command, you need to specify that a separate security association should be used for each source/destination host pair.

Normally, within a given crypto map, IPSec will attempt to request security associations at the granularity specified by the access list entry. For example, if the access list entry permits IP protocol traffic between subnet A and subnet B, IPSec will attempt to request security associations between subnet A and subnet B (for any IP protocol), and unless finer-grained security associations are established (by a peer request), all IPSec-protected traffic between these two subnets would use the same security association.

This command causes IPSec to request separate security associations for each source/destination host pair. In this case, each host pairing (where one host was in subnet A and the other host was in subnet B) would cause IPSec to request a separate security association.

With this command, one security association would be requested to protect traffic between host A and host B, and a different security association would be requested to protect traffic between host A and host C.

The access list entry can specify local and remote subnets, or it can specify a host-and-subnet combination. If the access list entry specifies protocols and ports, these values are applied when establishing the unique security associations.

Use this command with care, as multiple streams between given subnets can rapidly consume system resources.

Examples

The following example shows what happens with an access list entry of **permit ip 1.1.1.0 0.0.0.255 2.2.2.0 0.0.0.255** and a per-host level:

- A packet from 1.1.1.1 to 2.2.2.1 will initiate a security association request, which would look like it originated via **permit ip host 1.1.1.1 host 2.2.2.1**.
- A packet from 1.1.1.1 to 2.2.2.2 will initiate a security association request, which would look like it originated via **permit ip host 1.1.1.1 host 2.2.2.2**.
- A packet from 1.1.1.2 to 2.2.2.1 will initiate a security association request, which would look like it originated via **permit ip host 1.1.1.2 host 2.2.2.1**.

Without the per-host level, any of the above packets will initiate a single security association request originated via **permit ip 1.1.1.0 0.0.0.255 2.2.2.0 0.0.0.255**.

Related Commands

Command	Description
crypto dynamic-map	Creates a dynamic crypto map entry and enters the crypto map configuration command mode.
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set pfs	Specifies that IPSec should ask for PFS when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations.
set security-association lifetime	Overrides (for a particular crypto map entry) the global lifetime value, which is used when negotiating IPSec security associations.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

set security-association lifetime

To override (for a particular crypto map entry) the global lifetime value, which is used when negotiating IP Security security associations, use the **set security-association lifetime** crypto map configuration command. To reset a crypto map entry's lifetime value to the global value, use the **no** form of this command.

set security-association lifetime {**seconds** *seconds* | **kilobytes** *kilobytes*}

no set security-association lifetime {**seconds** | **kilobytes**}

Syntax Description

seconds *seconds*	Specifies the number of seconds a security association will live before expiring.
kilobytes *kilobytes*	Specifies the volume of traffic (in kilobytes) that can pass between IPSec peers using a given security association before that security association expires.

Defaults

The crypto map's security associations are negotiated according to the global lifetimes.

Command Modes

Crypto map configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command is available only for **ipsec-isakmp** crypto map entries and dynamic crypto map entries.

IPSec security associations use shared secret keys. These keys and their security associations time out together.

Assuming that the particular crypto map entry has lifetime values configured, when the router requests new security associations during security association negotiation, it will specify its crypto map lifetime value in the request to the peer; it will use this value as the lifetime of the new security associations. When the router receives a negotiation request from the peer, it will use the smaller of the lifetime value proposed by the peer or the locally configured lifetime value as the lifetime of the new security associations.

There are two lifetimes: a "timed" lifetime and a "traffic-volume" lifetime. The session keys/security association expires after the first of these lifetimes is reached.

If you change a lifetime, the change will not be applied to existing security associations, but will be used in subsequent negotiations to establish security associations for data flows supported by this crypto map entry. If you want the new settings to take effect sooner, you can clear all or part of the security association database by using the **clear crypto sa** command. Refer to the **clear crypto sa** command for more detail.

To change the timed lifetime, use the **set security-association lifetime seconds** form of the command. The timed lifetime causes the keys and security association to time out after the specified number of seconds have passed.

To change the traffic-volume lifetime, use the **set security-association lifetime kilobytes** form of the command. The traffic-volume lifetime causes the key and security association to time out after the specified amount of traffic (in kilobytes) has been protected by the security association's key.

Shorter lifetimes can make it harder to mount a successful key recovery attack, because the attacker has less data encrypted under the same key to work with. However, shorter lifetimes need more CPU processing time.

The lifetime values are ignored for manually established security associations (security associations installed via an **ipsec-manual** crypto map entry).

How These Lifetimes Work

Assuming that the particular crypto map entry does not have lifetime values configured, when the router requests new security associations it will specify its global lifetime values in the request to the peer; it will use this value as the lifetime of the new security associations. When the router receives a negotiation request from the peer, it will use the smaller of either the lifetime value proposed by the peer or the locally configured lifetime value as the lifetime of the new security associations.

The security association (and corresponding keys) will expire according to whichever occurs sooner, either after the **seconds** time out or after the **kilobytes** amount of traffic is passed.

A new security association is negotiated *before* the lifetime threshold of the existing security association is reached, to ensure that a new security association is ready for use when the old one expires. The new security association is negotiated either 30 seconds before the **seconds** lifetime expires or when the volume of traffic through the tunnel reaches 256 kilobytes less than the **kilobytes** lifetime (whichever occurs first).

If no traffic has passed through the tunnel during the entire life of the security association, a new security association is not negotiated when the lifetime expires. Instead, a new security association will be negotiated only when IPSec sees another packet that should be protected.

Examples

The following example shortens the timed lifetime for a particular crypto map entry, because there is a higher risk that the keys could be compromised for security associations belonging to the crypto map entry. The traffic-volume lifetime is not changed because there is not a high volume of traffic anticipated for these security associations. The timed lifetime is shortened to 2700 seconds (45 minutes).

```
crypto map mymap 10 ipsec-isakmp
 set security-association lifetime seconds 2700
```

Related Commands

Command	Description
crypto dynamic-map	Creates a dynamic crypto map entry and enters the crypto map configuration command mode.
crypto ipsec security-association lifetime	Changes global lifetime values used when negotiating IPSec security associations.
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.

Command	Description
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set pfs	Specifies that IPSec should ask for PFS when requesting new security associations for this crypto map entry, or that IPSec requires PFS when receiving requests for new security associations.
set security-association level per-host	Specifies that separate IPSec security associations should be requested for each source/destination host pair.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

set session-key

To manually specify the IP Security session keys within a crypto map entry, use the **set session-key** crypto map configuration command. This command is only available for **ipsec-manual** crypto map entries. To remove IPSec session keys from a crypto map entry, use the **no** form of this command.

set session-key {**inbound** | **outbound**} **ah** *spi hex-key-string*

set session-key {**inbound** | **outbound**} **esp** *spi cipher hex-key-string* [**authenticator** *hex-key-string*]

no set session-key {**inbound** | **outbound**} **ah**

no set session-key {**inbound** | **outbound**} **esp**

Syntax Description

inbound	Sets the inbound IPSec session key. (You must set both inbound and outbound keys.)
outbound	Sets the outbound IPSec session key. (You must set both inbound and outbound keys.)
ah	Sets the IPSec session key for the Authentication Header protocol. Use when the crypto map entry's transform set includes an AH transform.
esp	Sets the IPSec session key for the Encapsulation Security Protocol. Use when the crypto map entry's transform set includes an ESP transform.
spi	Specifies the security parameter index (SPI), a number that is used to uniquely identify a security association. The SPI is an arbitrary number you assign in the range of 256 to 4,294,967,295 (FFFF FFFF). You can assign the same SPI to both directions and both protocols. However, not all peers have the same flexibility in SPI assignment. For a given destination address/protocol combination, unique SPI values must be used. The destination address is that of the router if inbound, the peer if outbound.
hex-key-string	Specifies the session key; enter in hexadecimal format. This is an arbitrary hexadecimal string of 8, 16, or 20 bytes. If the crypto map's transform set includes a DES algorithm, specify at least 8 bytes per key. If the crypto map's transform set includes an MD5 algorithm, specify at least 16 bytes per key. If the crypto map's transform set includes an SHA algorithm, specify 20 bytes per key. Keys longer than the above sizes are simply truncated.
cipher	Indicates that the key string is to be used with the ESP encryption transform.
authenticator	(Optional) Indicates that the key string is to be used with the ESP authentication transform. This argument is required only when the crypto map entry's transform set includes an ESP authentication transform.

Defaults

No session keys are defined by default.

Command Modes Crypto map configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines Use this command to define IPSec keys for security associations via **ipsec-manual** crypto map entries. (In the case of **ipsec-isakmp** crypto map entries, the security associations with their corresponding keys are automatically established via the IKE negotiation.)

If the crypto map's transform set includes an AH protocol, you must define IPSec keys for AH for both inbound and outbound traffic. If the crypto map's transform set includes an ESP encryption protocol, you must define IPSec keys for ESP encryption for both inbound and outbound traffic. If your transform set includes an ESP authentication protocol, you must define IPSec keys for ESP authentication for inbound and outbound traffic.

When you define multiple IPSec session keys within a single crypto map, you can assign the same security parameter index (SPI) number to all the keys. The SPI is used to identify the security association used with the crypto map. However, not all peers have the same flexibility in SPI assignment. You should coordinate SPI assignment with your peer's operator, making certain that the same SPI is not used more than once for the same destination address/protocol combination.

Security associations established via this command do not expire (unlike security associations established via IKE).

Session keys at one peer must match the session keys at the remote peer.

If you change a session key, the security association using the key will be deleted and reinitialized.

Examples The following example shows a crypto map entry for manually established security associations. The transform set "t_set" includes only an AH protocol.

```
crypto ipsec transform-set t_set ah-sha-hmac

crypto map mymap 20 ipsec-manual
 match address 102
 set transform-set t_set
 set peer 10.0.0.21
 set session-key inbound ah 300 1111111111111111111111111111111111111111
 set session-key outbound ah 300 2222222222222222222222222222222222222222
```

The following example shows a crypto map entry for manually established security associations. The transform set "someset" includes both an AH and an ESP protocol, so session keys are configured for both AH and ESP for both inbound and outbound traffic. The transform set includes both encryption and authentication ESP transforms, so session keys are created for both using the **cipher** and **authenticator** keywords.

```
crypto ipsec transform-set someset ah-sha-hmac esp-des esp-sha-hmac

crypto map mymap 10 ipsec-manual
 match address 101
 set transform-set someset
 set peer 10.0.0.1
 set session-key inbound ah 300 9876543210987654321098765432109876543210
 set session-key outbound ah 300 fedcbafedcbafedcbafedcbafedcbafedcbafedc
 set session-key inbound esp 300 cipher 0123456789012345
```

```
 authenticator 000011112222333344445555666677778888999
set session-key outbound esp 300 cipher abcdefabcdefabcd
 authenticator 99998888777766665555444433332222111110000
```

Related Commands

Command	Description
crypto map (global IPSec)	Creates or modifies a crypto map entry and enters the crypto map configuration mode.
crypto map (interface IPSec)	Applies a previously defined crypto map set to an interface.
crypto map local-address	Specifies and names an identifying interface to be used by the crypto map for IPSec traffic.
match address (IPSec)	Specifies an extended access list for a crypto map entry.
set peer (IPSec)	Specifies an IPSec peer in a crypto map entry.
set transform-set	Specifies which transform sets can be used with the crypto map entry.
show crypto map (IPSec)	Displays the crypto map configuration.

set transform-set

To specify which transform sets can be used with the crypto map entry, use the **set transform-set** crypto map configuration command. To remove all transform sets from a crypto map entry, use the **no** form of this command.

set transform-set *transform-set-name* [*transform-set-name2...transform-set-name6*]

no set transform-set

Syntax Description

transform-set-name	Name of the transform set. For an **ipsec-manual** crypto map entry, you can specify only one transform set. For an **ipsec-isakmp** or dynamic crypto map entry, you can specify up to 6 transform sets.

Defaults

No transform sets are included by default.

Command Modes

Crypto map configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command is required for all static and dynamic crypto map entries.

Use this command to specify which transform sets to include in a crypto map entry.

For an **ipsec-isakmp** crypto map entry, you can list multiple transform sets with this command. List the higher priority transform sets first.

If the local router initiates the negotiation, the transform sets are presented to the peer in the order specified in the crypto map entry. If the peer initiates the negotiation, the local router accepts the first transform set that matches one of the transform sets specified in the crypto map entry.

The first matching transform set that is found at both peers is used for the security association. If no match is found, IPSec will not establish a security association. The traffic will be dropped because there is no security association to protect the traffic.

For an **ipsec-manual** crypto map entry, you can specify only one transform set. If the transform set does not match the transform set at the remote peer's crypto map, the two peers will fail to correctly communicate because the peers are using different rules to process the traffic.

If you want to change the list of transform sets, re-specify the new list of transform sets to replace the old list. This change is only applied to crypto map entries that reference this transform set. The change will not be applied to existing security associations, but will be used in subsequent negotiations to establish new security associations. If you want the new settings to take effect sooner, you can clear all or part of the security association database by using the **clear crypto sa** command.

Any transform sets included in a crypto map must previously have been defined using the **crypto ipsec transform-set** command.

Examples

The following example defines two transform sets and specifies that they can both be used within a crypto map entry. (This example applies only when IKE is used to establish security associations. With crypto maps used for manually established security associations, only one transform set can be included in a given crypto map entry.)

```
crypto ipsec transform-set my_t_set1 esp-des esp-sha-hmac
crypto ipsec transform-set my_t_set2 ah-sha-hmac esp-des esp-sha-hmac

crypto map mymap 10 ipsec-isakmp
 match address 101
 set transform-set my_t_set1 my_t_set2
 set peer 10.0.0.1
 set peer 10.0.0.2
```

In this example, when traffic matches access list 101, the security association can use either transform set “my_t_set1” (first priority) or “my_t_set2” (second priority) depending on which transform set matches the remote peer’s transform sets.

show crypto dynamic-map

To view a dynamic crypto map set, use the **show crypto dynamic-map** EXEC command.

show crypto dynamic-map [**tag** *map-name*]

Syntax Description

tag *map-name*	(Optional) Displays only the crypto dynamic map set with the specified *map-name*.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use the **show crypto dynamic-map** command to view a dynamic crypto map set.

Examples

The following is sample output for the **show crypto dynamic-map** command:

```
Router# show crypto dynamic-map

Crypto Map Template"dyn1" 10
        Extended IP access list 152
            access-list 152 permit ip
                source: addr = 172.21.114.67/0.0.0.0
                dest:   addr = 0.0.0.0/255.255.255.255
        Current peer: 0.0.0.0
        Security association lifetime: 4608000 kilobytes/120 seconds
        PFS (Y/N): N
        Transform sets={ tauth, t1, }
```

The following partial configuration was in effect when the above **show crypto dynamic-map** command was issued:

```
crypto ipsec security-association lifetime seconds 120
!
crypto ipsec transform-set t1 esp-des esp-md5-hmac
crypto ipsec transform-set tauth ah-sha-hmac
!
crypto dynamic-map dyn1 10
 set transform-set tauth t1
 match address 152
crypto map to-router local-address Ethernet0
crypto map to-router 10 ipsec-isakmp
 set peer 172.21.114.123
 set transform-set tauth t1
 match address 150
crypto map to-router 20 ipsec-isakmp dynamic dyn1
!
access-list 150 permit ip host 172.21.114.67 host 172.21.114.123
access-list 150 permit ip host 15.15.15.1 host 172.21.114.123
access-list 150 permit ip host 15.15.15.1 host 8.8.8.1
```

```
access-list 152 permit ip host 172.21.114.67 any
```

show crypto engine accelerator logs

To display information about the last 32 CryptoGraphics eXtensions (CGX) Library packet processing commands and associated parameters sent from the VPN module driver to the VPN module hardware, use the **show crypto engine accelerator logs** command in privileged EXEC mode.

show crypto engine accelerator logs

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(1)XC	This command was introduced on the Cisco 1720 and Cisco 1750 platforms.
12.1(2)T	This command was integrated into Cisco IOS Release 12.1(2)T.

Usage Guidelines

Use this command when encrypted traffic is sent to the router and a problem with the encryption module is suspected. Use the **debug crypto engine accelerator logs** command to enable command logging *before* using this command.

Note The **show crypto engine accelerator logs** command is intended only for Cisco Systems TAC personnel to collect debugging information.

Examples

The following is sample output for the **show crypto engine accelerator logs** command:

```
Router# show crypto engine accelerator logs

Contents of packet log (current index = 20):

tag = 0x5B02, cmd = 0x5000
param[0] = 0x000E, param[1] = 0x57E8
param[2] = 0x0008, param[3] = 0x0000
param[4] = 0x0078, param[5] = 0x0004
param[6] = 0x142C, param[7] = 0x142C
param[8] = 0x0078, param[9] = 0x000C
tag = 0x5B03, cmd = 0x4100
param[0] = 0x000E, param[1] = 0x583C
param[2] = 0x0034, param[3] = 0x0040
param[4] = 0x00B0, param[5] = 0x0004
param[6] = 0x1400, param[7] = 0x1400
param[8] = 0x0020, param[9] = 0x000C
```

```
tag = 0x5C00, cmd = 0x4100
param[0] = 0x000E, param[1] = 0x57BC
param[2] = 0x0034, param[3] = 0x0040
param[4] = 0x00B0, param[5] = 0x0004
param[6] = 0x1400, param[7] = 0x1400
param[8] = 0x0020, param[9] = 0x000C
            •
            •
            •
tag = 0x5A01, cmd = 0x4100
param[0] = 0x000E, param[1] = 0x593C
param[2] = 0x0034, param[3] = 0x0040
param[4] = 0x00B0, param[5] = 0x0004
param[6] = 0x1400, param[7] = 0x1400
param[8] = 0x0020, param[9] = 0x000C

Contents of cgx log (current index = 12):

cmd = 0x0074 ret = 0x0000
param[0] = 0x0010, param[1] = 0x028E
param[2] = 0x0039, param[3] = 0x0D1E
param[4] = 0x0100, param[5] = 0x0000
param[6] = 0x0000, param[7] = 0x0000
param[8] = 0x0000, param[9] = 0x0000
cmd = 0x0062 ret = 0x0000
param[0] = 0x0035, param[1] = 0x1BE0
param[2] = 0x0100, param[3] = 0x0222
param[4] = 0x0258, param[5] = 0x0000
param[6] = 0x0000, param[7] = 0x0000
param[8] = 0x0000, param[9] = 0x0000
cmd = 0x0063 ret = 0x0000
param[0] = 0x0222, param[1] = 0x0258
param[2] = 0x0000, param[3] = 0x0000
param[4] = 0x0000, param[5] = 0x0000
param[6] = 0x0000, param[7] = 0x020A
param[8] = 0x002D, param[9] = 0x0000
            •
            •
            •
cmd = 0x0065 ret = 0x0000
param[0] = 0x0222, param[1] = 0x0258
param[2] = 0x0010, param[3] = 0x028E
param[4] = 0x00A0, param[5] = 0x0008
param[6] = 0x0001, param[7] = 0x0000
param[8] = 0x0000, param[9] = 0x0000
```

Related Commands

Command	Description
debug crypto engine acclerator logs	Enables logging of commands and associated parameters sent from the VPN module driver to the VPN module hardware using a debug flag.
crypto engine accelerator	Enables or disables the IPSec accelerator.

show crypto engine accelerator sa-database

To display active (in-use) entries in the platform-specific virtual private network (VPN) module database, use the **show crypto engine accelerator sa-database** command in privileged EXEC configuration mode.

show crypto engine accelerator sa-database

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(1)XC	This command was introduced on the Cisco 1720 and Cisco 1750 platforms.
12.1(2)T	This command was integrated into Cisco IOS Release 12.1(2)T.

Usage Guidelines

Use this command when encrypted traffic is sent to the router and a problem with the encryption module is suspected.

Note The **show crypto engine accelerator sa-database** command is intended only for Cisco Systems TAC personnel to collect debugging information.

Examples

The following is sample output for the **show crypto engine accelerator sa-database** command:

```
Router# show crypto engine accelerator sa-database
Flow Summary
        Index   Algorithms
        005      tunnel inbound  esp-md5-hmac esp-des ah-sha-hmac
        006      tunnel outbound esp-md5-hmac esp-des ah-sha-hmac
        007      tunnel inbound  esp-md5-hmac esp-des ah-sha-hmac
        008      tunnel outbound esp-md5-hmac esp-des ah-sha-hmac
        009      tunnel inbound  esp-md5-hmac esp-des ah-sha-hmac
        010      tunnel outbound esp-md5-hmac esp-des ah-sha-hmac
SA Summary:
        Index   DH-Index        Algorithms
        003     001(deleted)    DES SHA
        004     002(deleted)    DES SHA
DH Summary
        Index Group Config
```

Related Commands

Command	Description
debug crypto engine acclerator logs	Enables logging of commands and associated parameters sent from the VPN module driver to the VPN module hardware using a debug flag.
crypto engine accelerator	Enables or disables the IPSec accelerator.

show crypto ipsec sa

To view the settings used by current security associations, use the **show crypto ipsec sa** EXEC command.

show crypto ipsec sa [**map** *map-name* | **address** | **identity**] [**detail**]

Syntax Description

map *map-name*	(Optional) Displays any existing security associations created for the crypto map set named *map-name*.
address	(Optional) Displays the all existing security associations, sorted by the destination address (either the local address or the address of the IP Security remote peer) and then by protocol (Authentication Header or Encapsulation Security Protocol).
identity	(Optional) Displays only the flow information. It does not show the security association information.
detail	(Optional) Displays detailed error counters. (The default is the high level send/receive error counters.)

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

If no keyword is used, all security associations are displayed. They are sorted first by interface, and then by traffic flow (for example, source/destination address, mask, protocol, port). Within a flow, the security associations are listed by protocol (ESP/AH) and direction (inbound/outbound).

Examples

The following is sample output for the **show crypto ipsec sa** command:

```
Router# show crypto ipsec sa

interface: Ethernet0
    Crypto map tag: router-alice, local addr. 172.21.114.123

   local  ident (addr/mask/prot/port): (172.21.114.123/255.255.255.255/0/0)
   remote ident (addr/mask/prot/port): (172.21.114.67/255.255.255.255/0/0)
   current_peer: 172.21.114.67
     PERMIT, flags={origin_is_acl,}
    #pkts encaps: 10, #pkts encrypt: 10, #pkts digest 10
    #pkts decaps: 10, #pkts decrypt: 10, #pkts verify 10
    #send errors 10, #recv errors 0

     local crypto endpt.: 172.21.114.123, remote crypto endpt.: 172.21.114.67
     path mtu 1500, media mtu 1500
     current outbound spi: 20890A6F
```

```
     inbound esp sas:
      spi: 0x257A1039(628756537)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 26, crypto map: router-alice
        sa timing: remaining key lifetime (k/sec): (4607999/90)
        IV size: 8 bytes
        replay detection support: Y

     inbound ah sas:

     outbound esp sas:
      spi: 0x20890A6F(545852015)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 27, crypto map: router-alice
        sa timing: remaining key lifetime (k/sec): (4607999/90)
        IV size: 8 bytes
        replay detection support: Y

     outbound ah sas:

interface: Tunnel0
    Crypto map tag: router-alice, local addr. 172.21.114.123

   local  ident (addr/mask/prot/port): (172.21.114.123/255.255.255.255/0/0)
   remote ident (addr/mask/prot/port): (172.21.114.67/255.255.255.255/0/0)
   current_peer: 172.21.114.67
     PERMIT, flags={origin_is_acl,}
    #pkts encaps: 10, #pkts encrypt: 10, #pkts digest 10
    #pkts decaps: 10, #pkts decrypt: 10, #pkts verify 10
    #send errors 10, #recv errors 0

     local crypto endpt.: 172.21.114.123, remote crypto endpt.: 172.21.114.67
     path mtu 1500, media mtu 1500
     current outbound spi: 20890A6F

     inbound esp sas:
      spi: 0x257A1039(628756537)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 26, crypto map: router-alice
        sa timing: remaining key lifetime (k/sec): (4607999/90)
        IV size: 8 bytes
        replay detection support: Y

     inbound ah sas:

     outbound esp sas:
      spi: 0x20890A6F(545852015)
        transform: esp-des esp-md5-hmac ,
        in use settings ={Tunnel, }
        slot: 0, conn id: 27, crypto map: router-alice
        sa timing: remaining key lifetime (k/sec): (4607999/90)
        IV size: 8 bytes
        replay detection support: Y

     outbound ah sas:
```

show crypto ipsec security-association lifetime

To view the security-association lifetime value configured for a particular crypto map entry, use the **show crypto ipsec security-association lifetime** EXEC command.

show crypto ipsec security-association lifetime

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Examples

The following is sample output for the **show crypto ipsec security-association lifetime** command:

```
Router# show crypto ipsec security-association lifetime

Security-association lifetime: 4608000 kilobytes/120 seconds
```

The following configuration was in effect when the previous **show crypto ipsec security-association lifetime** command was issued:

```
crypto ipsec security-association lifetime seconds 120
```

show crypto ipsec transform-set

To view the configured transform sets, use the **show crypto ipsec transform-set** EXEC command.

show crypto ipsec transform-set [**tag** *transform-set-name*]

Syntax Description

tag *transform-set-name*	(Optional) Displays only the transform sets with the specified *transform-set-name*.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Examples

The following is sample output for the **show crypto ipsec transform-set** command:

```
Router# show crypto ipsec transform-set

Transform set combined-des-sha: { esp-des esp-sha-hmac  }
   will negotiate = { Tunnel,  },

Transform set combined-des-md5: { esp-des esp-md5-hmac  }
   will negotiate = { Tunnel,  },

Transform set t1: { esp-des esp-md5-hmac  }
   will negotiate = { Tunnel,  },

Transform set t100: { ah-sha-hmac  }
   will negotiate = { Transport,  },

Transform set t2: { ah-sha-hmac  }
   will negotiate = { Tunnel,  },
   { esp-des  }
   will negotiate = { Tunnel,  },
```

The following configuration was in effect when the previous **show crypto ipsec transform-set** command was issued:

```
crypto ipsec transform-set combined-des-sha esp-des esp-sha-hmac
crypto ipsec transform-set combined-des-md5 esp-des esp-md5-hmac
crypto ipsec transform-set t1 esp-des esp-md5-hmac
crypto ipsec transform-set t100 ah-sha-hmac
 mode transport
crypto ipsec transform-set t2 ah-sha-hmac esp-des
```

show crypto map (IPSec)

To view the crypto map configuration, use the **show crypto map** EXEC command.

show crypto map [**interface** *interface* | **tag** *map-name*]

Syntax Description

interface *interface*	(Optional) Displays only the crypto map set applied to the specified interface.
tag *map-name*	(Optional) Displays only the crypto map set with the specified *map-name*.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following is sample output for the **show crypto map** command:

```
Router# show crypto map

Crypto Map: "router-alice" idb: Ethernet0 local address: 172.21.114.123

Crypto Map "router-alice" 10 ipsec-isakmp
        Peer = 172.21.114.67
        Extended IP access list 141
            access-list 141 permit ip
                source: addr = 172.21.114.123/0.0.0.0
                dest:   addr = 172.21.114.67/0.0.0.0
        Current peer: 172.21.114.67
        Security-association lifetime: 4608000 kilobytes/120 seconds
        PFS (Y/N): N
        Transform sets={ t1, }
```

The following configuration was in effect when the above **show crypto map** command was issued:

```
crypto map router-alice local-address Ethernet0
crypto map router-alice 10 ipsec-isakmp
 set peer 172.21.114.67
 set transform-set t1
 match address 141
```

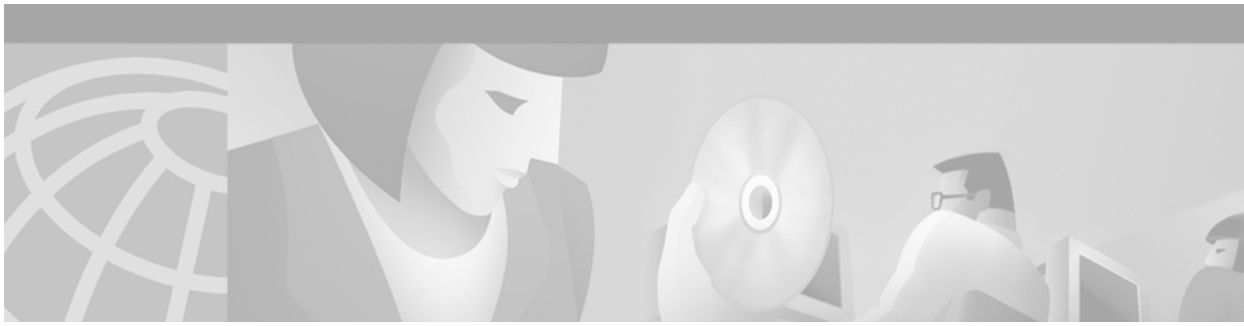
The following is sample output for the **show crypto map** command when manually established security associations are used:

```
Router# show crypto map

Crypto Map "multi-peer" 20 ipsec-manual
        Peer = 172.21.114.67
        Extended IP access list 120
            access-list 120 permit ip
                source: addr = 1.1.1.1/0.0.0.0
                dest:   addr = 1.1.1.2/0.0.0.0
        Current peer: 172.21.114.67
        Transform sets={ t2, }
        Inbound esp spi: 0,
         cipher key: ,
```

```
 auth_key: ,
Inbound ah spi: 256,
    key: 0102030405060708090102030405060708090102030405060708090,
Outbound esp spi: 0
 cipher key: ,
 auth key: ,
Outbound ah spi: 256,
    key: 0102030405060708090102030405060708090102030405060708090,
```

The following configuration was in effect when the above **show crypto map** command was issued:

```
crypto map multi-peer 20 ipsec-manual
 set peer 172.21.114.67
 set session-key inbound ah 256
0102030405060708090102030405060708090102030405060708090
 set session-key outbound ah 256
0102030405060708090102030405060708090102030405060708090
 set transform-set t2
 match address 120
```



Certification Authority Interoperability Commands

This chapter describes certification authority (CA) interoperability commands. CA interoperability is provided in support of the IP Security (IPSec) standard. CA interoperability permits Cisco IOS devices and CAs to communicate so that your Cisco IOS device can obtain and use digital certificates from the CA. Although IPSec can be implemented in your network without the use of a CA, using a CA provides manageability and scalability for IPSec.

Without CA interoperability, Cisco IOS devices could not use CAs when deploying IPSec. CAs provide a manageable, scalable solution for IPSec networks.

To find complete descriptions of other commands used in this chapter, refer to the *Cisco IOS Command Reference Master Index* or search online.

For configuration information, refer to the chapter "Configuring Certification Authority Interoperability" in the *Cisco IOS Security Configuration Guide.*

certificate

To manually add certificates, use the **certificate** command in certificate chain configuration mode. To delete your router's certificate or any registration authority certificates stored on your router, use the **no** form of this command.

certificate *certificate-serial-number*

no certificate *certificate-serial-number*

Syntax Description

certificate-serial-number	Serial number of the certificate to add or delete.

Defaults

No default behavior or values.

Command Modes

Certificate chain configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

You could use this command to manually specify a certificate. However, this command is rarely used in this manner. Instead, this command is usually used only to add or delete certificates.

Examples

The following example deletes the router's certificate. In this example, the router had a general purpose RSA key pair with one corresponding certificate. The **show** command is used in this example to determine the serial number of the certificate to be deleted.

```
myrouter# show crypto ca certificates

Certificate
  Subject Name
    Name: myrouter.example.com
    IP Address: 10.0.0.1
  Status: Available
  Certificate Serial Number: 0123456789ABCDEF0123456789ABCDEF
  Key Usage: General Purpose

CA Certificate
  Status: Available
  Certificate Serial Number: 3051DF7123BEE31B8341DFE4B3A338E5F
  Key Usage: Not Set

myrouter# configure terminal
myrouter(config)# crypto ca certificate chain myca
myrouter(config-cert-chain)# no certificate 0123456789ABCDEF0123456789ABCDEF
% Are you sure you want to remove the certificate [yes/no]? yes
% Be sure to ask the CA administrator to revoke this certificate.
myrouter(config-cert-chain)# exit
myrouter(config)#
```

Related Commands

Command	Description
crypto ca certificate chain	Enters the certificate chain configuration mode.

crl optional

Note Effective with Cisco IOS Release 12.3(2)T, this command was replaced by the **revocation-check** command.

To allow the certificates of other peers to be accepted without trying to obtain the appropriate CRL, use the **crl optional** command in ca-identity configuration mode. To return to the default behavior in which CRL checking is mandatory before your router can accept a certificate, use the **no** form of this command.

crl optional

no crl optional

Syntax Description

This command has no arguments or keywords.

Defaults

The router must have and check the appropriate CRL before accepting the certificate of another IP Security peer.

Command Modes

Ca-identity configuration

Command History

Release	Modification
11.3 T	This command was introduced.
12.3(2)T	This command was replaced by the **revocation-check** command.

Usage Guidelines

When your router receives a certificate from a peer, it will search its memory for the appropriate CRL. If the router finds the appropriate CRL, that CRL will be used. Otherwise, the router will download the CRL from either the certificate authority (CA) or from a CRL distribution point (CDP) as designated in the certificate of the peer. Your router will then check the CRL to ensure that the certificate that the peer sent has not been revoked. (If the certificate appears on the CRL, your router will not accept the certificate and will not authenticate the peer.) To instruct the router not to download the CRL and treat the certificate as not revoked, use the **crl optional** command.

Note If the CRL already exists in the memory (for example, by using the **crypto ca crl request** command to manually download the CRL), the CRL will still be checked even if the **crl optional** command is configured.

Examples

The following example declares a CA and permits your router to accept certificates without trying to obtain a CRL. This example also specifies a nonstandard retry period and retry count.

```
crypto ca identity myca
 enrollment url http://ca_server
 enrollment retry-period 20
```

```
enrollment retry-count 100
crl optional
```

Related Commands

Command	Description
crypto ca identity	Declares the CA your router should use.

crl query

If you have to query the certificate revocation list (CRL) to ensure that the certificate of the peer has not been revoked and you have to provide the Lightweight Directory Access Protocol (LDAP) server information, use the **crl query** command in ca-trustpoint configuration mode. To return to the default behavior, assuming that the CRL distribution point (CDP) has a complete LDAP URL, use **no** form of this command.

crl query ldap://*hostname***:**[*port*]

no crl query ldap://*hostname***:**[*port*]

Syntax Description

ldap://*hostname*	Query is made to the hostname of the LDAP server that serves the CRL for the certification authority (CA) server (for example, ldap://myldap.cisco.com).
:*port*	(Optional) Port number of the LDAP server (for example, ldap://myldap.cisco.com:3899).

Defaults

Not enabled. If **crl query ldap://***hostname***:**[*port*] is not enabled, the router assumes that the CDP that is embedded in the certificate is a complete URL (for example, ldap:myldap.cisco.com/CN=myCA,O=Cisco) and uses it to download the CRL.

If the port number is not configured, the default LDAP server port 389 will be used.

Command Modes

Ca-trustpoint configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.
12.2(8)T	This command replaced the **query url** command.

Usage Guidelines

When Cisco IOS software tries to verify a peer certificate (for example, during Internet Key Exchange [IKE] or Secure Sockets Layer [SSL] handshake), it queries the CRL to ensure that the certificate has not been revoked. To locate the CRL, it first looks for the CDP extension in the certificate. If the extension exists, it is used to download the CRL. Otherwise, the Simple Certificate Enrollment Protocol (SCEP) GetCRL mechanism is used to query the CRL from the CA server directly (some CA servers do not support this method).

Cisco IOS software supports three types of CDP:

- HTTP URL (Example1: http://10.10.10.10:81/myca.crl)
- LDAP URL (Example 2: ldap://10.10.10.10:3899/CN=myca, O=cisco or Example 3: ldap:///CN=myca, O=cisco)
- LDAP/X.500 DN (Example 4: CN=myca, O=cisco)

To locate the CRL, a complete URL needs to be formed. As a result, Example 3 and Example 4 still require the hostname and the port number. The **ldap://***hostname***:**[*port*} keywords and arguments are used to provide this information.

Note The **crypto ca trustpoint** command replaces the **crypto ca identity** and **crypto ca trusted-root** commands and all related subcommands (all ca-identity and trusted-root configuration mode commands). If you enter a ca-identity or trusted-root subcommand, the configuration mode and command will be written back as ca-trustpoint.

Examples

The following example shows how to configure your router to query the CRL with the LDAP URL that is published by the CA named "bar":

```
crypto ca trustpoint mytp
 enrollment url http://bar.cisco.com
 crl query ldap://bar.cisco.com:3899
```

Related Commands

Command	Description
crypto ca trustpoint	Declares the CA that your router should use.
revocation-check	Checks the revocation status of a certificate.

crypto ca authenticate

To authenticate the certification authority (by getting the CA's certificate), use the **crypto ca authenticate** command in global configuration mode.

crypto ca authenticate *name*

Syntax Description

name	Specifies the name of the CA. This is the same name used when the CA was declared with the **crypto ca identity** command.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command is required when you initially configure CA support at your router.

This command authenticates the CA to your router by obtaining the CA's self-signed certificate which contains the CA's public key. Because the CA signs its own certificate, you should manually authenticate the CA's public key by contacting the CA administrator when you perform this command.

If you are using RA mode (using the **enrollment mode ra** command) when you issue the **crypto ca authenticate** command, then registration authority signing and encryption certificates will be returned from the CA as well as the CA certificate.

This command is not saved to the router configuration. However, the public keys embedded in the received CA (and RA) certificates are saved to the configuration as part of the RSA public key record (called the "RSA public key chain").

Note If the CA does not respond by a timeout period after this command is issued, the terminal control will be returned so it will not be tied up. If this happens, you must re-enter the command.Cisco IOS software will not recognize CA certificate expiration dates set for beyond the year 2049. If the validity period of the CA certificate is set to expire after the year 2049, the following error message will be displayed when authentication with the CA server is attempted:

```
error retrieving certificate :incomplete chain
```

If you receive an error message similar to this one, check the expiration date of your CA certificate. If the expiration date of your CA certificate is set after the year 2049, you must reduce the expiration date by a year or more.

Examples

In the following example, the router requests the CA's certificate. The CA sends its certificate and the router prompts the administrator to verify the CA's certificate by checking the CA certificate's fingerprint. The CA administrator can also view the CA certificate's fingerprint, so you should compare what the CA administrator sees to what the router displays on the screen. If the fingerprint on the router's screen matches the fingerprint viewed by the CA administrator, you should accept the certificate as valid.

```
crypto ca authenticate myca
Certificate has the following attributes:
Fingerprint: 0123 4567 89AB CDEF 0123
Do you accept this certificate? [yes/no] y#
```

Related Commands

Command	Description
crypto ca identity	Declares the CA your router should use.
debug crypto pki transactions	Displays debug messages for the trace of interaction (message type) between the CA and the router.
show crypto ca certificates	Displays information about your certificate, the certificate of the CA, and any RA certificates.

crypto ca certificate chain

To enter the certificate chain configuration mode, use the **crypto ca certificate chain** command in global configuration mode. (You need to be in certificate chain configuration mode to delete certificates.)

crypto ca certificate chain *name*

Syntax Description

name	Specifies the name of the CA. Use the same name as when you declared the CA using the **crypto ca identity** command.

Defaults

No default behavior or values.

Command Modes

Global configuration.

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command puts you into certificate chain configuration mode. When you are in certificate chain configuration mode, you can delete certificates using the **certificate** command.

Examples

The following example deletes the router's certificate. In this example, the router had a general-purpose RSA key pair with one corresponding certificate. The **show** command is used to determine the serial number of the certificate to be deleted.

```
myrouter# show crypto ca certificates

Certificate
  Subject Name
    Name: myrouter.example.com
    IP Address: 10.0.0.1
  Status: Available
  Certificate Serial Number: 0123456789ABCDEF0123456789ABCDEF
  Key Usage: General Purpose

CA Certificate
  Status: Available
  Certificate Serial Number: 3051DF7123BEE31B8341DFE4B3A338E5F
  Key Usage: Not Set

myrouter# configure terminal
myrouter(config)# crypto ca certificate chain myca
myrouter(config-cert-chain)# no certificate 0123456789ABCDEF0123456789ABCDEF
% Are you sure you want to remove the certificate [yes/no]? yes
% Be sure to ask the CA administrator to revoke this certificate.
myrouter(config-cert-chain)# exit
myrouter(config)#
```

Related Commands

Command	Description
certificate	Adds certificates manually.
crypto ca identity	Declares the CA your router should use.

crypto ca certificate query

To specify that certificates and certificate revocation lists (CRLs) should not be stored locally but retrieved from the certification authority when needed, use the **crypto ca certificate query** command in global configuration mode. This command puts the router into query mode. To cause certificates and CRLs to be stored locally (the default), use the **no** form of this command.

crypto ca certificate query

no crypto ca certificate query

Syntax Description

This command has no arguments or keywords.

Defaults

Certificates and CRLs are stored locally in the router's NVRAM.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Normally, certain certificates and certificate revocation lists (CRLs) are stored locally in the router's NVRAM, and each certificate and CRL uses a moderate amount of memory.

To save NVRAM space, you can use this command to put the router into query mode, which prevents certificates and CRLs from being stored locally; instead, they are retrieved from the CA when needed. This will save NVRAM space but could result in a slight performance impact.

Examples

The following example prevents certificates and CRLs from being stored locally on the router; instead, they are retrieved from the CA when needed.

```
crypto ca certificate query
```

crypto ca crl request

Note Effective with Cisco IOS Release 12.3(7)T, this command was replaced by the **crypto pki crl request** command.

To request that a new certificate revocation list (CRL) be obtained immediately from the certification authority, use the **crypto ca crl request** command in global configuration mode.

crypto ca crl request *name*

Syntax Description

name	Specifies the name of the CA. This is the same name used when the CA was declared with the **crypto pki trustpoint** command.

Defaults

Normally, the router requests a new CRL when it is verifying a certificate and there is no CRL cached.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.
12.3(7)T	This command was replaced by the **crypto pki crl request** command.

Usage Guidelines

A CRL lists all the certificates of the network device that have been revoked. Revoked certificates will not be honored by your router; therefore, any IPSec device with a revoked certificate cannot exchange IP Security traffic with your router.

The first time your router receives a certificate from a peer, it will download a CRL from the CA. Your router then checks the CRL to make sure the certificate of the peer has not been revoked. (If the certificate appears on the CRL, it will not accept the certificate and will not authenticate the peer.)

A CRL can be reused with subsequent certificates until the CRL expires. If your router receives the certificate of a peer after the applicable CRL has expired, it will download the new CRL.

If your router has a CRL which has not yet expired, but you suspect that the contents of the CRL are out of date, use the **crypto ca crl request** command to request that the latest CRL be immediately downloaded to replace the old CRL.

This command is not saved to the configuration.

Note This command should be used only after the trustpoint is enrolled.

Examples

The following example immediately downloads the latest CRL to your router:

```
crypto ca crl request
```

crypto ca enroll

To obtain your router's certificate(s) from the certification authority, use the **crypto ca enroll** command in global configuration mode. To delete a current enrollment request, use the **no** form of this command.

crypto ca enroll *name*

no crypto ca enroll *name*

Syntax Description

name	Specifies the name of the CA. Use the same name as when you declared the CA using the **crypto ca identity** command.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command requests certificates from the CA for all of your router's RSA key pairs. This task is also known as enrolling with the CA. (Technically, enrolling and obtaining certificates are two separate events, but they both occur when this command is issued.)

Your router needs a signed certificate from the CA for each of your router's RSA key pairs; if you previously generated general purpose keys, this command will obtain the one certificate corresponding to the one general purpose RSA key pair. If you previously generated special usage keys, this command will obtain two certificates corresponding to each of the special usage RSA key pairs.

If you already have a certificate for your keys you will be unable to complete this command; instead, you will be prompted to remove the existing certificate first. (You can remove existing certificates with the **no certificate** command.)

The **crypto ca enroll** command is not saved in the router configuration.

Note If your router reboots after you issue the **crypto ca enroll** command but before you receive the certificate(s), you must reissue the command.

Responding to Prompts

When you issue the **crypto ca enroll** command, you are prompted a number of times.

First, you are prompted to create a challenge password. This password can be up to 80 characters in length. This password is necessary in the event that you ever need to revoke your router's certificate(s). When you ask the CA administrator to revoke your certificate, you must supply this challenge password as a protection against fraudulent or mistaken revocation requests.

Note This password is not stored anywhere, so you need to remember this password.

If you lose the password, the CA administrator may still be able to revoke the router's certificate but will require further manual authentication of the router administrator identity.

You are also prompted to indicate whether or not your router's serial number should be included in the obtained certificate. The serial number is not used by IP Security or Internet Key Exchange but may be used by the CA to either authenticate certificates or to later associate a certificate with a particular router. (Note that the serial number stored is the serial number of the internal board, not the one on the enclosure.) Ask your CA administrator if serial numbers should be included. If you are in doubt, include the serial number.

Normally, you would not include the IP address because the IP address binds the certificate more tightly to a specific entity. Also, if the router is moved, you would need to issue a new certificate. Finally, a router has multiple IP addresses, any of which might be used with IPSec.

If you indicate that the IP address should be included, you will then be prompted to specify the interface of the IP address. This interface should correspond to the interface that you apply your crypto map set to. If you apply crypto map sets to more than one interface, specify the interface that you name in the **crypto map local-address** command.

Examples

In the following example, a router with a general-purpose RSA key pair requests a certificate from the CA. When the router displays the certificate fingerprint, the administrator verifies this number by calling the CA administrator, who checks the number. The fingerprint is correct, so the router administrator accepts the certificate.

There can be a delay between when the router administrator sends the request and when the certificate is actually received by the router. The amount of delay depends on the CA method of operation.

```
myrouter(config)# crypto ca enroll myca
%
% Start certificate enrollment ..
% Create a challenge password. You will need to verbally provide this
   password to the CA Administrator in order to revoke your certificate.
   For security reasons your password will not be saved in the configuration.
   Please make a note of it.

Password: <mypassword>
Re-enter password: <mypassword>

% The subject name in the certificate will be: myrouter.example.com
% Include the router serial number in the subject name? [yes/no]: yes
% The serial number in the certificate will be: 03433678
% Include an IP address in the subject name [yes/no]? yes
Interface: ethernet0/0
Request certificate from CA [yes/no]? yes
% Certificate request sent to Certificate Authority
% The certificate request fingerprint will be displayed.
% The 'show crypto ca certificate' command will also show the fingerprint.

myrouter(config)#
```

Some time later, the router receives the certificate from the CA and displays the following confirmation message:

```
myrouter(config)#   Fingerprint: 01234567 89ABCDEF FEDCBA98 75543210
```

```
%CRYPTO-6-CERTRET: Certificate received from Certificate Authority

myrouter(config)#
```

If necessary, the router administrator can verify the displayed Fingerprint with the CA administrator.

If there is a problem with the certificate request and the certificate is not granted, the following message is displayed on the console instead:

```
%CRYPTO-6-CERTREJ: Certificate enrollment request was rejected by Certificate Authority
```

The subject name in the certificate is automatically assigned to be the same as the RSA key pair's name. In the above example, the RSA key pair was named "myrouter.example.com." (The router assigned this name.)

Requesting certificates for a router with special usage keys would be the same as the previous example, except that two certificates would have been returned by the CA. When the router received the two certificates, the router would have displayed the same confirmation message:

```
%CRYPTO-6-CERTRET: Certificate received from Certificate Authority
```

Related Commands

Command	Description
crypto ca identity	Declares the CA your router should use.
debug crypto pki messages	Displays debug messages for the details of the interaction (message dump) between the CA and the router.
debug crypto pki transactions	Displays debug messages for the trace of interaction (message type) between the CA and the router.
show crypto ca certificates	Displays information about your certificate, the certificate of the CA, and any RA certificates.

crypto ca identity

To declare the certification authority that your router should use, use the **crypto ca identity** command in global configuration mode. To delete all identity information and certificates associated with the CA, use the **no** form of this command.

crypto ca identity *name*

no crypto ca identity *name*

Syntax Description

name	Creates a name for the CA. (If you previously declared the CA and just want to update its characteristics, specify the name you previously created.) The CA might require a particular name, such as its domain name.

Defaults

Your router does not know about any CA until you declare one with this command.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to declare a CA. Performing this command puts you into the ca-identity configuration mode, where you can specify characteristics for the CA with the following commands:

- **enrollment url** (Specify the URL of the CA—always required.)
- **enrollment mode ra** (Specify RA mode, required only if your CA system provides a registration authority [RA]).
- **query url** (Specify the URL of the Lightweight Directory Access Protocol server, required only if your CA supports an RA and the LDAP protocol.)
- **enrollment retry period** (Specify a period of time the router should wait between sending certificate request retries—optional.)
- **enrollment retry count** (Specify how many certificate request retries your router will send before giving up—optional.)
- **crl optional** (Specify that your router can still accept other peers' certificates if the certificate revocation list is not accessible—optional.)

Examples

The following example declares a CA and identifies characteristics of the CA. In this example, the name "myca" is created for the CA, which is located at http://ca_server.

The CA does not use an RA or LDAP, and the CA's scripts are stored in the default location. This is the minimum possible configuration required to declare a CA.

```
crypto ca identity myca
 enrollment url http://ca_server
```

The following example declares a CA when the CA uses an RA. The CA's scripts are stored in the default location, and the CA uses the SCEP instead of LDAP. This is the minimum possible configuration required to declare a CA that uses an RA.

```
crypto ca identity myca_with_ra
 enrollment url http://ca_server
 enrollment mode ra
 query url ldap://serverx
```

The following example declares a CA that uses an RA and a nonstandard cgi-bin script location. This example also specifies a nonstandard retry period and retry count, and permits the router to accept certificates when CRLs are not obtainable.

```
crypto ca identity myca_with_ra
 enrollment url http://example_ca/cgi-bin/somewhere/scripts.exe
 enrollment mode ra
 query url ldap://serverx
 enrollment retry-period 20
 enrollment retry-count 100
 crl optional
```

In the previous example, if the router does not receive a certificate back from the CA within 20 minutes of sending a certificate request, the router will resend the certificate request. The router will keep sending a certificate request every 20 minutes until a certificate is received or until 100 requests have been sent.

If the CA cgi-bin script location is not /cgi-bin/pkiclient.exe at the CA (the default CA cgi-bin script location) you need to also include the nonstandard script location in the URL, in the form of http://CA_name/script_location where script_location is the full path to the CA scripts.

Related Commands

Command	Description
crl optional	Allows other peer certificates to still be accepted by your router even if the appropriate CRL is not accessible to your router.
enrollment mode ra	Turns on RA mode.
enrollment retry count	Specifies how many times a router will resend a certificate request.
enrollment retry period	Specifies the wait period between certificate request retries.
enrollment url	Changes the URL of the CA.
query url	Specifies LDAP protocol support.

crypto ca trusted-root

To configure a trusted root with a selected name, use the **crypto ca trusted-root** global configuration command. To deconfigure a trusted root, use the **no** form of this command.

crypto ca trusted-root *name*

no crypto ca trusted-root *name*

Syntax Description

name	Creates a name for the trusted root.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

This command allows you to configure a trusted root with a selected name. You want to configure a trusted root so that your router can verify certificates issued to peers. Thus, your router does not have to enroll with the certification authority that issued the certificates to the peers. This command enables trusted root configuration mode.

You can specify characteristics for the trusted root with the following commands:

- **crl query**—Queries the certificate revocation list (CRL) published by the configured root with the Lightweight Directory Access Protocol URL (optional).
- **crl optional**—Specifies that your router can still accept other peers' certificates if the CRL is not accessible (optional).
- **root CEP**—Specifies Simple Certificate Enrollment Protocol, which is formerly known as Cisco Enrollment Protocol (CEP), (or TFTP) to get the root certificate (required).
- **root PROXY**—Specifies the Hypertext Transfer Protocol (HTTP) proxy server for getting the root certificate (required).
- **root TFTP**—Specifies TFTP (or SCEP) to get the root certificate (required).

Examples

The following example shows configuring a trusted root. In this example, the name "netscape" is created for the trusted root.

```
crypto ca trusted-root netscape
```

Related Commands

Command	Description
crl optional	Allows other peer certificates to be accepted by your router even if the appropriate CRL is not accessible to your router.
crl query	Uses the LDAP URL to query the CRL published by the configured root.
crypto ca authenticate	Authenticates the CA (by getting the certificate of a CA).
crypto ca identity	Declares the CA that your router should use.
root CEP	Defines the CEP protocol, which gets the root certificate of a given CA.
root PROXY	Defines the HTTP proxy server for getting the root certificate of a CA.
root TFTP	Defines the TFTP protocol, which gets the root certificate of a given CA.

crypto key zeroize rsa

To delete all RSA keys from your router, use the **crypto key zeroize rsa** command in global configuration mode.

crypto key zeroize rsa

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command deletes all RSA keys that were previously generated by your router. If you issue this command, you must also perform two additional tasks:

- Ask the certification authority administrator to revoke your router's certificates at the CA; you must supply the challenge password you created when you originally obtained the router's certificates with the **crypto ca enroll** command.
- Manually remove the router's certificates from the configuration using the **certificate** command.

Note This command cannot be undone (after you save your configuration), and after RSA keys have been deleted you cannot use certificates or the CA or participate in certificate exchanges with other IP Security peers unless you reconfigure CA interoperability by regenerating RSA keys, getting the CA's certificate, and requesting your own certificate again.

This command is not saved to the configuration.

Examples

The following example deletes the general purpose RSA key pair that was previously generated for the router. After deleting the RSA key pair, the administrator contacts the CA administrator and requests that the router's certificate be revoked. The administrator then deletes the router's certificate from the configuration.

```
crypto key zeroize rsa
crypto ca certificate chain
 no certificate
```

Related Commands

Command	Description
certificate	Adds certificates manually.
crypto ca certificate chain	Enters the certificate chain configuration mode.

enrollment mode ra

To turn on registration authority mode, use the **enrollment mode ra** command in ca-identity configuration mode. To turn off RA mode, use the **no** form of the command.

enrollment mode ra

no enrollment mode ra

Syntax Description

This command has no arguments or keywords.

Defaults

RA mode is turned off.

Command Modes

Ca-identity configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command is required if your CA system provides a registration authority (RA). This command provides compatibility with RA systems.

Examples

The following example shows the minimum configuration required to declare a CA when the CA provides an RA:

```
crypto ca identity myca
 enrollment url http://ca_server
 enrollment mode ra
 ldap://serverx
```

Related Commands

Command	Description
crypto ca identity	Declares the CA that your router should use.

enrollment retry count

To specify how many times a router will resend a certificate request, use the **enrollment retry-count** command in ca-identity configuration mode. To reset the retry count to the default of 0, which indicates an infinite number of retries, se the **no** form of the command.

enrollment retry count *number*

no enrollment retry count

Syntax Description

number	Specify how many times the router will resend a certificate request when the router does not receive a certificate from the CA from the previous request. Specify from 1 to 100 retries.

Defaults

The router will send the CA another certificate request until a valid certificate is received (there is no limit to the number of retries).

Command Modes

Ca-identity configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

After requesting a certificate, the router waits to receive a certificate from the CA. If the router does not receive a certificate within a period of time (the retry period), the router will send another certificate request. The router will continue to send requests until it receives a valid certificate, until the CA returns an enrollment error, or until the configured number of retries (the retry count) is exceeded. By default, the router will keep sending requests forever, but you can change this to a finite number with this command.

A retry count of 0 indicates that there is no limit to the number of times the router should resend the certificate request. By default, the retry count is 0.

Examples

The following example declares a CA, changes the retry period to 10 minutes, and changes the retry count to 60 retries. The router will resend the certificate request every 10 minutes until the router receives the certificate or until approximately 10 hours pass since the original request was sent, whichever occurs first. (10 minutes x 60 tries = 600 minutes = 10 hours.)

```
crypto ca identity myca
 enrollment url http://ca_server
 enrollment retry-period 10
 enrollment retry-count 60
```

Related Commands

Command	Description
crypto ca identity	Declares the CA that your router should use.
enrollment retry period	Specifies the wait period between certificate request retries.

enrollment retry period

To specify the wait period between certificate request retries, use the **enrollment retry period** command in ca-identity configuration mode. To reset the retry period to the default of 1 minute, use the **no** form of this command.

enrollment retry period *minutes*

no enrollment retry period

Syntax Description

minutes	Specify the number of minutes the router waits before resending a certificate request to the certification authority, when the router does not receive a certificate from the CA by the previous request. Specify from 1 to 60 minutes. By default, the router retries every 1 minute.

Defaults

The router will send the CA another certificate request every 1 minute until a valid certificate is received.

Command Modes

Ca-identity configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

After requesting a certificate, the router waits to receive a certificate from the CA. If the router does not receive a certificate within a period of time (the retry period) the router will send another certificate request. The router will continue to send requests until it receives a valid certificate, until the CA returns an enrollment error, or until the configured number of retries is exceeded. (By default, the router will keep sending requests forever, but you can change this to a finite number of permitted retries with the **enrollment retry count** command.)

Use the **enrollment retry-period** command to change the retry period from the default of 1 minute between retries.

Examples

The following example declares a CA and changes the retry period to 5 minutes:

```
crypto ca identity myca
 enrollment url http://ca_server
 enrollment retry-period 5
```

Related Commands

Command	Description
crypto ca identity	Declares the CA that your router should use.
enrollment retry count	Specifies how many times a router will resend a certificate request.

enrollment url

To specify the certification authority location by naming the CA's URL, use the **enrollment url** command in ca-identity configuration mode. To remove the CA's URL from the configuration, use the **no** form of this command.

enrollment url *url*

no enrollment url *url*

Syntax Description

url	Specify the URL of the CA where your router should send certificate requests, for example, http://ca_server. This URL must be in the form of http://*CA_name*, where *CA_name* is the CA's host Domain Name System name or IP address. If the CA cgi-bin script location is not /cgi-bin/pkiclient.exe at the CA (the default CA cgi-bin script location) you need to also include the non-standard script location in the URL, in the form of http://CA_name/script_location where script_location is the full path to the CA scripts.

Defaults

Your router does not know the CA URL until you specify it with this command.

Command Modes

Ca-identity configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify the CA's URL. This command is required when you declare a CA with the **crypto ca identity** command.

The URL must include the CA script location if the CA scripts are not loaded into the default cgi-script location. The CA administrator should be able to tell you where the CA scripts are located.

To change a CA's URL, repeat the **enrollment url** command to overwrite the older URL.

Examples

The following example shows the absolute minimum configuration required to declare a CA:

```
crypto ca identity myca
 enrollment url http://ca_server
```

Related Commands

Command	Description
crypto ca identity	Declares the CA that your router should use.

query url

Note Effective with Cisco IOS Release 12.2(8)T, this command was replaced by the **crl query** command.

If you have to query the certificate revocation list (CRL) to ensure that the certificate of the peer has not been revoked and you have to provide the Lightweight Directory Access Protocol (LDAP) server information, use the **query url** command in ca-trustpoint configuration mode. To return to the default behavior, assuming that the CRL distribution point (CDP) has a complete (LDAP) URL, use **no** form of this command.

query url ldap://*hostname***:**[*port*]

query url ldap://*hostname***:**[*port*]

Syntax Description

ldap://*hostname*	Query is made to the hostname of the LDAP server that serves the CRL for the certification authority (CA) server (for example, ldap://myldap.cisco.com).
:*port*	(Optional) Port number of the LDAP server (for example, ldap://myldap.cisco.com:3899).

Defaults

No enabled. If **query url ldap://***hostname***:**[*port*] is not enabled, the router assumes that the CDP that is embedded in the certificate is a complete URL (for example, ldap:myldap.cisco.com/CN=myCA,O=Cisco) and uses it to download the CRL.

If the port number is not configured, the default LDAP server port 389 will be used.

Command Modes

Ca-trustpoint configuration

Command History

Release	Modification
11.3 T	This command was introduced.
12.2(8)T	This command was replaced by the **crl query** command.

Usage Guidelines

When Cisco IOS software tries to verify a peer certificate (for example, during Internet Key Exchange [IKE] or Secure Sockets Layer [SSL] handshake), it queries the CRL to ensure that the certificate has not been revoked. To locate the CRL, it first looks for the CDP extension in the certificate. If the extension exists, it is used to download the CRL. Otherwise, the Simple Certificate Enrollment Protocol (SCEP) GetCRL mechanism is used to query the CRL from the CA server directly (some CA servers do not support this method).

Cisco IOS software supports three types of CDP:

- HTTP URL (Example1: http://10.10.10.10:81/myca.crl)
- LDAP URL (Example 2: ldap://10.10.10.10:3899/CN=myca, O=cisco or Example 3: ldap:///CN=myca, O=cisco)

- LDAP/X.500 DN (Example 4: CN=myca, O=cisco)

To locate the CRL, a complete URL needs to be formed. As a result, Example 3 and Example 4 still require the hostname and the port number. The **ldap://***hostname***:**[*port*} keywords and arguments are used to provide this information.

Note The **crypto ca trustpoint** command replaces the **crypto ca identity** and **crypto ca trusted-root** commands and all related subcommands (all ca-identity and trusted-root configuration mode commands). If you enter a ca-identity or trusted-root subcommand, the configuration mode and command will be written back as ca-trustpoint.

Examples

The following example shows how to configure your router to query the CRL with the LDAP URL that is published by the CA named "bar":

```
crypto ca trustpoint mytp
 enrollment url http://bar.cisco.com
 query url ldap://bar.cisco.com:3899
```

Related Commands

Command	Description
crypto ca trustpoint	Declares the CA that your router should use.
revocation-check	Checks the revocation status of a certificate.

root CEP

To define the Simple Certificate Enrollment Protocol (SCEP), which gets the root certificate of a given certification authority, use the **root CEP** trusted root configuration command.

root CEP *url*

Syntax Description

url	Specifies the given URL of the configured root.

Defaults

No default behavior or values.

Command Modes

Trusted root configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

After configuring a trusted root, use this command to get the root certificate of a given CA using the SCEP protocol. To ensure authenticity of the root certificate, the router administrator is expected to compare the root certificate fingerprint with the image in the server administrator. The fingerprint of the root certificate is an MD5 hash of the complete root certificate.

Note SCEP is formerly known as Cisco Enrollment Protocol; the functionality remains the same.

Examples

The following example shows defining SCEP as the desired protocol to get the root certificate of the CA. In this example, the URL is defined as “http://ciscoca-ultra:80”.

```
crypto ca trusted-root netscape
    root CEP http://ciscoca-ultra:80
```

Related Commands

Command	Description
crl query	Uses the LDAP URL to query the CRL published by the configured root.
crypto ca identity	Declares the CA that your router should use.
crypto ca trusted-root	Configures a trusted root with a selected name.
root PROXY	Defines the HTTP proxy server for getting the root certificate of a CA.
root TFTP	Defines the TFTP protocol, which gets the root certificate of a given CA.

root PROXY

To define the Hypertext Transfer Protocol proxy server for getting the root certificate, use the **root PROXY** trusted root configuration command.

root PROXY *url*

Syntax Description

url	Specifies the URL of the HTTP proxy server; for example, http://proxy_server.

Defaults

No default behavior or values.

Command Modes

Trusted root configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

After configuring a trusted root and defining the protocol, use this command to define the HTTP proxy server for getting the given root certificate of a certification authority.

Examples

The following example defines the HTTP proxy server for getting the root certificate of a certification authority. In this example, SCEP is the defined protocol, and the HTTP proxy server is "megatron."

```
crypto ca trusted-root griffin
    root CEP http://griffin:80
    root proxy http://megatron:8080
```

Related Commands

Command	Description
crl query	Uses the LDAP URL to query the CRL published by the configured root.
crypto ca identity	Declares the CA that your router should use.
crypto ca trusted-root	Configures a trusted root with a selected name.
root CEP	Defines the CEP protocol, which gets the root certificate of a given CA.
root TFTP	Defines the TFTP protocol, which gets the root certificate of a given CA.

root TFTP

To define the TFTP protocol, which gets the root certificate of a given certification authority, use the **root TFTP** trusted root configuration command.

root TFTP *server-hostname filename*

Syntax Description

server-hostname	Creates a name for the server.
filename	Creates a name for the file that will store the root certificate.

Defaults

No default behavior or values.

Command Modes

Trusted root configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

After configuring a trusted root, use this command to get the root certificate of a given CA using the TFTP protocol. This command enables an authenticated root certificate to be stored as a file on the TFTP server.

Note This command should be used if your CA server does not support Simple Certificate Enrollment Protocol, which is formerly known as Cisco Enrollment Protocol (CEP).

Examples

The following example shows defining TFTP as the desired protocol to get the root certificate of a certification authority. In this example, the name "banana" is created for the trusted root, "strawberry" is the server hostname, and "ca-cert/banana" is the filename where the root certificate is stored.

```
crypto ca trusted-root banana
    root tftp strawberry ca-cert/banana
```

Related Commands

Command	Description
crl query	Uses the LDAP URL to query the CRL published by the configured root.
crypto ca identity	Declares the CA that your router should use.
crypto ca trusted-root	Configures a trusted root with a selected name.
root CEP	Defines the CEP protocol, which gets the root certificate of a given CA.
root PROXY	Defines the HTTP proxy server for getting the root certificate of a CA.

show crypto ca certificates

To view information about your certificate, the certification authority certificate, and any registration authority certificates, use the **show crypto ca certificates** command in EXEC mode.

show crypto ca certificates

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command shows information about the following certificates:

- Your certificate, if you have requested one from the CA (see the **crypto ca enroll** command)
- The CA's certificate, if you have received the CA's certificate (see the **crypto ca authenticate** command)
- RA certificates, if you have received RA certificates (see the **crypto ca authenticate** command)

Examples

The following is sample output from the **show crypto ca certificates** command after you authenticated the CA by requesting the CA's certificate and public key with the **crypto ca authenticate** command:

```
CA Certificate
  Status: Available
  Certificate Serial Number: 3051DF7123BEE31B8341DFE4B3A338E5F
  Key Usage: Not Set
```

The CA certificate might show Key Usage as "Not Set."

The following is sample output from the **show crypto ca certificates** command, and shows the router's certificate and the CA's certificate. In this example, a single, general purpose RSA key pair was previously generated, and a certificate was requested but not received for that key pair.

```
Certificate
  Subject Name
    Name: myrouter.example.com
    IP Address: 10.0.0.1
    Serial Number: 04806682
  Status: Pending
  Key Usage: General Purpose
    Fingerprint: 428125BD A3419600 3F6C7831 6CD8FA95 00000000

CA Certificate
  Status: Available
  Certificate Serial Number: 3051DF7123BEE31B8341DFE4B3A338E5F
  Key Usage: Not Set
```

Note that in the previous sample, the router's certificate Status shows "Pending." After the router receives its certificate from the CA, the Status field changes to "Available" in the **show** output.

The following is sample output from the **show crypto ca certificates** command, and shows two router's certificates and the CA's certificate. In this example, special usage RSA key pairs were previously generated, and a certificate was requested and received for each key pair.

```
Certificate
  Subject Name
    Name: myrouter.example.com
    IP Address: 10.0.0.1
  Status: Available
  Certificate Serial Number: 428125BDA34196003F6C78316CD8FA95
  Key Usage: Signature

Certificate
  Subject Name
    Name: myrouter.example.com
    IP Address: 10.0.0.1
  Status: Available
  Certificate Serial Number: AB352356AFCD0395E333CCFD7CD33897
  Key Usage: Encryption

CA Certificate
  Status: Available
  Certificate Serial Number: 3051DF7123BEE31B8341DFE4B3A338E5F
  Key Usage: Not Set
```

The following is sample output from the **show crypto ca certificates** command when the CA supports an RA. In this example, the CA and RA certificates were previously requested with the **crypto ca authenticate** command.

```
CA Certificate
  Status: Available
  Certificate Serial Number: 3051DF7123BEE31B8341DFE4B3A338E5F
  Key Usage: Not Set

RA Signature Certificate
  Status: Available
  Certificate Serial Number: 34BCF8A0
  Key Usage: Signature

RA KeyEncipher Certificate
  Status: Available
  Certificate Serial Number: 34BCF89F
  Key Usage: Encryption
```

Related Commands

Command	Description
crypto ca authenticate	Authenticates the CA (by obtaining the certificate of the CA).
crypto ca enroll	Obtains the certificates of your router from the CA.
debug crypto pki messages	Displays debug messages for the details of the interaction (message dump) between the CA and the route.
debug crypto pki transactions	Displays debug messages for the trace of interaction (message type) between the CA and the router.

show crypto ca crls

To display the current certificate revocation list (CRL) on router, use the **show crypto ca crls** command in EXEC configuration mode.

show crypto ca crls

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.1	This command was introduced.

Examples

The following is sample output of the **show crypto ca crls** command:

```
Router# show crypto ca crls

          CRL Issuer Name:
              OU = sjvpn, O = cisco, C = us
              LastUpdate: 16:17:34 PST Jan 10 2002
              NextUpdate: 17:17:34 PST Jan 11 2002
              Retrieved from CRL Distribution Point:
                LDAP: CN = CRL1, OU = sjvpn, O = cisco, C = us
```

Related Commands

Command	Description
crypto ca crl request	Requests that a new CRL be obtained immediately from the CA.

show crypto ca roots

To display the roots configured in the router, use the **show crypto ca roots** EXEC configuration command.

show crypto ca roots

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
12.1(1)T	This command was introduced.

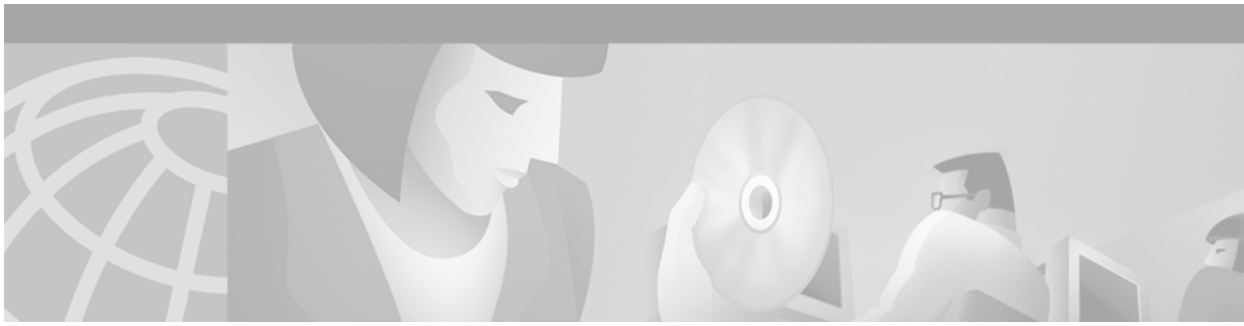
Examples

The following is sample output of the **show crypto ca roots** command:

```
Router# show crypto ca roots

Root netscape:
      Subject Name:
      CN=Certificate Manager
      OU=On 07/01
      O=cisco
      C=US
      Serial Number:01
      Certificate configured.
      Root identity:netscape
      CEP URL:http://cisco-ultra
      CRL query url: ldap://cisco-ultra
```

Related Commands

Command	Description
crypto ca authenticate	Authenticates the CA (by getting the certificate of a CA).
crypto ca identity	Declares the CA that your router should use.
crypto ca trusted-root	Configures a trusted root with a selected name.
root CEP	Defines the CEP protocol, which gets the root certificate of a given CA.
root PROXY	Defines the HTTP proxy server for getting the root certificate of a CA.
root TFTP	Defines the TFTP protocol, which gets the root certificate of a given CA.



Internet Key Exchange Security Protocol Commands

This chapter describes Internet Key Exchange Security Protocol (IKE) commands. The IKE protocol is a key management protocol standard that is used in conjunction with the IPSec standard. IP Security is an IP security feature that provides robust authentication and encryption of IP packets.

IPSec can be configured without IKE, but IKE enhances IPSec by providing additional features, flexibility, and ease of configuration for the IPSec standard.

IKE is a hybrid protocol that implements the Oakley key exchange and Skeme key exchange inside the Internet Security Association and Key Management Protocol (ISAKMP) framework. (ISAKMP, Oakley, and Skeme are security protocols implemented by IKE.)

For configuration information, refer to the chapter "Configuring Internet Key Exchange Security Protocol" in the *Cisco IOS Security Configuration Guide.*

address

To specify the IP address of the remote peer's RSA public key you will manually configure, use the **address** public key configuration command.

address *ip-address*

Syntax Description

ip-address	Specifies the IP address of the remote peer.

Defaults

No default behavior or values.

Command Modes

Public key configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command in conjunction with the **named-key** command to specify which IP Security peer's RSA public key you will manually configure next. This command should only be used when the router has a single interface that processes IPSec.

Examples

The following example manually specifies the RSA public keys of an IPSec peer:

```
Router(config)# crypto key pubkey-chain rsa
Router(config-pubkey-chain)# named-key otherpeer.example.com
Router(config-pubkey-key)# address 10.5.5.1
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 005C300D 06092A86 4886F70D 01010105
Router(config-pubkey)# 00034B00 30480241 00C5E23B 55D6AB22
Router(config-pubkey)# 04AEF1BA A54028A6 9ACC01C5 129D99E4
Router(config-pubkey)# 64CAB820 847EDAD9 DF0B4E4C 73A05DD2
Router(config-pubkey)# BD62A8A9 FA603DD2 E2A8A6F8 98F76E28
Router(config-pubkey)# D58AD221 B583D7A4 71020301 0001
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
Router(config-pubkey-chain)# exit
Router(config)#
```

Related Commands

Command	Description
addressed-key	Specifies the RSA public key of the peer you will manually configure.
crypto key pubkey-chain rsa	Enters public key configuration mode (to allow you to manually specify the RSA public keys of other devices).

Command	Description
key-string (IKE)	Specifies the RSA public key of a remote peer.
show crypto key pubkey-chain rsa	Displays peer RSA public keys stored on your router.

addressed-key

To specify which peer's RSA public key you will manually configure, use the **addressed-key** public key chain configuration command.

addressed-key *key-address* [**encryption** | **signature**]

Syntax Description

key-address	Specifies the IP address of the remote peer's RSA keys.
encryption	(Optional) Indicates that the RSA public key to be specified will be an encryption special usage key.
signature	(Optional) Indicates that the RSA public key to be specified will be a signature special usage key.

Defaults

If neither the **encryption** nor **signature** keywords are used, general purpose keys will be specified.

Command Modes

Public key chain configuration. This command invokes public key configuration mode.

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command or the **named-key** command to specify which IP Security peer's RSA public key you will manually configure next.

Follow this command with the **key string** command to specify the key.

If the IPSec remote peer generated general-purpose RSA keys, do not use the **encryption** or **signature** keywords.

If the IPSec remote peer generated special-usage keys, you must manually specify both keys: use this command and the **key-string** command twice and use the **encryption** and **signature** keywords respectively.

Examples

The following example manually specifies the RSA public keys of two IPSec peers. The peer at 10.5.5.1 uses general-purpose keys, and the other peer uses special-usage keys.

```
Router(config)# crypto key pubkey-chain rsa
Router(config-pubkey-chain)# named-key otherpeer.example.com
Router(config-pubkey-key)# address 10.5.5.1
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 005C300D 06092A86 4886F70D 01010105
Router(config-pubkey)# 00034B00 30480241 00C5E23B 55D6AB22
Router(config-pubkey)# 04AEF1BA A54028A6 9ACC01C5 129D99E4
Router(config-pubkey)# 64CAB820 847EDAD9 DF0B4E4C 73A05DD2
Router(config-pubkey)# BD62A8A9 FA603DD2 E2A8A6F8 98F76E28
Router(config-pubkey)# D58AD221 B583D7A4 71020301 0001
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
```

```
Router(config-pubkey-chain)# addressed-key 10.1.1.2 encryption
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 00302017 4A7D385B 1234EF29 335FC973
Router(config-pubkey)# 2DD50A37 C4F4B0FD 9DADE748 429618D5
Router(config-pubkey)# 18242BA3 2EDFBDD3 4296142A DDF7D3D8
Router(config-pubkey)# 08407685 2F2190A0 0B43F1BD 9A8A26DB
Router(config-pubkey)# 07953829 791FCDE9 A98420F0 6A82045B
Router(config-pubkey)# 90288A26 DBC64468 7789F76E EE21
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
Router(config-pubkey-chain)# addressed-key 10.1.1.2 signature
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 0738BC7A 2BC3E9F0 679B00FE 53987BCC
Router(config-pubkey)# 01030201 42DD06AF E228D24C 458AD228
Router(config-pubkey)# 58BB5DDD F4836401 2A2D7163 219F882E
Router(config-pubkey)# 64CE69D4 B583748A 241BED0F 6E7F2F16
Router(config-pubkey)# 0DE0986E DF02031F 4B0B0912 F68200C4
Router(config-pubkey)# C625C389 0BFF3321 A2598935 C1B1
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
Router(config-pubkey-chain)# exit
Router(config)#
```

Related Commands

Command	Description
crypto key pubkey-chain rsa	Enters public key configuration mode (to allow you to manually specify the RSA public keys of other devices).
key-string (IKE)	Specifies the RSA public key of a remote peer.
named-key	Specifies which peer RSA public key you will manually configure.
show crypto key pubkey-chain rsa	Displays peer RSA public keys stored on your router.

authentication (IKE policy)

To specify the authentication method within an Internet Key Exchange policy, use the **authentication** ISAKMP policy configuration command. IKE policies define a set of parameters to be used during IKE negotiation. To reset the authentication method to the default value, use the **no** form of this command.

authentication {**rsa-sig** | **rsa-encr** | **pre-share**}

no authentication

Syntax Description

rsa-sig	Specifies RSA signatures as the authentication method.
rsa-encr	Specifies RSA encrypted nonces as the authentication method.
pre-share	Specifies preshared keys as the authentication method.

Defaults

RSA signatures

Command Modes

ISAKMP policy configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify the authentication method to be used in an IKE policy.

If you specify RSA signatures, you must configure your peer routers to obtain certificates from a certification authority (CA).

If you specify RSA encrypted nonces, you must ensure that each peer has the other peer's RSA public keys. (See the **crypto key pubkey-chain rsa**, **addressed-key**, **named-key**, **address**, and commands.)

If you specify preshared keys, you must also separately configure these preshared keys. (See the **crypto isakmp identity** and **crypto isakmp key** commands.)

Examples

The following example configures an IKE policy with preshared keys as the authentication method (all other parameters are set to the defaults):

```
crypto isakmp policy 15
    authentication pre-share
    exit
```

Related Commands

Command	Description
crypto isakmp key	Configures a preshared authentication key.
crypto isakmp policy	Defines an IKE policy.
crypto key generate rsa	Generates RSA key pairs.
encryption (IKE policy)	Specifies the encryption algorithm within an IKE policy.
group (IKE policy)	Specifies the Diffie-Hellman group identifier within an IKE policy.
hash (IKE policy)	Specifies the hash algorithm within an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.
show crypto isakmp policy	Displays the parameters for each IKE policy.

clear crypto isakmp

To clear active Internet Key Exchange connections, use the **clear crypto isakmp** EXEC configuration command.

clear crypto isakmp [*connection-id*]

Syntax Description

connection-id	(Optional) Specifies which connection to clear. If this argument is not used, all existing connections will be cleared.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to clear active IKE connections.

Caution If the *connection-id* argument is not used, all existing IKE connections will be cleared when this command is issued.

Examples

The following example clears an IKE connection between two peers connected by interfaces 172.21.114.123 and 172.21.114.67:

```
Router# show crypto isakmp sa

    dst           src           state        conn-id   slot
172.21.114.123 172.21.114.67  QM_IDLE           1       0
155.0.0.2      155.0.0.1      QM_IDLE           8       0

Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# clear crypto isakmp 1
Router(config)# exit
Router# show crypto isakmp sa
    dst           src           state        conn-id   slot
155.0.0.2      155.0.0.1      QM_IDLE           8       0

Router#
```

Related Commands

Command	Description
show crypto isakmp sa	Displays all current IKE SAs at a peer.

crypto isakmp client configuration address-pool local

To configure the IP address local pool to reference Internet Key Exchange on your router, use the **crypto isakmp client configuration address-pool local** global configuration command. To restore the default value, use the **no** form of this command.

crypto isakmp client configuration address-pool local *pool-name*

no crypto isakmp client configuration address-pool local

Syntax Description

pool-name	Specifies the name of a local address pool.

Defaults

IP address local pools do not reference IKE.

Command Modes

Global configuration

Command History

Release	Modification
12.0(4)XE	This command was introduced.
12.0(7)T	This command was integrated into Cisco IOS release 12.0(7)T.

Examples

The following example references IP address local pools to IKE on your router, with “ire” as the *pool-name*:

```
crypto isakmp client configuration address-pool local ire
```

Related Commands

Command	Description
ip local pool	Configures a local pool of IP addresses to be used when a remote peer connects to a point-to-point interface.

crypto isakmp enable

To globally enable Internet Key Exchange at your peer router, use the **crypto isakmp enable** global configuration command. To disable IKE at the peer, use the **no** form of this command.

crypto isakmp enable

no crypto isakmp enable

Syntax Description

This command has no arguments or keywords.

Defaults

IKE is enabled.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

IKE is enabled by default. IKE does not have to be enabled for individual interfaces, but is enabled globally for all interfaces at the router.

If you do not want IKE to be used in your IPSec implementation, you can disable IKE at all your IP Security peers. If you disable IKE at one peer, you must disable it at all your IPSec peers.

If you disable IKE, you will have to make these concessions at the peers:

- You must manually specify all the IPSec security associations (SAs) in the crypto maps at the peers. (Crypto map configuration is described in the chapter "Configuring IPSec Network Security" in the *Cisco IOS Security Configuration Guide*.)
- The IPSec SAs of the peers will never time out for a given IPSec session.
- During IPSec sessions between the peers, the encryption keys will never change.
- Anti-replay services will not be available between the peers.
- Certification authority (CA) support cannot be used.

Examples

The following example disables IKE at one peer. (The same command should be issued at all remote peers.)

```
no crypto isakmp enable
```

crypto isakmp identity

To define the identity used by the router when participating in the Internet Key Exchange protocol, use the **crypto isakmp identity** global configuration command. Set an Internet Security Association Key Management Protocol identity whenever you specify preshared keys. To reset the ISAKMP identity to the default value (address), use the **no** form of this command.

crypto isakmp identity {**address** | **hostname**}

no crypto isakmp identity

Syntax Description

address	Sets the ISAKMP identity to the IP address of the interface that is used to communicate to the remote peer during IKE negotiations.
hostname	Sets the ISAKMP identity to the host name concatenated with the domain name (for example, myhost.example.com).

Defaults

The IP address is used for the ISAKMP identity.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify an ISAKMP identity either by IP address or by host name.

The **address** keyword is typically used when there is only one interface (and therefore only one IP address) that will be used by the peer for IKE negotiations, and the IP address is known.

The **hostname** keyword should be used if there is more than one interface on the peer that might be used for IKE negotiations, or if the interface's IP address is unknown (such as with dynamically assigned IP addresses).

As a general rule, you should set all peers' identities in the same way, either by IP address or by host name.

Examples

The following example uses preshared keys at two peers and sets both their ISAKMP identities to IP address.

At the local peer (at 10.0.0.1) the ISAKMP identity is set and the preshared key is specified.

```
crypto isakmp identity address
crypto isakmp key sharedkeystring address 192.168.1.33
```

At the remote peer (at 192.168.1.33) the ISAKMP identity is set and the same preshared key is specified.

```
crypto isakmp identity address
crypto isakmp key sharedkeystring address 10.0.0.1
```

Note In the preceding example if the **crypto isakmp identity** command had not been performed, the ISAKMP identities would have still been set to IP address, the default identity.

The following example uses preshared keys at two peers and sets both their ISAKMP identities to hostname.

At the local peer the ISAKMP identity is set and the preshared key is specified.

```
crypto isakmp identity hostname
crypto isakmp key sharedkeystring hostname RemoteRouter.example.com
ip host RemoteRouter.example.com 192.168.0.1
```

At the remote peer the ISAKMP identity is set and the same preshared key is specified.

```
crypto isakmp identity hostname
crypto isakmp key sharedkeystring hostname LocalRouter.example.com
ip host LocalRouter.example.com 10.0.0.1 10.0.0.2
```

In the above example, host names are used for the peers' identities because the local peer has two interfaces that might be used during an IKE negotiation.

In the above example the IP addresses are also mapped to the host names; this mapping is not necessary if the routers' host names are already mapped in DNS.

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp key	Configures a preshared authentication key.

crypto isakmp keepalive

To send Internet Key Exchange (IKE) keepalive messages from one router to another router, use the **crypto isakmp keepalive** command in global configuration mode. To disable keepalives, use the **no** form of this command.

crypto isakmp keepalive *secs*

no crypto isakmp keepalive *secs*

Syntax Description

secs	Number of seconds between keepalive messages.

Defaults

This command is not enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1M	This command was introduced.

Usage Guidelines

The **crypto isakmp keepalive** command is used to send IKE keepalives, which detect the continued connectivity of an IKE security association (SA), between two peer points.

Examples

The following example shows how to configure keepalive messages to be sent every 40 seconds:

```
crypto isakmp keepalive 40
```

crypto isakmp key

To configure a preshared authentication key, use the **crypto isakmp key** global configuration command. You must configure this key whenever you specify preshared keys in an Internet Key Exchange policy. To delete a preshared authentication key, use the **no** form of this command.

crypto isakmp key *keystring* **address** *peer-address* [*mask*]

crypto isakmp key *keystring* **hostname** *peer-hostname*

no crypto isakmp key *keystring* **address** *peer-address*

no crypto isakmp key *keystring* **hostname** *peer-hostname*

Syntax Description

address	Use this keyword if the remote peer Internet Security Association Key Management Protocol identity was set with its IP address.
hostname	Use this keyword if the remote peer ISAKMP identity was set with its hostname.
keystring	Specify the preshared key. Use any combination of alphanumeric characters up to 128 bytes. This preshared key must be identical at both peers.
peer-address	Specify the IP address of the remote peer.
peer-hostname	Specify the host name of the remote peer. This is the peer's host name concatenated with its domain name (for example, myhost.example.com).
mask	(Optional) Specify the subnet address of the remote peer. (The argument can be used only if the remote peer ISAKMP identity was set with its IP address.)

Defaults

There is no default preshared authentication key.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.
12.1(1)T	The *mask* argument was added.

Usage Guidelines

Use this command to configure preshared authentication keys. You must perform this command at both peers.

If an IKE policy includes preshared keys as the authentication method, these preshared keys must be configured at both peers—otherwise the policy cannot be used (the policy will not be submitted for matching by the IKE process). The **crypto isakmp key** command is the second task required to configure the preshared keys at the peers. (The first task is accomplished with the **crypto isakmp identity** command.)

Use the **address** keyword if the remote peer ISAKMP identity was set with its IP address.

Use the **hostname** keyword if the remote ISAKMP identity was set with its host name.

With the **address** keyword, you can also use the *mask* argument to indicate the remote peer ISAKMP identity will be established using the preshared key only. If the *mask* argument is used, preshared keys are no longer restricted between two users.

Note If you specify *mask*, you must use a subnet address. (The subnet address 0.0.0.0 is not recommended because it encourages group preshared keys, which allow all peers to have the same group key, thereby reducing the security of your user authentication.)

With the **hostname** keyword, you might also have to map the host name of the remote peer to all IP addresses of the remote peer interfaces that could be used during the IKE negotiation. (This is done with the **ip host** command.) You must map the host name to IP address unless this mapping is already done in a Domain Name System (DNS) server.

Examples

In the following example, the remote peer "RemoteRouter" specifies an ISAKMP identity by address:

```
crypto isakmp identity address
```

In the following example, the local peer "LocalRouter" also specifies an ISAKMP identity, but by host name:

```
crypto isakmp identity hostname
```

Now, the preshared key must be specified at each peer.

In the following example, the local peer specifies the preshared key and designates the remote peer by its IP address and a mask:

```
crypto isakmp key sharedkeystring address 172.21.230.33  255.255.255.255
```

In the following example, the remote peer specifies the same preshared key and designates the local peer by its host name:

```
crypto isakmp key sharedkeystring hostname LocalRouter.example.com
```

The remote peer also maps multiple IP addresses to the same host name for the local peer because the local peer has two interfaces which both might be used during an IKE negotiation with the local peer. These two interfaces' IP addresses (10.0.0.1 and 10.0.0.2) are both mapped to the remote peer's host name.

```
ip host LocalRouter.example.com 10.0.0.1 10.0.0.2
```

(This mapping would not have been necessary if LocalRouter.example.com was already mapped in DNS.)

In this example, a remote peer specifies its ISAKMP identity by address, and the local peer specifies its ISAKMP identity by host name. Depending on the circumstances in your network, both peers could specify their ISAKMP identity by address, or both by host name.

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp identity	Defines the identity the router uses when participating in the IKE protocol.
ip host	Defines a static host name-to-address mapping in the host cache.

crypto isakmp policy

To define an Internet Key Exchange policy, use the **crypto isakmp policy** global configuration command. IKE policies define a set of parameters to be used during the IKE negotiation. To delete an IKE policy, use the **no** form of this command.

crypto isakmp policy *priority*

no crypto isakmp policy

Syntax Description

priority	Uniquely identifies the IKE policy and assigns a priority to the policy. Use an integer from 1 to 10,000, with 1 being the highest priority and 10,000 the lowest.

Defaults

There is a default policy, which always has the lowest priority. This default policy contains default values for the encryption, hash, authentication, Diffie-Hellman group, and lifetime parameters. (The parameter defaults are listed below in the Usage Guidelines section.)

When you create an IKE policy, if you do not specify a value for a particular parameter, the default for that parameter will be used.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify the parameters to be used during an IKE negotiation. (These parameters are used to create the IKE security association [SA].)

This command invokes the Internet Security Association Key Management Protocol policy configuration (config-isakmp) command mode. While in the ISAKMP policy configuration command mode, the following commands are available to specify the parameters in the policy:

- **encryption (IKE policy)**; default = 56-bit DES-CBC
- **hash (IKE policy)**; default = SHA-1
- **authentication (IKE policy)**; default = RSA signatures
- **group (IKE policy)**; default = 768-bit Diffie-Hellman
- **lifetime (IKE policy)**; default = 86,400 seconds (one day)

If you do not specify one of these commands for a policy, the default value will be used for that parameter.

To exit the config-isakmp command mode, type **exit**.

You can configure multiple IKE policies on each peer participating in IPSec. When the IKE negotiation begins, it tries to find a common policy configured on both peers, starting with the highest priority policies as specified on the remote peer.

Examples

The following example configures two policies for the peer:

```
crypto isakmp policy 15
 hash md5
 authentication rsa-sig
 group 2
 lifetime 5000
crypto isakmp policy 20
 authentication pre-share
 lifetime 10000
```

The above configuration results in the following policies:

```
Router# show crypto isakmp policy

Protection suite priority 15
encryption algorithm:DES - Data Encryption Standard (56 bit keys)
hash algorithm:Message Digest 5
authentication method:Rivest-Shamir-Adleman Signature
Diffie-Hellman Group:#2 (1024 bit)
lifetime:5000 seconds, no volume limit
Protection suite priority 20
encryption algorithm:DES - Data Encryption Standard (56 bit keys)
hash algorithm:Secure Hash Standard
authentication method:preshared Key
Diffie-Hellman Group:#1 (768 bit)
lifetime:10000 seconds, no volume limit
Default protection suite
encryption algorithm:DES - Data Encryption Standard (56 bit keys)
hash algorithm:Secure Hash Standard
authentication method:Rivest-Shamir-Adleman Signature
Diffie-Hellman Group:#1 (768 bit)
lifetime:86400 seconds, no volume limit
```

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
encryption (IKE policy)	Specifies the encryption algorithm within an IKE policy.
group (IKE policy)	Specifies the Diffie-Hellman group identifier within an IKE policy.
hash (IKE policy)	Specifies the hash algorithm within an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.
show crypto isakmp policy	Displays the parameters for each IKE policy.

crypto key generate rsa

To generate Rivest, Shamir, and Adelman (RSA) key pairs, use the **crypto key generate rsa** command in global configuration mode.

crypto key generate rsa {**general-keys** | **usage-keys**} [**label** *key-label*] [**exportable**] [**modulus** *modulus-size*]

Syntax Description

general-keys	Specifies that the general-purpose key pair should be generated.
usage-keys	Specifies that two RSA special-usage key pairs should be generated (that is, one encryption pair and one signature pair) instead of one general-purpose key pair.
label *key-label*	(Optional) Name that is used for an RSA key pair when they are being exported. If a key label is not specified, the fully qualified domain name (FQDN) of the router is used.
exportable	(Optional) Specifies that the RSA key pair can be exported to another Cisco device, such as a router.
modulus *modulus-size*	(Optional) IP size of the key modulus in a range from 350 to 2048. If you do not enter the modulus keyword and specify a size, you will be prompted.

Defaults

RSA key pairs do not exist.

Command Modes

Global configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(8)T	The *key-pair-label* argument was added.
12.2(15)T	The **exportable** keywords was added.

Usage Guidelines

Use this command to generate RSA key pairs for your Cisco device (such as a router).

RSA keys are generated in pairs—one public RSA key and one private RSA key.

If your router already has RSA keys when you issue this command, you will be warned and prompted to replace the existing keys with new keys.

Note Before issuing this command, ensure that your router has a host name and IP domain name configured (with the **hostname** and **ip domain-name** commands). You will be unable to complete the **crypto key generate rsa** command without a host name and IP domain name. (This situation is not true when you only generate a named key pair.)

This command is not saved in the router configuration; however, the RSA keys generated by this command are saved in the private configuration in NVRAM (which is never displayed to the user or backed up to another device).

There are two mutually exclusive types of RSA key pairs: special-usage keys and general-purpose keys. When you generate RSA key pairs, you will be prompted to select either special-usage keys or general-purpose keys.

Special-Usage Keys

If you generate special-usage keys, two pairs of RSA keys will be generated. One pair will be used with any Internet Key Exchange (IKE) policy that specifies RSA signatures as the authentication method, and the other pair will be used with any IKE policy that specifies RSA encrypted keys as the authentication method.

A certification authority (CA) is used only with IKE policies specifying RSA signatures, not with IKE policies specifying RSA-encrypted nonces. (However, you could specify more than one IKE policy and have RSA signatures specified in one policy and RSA-encrypted nonces in another policy.)

If you plan to have both types of RSA authentication methods in your IKE policies, you may prefer to generate special-usage keys. With special-usage keys, each key is not unnecessarily exposed. (Without special-usage keys, one key is used for both authentication methods, increasing the exposure of that key.)

General-Purpose Keys

If you generate general-purpose keys, only one pair of RSA keys will be generated. This pair will be used with IKE policies specifying either RSA signatures or RSA encrypted keys. Therefore, a general-purpose key pair might get used more frequently than a special-usage key pair.

Named Key Pairs

If you generate a named key pair using the *key-pair-label* argument, you must also specify the **usage-keys** keyword or the **general-keys** keyword. Named key pairs allow you to have multiple RSA key pairs, enabling the Cisco IOS software to maintain a different key pair for each identity certificate.

Modulus Length

When you generate RSA keys, you will be prompted to enter a modulus length. A longer modulus could offer stronger security but takes longer to generate (see Table 24 for sample times) and takes longer to use. (The Cisco IOS software does not support a modulus greater than 2048 bits.) A length of less than 512 is normally not recommended. (In certain situations, the shorter modulus may not function properly with IKE, so Cisco recommends using a minimum modulus of 1024.)

Table 24 Sample Times Required to Generate RSA Keys

	Modulus Length			
Router	**360 bits**	**512 bits**	**1024 bits**	**2048 bits (maximum)**
Cisco 2500	11 seconds	20 seconds	4 minutes, 38 seconds	longer than 1 hour
Cisco 4700	less than 1 second	1 second	4 seconds	50 seconds

Examples

The following example generates special-usage RSA keys:

```
Router(config)# crypto key generate rsa usage-keys
The name for the keys will be: myrouter.example.com
```

```
Choose the size of the key modulus in the range of 360 to 2048 for your Signature Keys.
Choosing a key modulus greater than 512 may take a few minutes.
How many bits in the modulus[512]? <return>
Generating RSA keys.... [OK].

Choose the size of the key modulus in the range of 360 to 2048 for your Encryption Keys.
Choosing a key modulus greater than 512 may take a few minutes.
How many bits in the modulus[512]? <return>
Generating RSA keys.... [OK].
```

The following example generates general-purpose RSA keys:

Note You cannot generate both special-usage and general-purpose keys; you can generate only one or the other.

```
Router(config)# crypto key generate rsa
The name for the keys will be: myrouter.example.com

Choose the size of the key modulus in the range of 360 to 2048 for your General Purpose
Keys. Choosing a key modulus greater than 512 may take a few minutes.
How many bits in the modulus[512]? <return>
Generating RSA keys.... [OK].
```

The following example generates the general-purpose RSA key pair “exampleCAkeys”:

```
crypto key generate rsa general-purpose exampleCAkeys
crypto ca trustpoint exampleCAkeys
 enroll url http://exampleCAkeys/certsrv/mscep/mscep.dll
 rsakeypair exampleCAkeys 1024 1024
```

Related Commands

Command	Description
debug crypto engine	Displays debug messages about crypto engines.
hostname	Specifies or modifies the host name for the network server.
ip domain-name	Defines a default domain name to complete unqualified host names (names without a dotted-decimal domain name).
show crypto key mypubkey rsa	Displays the RSA public keys of your router.

crypto key pubkey-chain rsa

To enter public key configuration mode (so you can manually specify other devices' RSA public keys), use the **crypto key pubkey-chain rsa** global configuration command.

crypto key pubkey-chain rsa

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to enter public key chain configuration mode. Use this command when you need to manually specify other IPSec peers' RSA public keys. You need to specify other peers' keys when you configure RSA encrypted nonces as the authentication method in an Internet Key Exchange policy at your peer router.

Examples

The following example specifies the RSA public keys of two other IPSec peers. The remote peers use their IP address as their identity.

```
Router(config)# crypto key pubkey-chain rsa
Router(config-pubkey-chain)# addressed-key 10.5.5.1
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 00302017 4A7D385B 1234EF29 335FC973
Router(config-pubkey)# 2DD50A37 C4F4B0FD 9DADE748 429618D5
Router(config-pubkey)# 18242BA3 2EDFBDD3 4296142A DDF7D3D8
Router(config-pubkey)# 08407685 2F2190A0 0B43F1BD 9A8A26DB
Router(config-pubkey)# 07953829 791FCDE9 A98420F0 6A82045B
Router(config-pubkey)# 90288A26 DBC64468 7789F76E EE21
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
Router(config-pubkey-chain)# addressed-key 10.1.1.2
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 0738BC7A 2BC3E9F0 679B00FE 53987BCC
Router(config-pubkey)# 01030201 42DD06AF E228D24C 458AD228
Router(config-pubkey)# 58BB5DDD F4836401 2A2D7163 219F882E
Router(config-pubkey)# 64CE69D4 B583748A 241BED0F 6E7F2F16
Router(config-pubkey)# 0DE0986E DF02031F 4B0B0912 F68200C4
Router(config-pubkey)# C625C389 0BFF3321 A2598935 C1B1
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
Router(config-pubkey-chain)# exit
Router(config)#
```

Related Commands

Command	Description
address	Specifies the IP address of the remote RSA public key of the remote peer you will manually configure.
addressed-key	Specifies the RSA public key of the peer you will manually configure.
key-string (IKE)	Specifies the RSA public key of a remote peer.
named-key	Specifies which peer RSA public key you will manually configure.
show crypto key pubkey-chain rsa	Displays peer RSA public keys stored on your router.

crypto map client authentication list

To configure Internet Key Exchange extended authentication (Xauth) on your router, use the **crypto map client authentication list** global configuration command. To restore the default value, use the **no** form of this command.

crypto map *map-name* **client authentication list** *list-name*

no crypto map *map-name* **client authentication list** *list-name*

Syntax Description

map-name	The name you assign to the crypto map set.
list-name	Character string used to name the list of authentication methods activated when a user logs in. The list-name must match the list-name defined during AAA configuration.

Defaults

Xauth is not enabled.

Command Modes

Global configuration mode

Command History

Release	Modification
12.1(1)T	This command was introduced.

Usage Guidelines

Before configuring Xauth, you should complete the following tasks:

- Set up an authentication list using AAA commands
- Configure an IP Security transform
- Configure a crypto map
- Configure Internet Security Association Key Management Protocol policy

After enabling Xauth, you should apply the crypto map on which Xauth is configured to the router interface.

Examples

The following example configures user authentication (a list of authentication methods called xauthlist) on an existing static crypto map called xauthmap:

```
crypto map xauthmap client authentication list xauthlist
```

The following example configures user authentication (a list of authentication methods called xauthlist) on a dynamic crypto map called xauthdynamic that has been applied to a static crypto map called xauthmap:

```
crypto map xauthmap client authentication list xauthlist
crypto map xauthmap 10 ipsec-isakmp dynamic xauthdynamic
```

Related Commands

Command	Description
aaa authentication login	Sets AAA authentication at login.
crypto ipsec transform-set	Defines a transform set, which is an acceptable combination of security protocols and algorithms, and enters crypto transform configuration mode.
crypto isakmp key	Configures a preshared authentication key.
crypto isakmp policy	Defines an IKE policy, and enters ISAKMP policy configuration mode.
crypto map (global configuration)	Creates or modify a crypto map entry, and enters the crypto map configuration mode.
interface	Enters the interface configuration mode.

crypto map client configuration address

To configure IKE Mode Configuration on your router, use the **crypto map client configuration address** global configuration command. To disable IKE Mode Configuration, use the **no** form of this command.

crypto map *tag* **client configuration address** [**initiate** | **respond**]

no crypto map *tag* **client configuration address**

Syntax Description

tag	The name that identifies the crypto map.
initiate	(Optional) A keyword that indicates the router will attempt to set IP addresses for each peer.
respond	(Optional) A keyword that indicates the router will accept requests for IP addresses from any requesting peer.

Defaults

IKE Mode Configuration is not enabled.

Command Modes

Global configuration.

Command History

Release	Modification
12.0(4)XE	This command was introduced.
12.0(7)T	This command was implemented in Cisco IOS release 12.0(7)T.

Usage Guidelines

At the time of this publication, this feature is an IETF draft with limited support. Therefore this feature was not designed to enable the configuration mode for every IKE connection by default.

Examples

The following examples configure IKE Mode Configuration on your router:

```
crypto map dyn client configuration address initiate
crypto map dyn client configuration address respond
```

Related Commands

Command	Description
crypto map (global)	Creates or modifies a crypto map entry and enters the crypto map configuration mode

crypto map isakmp authorization list

To enable Internet Key Exchange (IKE) querying of authentication, authorization, and accounting (AAA) for tunnel attributes in aggressive mode, use the **crypto map isakmp authorization list** global configuration command. To restore the default value, use the **no** form of this command.

crypto map *map-name* **isakmp authorization list** *list-name*

no crypto map *map-name* **isakmp authorization list** *list-name*

Syntax Description

map-name	Name you assign to the crypto map set.
list-name	Character string used to name the list of authorization methods activated when a user logs in. The list name must match the list name defined during AAA configuration.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(1)T	This command was introduced

Usage Guidelines

Use the **crypto map client authorization list** command to enable key lookup from a AAA server.

Preshared keys deployed in a large-scale Virtual Private Network (VPN) without a certification authority, with dynamic IP addresses, are accessed during aggression mode of IKE negotiation through a AAA server. Thus, users have their own key, which is stored on an external AAA server. This allows for central management of the user database, linking it to an existing database, in addition to allowing every user to have their own unique, more secure pre-shared key.

Before configuring the **crypto map client authorization list** command, you should perform the following tasks:

- Set up an authorization list using AAA commands.
- Configure an IPSec transform.
- Configure a crypto map.
- Configure an Internet Security Association Key Management Protocol policy using IPSec and IKE commands.

After enabling the **crypto map client authorization list** command, you should apply the previously defined crypto map to the interface.

Examples

The following example shows how to configure the **crypto map client authorization list** command:

```
crypto map ikessaaamap isakmp authorization list ikessaaalist
crypto map ikessaaamap 10 ipsec-isakmp dynamic ikessaaadyn
```

Related Commands

Command	Description
aaa authorization	Sets parameters that restrict a user's network access.
crypto ipsec transform-set	Defines a transform set, which is an acceptable combination of security protocols and algorithms, and enters crypto transform configuration mode.
crypto map (global configuration)	Creates or modifies a crypto map entry and enters the crypto map configuration mode
crypto isakmp policy	Defines an IKE policy and enters ISAKMP policy configuration mode.
crypto isakmp key	Configures a preshared authentication key.
interface	Enters interface configuration mode.

encryption (IKE policy)

To specify the encryption algorithm within an Internet Key Exchange policy, use the **encryption** ISAKMP policy configuration command. IKE policies define a set of parameters to be used during IKE negotiation. To reset the encryption algorithm to the default value, use the **no** form of this command.

encryption {**des** | **3des**}

no encryption

Syntax Description

des	Specifies 56-bit DES-CBC as the encryption algorithm.
3des	Specifies 168-bit DES (3DES) as the encryption algorithm.

Defaults

The 56-bit DES-CBC encryption algorithm.

Command Modes

ISAKMP policy configuration

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(2)T	The **3des** option was added.

Usage Guidelines

Use this command to specify the encryption algorithm to be used in an IKE policy.

Examples

The following example configures an IKE policy with the 3DES encryption algorithm (all other parameters are set to the defaults):

```
crypto isakmp policy
    encryption 3des
    exit
```

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp policy	Defines an IKE policy.
group (IKE policy)	Specifies the Diffie-Hellman group identifier within an IKE policy.
hash (IKE policy)	Specifies the hash algorithm within an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.
show crypto isakmp policy	Displays the parameters for each IKE policy.

group (IKE policy)

To specify the Diffie-Hellman group identifier within an Internet Key Exchange policy, use the **group** ISAKMP policy configuration command. IKE policies define a set of parameters to be used during IKE negotiation. To reset the Diffie-Hellman group identifier to the default value, use the **no** form of this command.

group {**1** | **2**}

no group

Syntax Description

1	Specifies the 768-bit Diffie-Hellman group.
2	Specifies the 1024-bit Diffie-Hellman group.

Defaults

768-bit Diffie-Hellman (group 1)

Command Modes

ISAKMP policy configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify the Diffie-Hellman group to be used in an IKE policy.

Examples

The following example configures an IKE policy with the 1024-bit Diffie-Hellman group (all other parameters are set to the defaults):

```
crypto isakmp policy 15
    group 2
    exit
```

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp policy	Defines an IKE policy.
encryption (IKE policy)	Specifies the encryption algorithm within an IKE policy.
hash (IKE policy)	Specifies the hash algorithm within an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.
show crypto isakmp policy	Displays the parameters for each IKE policy.

hash (IKE policy)

To specify the hash algorithm within an Internet Key Exchange policy, use the **hash** ISAKMP policy configuration command. IKE policies define a set of parameters to be used during IKE negotiation. To reset the hash algorithm to the default SHA-1 hash algorithm, use the **no** form of this command.

hash {**sha** | **md5**}

no hash

Syntax Description

sha	Specifies SHA-1 (HMAC variant) as the hash algorithm.
md5	Specifies MD5 (HMAC variant) as the hash algorithm.

Defaults

The SHA-1 hash algorithm

Command Modes

ISAKMP policy configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify the hash algorithm to be used in an IKE policy.

Examples

The following example configures an IKE policy with the MD5 hash algorithm (all other parameters are set to the defaults):

```
crypto isakmp policy 15
    hash md5
    exit
```

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp policy	Defines an IKE policy.
encryption (IKE policy)	Specifies the encryption algorithm within an IKE policy.
group (IKE policy)	Specifies the Diffie-Hellman group identifier within an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.
show crypto isakmp policy	Displays the parameters for each IKE policy.

key-string (IKE)

To manually specify a remote peer's RSA public key, use the **key-string** public key configuration command.

key-string *key-string*

Syntax Description

key-string	Enter the key in hexadecimal format. While entering the key data you can press Return to continue entering data.

Defaults

No default behavior or values.

Command Modes

Public key configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to manually specify the RSA public key of an IP Security peer. Before using this command, you must identify the remote peer using either the **addressed-key** or **named-key** command.

If possible, to avoid mistakes, you should cut and paste the key data (instead of attempting to type in the data).

To complete the command, you must return to the global configuration mode by typing **quit** at the config-pubkey prompt.

Examples

The following example manually specifies the RSA public keys of an IPSec peer:

```
Router(config)# crypto key pubkey-chain rsa
Router(config-pubkey-chain)# named-key otherpeer.example.com
Router(config-pubkey-key)# address 10.5.5.1
Router(config-pubkey-key)# key-string
Router(config-pubkey)# 005C300D 06092A86 4886F70D 01010105
Router(config-pubkey)# 00034B00 30480241 00C5E23B 55D6AB22
Router(config-pubkey)# 04AEF1BA A54028A6 9ACC01C5 129D99E4
Router(config-pubkey)# 64CAB820 847EDAD9 DF0B4E4C 73A05DD2
Router(config-pubkey)# BD62A8A9 FA603DD2 E2A8A6F8 98F76E28
Router(config-pubkey)# D58AD221 B583D7A4 71020301 0001
Router(config-pubkey)# quit
Router(config-pubkey-key)# exit
Router(config-pubkey-chain)# exit
Router(config)#
```

Related Commands

Command	Description
addressed-key	Specifies the RSA public key of the peer you will manually configure.
crypto key pubkey-chain rsa	Enters public key configuration mode (to allow you to manually specify the RSA public keys of other devices).
named-key	Specifies which peer RSA public key you will manually configure.
show crypto key pubkey-chain rsa	Displays peer RSA public keys stored on your router.

lifetime (IKE policy)

To specify the lifetime of an Internet Key Exchange security association (SA), use the **lifetime** Internet Security Association Key Management Protocol policy configuration command. To reset the SA lifetime to the default value, use the **no** form of this command.

lifetime *seconds*

no lifetime

Syntax Description

seconds	Number of many seconds for each each SA should exist before expiring. Use an integer from 60 to 86,400 seconds.

Defaults

86,400 seconds (one day)

Command Modes

ISAKMP policy configuration

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command to specify how long an IKE SA exists before expiring.

When IKE begins negotiations, the first thing it does is agree upon the security parameters for its own session. The agreed-upon parameters are then referenced by an SA at each peer. The SA is retained by each peer until the SA's lifetime expires. Before an SA expires, it can be reused by subsequent IKE negotiations, which can save time when setting up new IPSec SAs. Before an SA expires, it can be reused by subsequent IKE negotiations, which can save time when setting up new IPSec SAs. New IPSec SAs are negotiated before current IPSec SAs expire.

So, to save setup time for IPSec, configure a longer IKE SA lifetime. However, shorter lifetimes limit the exposure to attackers of this SA. The longer an SA is used, the more encrypted traffic can be gathered by an attacker and possibly used in an attack.

Note that when your local peer initiates an IKE negotiation between itself and a remote peer, an IKE policy can be selected only if the lifetime of the remote peer's policy is longer than or equal to the lifetime of the local peer's policy. Then, if the lifetimes are not equal, the shorter lifetime will be selected. To restate this behavior: If the two peer's policies' lifetimes are not the same, the initiating peer's lifetime must be shorter and the responding peer's lifetime must be longer, and the shorter lifetime will be used.

Examples

The following example configures an IKE policy with a security association lifetime of 600 seconds (10 minutes), and all other parameters are set to the defaults:

```
crypto isakmp policy 15
  lifetime 600
  exit
```

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp policy	Defines an IKE policy.
encryption (IKE policy)	Specifies the encryption algorithm within an IKE policy.
group (IKE policy)	Specifies the Diffie-Hellman group identifier within an IKE policy.
hash (IKE policy)	Specifies the hash algorithm within an IKE policy.
show crypto isakmp policy	Displays the parameters for each IKE policy.

named-key

To specify which peer's RSA public key you will manually configure, use the **named-key** public key chain configuration command. This command should only be used when the router has a single interface that processes IP Security.

named-key *key-name* [**encryption** | **signature**]

Syntax Description

key-name	Specifies the name of the remote peer's RSA keys. This is always the fully qualified domain name of the remote peer; for example, router.example.com.
encryption	(Optional) Indicates that the RSA public key to be specified will be an encryption special-usage key.
signature	(Optional) Indicates that the RSA public key to be specified will be a signature special-usage key.

Defaults

If neither the **encryption** nor the **signature** keyword is used, general-purpose keys will be specified.

Command Modes

Public key chain configuration. This command invokes public key configuration mode.

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

Use this command or the **addressed-key** command to specify which IPSec peer's RSA public key you will manually configure next.

Follow this command with the **key-string** command to specify the key.

If you use the **named-key** command, you also need to use the **address** public key configuration command to specify the IP address of the peer.

If the IPSec remote peer generated general purpose RSA keys, do not use the **encryption** or **signature** keyword.

If the IPSec remote peer generated special usage keys, you must manually specify both keys: perform this command and the **key-string** command twice and use the **encryption** and **signature** keywords in turn.

Examples

The following example manually specifies the RSA public keys of two IPSec peers. The peer at 10.5.5.1 uses general-purpose keys, and the other peer uses special-purpose keys.

```
crypto key pubkey-chain rsa
  named-key otherpeer.example.com
  address 10.5.5.1
  key-string
 005C300D 06092A86 4886F70D 01010105
 00034B00 30480241 00C5E23B 55D6AB22
 04AEF1BA A54028A6 9ACC01C5 129D99E4
```

```
64CAB820 847EDAD9 DF0B4E4C 73A05DD2
BD62A8A9 FA603DD2 E2A8A6F8 98F76E28
D58AD221 B583D7A4 71020301 0001
quit
exit
 addressed-key 10.1.1.2 encryption
 key-string
00302017 4A7D385B 1234EF29 335FC973
2DD50A37 C4F4B0FD 9DADE748 429618D5
18242BA3 2EDFBDD3 4296142A DDF7D3D8
08407685 2F2190A0 0B43F1BD 9A8A26DB
07953829 791FCDE9 A98420F0 6A82045B
90288A26 DBC64468 7789F76E EE21
quit
 exit
 addressed-key 10.1.1.2 signature
 key-string
0738BC7A 2BC3E9F0 679B00FE 098533AB
01030201 42DD06AF E228D24C 458AD228
58BB5DDD F4836401 2A2D7163 219F882E
64CE69D4 B583748A 241BED0F 6E7F2F16
0DE0986E DF02031F 4B0B0912 F68200C4
C625C389 0BFF3321 A2598935 C1B1
quit
 exit
 exit
```

Related Commands

Command	Description
address	Specifies the IP address of the remote RSA public key of the remote peer you will manually configure.
addressed-key	Specifies the RSA public key of the peer you will manually configure.
crypto key pubkey-chain rsa	Enters public key configuration mode (to allow you to manually specify the RSA public keys of other devices).
key-string (IKE)	Specifies the RSA public key of a remote peer.
show crypto key pubkey-chain rsa	Displays peer RSA public keys stored on your router.

show crypto isakmp policy

To view the parameters for each Internet Key Exchange policy, use the **show crypto isakmp policy** EXEC command.

show crypto isakmp policy

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Examples

The following is sample output from the **show crypto isakmp policy** command, after two IKE policies have been configured (with priorities 15 and 20 respectively):

```
Router# show crypto isakmp policy

Protection suite priority 15
encryption algorithm:DES - Data Encryption Standard (56 bit keys)
hash algorithm:Message Digest 5
authentication method:Rivest-Shamir-Adleman Signature
Diffie-Hellman Group:#2 (1024 bit)
lifetime:5000 seconds, no volume limit
Protection suite priority 20
encryption algorithm:DES - Data Encryption Standard (56 bit keys)
hash algorithm:Secure Hash Standard
authentication method:preshared Key
Diffie-Hellman Group:#1 (768 bit)
lifetime:10000 seconds, no volume limit
Default protection suite
encryption algorithm:DES - Data Encryption Standard (56 bit keys)
hash algorithm:Secure Hash Standard
authentication method:Rivest-Shamir-Adleman Signature
Diffie-Hellman Group:#1 (768 bit)
lifetime:86400 seconds, no volume limit
```

Note Although the output shows "no volume limit" for the lifetimes, you can currently only configure a time lifetime (such as 86,400 seconds); volume limit lifetimes are not used.

Related Commands

Command	Description
authentication (IKE policy)	Specifies the authentication method within an IKE policy.
crypto isakmp policy	Defines an IKE policy.
encryption (IKE policy)	Specifies the encryption algorithm within an IKE policy.
group (IKE policy)	Specifies the Diffie-Hellman group identifier within an IKE policy.

Command	Description
hash (IKE policy)	Specifies the hash algorithm within an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.

show crypto isakmp sa

To view all current Internet Key Exchange security associations (SAs) at a peer, use the **show crypto isakmp sa** EXEC command.

show crypto isakmp sa

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Examples

The following is sample output from the **show crypto isakmp sa** command, after IKE negotiations have successfully completed between two peers:

```
Router# show crypto isakmp sa
    dst             src          state          conn-id   slot
172.21.114.123 172.21.114.67  QM_IDLE             1       0
155.0.0.2      155.0.0.1      QM_IDLE             8       0
```

Table 25 through Table 27 show the various states that may be displayed in the output of the **show crypto isakmp sa** command. When an Internet Security Association and Key Management Protocol SA exists, it will most likely be in its quiescent state (QM_IDLE). For long exchanges, some of the MM_xxx states may be observed.

Table 25 States in Main Mode Exchange

State	Explanation
MM_NO_STATE	The ISAKMP SA has been created, but nothing else has happened yet. It is “larval” at this stage—there is no state.
MM_SA_SETUP	The peers have agreed on parameters for the ISAKMP SA.
MM_KEY_EXCH	The peers have exchanged Diffie-Hellman public keys and have generated a shared secret. The ISAKMP SA remains unauthenticated.
MM_KEY_AUTH	The ISAKMP SA has been authenticated. If the router initiated this exchange, this state transitions immediately to QM_IDLE, and a Quick Mode exchange begins.

Table 26 States in Aggressive Mode Exchange

State	Explanation
AG_NO_STATE	The ISAKMP SA has been created, but nothing else has happened yet. It is "larval" at this stage—there is no state.
AG_INIT_EXCH	The peers have done the first exchange in Aggressive Mode, but the SA is not authenticated.
AG_AUTH	The ISAKMP SA has been authenticated. If the router initiated this exchange, this state transitions immediately to QM_IDLE, and a Quick Mode exchange begins.

Table 27 States in Quick Mode Exchange

State	Explanation
QM_IDLE	The ISAKMP SA is idle. It remains authenticated with its peer and may be used for subsequent Quick Mode exchanges. It is in a quiescent state.

Related Commands

Command	Description
crypto isakmp policy	Defines an IKE policy.
lifetime (IKE policy)	Specifies the lifetime of an IKE SA.

show crypto key mypubkey rsa

To view the RSA public keys of your router, use the **show crypto key mypubkey rsa** EXEC command.

show crypto key mypubkey rsa

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command displays your router's RSA public keys.

Examples

The following is sample output from the **show crypto key mypubkey rsa** command. Special usage RSA keys were previously generated for this router using the **crypto key generate rsa** command.

```
% Key pair was generated at: 06:07:49 UTC Jan 13 1996
Key name: myrouter.example.com
 Usage: Signature Key
 Key Data:
  005C300D 06092A86 4886F70D 01010105 00034B00 30480241 00C5E23B 55D6AB22
  04AEF1BA A54028A6 9ACC01C5 129D99E4 64CAB820 847EDAD9 DF0B4E4C 73A05DD2
  BD62A8A9 FA603DD2 E2A8A6F8 98F76E28 D58AD221 B583D7A4 71020301 0001

% Key pair was generated at: 06:07:50 UTC Jan 13 1996
Key name: myrouter.example.com
 Usage: Encryption Key
 Key Data:
  00302017 4A7D385B 1234EF29 335FC973 2DD50A37 C4F4B0FD 9DADE748 429618D5
  18242BA3 2EDFBDD3 4296142A DDF7D3D8 08407685 2F2190A0 0B43F1BD 9A8A26DB
  07953829 791FCDE9 A98420F0 6A82045B 90288A26 DBC64468 7789F76E EE21
```

Related Commands

Command	Description
crypto key generate rsa	Generates RSA key pairs.

show crypto key pubkey-chain rsa

To view peers' RSA public keys stored on your router, use the **show crypto key pubkey-chain rsa** EXEC command.

show crypto key pubkey-chain rsa [**name** *key-name* | **address** *key-address*]

Syntax Description

name *key-name*	(Optional) The name of a particular public key to view.
address *key-address*	(Optional) The address of a particular public key to view.

Command Modes

EXEC

Command History

Release	Modification
11.3 T	This command was introduced.

Usage Guidelines

This command shows RSA public keys stored on your router. This includes peers' RSA public keys manually configured at your router and keys received by your router via other means (such as by a certificate, if certification authority support is configured).

If a router reboots, any public key derived by certificates will be lost. This is because the router will ask for certificates again, at which time the public key will be derived again.

Use the **name** or **address** keywords to display details about a particular RSA public key stored on your router.

If no keywords are used, this command displays a list of all RSA public keys stored on your router.

Examples

The following is sample output from the **show crypto key pubkey-chain rsa** command:

```
Codes: M - Manually Configured, C - Extracted from certificate

Code  Usage        IP-address     Name
M     Signature    10.0.0.1       myrouter.example.com
M     Encryption   10.0.0.1       myrouter.example.com
C     Signature    172.16.0.1     routerA.example.com
C     Encryption   172.16.0.1     routerA.example.com
C     General      192.168.10.3   routerB.domain1.com
```

This sample shows manually configured special usage RSA public keys for the peer "somerouter." This sample also shows three keys obtained from peers' certificates: special usage keys for peer "routerA" and a general purpose key for peer "routerB."

Certificate support is used in the above example; if certificate support was not in use, none of the peers' keys would show "C" in the code column, but would all have to be manually configured.

The following is sample output when you issue the command **show crypto key pubkey rsa name somerouter.example.com**:

```
Key name: somerouter.example.com
Key address: 10.0.0.1
 Usage: Signature Key
 Source: Manual
 Data:
  305C300D 06092A86 4886F70D 01010105 00034B00 30480241 00C5E23B 55D6AB22
  04AEF1BA A54028A6 9ACC01C5 129D99E4 64CAB820 847EDAD9 DF0B4E4C 73A05DD2
  BD62A8A9 FA603DD2 E2A8A6F8 98F76E28 D58AD221 B583D7A4 71020301 0001

Key name: somerouter.example.com
Key address: 10.0.0.1
 Usage: Encryption Key
 Source: Manual
 Data:
  00302017 4A7D385B 1234EF29 335FC973 2DD50A37 C4F4B0FD 9DADE748 429618D5
  18242BA3 2EDFBDD3 4296142A DDF7D3D8 08407685 2F2190A0 0B43F1BD 9A8A26DB
  07953829 791FCDE9 A98420F0 6A82045B 90288A26 DBC64468 7789F76E EE21
```

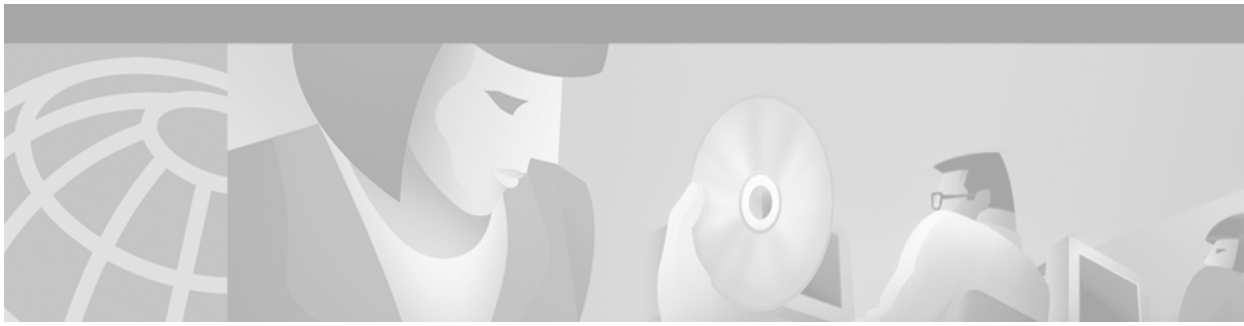
Note The Source field in the above example indicates "Manual," meaning that the keys were manually configured on the router, not received in the peer's certificate.

The following is sample output when you issue the command **show crypto key pubkey rsa address 192.168.10.3**:

```
Key name: routerB.example.com
Key address: 192.168.10.3
 Usage: General Purpose Key
 Source: Certificate
 Data:
  0738BC7A 2BC3E9F0 679B00FE 53987BCC 01030201 42DD06AF E228D24C 458AD228
  58BB5DDD F4836401 2A2D7163 219F882E 64CE69D4 B583748A 241BED0F 6E7F2F16
  0DE0986E DF02031F 4B0B0912 F68200C4 C625C389 0BFF3321 A2598935 C1B1
```

The Source field in the above example indicates "Certificate," meaning that the keys were received by the router by way of the other router's certificate.

Other Security Features



Passwords and Privileges Commands

This chapter describes the commands used to establish password protection and configure privilege levels. Password protection lets you restrict access to a network or a network device. Privilege levels let you define what commands users can issue after they have logged in to a network device.

For information on how to establish password protection or configure privilege levels, refer to the "Configuring Passwords and Privileges" chapter in the *Cisco IOS Security Configuration Guide*. For configuration examples using the commands in this chapter, refer to the "Passwords and Privileges Configuration Examples" section located at the end of the "Configuring Passwords and Privileges" chapter in the *Cisco IOS Security Configuration Guide*.

enable password

To set a local password to control access to various privilege levels, use the **enable password** command in global configuration mode. To remove the password requirement use the **no** form of this command.

enable password [**level** *level*] {*password* | [*encryption-type*] *encrypted-password*}

no enable password [**level** *level*]

Syntax Description

level *level*	(Optional) Level for which the password applies. You can specify up to 16 privilege levels, using numbers 0 through 15. Level 1 is normal EXEC-mode user privileges. If this argument is not specified in the command or the **no** form of the command, the privilege level defaults to 15 (traditional enable privileges).
password	Password users type to enter enable mode.
encryption-type	(Optional) Cisco-proprietary algorithm used to encrypt the password. Currently the only encryption type available is 7. If you specify *encryption-type*, the next argument you supply must be an encrypted password (a password already encrypted by a Cisco router).
encrypted-password	Encrypted password you enter, copied from another router configuration.

Defaults

No password is defined. The default is level 15.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Caution If neither the **enable password** command nor the **enable secret** command is configured, and if there is a line password configured for the console, the console line password will serve as the enable password for all VTY (Telnet and Secure Shell [SSH]) sessions.

Use this command with the **level** option to define a password for a specific privilege level. After you specify the level and the password, give the password to the users who need to access this level. Use the **privilege level** configuration command to specify commands accessible at various levels.

You will not ordinarily enter an encryption type. Typically you enter an encryption type only if you copy and paste into this command a password that has already been encrypted by a Cisco router.

Caution If you specify an encryption type and then enter a clear text password, you will not be able to reenter enable mode. You cannot recover a lost password that has been encrypted by any method.

If the **service password-encryption** command is set, the encrypted form of the password you create with the **enable password** command is displayed when a **more nvram:startup-config** command is entered.

You can enable or disable password encryption with the **service password-encryption** command.

An enable password is defined as follows:

- Must contain from 1 to 25 uppercase and lowercase alphanumeric characters.
- Must not have a number as the first character.
- Can have leading spaces, but they are ignored. However, intermediate and trailing spaces are recognized.
- Can contain the question mark (?) character if you precede the question mark with the key combination Crtl-v when you create the password; for example, to create the password *abc?123,* do the following:
  - Enter **abc**.
  - Type **Crtl-v**.
  - Enter **?123**.

  When the system prompts you to enter the enable password, you need not precede the question mark with the Ctrl-v; you can simply enter abc?123 at the password prompt.

Examples

The following example enables the password “pswd2” for privilege level 2:

```
enable password level 2 pswd2
```

The following example sets the encrypted password “1i5Rkls3LoyxzS8t9”, which has been copied from a router configuration file, for privilege level 2 using encryption type 7:

```
enable password level 2 7 $1$i5Rkls3LoyxzS8t9
```

Related Commands

Command	Description
disable	Exits privileged EXEC mode and returns to user EXEC mode.
enable	Enters privileged EXEC mode.
enable secret	Specifies an additional layer of security over the **enable password** command.
privilege	Configures a new privilege level for users and associate commands with that privilege level.
service password-encryption	Encrypts passwords.
show privilege	Displays your current level of privilege.

enable secret

To specify an additional layer of security over the **enable password** command, use the **enable secret** command in global configuration mode. To turn off the **enable secret** function, use the **no** form of this command.

enable secret [**level** *level*] {*password* | [*encryption-type*] *encrypted-password*}

no enable secret [**level** *level*]

Syntax Description

level *level*	(Optional) Level for which the password applies. You can specify up to sixteen privilege levels, using numbers 0 through 15. Level 1 is normal EXEC-mode user privileges. If this argument is not specified in the command or in the **no** form of the command, the privilege level defaults to 15 (traditional enable privileges). The same holds true for the **no** form of the command.
password	Password for users to enter enable mode. This password should be different from the password created with the **enable password** command.
encryption-type	(Optional) Cisco-proprietary algorithm used to encrypt the password. Currently the only encryption type available for this command is 5. If you specify *encryption-type*, the next argument you supply must be an encrypted password (a password encrypted by a Cisco router).
encrypted-password	Encrypted password you enter, copied from another router configuration.

Defaults

No password is defined. The default level is 15.

Command Modes

Global configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

Caution If neither the **enable password** command nor the **enable secret** command is configured, and if there is a line password configured for the console, the console line password will serve as the enable password for all VTY (Telnet and Secure Shell [SSH]) sessions.

Use this command to provide an additional layer of security over the enable password. The **enable secret** command provides better security by storing the enable secret password using a non-reversible cryptographic function. The added layer of security encryption provides is useful in environments where the password crosses the network or is stored on a TFTP server.

You will not ordinarily enter an encryption type. Typically you enter an encryption type only if you paste into this command an encrypted password that you copied from a router configuration file.

Caution If you specify an encryption type and then enter a clear text password, you will not be able to reenter enable mode. You cannot recover a lost password that has been encrypted by any method.

If you use the same password for the **enable password** and **enable secret** commands, you receive an error message warning that this practice is not recommended, but the password will be accepted. By using the same password, however, you undermine the additional security the **enable secret** command provides.

Note After you set a password using the **enable secret** command, a password set using the **enable password** command works only if the **enable secret** is disabled or an older version of Cisco IOS software is being used, such as when running an older rxboot image. Additionally, you cannot recover a lost password that has been encrypted by any method.

If **service password-encryption** is set, the encrypted form of the password you create here is displayed when a **more nvram:startup-config** command is entered.

You can enable or disable password encryption with the **service password-encryption** command.

An enable password is defined as follows:

- Must contain from 1 to 25 uppercase and lowercase alphanumeric characters
- Must not have a number as the first character
- Can have leading spaces, but they are ignored. However, intermediate and trailing spaces are recognized.
- Can contain the question mark (?) character if you precede the question mark with the key combination Crtl-v when you create the password; for example, to create the password *abc?123,* do the following:
  - Enter **abc**.
  - Type **Crtl-v**.
  - Enter **?123**.

  When the system prompts you to enter the enable password, you need not precede the question mark with the Ctrl-v; you can simply enter **abc?123** at the password prompt.

Examples

The following example specifies the enable secret password of “greentree”:

```
enable secret greentree
```

After specifying an enable secret password, users must enter this password to gain access. Any passwords set through enable password will no longer work.

```
Password: greentree
```

The following example enables the encrypted password “1FaD0$Xyti5Rkls3LoyxzS8”, which has been copied from a router configuration file, for privilege level 2 using encryption type 5:

```
enable password level 2 5 $1$FaD0$Xyti5Rkls3LoyxzS8
```

Related Commands

Command	Description
enable	Enters privileged EXEC mode.
enable password	Sets a local password to control access to various privilege levels.

password

To specify a password on a line, use the **password** command in line configuration mode. To remove the password, use the **no** form of this command.

password *password*

no password

Syntax Description

password	Character string that specifies the line password. The first character cannot be a number. The string can contain any alphanumeric characters, including spaces, up to 80 characters. You cannot specify the password in the format number-space-anything. The space after the number causes problems. For example, hello 21 is a legal password, but 21 hello is not. The password checking is case sensitive. For example, the password Secret is different than the password secret.

Defaults

No password is specified.

Command Modes

Line configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When an EXEC process is started on a line with password protection, the EXEC prompts for the password. If the user enters the correct password, the EXEC prints its normal privileged prompt. The user can try three times to enter a password before the EXEC exits and returns the terminal to the idle state.

Examples

The following example removes the password from virtual terminal lines 1 to 4:

```
line vty 1 4
 no password
```

Related Commands

Command	Description
enable password	Sets a local password to control access to various privilege levels.

privilege

To configure a new privilege level for users and associate commands with that privilege level, use the **privilege** command in global configuration mode. Use the **no** form of this command to revert to default privileges for the specified command.

privilege *mode* {**level** *level* | **reset**} *command-string*

no privilege *mode* {**level** *level* | **reset**} *command-string*

Syntax Description

mode	Configuration mode for the specified command. See Table 28 in the "Usage Guidelines" section for a list of options for this argument.
level *level*	Specifies the privilege level you are configuring for the specified command or commands. The level argument must be a number from 0 to 15.
reset	Resets the privilege level of the specified command or commands to the default and removes the privilege level configuration from the running-config file. **Note** If you use the **no** form of this command to reset the privilege level to the default, the default form of this command will still appear in the configuration file. To completely remove a privilege configuration, use the **reset** keyword.
command-string	Command associated with the specified privilege level.

Defaults

User EXEC mode commands are privilege level 1.

Privileged EXEC mode and configuration mode commands are privilege level 15.

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

The password for a privilege level defined using the **privilege** global configuration command is configured using the **enable secret** command.

Level 0 can be used to specify a more-limited subset of commands for specific users or lines. For example, you can allow user "guest" to use only the **show users** and **exit** commands.

Note There are five commands associated with privilege level 0: **disable**, **enable**, **exit**, **help**, and **logout**. If you configure AAA authorization for a privilege level greater than 0, these five commands will not be included.

When you set the privilege level for a command with multiple words, note that the commands starting with the first word will also have the specified access level. For example, if you set the **show ip route** command to level 15, the **show** commands and **show ip** commands are automatically set to privilege level 15—unless you set them individually to different levels. This is necessary because you can't execute, for example, the **show ip** command unless you have access to **show** commands.

Table 28 shows some of the keyword options for the mode argument in the **privilege** command. The available mode keywords will vary depending on your hardware and software version. To see a list of available mode options on your system, use the **privilege ?** command.

Table 28 Mode Argument Options

Command	Description
accept-dialin	VPDN Accept-dialin group configuration mode
accept-dialout	VPDN Accept-dialout group configuration mode
address-family	Address family configuration mode
alps-ascu	ALPS ASCU configuration mode
alps-circuit	ALPS circuit configuration mode
atm-bm-config	ATM VC bundle-member configuration mode
atm-bundle-config	ATM VC bundle configuration mode
atm-vc-config	ATM virtual circuit (VC) configuration mode
atmsig_e164_table_mode	ATMSIG E164 Table
cascustom	CAS custom configuration mode
config-rtr-http	SAA/RTR HTTP raw request configuration mode
configure	Global configuration mode
controller	Controller configuration mode
crypto-map	Crypto map configuration mode
crypto-transform	Crypto transform configuration mode
dhcp	DHCP pool configuration mode
dspfarm	DSP farm configuration mode
exec	EXEC mode
flow-cache	Flow aggregation cache configuration mode
gateway	Gateway configuration mode
interface	Interface configuration mode
interface-dlci	Frame Relay DLCI configuration mode
ipenacl	IP named extended access-list configuration mode
ipsnacl	IP named simple access-list configuration mode
ip-vrf	Configure IP VRF parameters
lane	ATM LAN Emulation LECS Configuration Table
line	Line configuration mode
map-class	Map class configuration mode
map-list	Map list configuration mode

Table 28 Mode Argument Options (continued)

Command	Description
mpoa-client	MPOA Client
mpoa-server	MPOA Server
null-interface	Null interface configuration mode
preaut	AAA Preauth definitions
request-dialin	VPDN Request-dialin group configuration mode
request-dialout	VPDN Request-dialout group configuration mode
route-map	Route map configuration mode
router	Router configuration mode
rsvp-local-policy	RSVP local policy configuration mode
rtr	SAA/RTR configuration mode
sg-radius	RADIUS server group definition
sg-tacacs+	TACACS+ server group
sip-ua	SIP UA configuration mode
subscriber-policy	Subscriber policy configuration mode
tcl	TCL configuration mode
tdm-conn	TDM connection configuration mode
template	Template configuration mode
translation-rule	Translation-rule configuration mode
vc-class	VC class configuration mode
voiceclass	Voice class configuration mode
voiceport	Voice configuration mode
voipdialpeer	Dial peer configuration mode
vpdn-group	VPDN group configuration mode

Examples

The following example shows how to set the **configure** command to privilege level 14 and establish SecretPswd14 as the password users must enter to use level 14 commands:

```
privilege exec level 14 configure
enable secret level 14 SecretPswd14
```

The following example resets the **configure** command privilege level:

```
privilege exec reset configure
```

Related Commands

Command	Description
enable password	Sets a local password to control access to various privilege levels.
enable secret	Specifies an additional layer of security over the **enable password** command.
privilege level	Sets the default privilege level for a line.

privilege level

To set the default privilege level for a line, use the **privilege level** command in line configuration mode. To restore the default user privilege level to the line, use the **no** form of this command.

privilege level *level*

no privilege level

Syntax Description

level	Privilege level associated with the specified line.

Defaults

Level 15 is the level of access permitted by the enable password.

Level 1 is normal EXEC-mode user privileges.

Command Modes

Line configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

Users can override the privilege level you set using this command by logging in to the line and enabling a different privilege level. They can lower the privilege level by using the **disable** command. If users know the password to a higher privilege level, they can use that password to enable the higher privilege level.

You can use level 0 to specify a subset of commands for specific users or lines. For example, you can allow user "guest" to use only the **show users** and **exit** commands.

You might specify a high level of privilege for your console line to restrict line usage.

Examples

The following example configures the auxiliary line for privilege level 5. Anyone using the auxiliary line has privilege level 5 by default:

```
line aux 0
 privilege level 5
```

The following example sets all **show ip** commands, which includes all **show** commands, to privilege level 7:

```
 privilege exec level 7 show ip route
```

This is equivalent to the following command:

```
 privilege exec level 7 show
```

The following example sets the **show ip route** to level 7 and the **show** and **show ip** commands to level 1:

```
 privilege exec level 7 show ip route
 privilege exec level 1 show ip
```

Related Commands

Command	Description
enable password	Sets a local password to control access to various privilege levels.

service password-encryption

To encrypt passwords, use the **service password-encryption** command in global configuration mode. To restore the default, use the **no** form of this command.

service password-encryption

no service password-encryption

Syntax Description

This command has no arguments or keywords.

Defaults

No encryption

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The actual encryption process occurs when the current configuration is written or when a password is configured. Password encryption is applied to all passwords, including username passwords, authentication key passwords, the privileged command password, console and virtual terminal line access passwords, and Border Gateway Protocol neighbor passwords. This command is primarily useful for keeping unauthorized individuals from viewing your password in your configuration file.

When password encryption is enabled, the encrypted form of the passwords is displayed when a **more system:running-config** command is entered.

Caution This command does not provide a high level of network security. If you use this command, you should also take additional network security measures.

Note You cannot recover a lost encrypted password. You must clear NVRAM and set a new password.

Examples

The following example causes password encryption to take place:

```
service password-encryption
```

Related Commands

Command	Description
enable password	Sets a local password to control access to various privilege levels.
key-string (authentication)	Specifies the authentication string for a key.
neighbor password	Enables MD5 authentication on a TCP connection between two BGP peers.

show privilege

To display your current level of privilege, use the **show privilege** command in EXEC mode.

show privilege

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

Use this command to display your current level of privilege.

Examples

The following example shows sample output from the **show privilege** command. The current privilege level is 15.

```
Router# show privilege

Current privilege level is 15
```

Related Commands

Command	Description
enable password	Sets a local password to control access to various privilege levels.
enable secret	Specifies an additional layer of security over the **enable password** command.

username

To establish a username-based authentication system, use the **username** command in global configuration mode.

username *name* {**nopassword** | **password** *password* | **password** *encryption-type encrypted-password*}

username *name* **password** *secret*

username *name* [**access-class** *number*]

username *name* [**autocommand** *command*]

username *name* [**callback-dialstring** *telephone-number*]

username *name* [**callback-rotary** *rotary-group-number*]

username *name* [**callback-line** [**tty**] *line-number* [*ending-line-number*]]

username *name* **dnis**

username *name* [**nocallback-verify**]

username *name* [**noescape**] [**nohangup**]

username *name* [**privilege** *level*]

username *name* **user-maxlinks** *number*

username [**lawful-intercept**] *name* [**privilege** *privilege-level* | **view** *view-name*] **password** *password*

Syntax Description

name	Host name, server name, user ID, or command name. The name argument can be only one word. Blank spaces and quotation marks are not allowed.
nopassword	No password is required for this user to log in. This is usually most useful in combination with the **autocommand** keyword.
password	Specifies a possibly encrypted password for this username.
password	Password a user enters.
encryption-type	Single-digit number that defines whether the text immediately following is encrypted, and, if so, what type of encryption is used. Currently defined encryption types are 0, which means that the text immediately following is not encrypted, and 7, which means that the text is encrypted using a Cisco-defined encryption algorithm.
encrypted-password	Encrypted password a user enters.
password	Password to access the name argument. A password must be from 1 to 25 characters, can contain embedded spaces, and must be the last option specified in the **username** command.

secret	For CHAP authentication: specifies the secret for the local router or the remote device. The secret is encrypted when it is stored on the local router. The secret can consist of any string of up to 11 ASCII characters. There is no limit to the number of username and password combinations that can be specified, allowing any number of remote devices to be authenticated.
access-class	(Optional) Specifies an outgoing access list that overrides the access list specified in the **access-class** line configuration command. It is used for the duration of the user's session.
number	(Optional) Access list number.
autocommand	(Optional) Causes the specified command to be issued automatically after the user logs in. When the command is complete, the session is terminated. Because the command can be any length and contain embedded spaces, commands using the **autocommand** keyword must be the last option on the line.
command	(Optional) The command string. Because the command can be any length and contain embedded spaces, commands using the **autocommand** keyword must be the last option on the line.
callback-dialstring	(Optional) For asynchronous callback only: permits you to specify a telephone number to pass to the DCE device.
telephone-number	(Optional) For asynchronous callback only: telephone number to pass to the DCE device.
callback-rotary	(Optional) For asynchronous callback only: permits you to specify a rotary group number. The next available line in the rotary group is selected.
rotary-group-number	(Optional) For asynchronous callback only: integer between 1 and 100 that identifies the group of lines on which you want to enable a specific username for callback.
callback-line	(Optional) For asynchronous callback only: specific line on which you enable a specific username for callback.
tty	(Optional) For asynchronous callback only: standard asynchronous line.
line-number	(Optional) For asynchronous callback only: relative number of the terminal line (or the first line in a contiguous group) on which you want to enable a specific username for callback. Numbering begins with zero.
ending-line-number	(Optional) Relative number of the last line in a contiguous group on which you want to enable a specific username for callback. If you omit the keyword (such as **tty**), then *line-number* and *ending-line-number* are absolute rather than relative line numbers.
dnis	Do not require password when obtained via DNIS.
nocallback-verify	(Optional) Authentication not required for EXEC callback on the specified line.
noescape	(Optional) Prevents a user from using an escape character on the host to which that user is connected.
nohangup	(Optional) Prevents Cisco IOS software from disconnecting the user after an automatic command (set up with the **autocommand** keyword) has completed. Instead, the user gets another EXEC prompt.
privilege	(Optional) Sets the privilege level for the user.
level	(Optional) Number between 0 and 15 that specifies the privilege level for the user.

user-maxlinks	Limit the user's number of inbound links.
number	User-maxlinks limit for inbound links.
lawful-intercept	(Optional) Configures lawful intercept users on a Cisco device.
name	Host name, server name, user ID, or command name. The name argument can be only one word. Blank spaces and quotation marks are not allowed.
privilege	(Optional) Sets the privilege level for the user.
privilege-level	(Optional) Number between 0 and 15 that specifies the privilege level for the user.
view	(Optional) For command-line interface (CLI) view only: associates a CLI view name with the local authentication, authorization, and accounting (AAA) database.
view-name	(Optional) For CLI view only: view name, which was specified via the **parser view** command, that is to be associated with the AAA local database.
password *password*	Password to access the CLI view.

Defaults

No username-based authentication system is established.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
11.1	The following keywords and arguments were added: • **username** *name* [**callback-dialstring** *telephone-number*] • **username** *name* [**callback-rotary** *rotary-group-number*] • **username** *name* [**callback-line** [**tty**] *line-number* [*ending-line-number*]] • **username** *name* [**nocallback-verify**]
12.3(7)T	The following keywords and arguments were added: • **lawful-intercept** • **view** • *view-name*

Usage Guidelines

The **username** command provides username or password authentication, or both, for login purposes only.

Multiple **username** commands can be used to specify options for a single user.

Add a username entry for each remote system with which the local router communicates and from which it requires authentication. The remote device must have a username entry for the local router. This entry must have the same password as the local router's entry for that remote device.

This command can be useful for defining usernames that get special treatment. For example, you can use this command to define an "info" username that does not require a password but connects the user to a general purpose information service.

The **username** command is required as part of the configuration for the Challenge Handshake Authentication Protocol (CHAP). Add a username entry for each remote system from which the local router requires authentication.

Note To enable the local router to respond to remote CHAP challenges, one **username** *name* entry must be the same as the **hostname** entry that has already been assigned to the other router.

Note To avoid the situation of a privilege level 1 user entering into a higher privilege level, configure a per-user privilege level other than 1 (for example, 0 or 2 through 15).

Note Per-user privilege levels override virtual terminal (VTY) privilege levels.

CLI and Lawful Intercept Views

Both CLI views and lawful intercept views restrict access to specified commands and configuration information. A lawful intercept view allows a user to secure access to lawful intercept commands that are held within the TAP-MIB, which is a special set of simple network management protocol (SNMP) commands that stores information about calls and users.

Users who are specified via the **lawful-intercept** keyword are placed in the lawful-intercept view, by default, if no other privilege level or view name has been explicitly specified.

If there is no *secret* specified and the **debug serial-interface** command is enabled, an error is displayed when a link is established and the CHAP challenge is not implemented. CHAP debugging information is available using the **debug ppp negotiation, debug serial-interface,** and **debug serial-packet** commands. For more information about **debug** commands, refer to the *Cisco IOS Debug Command Reference*.

Examples

The following example implements a service similar to the UNIX **who** command, which can be entered at the login prompt and lists the current users of the router:

```
username who nopassword nohangup autocommand show users
```

The following example implements an information service that does not require a password to be used. The command takes the following form:

```
username info nopassword noescape autocommand telnet nic.ddn.mil
```

The following example implements an ID that works even if all the TACACS+ servers break. The command takes the following form:

```
username superuser password superpassword
```

The following example enables CHAP on interface serial 0 of "server_1." It also defines a password for a remote server named "server_r."

```
hostname server_1
username server_r password theirsystem
interface serial 0
 encapsulation ppp
 ppp authentication chap
```

When you look at your configuration file, the passwords will be encrypted, and the display will look similar to the following:

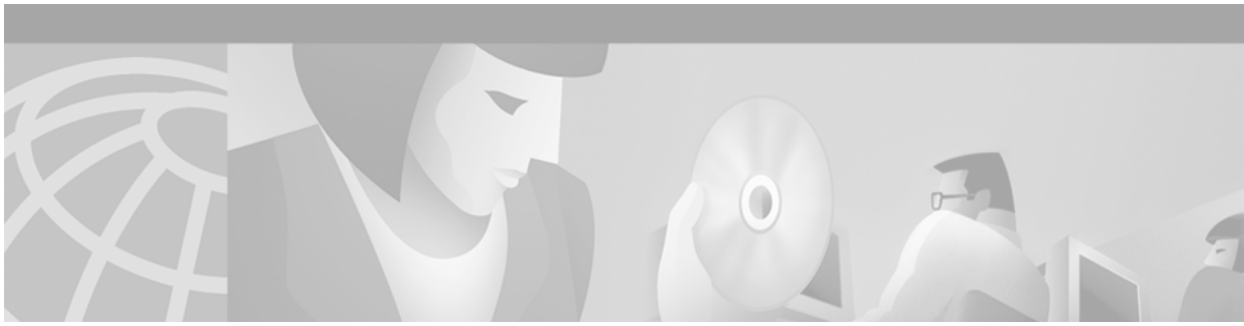
```
hostname server_1
username server_r password 7 121F0A18
interface serial 0
 encapsulation ppp
 ppp authentication chap
```

In both of the following configuration examples, a privilege level 1 user is denied access to privilege levels higher than 1:

```
username user privilege 0 password 0 cisco

username user 2 privilege 2 password 0 cisco
```

Related Commands

Command	Description
arap callback	Enables an ARA client to request a callback from an ARA client.
callback forced-wait	Forces the Cisco IOS software to wait before initiating a callback to a requesting client.
ppp callback (DDR)	Enables a dialer interface that is not a DTR interface to function either as a callback client that requests callback or as a callback server that accepts callback requests.
ppp callback (PPP client)	Enables a PPP client to dial into an asynchronous interface and request a callback.
show users	Displays information about the active lines on the router.



IP Security Options Commands

This chapter describes IP Security Options (IPSO) commands. IPSO is generally used to comply with the U.S. government's Department of Defense security policy.

To find complete descriptions of other commands used when configuring IPSO, refer to the *Cisco IOS Command Reference Master Index* or search online.

For IPSO configuration information, refer to the "Configuring IP Security Options" chapter in the *Cisco IOS Security Configuration Guide*.

dnsix-dmdp retries

To set the retransmit count used by the Department of Defense Intelligence Information System Network Security for Information Exchange (DNSIX) Message Delivery Protocol (DMDP), use the **dnsix-dmdp retries** command in global configuration mode. To restore the default number of retries, use the **no** form of this command.

dnsix-dmdp retries *count*

no dnsix-dmdp retries *count*

Syntax Description

count	Number of times DMDP will retransmit a message. It can be an integer from 0 to 200. The default is 4 retries, or until acknowledged.

Defaults

Retransmits messages up to 4 times, or until acknowledged.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the number of times DMDP will attempt to retransmit a message to 150:

```
dnsix-dmdp retries 150
```

Related Commands

Command	Description
dnsix-nat authorized-redirection	Specifies the address of a collection center that is authorized to change the primary and secondary addresses of the host to receive audit messages.
dnsix-nat primary	Specifies the IP address of the host to which DNSIX audit messages are sent.
dnsix-nat secondary	Specifies an alternate IP address for the host to which DNSIX audit messages are sent.
dnsix-nat source	Starts the audit-writing module and defines audit trail source address.
dnsix-nat transmit-count	Causes the audit-writing module to collect multiple audit messages in the buffer before sending the messages to a collection center.

dnsix-nat authorized-redirection

To specify the address of a collection center that is authorized to change the primary and secondary addresses of the host to receive audit messages, use the **dnsix-nat authorized-redirection** global configuration command. To delete an address, use the **no** form of this command.

dnsix-nat authorized-redirection *ip-address*

no dnsix-nat authorized-redirection *ip-address*

Syntax Description

ip-address	IP address of the host from which redirection requests are permitted.

Defaults

An empty list of addresses.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use multiple **dnsix-nat authorized-redirection** commands to specify a set of hosts that are authorized to change the destination for audit messages. Redirection requests are checked against the configured list, and if the address is not authorized the request is rejected and an audit message is generated. If no address is specified, no redirection messages are accepted.

Examples

The following example specifies that the address of the collection center that is authorized to change the primary and secondary addresses is 192.168.1.1:

```
dnsix-nat authorization-redirection 192.168.1.1.
```

dnsix-nat primary

To specify the IP address of the host to which Department of Defense Intelligence Information System Network Security for Information Exchange (DNSIX) audit messages are sent, use the **dnsix-nat primary** command in global configuration mode. To delete an entry, use the **no** form of this command.

dnsix-nat primary *ip-address*

no dnsix-nat primary *ip-address*

Syntax Description

ip-address	IP address for the primary collection center.

Defaults

Messages are not sent.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

An IP address must be configured before audit messages can be sent.

Examples

The following example configures an IP address as the address of the host to which DNSIX audit messages are sent:

```
dnsix-nat primary 172.1.1.1
```

dnsix-nat secondary

To specify an alternate IP address for the host to which Department of Defense Intelligence Information System Network Security for Information Exchange (DNSIX) audit messages are sent, use the **dnsix-nat secondary** command in global configuration mode. To delete an entry, use the **no** form of this command.

dnsix-nat secondary *ip-address*

no dnsix-nat secondary *ip-address*

Syntax Description

ip-address	IP address for the secondary collection center.

Defaults

No alternate IP address is known.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When the primary collection center is unreachable, audit messages are sent to the secondary collection center instead.

Examples

The following example configures an IP address as the address of an alternate host to which DNSIX audit messages are sent:

```
dnsix-nat secondary 192.168.1.1
```

dnsix-nat source

To start the audit-writing module and to define the audit trail source address, use the **dnsix-nat source** command in global configuration mode. To disable the Department of Defense Intelligence Information System Network Security for Information Exchange (DNSIX) audit trail writing module, use the **no** form of this command.

dnsix-nat source *ip-address*

no dnsix-nat source *ip-address*

Syntax Description

ip-address	Source IP address for DNSIX audit messages.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

You must issue the **dnsix-nat source** command before any of the other **dnsix-nat** commands. The configured IP address is used as the source IP address for DMDP protocol packets sent to any of the collection centers.

Examples

The following example enables the audit trail writing module, and specifies that the source IP address for any generated audit messages should be the same as the primary IP address of Ethernet interface 0:

```
dnsix-nat source 192.168.2.5
interface ethernet 0
 ip address 192.168.2.5 255.255.255.0
```

dnsix-nat transmit-count

To have the audit writing module collect multiple audit messages in the buffer before sending the messages to a collection center, use the **dnsix-nat transmit-count** command in global configuration mode. To revert to the default audit message count, use the **no** form of this command.

dnsix-nat transmit-count *count*

no dnsix-nat transmit-count *count*

Syntax Description

count	Number of audit messages to buffer before transmitting to the server. It can be an integer from 1 to 200.

Defaults

One message is sent at a time.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

An audit message is sent as soon as the message is generated by the IP packet-processing code. The audit writing module can, instead, buffer up to several audit messages before transmitting to a collection center.

Examples

The following example configures the system to buffer five audit messages before transmitting them to a collection center:

```
dnsix-nat transmit-count 5
```

ip security add

To add a basic security option to all outgoing packets, use the **ip security add** command in interface configuration mode. To disable the adding of a basic security option to all outgoing packets, use the **no** form of this command.

ip security add

no ip security add

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled, when the security level of the interface is "Unclassified Genser" (or unconfigured). Otherwise, the default is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If an outgoing packet does not have a security option present, this interface configuration command will add one as the first IP option. The security label added to the option field is the label that was computed for this packet when it first entered the router. Because this action is performed after all the security tests have been passed, this label will either be the same or will fall within the range of the interface.

Examples

The following example adds a basic security option to each packet leaving Ethernet interface 0:

```
interface ethernet 0
 ip security add
```

Related Commands

Command	Description
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security multilevel	Sets the range of classifications and authorities on an interface.

Command	Description
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security aeso

To attach Auxiliary Extended Security Options (AESOs) to an interface, use the **ip security aeso** command in interface configuration mode. To disable AESO on an interface, use the **no** form of this command.

ip security aeso *source compartment-bits*

no ip security aeso *source compartment-bits*

Syntax Description

source	Extended Security Option (ESO) source. This can be an integer from 0 to 255.
compartment-bits	Number of compartment bits in hexadecimal.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Compartment bits are specified only if this AESO is to be inserted in a packet. On every incoming packet at this level on this interface, these AESOs should be present.

Beyond being recognized, no further processing of AESO information is performed. AESO contents are not checked and are assumed to be valid if the source is listed in the configurable AESO table.

Configuring any per-interface extended IP Security Option (IPSO) information automatically enables **ip security extended-allowed** (disabled by default).

Examples

The following example defines the Extended Security Option source as 5 and sets the compartments bits to 5:

```
interface ethernet 0
 ip security aeso 5 5
```

Related Commands

Command	Description
ip security eso-info	Configures system-wide defaults for extended IPSO information.
ip security eso-max	Specifies the maximum sensitivity level for an interface.
ip security eso-min	Configures the minimum sensitivity level for an interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.

ip security dedicated

To set the level of classification and authority on the interface, use the **ip security dedicated** command in interface configuration mode. To reset the interface to the default classification and authorities, use the **no** form of this command.

ip security dedicated *level authority* [*authority...*]

no ip security dedicated *level authority* [*authority...*]

Syntax Description

level	Degree of sensitivity of information. The *level* keywords are listed in Table 29.
authority	Organization that defines the set of security levels that will be used in a network. The authority keywords are listed in Table 30.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

All traffic entering the system on this interface must have a security option that exactly matches this label. Any traffic leaving via this interface will have this label attached to it.

The following definitions apply to the descriptions of the IP Security Option (IPSO) in this section:

- level—The degree of sensitivity of information. For example, data marked TOPSECRET is more sensitive than data marked SECRET. The level keywords and their corresponding bit patterns are shown in Table 29.

Table 29 IPSO Level Keywords and Bit Patterns

Level Keyword	Bit Pattern
Reserved4	0000 0001
TopSecret	0011 1101
Secret	0101 1010
Confidential	1001 0110
Reserved3	0110 0110
Reserved2	1100 1100
Unclassified	1010 1011
Reserved1	1111 0001

- authority—An organization that defines the set of security levels that will be used in a network. For example, the Genser authority consists of level names defined by the U.S. Defense Communications Agency (DCA). The authority keywords and their corresponding bit patterns are shown in Table 30.

Table 30 IPSO Authority Keywords and Bit Patterns

Authority Keyword	Bit Pattern
Genser	1000 0000
Siop-Esi	0100 0000
DIA	0010 0000
NSA	0001 0000
DOE	0000 1000

- label—A combination of a security level and an authority or authorities.

Examples

The following example sets a confidential level with Genser authority:

```
ip security dedicated confidential Genser
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security eso-info

To configure system-wide defaults for extended IP Security Option (IPSO) information, use the **ip security eso-info** command in global configuration mode. To return to the default settings, use the **no** form of this command.

ip security eso-info *source compartment-size default-bit*

no ip security eso-info *source compartment-size default-bit*

Syntax Description

source	Hexadecimal or decimal value representing the extended IPSO source. This is an integer from 0 to 255.
compartment-size	Maximum number of bytes of compartment information allowed for a particular extended IPSO source. This is an integer from 1 to 16.
default-bit	Default bit value for any unsent compartment bits.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command configures Extended Security Option (ESO) information, including Auxiliary Extended Security Option (AESO). Transmitted compartment information is padded to the size specified by the *compartment-size* argument.

Examples

The following example sets system-wide defaults for source, compartment size, and the default bit value:

```
ip security eso-info 100 5 1
```

Related Commands

Command	Description
ip security eso-max	Specifies the maximum sensitivity level for an interface.
ip security eso-min	Configures the minimum sensitivity level for an interface.

ip security eso-max

To specify the maximum sensitivity level for an interface, use the **ip security eso-max** command in interface configuration mode. To return to the default, use the **no** form of this command.

ip security eso-max *source compartment-bits*

no ip security eso-max *source compartment-bits*

Syntax Description

source	Extended Security Option (ESO) source. This is an integer from 1 to 255.
compartment-bits	Number of compartment bits in hexadecimal.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The command is used to specify the maximum sensitivity level for a particular interface. Before the per-interface compartment information for a particular Network-Level Extended Security Option (NLESO) source can be configured, the **ip security eso-info** global configuration command must be used to specify the default information.

On every incoming packet on the interface, these Extended Security Options should be present at the minimum level and should match the configured compartment bits. Every outgoing packet must have these ESOs.

On every packet transmitted or received on this interface, any NLESO sources present in the IP header should be bounded by the minimum sensitivity level and bounded by the maximum sensitivity level configured for the interface.

When transmitting locally generated traffic out this interface, or adding security information (with the **ip security add** command), the maximum compartment bit information can be used to construct the NLESO sources placed in the IP header.

A maximum of 16 NLESO sources can be configured per interface. Due to IP header length restrictions, a maximum of 9 of these NLESO sources appear in the IP header of a packet.

Examples

In the following example, the specified ESO source is 240 and the compartment bits are specified as 500:

```
interface ethernet 0
 ip security eso-max 240 500
```

Related Commands

Command	Description
ip security eso-info	Configures system-wide defaults for extended IPSO information.
ip security eso-min	Configures the minimum sensitivity level for an interface.

ip security eso-min

To configure the minimum sensitivity for an interface, use the **ip security eso-min** command in interface configuration mode. To return to the default, use the **no** form of this command.

ip security eso-min *source compartment-bits*

no ip security eso-min *source compartment-bits*

Syntax Description

source	Extended Security Option (ESO) source. This is an integer from 1 to 255.
compartment-bits	Number of compartment bits in hexadecimal.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The command is used to specify the minimum sensitivity level for a particular interface. Before the per-interface compartment information for a particular Network Level Extended Security Option (NLESO) source can be configured, the **ip security eso-info** global configuration command must be used to specify the default information.

On every incoming packet on this interface, these Extended Security Options should be present at the minimum level and should match the configured compartment bits. Every outgoing packet must have these ESOs.

On every packet transmitted or received on this interface, any NLESO sources present in the IP header should be bounded by the minimum sensitivity level and bounded by the maximum sensitivity level configured for the interface.

When transmitting locally generated traffic out this interface, or adding security information (with the **ip security add** command), the maximum compartment bit information can be used to construct the NLESO sources placed in the IP header.

A maximum of 16 NLESO sources can be configured per interface. Due to IP header length restrictions, a maximum of 9 of these NLESO sources appear in the IP header of a packet.

Examples

In the following example, the specified ESO source is 5, and the compartment bits are specified as 5:

```
interface ethernet 0
 ip security eso-min 5 5
```

Related Commands

Command	Description
ip security eso-info	Configures system-wide defaults for extended IPSO information.
ip security eso-max	Specifies the maximum sensitivity level for an interface.

ip security extended-allowed

To accept packets on an interface that has an extended security option present, use the **ip security extended-allowed** command in interface configuration mode. To restore the default, use the **no** form of this command.

ip security extended-allowed

no ip security extended-allowed

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Packets containing extended security options are rejected.

Examples

The following example allows interface Ethernet 0 to accept packets that have an extended security option present:

```
interface ethernet 0
 ip security extended-allowed
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security first

To prioritize the presence of security options on a packet, use the **ip security first** command in interface configuration mode. To prevent packets that include security options from moving to the front of the options field, use the **no** form of this command.

ip security first

no ip security first

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If a basic security option is present on an outgoing packet, but it is not the first IP option, then the packet is moved to the front of the options field when this interface configuration command is used.

Examples

The following example ensures that, if a basic security option is present in the options field of a packet exiting interface Ethernet 0, the packet is moved to the front of the options field:

```
interface ethernet 0
 ip security first
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security ignore-authorities

To have the Cisco IOS software ignore the authorities field of all incoming packets, use the **ip security ignore-authorities** command in interface configuration mode. To disable this function, use the **no** form of this command.

ip security ignore-authorities

no ip security ignore-authorities

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When the packet's authority field is ignored, the value used in place of this field is the authority value declared for the specified interface. The **ip security ignore-authorities** can be configured only on interfaces that have dedicated security levels.

Examples

The following example causes interface Ethernet 0 to ignore the authorities field on all incoming packets:

```
interface ethernet 0
 ip security ignore-authorities
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security first	Prioritizes the presence of security options on a packet.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security implicit-labelling

To force the Cisco IOS software to accept packets on the interface, even if they do not include a security option, use the **ip security implicit-labelling** command in interface configuration mode. To require security options, use the **no** form of this command.

ip security implicit-labelling [*level authority* [*authority...*]]

no ip security implicit-labelling [*level authority* [*authority...*]]

Syntax Description

level	(Optional) Degree of sensitivity of information. If your interface has multilevel security set, you must specify this argument. (See the *level* keywords listed in Table 29 in the **ip security dedicated** command section.)
authority	(Optional) Organization that defines the set of security levels that will be used in a network. If your interface has multilevel security set, you must specify this argument. You can specify more than one. (See the *authority* keywords listed in Table 30 in the **ip security dedicated** command section.)

Defaults

Enabled, when the security level of the interface is "Unclassified Genser" (or unconfigured). Otherwise, the default is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If your interface has multilevel security set, you must use the expanded form of the command (with the optional arguments as noted in brackets) because the arguments are used to specify the precise level and authority to use when labeling the packet. If your interface has dedicated security set, the additional arguments are ignored.

Examples

In the following example, an interface is set for security and will accept unlabeled packets:

```
ip security dedicated confidential genser
ip security implicit-labelling
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.

Command	Description
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security multilevel

To set the range of classifications and authorities on an interface, use the **ip security multilevel** command in interface configuration mode. To remove security classifications and authorities, use the **no** form of this command.

ip security multilevel *level1* [*authority1...*] **to** *level2 authority2* [*authority2...*]

no ip security multilevel

Syntax Description

level1	Degree of sensitivity of information. The classification level of incoming packets must be equal to or greater than this value for processing to occur. (See the *level* keywords found in Table 29 in the **ip security dedicated** command section.)
authority1	(Optional) Organization that defines the set of security levels that will be used in a network. The authority bits must be a superset of this value. (See the *authority* keywords listed in Table 30 in the **ip security dedicated** command section.)
to	Separates the range of classifications and authorities.
level2	Degree of sensitivity of information. The classification level of incoming packets must be equal to or less than this value for processing to occur. (See the *level* keywords found in Table 29 in the **ip security dedicated** command section.)
authority2	Organization that defines the set of security levels that will be used in a network. The authority bits must be a proper subset of this value. (See the *authority* keywords listed in Table 30 in the **ip security dedicated** command section.)

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

All traffic entering or leaving the system must have a security option that falls within this range. Being within range requires that the following two conditions be met:

- The classification level must be greater than or equal to *level1* and less than or equal to *level2*.
- The authority bits must be a superset of *authority1* and a proper subset of *authority2*. That is, *authority1* specifies those authority bits that are required on a packet, and *authority2* specifies the required bits plus any optional authorities that also can be included. If the *authority1* field is the empty set, then a packet is required to specify any one or more of the authority bits in *authority2*.

Examples

The following example specifies levels Unclassified to Secret and NSA authority:

```
ip security multilevel unclassified to secret nsa
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security reserved-allowed

To treat as valid any packets that have Reserved1 through Reserved4 security levels, use the **ip security reserved-allowed** command in interface configuration mode. To disallow packets that have security levels of Reserved3 and Reserved2, use the **no** form of this command.

ip security reserved-allowed

no ip security reserved-allowed

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

When you set multilevel security on an interface, and indicate, for example, that the highest range allowed is Confidential, and the lowest is Unclassified, the Cisco IOS software neither allows nor operates on packets that have security levels of Reserved3 and Reserved2 because they are undefined.

If you use the IP Security Option (IPSO) to block transmission out of unclassified interfaces, and you use one of the Reserved security levels, you *must* enable this feature to preserve network security.

Examples

The following example allows a security level of Reserved through Ethernet interface 0:

```
interface ethernet 0
 ip security reserved-allowed
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.

Command	Description
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security strip	Removes any basic security option on outgoing packets on an interface.

ip security strip

To remove any basic security option on outgoing packets on an interface, use the **ip security strip** command in interface configuration mode. To restore security options, use the **no** form of this command.

ip security strip

no ip security strip

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The removal procedure is performed after all security tests in the router have been passed. This command is not allowed for multilevel interfaces.

Examples

The following example removes any basic security options on outgoing packets on Ethernet interface 0:

```
interface ethernet 0
 ip security strip
```

Related Commands

Command	Description
ip security add	Adds a basic security option to all outgoing packets.
ip security dedicated	Sets the level of classification and authority on the interface.
ip security extended-allowed	Accepts packets on an interface that has an Extended Security Option present.
ip security first	Prioritizes the presence of security options on a packet.
ip security ignore-authorities	Causes the Cisco IOS software to ignore the authorities field of all incoming packets.
ip security implicit-labelling	Forces the Cisco IOS software to accept packets on the interface, even if they do not include a security option.
ip security multilevel	Sets the range of classifications and authorities on an interface.
ip security reserved-allowed	Treats as valid any packets that have Reserved1 through Reserved4 security levels.

show dnsix

To display state information and the current configuration of the DNSIX audit writing module, use the **show dnsix** command in privileged EXEC mode.

show dnsix

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

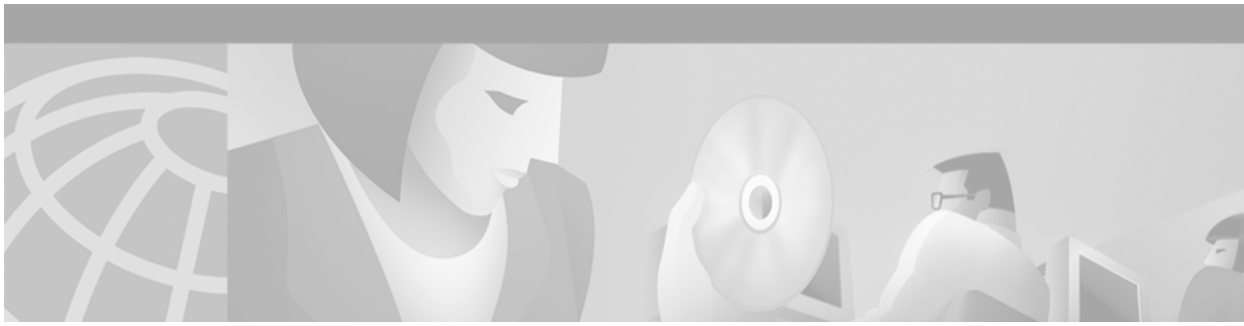
Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show dnsix** command:

```
Router# show dnsix

Audit Trail Enabled with Source 192.168.2.5
          State: PRIMARY
          Connected to 192.168.2.4
          Primary 192.168.2.4
          Transmit Count 1
          DMDP retries 4
          Authorization Redirection List:
               192.168.2.4
          Record count: 0
          Packet Count: 0
          Redirect Rcv: 0
```



Unicast Reverse Path Forwarding Commands

This chapter describes Unicast Reverse Path Forwarding (Unicast RPF) commands. The Unicast RPF feature helps mitigate problems caused by the introduction of malformed or forged (spoofed) IP source addresses into a network by discarding IP packets that lack a verifiable IP source address.

To find complete descriptions of other commands used when configuring Unicast RPF, refer to the *Cisco IOS Command Reference Master Index* or search online.

For Unicast RPF configuration information, refer to the "Configuring Unicast Reverse Path Forwarding" chapter in the *Cisco IOS Security Configuration Guide*.

ip verify unicast reverse-path

To enable Unicast Reverse Path Forwarding (Unicast RPF), use the **ip verify unicast reverse-path** interface configuration command. To disable Unicast RPF, use the **no** form of this command.

ip verify unicast reverse-path [*list*]

no ip verify unicast reverse-path [*list*]

Syntax Description

list	(Optional) Specifies a numbered access control list (ACL) in the following ranges: • 1 to 99 (IP standard access list) • 100 to 199 (IP extended access list) • 1300 to 1999 (IP standard access list, expanded range) • 2000 to 2699 (IP extended access list, expanded range)

Defaults

Unicast RPF is disabled.

Command Modes

Interface configuration mode

Command History

Release	Modification
11.1(CC), 12.0	This command was introduced. This command was not included in Cisco IOS Release 11.2 or 11.3
12.1(2)T	Added ACL support using the *list* argument. Added per-interface statistics on dropped or suppressed packets.
12.2(13)T	This command was replaced by the **ip verify unicast reachable-via** command. For information about the **ip verify unicast reachable-via** command, see the *Cisco IOS Security Command Reference*, Release 12.4T.

Usage Guidelines

Use the **ip verify unicast reverse-path** interface command to mitigate problems caused by malformed or forged (spoofed) IP source addresses that pass through a router. Malformed or forged source addresses can indicate denial-of-service (DoS) attacks based on source IP address spoofing.

When Unicast RPF is enabled on an interface, the router examines all packets received on that interface. The router checks to make sure that the source address appears in the routing table and matches the interface on which the packet was received. This “look backwards” ability is available only when Cisco Express Forwarding (CEF) is enabled on the router because the lookup relies on the presence of the Forwarding Information Base (FIB). CEF generates the FIB as part of its operation.

Note Unicast RPF is an input function and is applied only on the input interface of a router at the upstream end of a connection.

The Unicast Reverse Path Forwarding feature checks to see if any packet received at a router interface arrives on one of the best return paths to the source of the packet. The feature does this by doing a reverse lookup in the CEF table. If Unicast RPF does not find a reverse path for the packet, Unicast RPF can drop or forward the packet, depending on whether an ACL is specified in the Unicast Reverse Path Forwarding command. If an ACL is specified in the command, then when (and only when) a packet fails the Unicast RPF check, the ACL is checked to see if the packet should be dropped (using a deny statement in the ACL) or forwarded (using a permit statement in the ACL). Whether a packet is dropped or forwarded, the packet is counted in the global IP traffic statistics for Unicast RPF drops and in the interface statistics for Unicast RPF.

If no ACL is specified in the Unicast Reverse Path Forwarding command, the router drops the forged or malformed packet immediately and no ACL logging occurs. The router and interface Unicast RPF counters are updated.

Unicast RPF events can be logged by specifying the logging option for the ACL entries used by the Unicast Reverse Path Forwarding command. Log information can be used to gather information about the attack, such as source address, time, and so on.

Note With Unicast RPF, all equal-cost "best" return paths are considered valid. This means that Unicast RPF works in cases where multiple return paths exist, provided that each path is equal to the others in terms of the routing cost (number of hops, weights, and so on) and as long as the route is in the FIB. Unicast RPF also functions where Enhanced Internet Gateway Routing Protocol (EIGRP) variants are being used and unequal candidate paths back to the source IP address exist.

To use Unicast RPF, enable CEF switching or distributed CEF (dCEF) switching in the router. There is no need to configure the input interface for CEF switching. As long as CEF is running on the router, individual interfaces can be configured with other switching modes.

Note It is very important for CEF to be configured globally in the router. Unicast RPF will not work without CEF.

Unicast RPF should not be used on interfaces that are internal to the network. Internal interfaces are likely to have routing asymmetry, meaning that there are multiple routes to the source of a packet. Unicast RPF should be applied only where there is natural or configured symmetry.

For example, routers at the edge of the network of an Internet service provider (ISP) are more likely to have symmetrical reverse paths than routers that are in the core of the ISP network. Routers that are in the core of the ISP network have no guarantee that the best forwarding path out of the router will be the path selected for packets returning to the router. Hence, it is not recommended that you apply Unicast RPF where there is a chance of asymmetric routing. It is simplest to place Unicast RPF only at the edge of a network or, for an ISP, at the customer edge of the network.

Examples

The following example shows enabling the Unicast Reverse Path Forwarding feature on a serial interface:

```
ip cef
! or "ip cef distributed" for RSP+VIP based routers
!
interface serial 5/0/0
 ip verify unicast reverse-path
```

The following example uses a very simple single-homed ISP to demonstrate the concepts of ingress and egress filters used in conjunction with Unicast RPF. The example illustrates an ISP-allocated classless interdomain routing (CIDR) block 209.165.202.129/28 that has both inbound and outbound filters on the upstream interface. Be aware that ISPs are usually not single-homed. Hence, provisions for asymmetrical flows (when outbound traffic goes out one link and returns via a different link) need to be designed into the filters on the border routers of the ISP.

```
ip cef distributed
!
interface Serial 5/0/0
 description Connection to Upstream ISP
 ip address 209.165.200.225 255.255.255.224
 no ip redirects
 no ip directed-broadcast
 no ip proxy-arp
 ip verify unicast reverse-path
 ip access-group 111 in
 ip access-group 110 out
!
access-list 110 permit ip 209.165.202.129 10.0.0.31 any
access-list 110 deny ip any any log
access-list 111 deny ip host 10.0.0.10 any log
access-list 111 deny ip 172.31.0.0 255.255.255.255 any log
access-list 111 deny ip 10.0.0.0 255.255.255.255 any log
access-list 111 deny ip 172.16.0.0 255.255.255.255 any log
access-list 111 deny ip 192.168.0.0 255.255.255.255 any log
access-list 111 deny ip 209.165.202.129 10.0.0.31 any log
access-list 111 permit ip any any
```

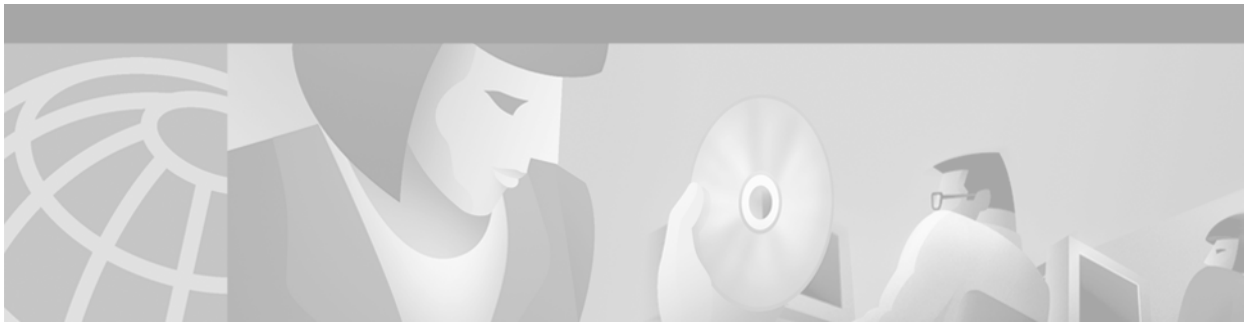
The following example demonstrates the use of ACLs and logging with Unicast RPF. In this example, extended ACL 197 provides entries that deny or permit network traffic for specific address ranges. Unicast RPF is configured on interface Ethernet0 to check packets arriving at that interface.

For example, packets with a source address of 192.168.201.10 arriving at interface Ethernet0 are dropped because of the deny statement in ACL 197. In this case, the ACL information is logged (the logging option is turned on for the ACL entry) and dropped packets are counted per-interface and globally. Packets with a source address of 192.168.201.100 arriving at interface Ethernet0/1/1 are forwarded because of the permit statement in ACL 197. ACL information about dropped or suppressed packets is logged (the logging option is turned on for the ACL entry) to the log server.

```
ip cef distributed
!
int eth0/1/1
 ip address 192.168.200.225 255.255.255.255
 ip verify unicast reverse-path 197
!
int eth0/1/2
 ip address 192.168.201.1 255.255.255.255
!
access-list 197 deny   ip 192.168.201.0 10.0.0.63 any log-input
access-list 197 permit ip 192.168.201.64 10.0.0.63 any log-input
access-list 197 deny   ip 192.168.201.128 10.0.0.63 any log-input
access-list 197 permit ip 192.168.201.192 10.0.0.63 any log-input
access-list 197 deny ip host 10.0.0.10 any log-input
access-list 197 deny ip 172.31.0.0 255.255.255.255 any log-input
access-list 197 deny ip 10.0.0.0 255.255.255.255 any log-input
access-list 197 deny ip 172.16.0.0 255.255.255.255 any log-input
access-list 197 deny ip 192.168.0.0 255.255.255.255 any log-input
```

Related Commands

Command	Description
ip cef	Enables CEF on the route processor card.



Secure Shell Commands

This chapter describes Secure Shell (SSH) commands. SSH is an application and a protocol that provides a secure replacement to the Berkeley r-tools. The protocol secures the remote connection to a router using standard cryptographic mechanisms, and the application can be used similarly to the Berkeley **rexec** and **rsh** tools. There are currently two versions of SSH available, SSH Version 1 and SSH Version 2. Only SSH Version 1 is implemented in the Cisco IOS software.

To find complete descriptions of other commands used when configuring SSH, refer to the *Cisco IOS Command Reference Master Index* or search online.

For SSH configuration information, refer to the "Configuring Secure Shell" chapter in the *Cisco IOS Security Configuration Guide*.

disconnect ssh

To terminate a Secure Shell (SSH) connection on your router, use the **disconnect ssh** privileged EXEC command.

disconnect ssh [**vty**] *session-id*

Syntax Description

vty	(Optional) Virtual terminal for remote console access.
session-id	The session-id is the number of connection displayed in the **show ip ssh** command output.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(5)S	This command was introduced.
12.1(1)T	This command was integrated into Cisco IOS Release 12.1 T.

Usage Guidelines

The **clear line vty** *n* command, where *n* is the connection number displayed in the **show ip ssh** command output, may be used instead of the **disconnect ssh** command.

When the EXEC connection ends, whether normally or abnormally, the SSH connection also ends.

Examples

The following example terminates SSH connection number 1:

```
disconnect ssh 1
```

Related Commands

Command	Description
clear line vty	Returns a terminal line to idle state using the privileged EXEC command.

ip ssh

To configure Secure Shell (SSH) control parameters on your router, use the **ip ssh** global configuration command. To restore the default value, use the **no** form of this command.

ip ssh {[**timeout** *seconds*]} | [**authentication-retries** *integer*]}

no ip ssh {[**timeout** *seconds*]} | [**authentication-retries** *integer*]}

Syntax Description

timeout	(Optional) The time interval that the router waits for the SSH client to respond. This setting applies to the SSH negotiation phase. Once the EXEC session starts, the standard timeouts configured for the vty apply. By default, there are 5 vtys defined (0–4), therefore 5 terminal sessions are possible. After the SSH executes a shell, the vty timeout starts. The vty timeout defaults to 10 minutes.
authentication-retries	(Optional) The number of attempts after which the interface is reset.
seconds	(Optional) The number of seconds until timeout disconnects, with a maximum of 120 seconds. The default is 120 seconds.
integer	(Optional) The number of retries, with a maximum of 5 authentication retries. The default is 3.

Defaults

120 seconds for the timeout timer.

3 authentication-retries.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)S	This command was introduced.
12.1(1)T	This command was integrated into Cisco IOS Release 12.1 T.

Usage Guidelines

Before you configure SSH on your router, you must enable the SSH server using the **crypto key generate rsa** command.

Examples

The following examples configure SSH control parameters on your router:

```
ip ssh timeout 120
ip ssh authentication-retries 3
```

show ip ssh

To display the version and configuration data for Secure Shell (SSH), use the **show ip ssh** privileged EXEC command.

show ip ssh

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(5)S	This command was introduced.
12.1(1)T	This command was integrated into Cisco IOS Release 12.1 T.
12.1(5)T	This command was modified to display the SSH status—enabled or disabled.

Usage Guidelines

Use the **show ip ssh** command to view the status of configured options such as retries and timeouts. This command allows you to see if SSH is enabled or disabled.

Examples

The following is sample output from the **show ip ssh** command when SSH has been enabled:

```
Router# show ip ssh

SSH Enabled - version 1.5
Authentication timeout: 120 secs; Authentication retries: 3
```

The following is sample output from the **show ip ssh** command when SSH has been disabled:

```
Router# show ip ssh

%SSH has not been enabled
```

Related Commands

Command	Description
show ssh	Displays the status of SSH server connections.

show ssh

To display the status of Secure Shell (SSH) server connections, use the **show ssh** privileged EXEC command.

show ssh

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

Use the **show ssh** command to display the status of the SSH connections on your router. This command does not display any SSH configuration data; use the **show ip ssh** command for SSH configuration information such as timeouts and retries.

Examples

The following is sample output from the **show ssh** command with SSH enabled:

```
Router# show ssh

Connection      Version     Encryption      State       Username
   0             1.5          3DES       Session Started  guest
```

The following is sample output from the show ssh command with SSH disabled:

```
Router# show ssh
%No SSH server connections running.
```

Related Commands

Command	Description
show ip ssh	Displays the version and configuration data for SSH.

ssh

To start an encrypted session with a remote networking device, use the **ssh** user EXEC command.

ssh [**-l** *userid*] [**-c** {**des** | **3des**}] [**-o numberofpasswdprompts** *n*] [**-p** *portnum*] {*ipaddr* | *hostname*} [*command*]

Syntax Description

-l *userid*	(Optional) Specifies the user ID to use when logging in as on the remote networking device running the SSH server. If no user ID is specified, the default is the current user ID.
-c {**des** | **3des**}	(Optional) Specifies the crypto algorithm, DES or 3DES, to use for encrypting data. To use SSH, you must have an encryption image must be running on the router. Cisco software images that include encryption have the designators "k8" (DES) or "k9" (3DES).
-o numberofpasswdprompts *n*	(Optional) Specifies the number of password prompts that the software generates before ending the session. The SSH server may also apply a limit to the number of attempts. If the limit set by the server is less than the value specified by the **-o numberofpasswdprompts** keyword, the limit set by the server takes precedence. The default is 3 attempts, which is also the Cisco IOS SSH server default. The range of values is from 1 to 5.
-p *portnum*	(Optional) Indicates the desired port number for the remote host. The default port number is 22.
ipaddr | *hostname*	Specifies the IP address or host name of the remote networking device.
command	(Optional) Specifies the Cisco IOS command that you want to run on the remote networking device. If the remote host is not running Cisco IOS software, this may be any command recognized by the remote host. If the command includes spaces, you must enclose the command in quotation marks.

Defaults

Disabled

Command Modes

User EXEC

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

The **ssh** command enables a Cisco router to make a secure, encrypted connection to another Cisco router or device running an SSH Version 1 server. This connection provides functionality that is similar to that of an outbound Telnet connection except that the connection is encrypted. With authentication and encryption, the SSH client allows for a secure communication over an insecure network.

Note SSH is supported on DES (56-bit) and 3DES (168-bit) data encryption software images only. In DES software images, DES is the only encryption algorithm available. In 3DES software images, both DES and 3DES encryption algorithms are available.

The **ssh** command requires that you first enable the SSH server on the router. The SSH client is available only when the SSH server is enabled.

Examples

The following example illustrates initiating a secure session between the local router and the remote host HQhost to run the **show users** command. The result of the **show users** command is a list of valid users who are logged in to HQhost. The remote host will prompt for the adminHQ password to authenticate the user adminHQ. If the authentication step is successful, the remote host will return the result of the **show users** command to the local router and will then close the session.

```
ssh -l adminHQ HQhost "show users"
```

The following example illustrates initiating a secure session between the local router and the edge router HQedge to run the **show ip route** command. In this example, the edge router prompts for the adminHQ password to authenticate the user. If the authentication step is successful, the edge router will return the result of the **show ip route** command to the local router.

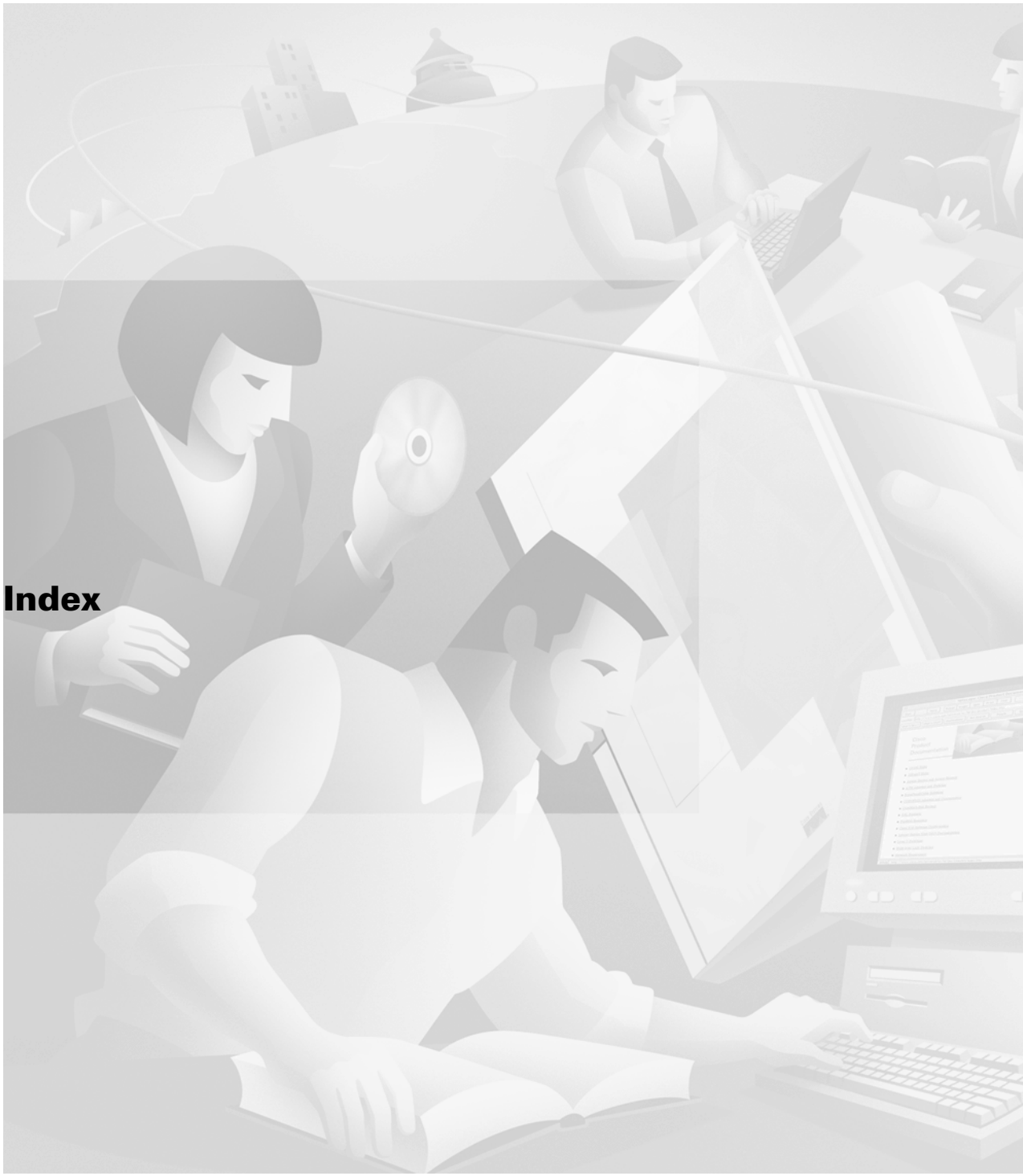
```
ssh -l adminHQ HQedge "show ip route"
```

The following example shows the SSH client using 3DES to initiate a secure remote command connection with the HQedge router. The SSH server running on HQedge authenticates the session for the admin7 user on the HQedge router using standard authentication methods. The HQedge router must have SSH enabled for this to work.

```
ssh -l admin7 -c 3des -o numberofpasswdprompts 5 HQedge
```

Related Commands

Command	Description
ip ssh	Configures SSH server control parameters on the router.
show ip ssh	Displays the version and configuration data for SSH.
show ssh	Displays the status of SSH server connections.



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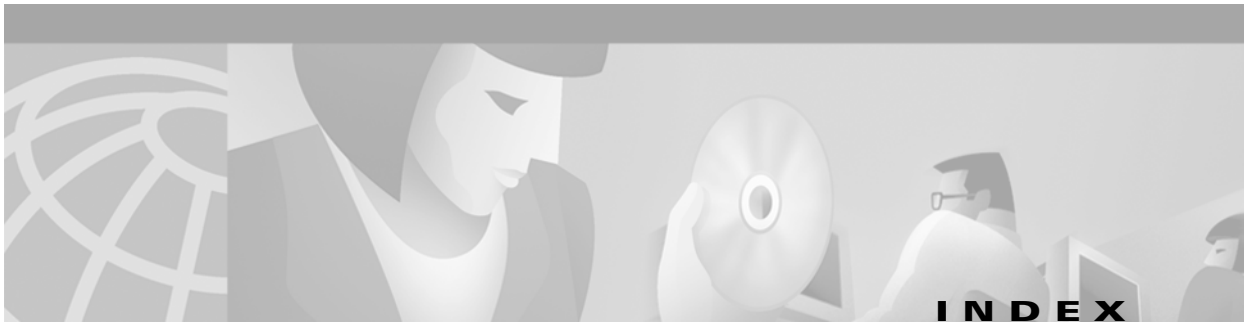

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