Authentication Authorization and Accounting Configuration Guide, Cisco IOS XE Release 3E

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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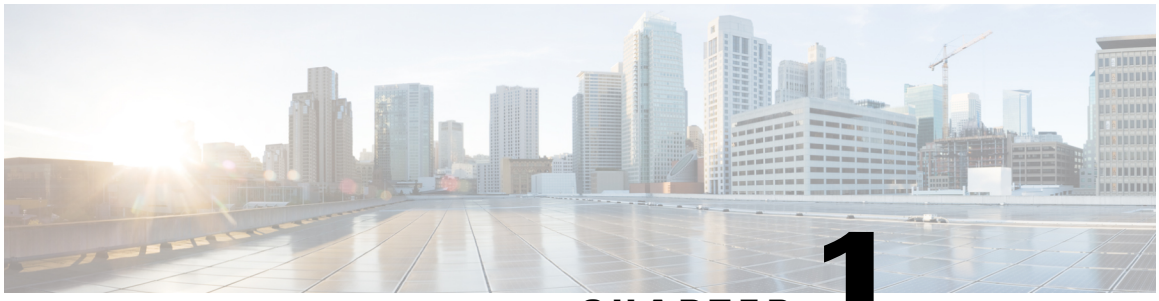


CHAPTER 1

Device Sensor

The Device Sensor feature is used to gather raw endpoint data from network devices using protocols such as Cisco Discovery Protocol (CDP), Link Layer Discovery Protocol (LLDP), and DHCP. The endpoint data that is gathered is made available to registered clients in the context of an access session.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for Device Sensor

- Only Cisco Discovery Protocol, LLDP, DHCP, MDNS, SIP, and H323 protocols are supported.
- The session limit for profiling ports is 32.
- The length of one Type-Length-Value (TLV) must not be more than 1024 and the total length of TLVs (combined length of TLVs) of all protocols must not be more than 4096.
- The sensor profiles devices that are only one hop away.

- The Device Sensor feature is enabled by default, but cannot be disabled. Disabling device classifier using **no device classifier** command in global configuration mode does not disable device sensor. This is because device sensor is independent of IP device tracking and device classifier.

Note In Cisco IOS Release 15.2(1)E and later releases, you can exclude the protocols so that the Device Sensor feature does not analyze the data. To exclude the protocols, use the **device-sensor filter-spec** *protocol* **exclude all** command in global configuration mode.

Information About Device Sensor

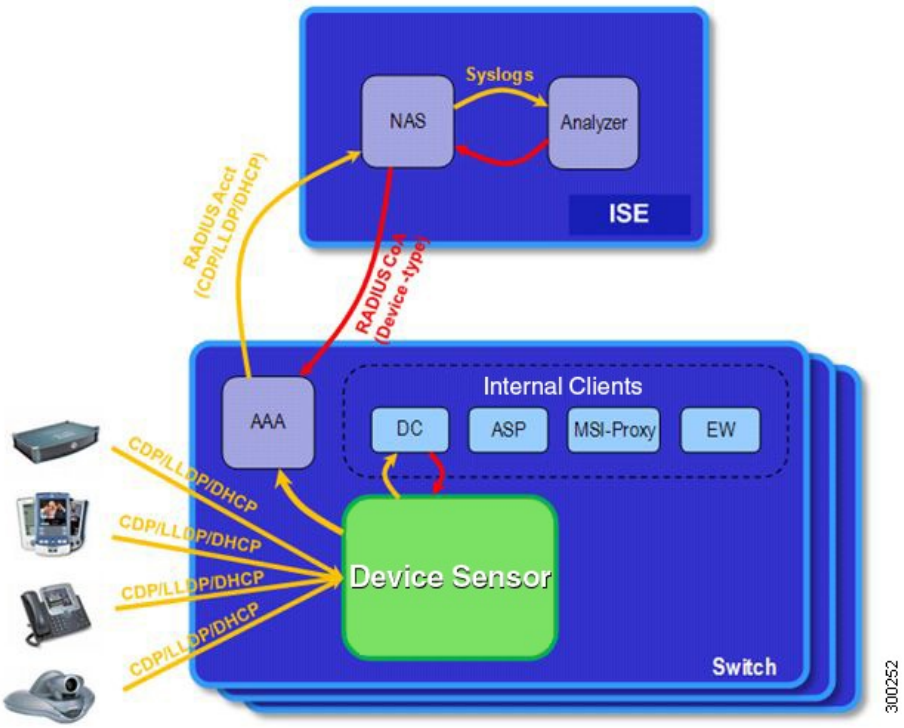
Device Sensor

The device sensor is used to gather raw endpoint data from network devices. The endpoint information that is gathered helps in completing the profiling capability of devices. Profiling is the determination of the endpoint type based on information gleaned from various protocol packets from an endpoint during its connection to a network.

The profiling capability consists of two parts:

- Collector—Gathers endpoint data from network devices.
- Analyzer—Processes the data and determines the type of device.

The device sensor represents the embedded collector functionality. The illustration below shows the Cisco sensor in the context of the profiling system and also features other possible clients of the sensor.



A device with sensor capability gathers endpoint information from network devices using protocols such as Cisco Discovery Protocol, LLDP, and DHCP, subject to statically configured filters, and makes this information available to its registered clients in the context of an access session. An access session represents an endpoint's connection to the network device.

The device sensor has internal and external clients. The internal clients include components such as the embedded Device Classifier (local analyzer), ATM switch processor (ASP), MSI-Proxy, and EnergyWise (EW). The external client, that is the Identity Services Engine (ISE) analyzer, will use RADIUS accounting to receive additional endpoint data.

Client notifications and accounting messages containing profiling data along with the session events and other session-related data, such as the MAC address and the ingress port, are generated and sent to the internal and external clients (ISE). By default, for each supported peer protocol, client notifications and accounting events are only generated where an incoming packet includes a TLV that has not previously been received in the context of a given session. You can enable client notifications and accounting events for all TLV changes, where either a new TLV has been received or a previously received TLV has been received with a different value using CLI commands.

The device sensor's port security protects the switch from consuming memory and crashing during deliberate or unintentional denial-of-service (DoS) type attacks. The sensor limits the maximum device monitoring sessions to 32 per port (access ports and trunk ports). In case of lack of activity from hosts, the age session time is 12 hours.

How to Configure Device Sensor

The device sensor is enabled by default.

Note In Cisco IOS Release 15.2(1)E and later releases, you can exclude the protocols so that the Device Sensor feature does not analyze the data. To exclude the protocols, use the **device-sensor filter-spec** *protocol* **exclude all** command in global configuration mode.

The following tasks are applicable only if you want to configure the sensor based on your specific requirements.

Note If you do not perform these configuration tasks, then the following TLVs are included by default:

- Cisco Discovery Protocol filter—secondport-status-type and powernet-event-type (type 28 and 29).
- LLDP filter—organizationally-specific (type 127).
- DHCP filter—message-type (type 53).

Enabling Accounting Augmentation

Perform this task to add device sensor protocol data to accounting records.

Before You Begin

For the sensor protocol data to be added to the accounting messages, you must enable session accounting by using the following standard authentication, authorization, and accounting (AAA), and RADIUS configuration commands:

```
Device(config)#aaa new-model
Device(config)#aaa accounting dot1x default start-stop group radius
Device(config)#radius-server host{hostname | ip-address}[auth-port port-number][acct-port
port-number][timeout seconds][retransmit retries][key string]
Device(config)#radius-server vsa send accounting
```

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **device-sensor accounting**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**device-sensor accounting** **Example:** `Device(config)# device-sensor accounting`	Enables the addition of sensor protocol data to accounting records and also enables the generation of additional accounting events when new sensor data is detected.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Creating a Cisco Discovery Protocol Filter

Perform this task to create a Cisco Discovery Protocol filter containing a list of TLVs that can be included or excluded in the device sensor output.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **device-sensor filter-list cdp list** *tlv-list-name*
4. **tlv** {**name** *tlv-name* | **number** *tlv-number*}
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**device-sensor filter-list cdp list** *tlv-list-name* **Example:** `Device(config)# device-sensor filter-list cdp list cdp-list`	Creates a TLV list and enters CDP sensor configuration mode, where you can configure individual TLVs.
Step 4	**tlv** {**name** *tlv-name* | **number** *tlv-number*} **Example:** `Device(config-sensor-cdplist)# tlv number 10`	Adds individual Cisco Discovery Protocol TLVs to the TLV list. • You can delete the TLV list without individually removing TLVs from the list by using the **no device-sensor filter-list cdp list** *tlv-list-name* command.
Step 5	**end** **Example:** `Device(config-sensor-cdplist)# end`	Returns to privileged EXEC mode.

Creating an LLDP Filter

Perform this task to create an LLDP filter containing a list of TLVs that can be included or excluded in the device sensor output.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **device-sensor filter-list lldp list** *tlv-list-name*
4. **tlv** {**name** *tlv-name* \| **number** *tlv-number*}
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Device> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**device-sensor filter-list lldp list** *tlv-list-name* **Example:** `Device(config)# device-sensor filter-list lldp list lldp-list`	Creates a TLV list and enters LLDP sensor configuration mode, where you can configure individual TLVs.
Step 4	**tlv** {**name** *tlv-name* | **number** *tlv-number*} **Example:** `Device(config-sensor-lldplist)# tlv number 15`	Adds individual LLDP TLVs to the TLV list. • You can delete the TLV list without individually removing TLVs from the list by using the **no device-sensor filter-list lldp list** *tlv-list-name* command.
Step 5	**end** **Example:** `Device(config-sensor-lldplist)# end`	Returns to privileged EXEC mode.

Creating a DHCP Filter

Perform this task to create a DHCP filter containing a list of options that can be included or excluded in the device sensor output.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **device-sensor filter-list dhcp list** *option-list-name*
4. **option** {**name** *option-name* | **number** *option-number*}
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**device-sensor filter-list dhcp list** *option-list-name* **Example:** `Device(config)# device-sensor filter-list dhcp list dhcp-list`	Creates an options list and enters DHCP sensor configuration mode, where you can configure individual options.
Step 4	**option** {**name** *option-name* | **number** *option-number*} **Example:** `Device(config-sensor-dhcplist)# option number 10`	Adds individual DHCP options to the option list. • You can delete the option list without individually removing options from the list by using the **no device-sensor filter-list dhcp list** *option-list-name* command.
Step 5	**end** **Example:** `Device(config-sensor-dhcplist)# end`	Returns to privileged EXEC mode.

Applying a Protocol Filter to the Sensor Output

Perform this task to apply a Cisco Discovery Protocol, LLDP, or DHCP filter to the sensor output. Session notifications are sent to internal sensor clients and accounting requests.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **device-sensor filter-spec** {**cdp** | **dhcp** | **lldp**} {**exclude** {**all** | **list** *list-name*} | **include list** *list-name*}
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**device-sensor filter-spec** {**cdp** | **dhcp** | **lldp**} {**exclude** {**all** | **list** *list-name*} | **include list** *list-name*} **Example:** `Device(config)# device-sensor filter-spec cdp include list list1`	Applies a specific protocol filter containing a list of TLV fields to the device sensor output. • **cdp—**Applies a Cisco Discovery Protocol TLV filter list to the device sensor output. • **lldp—**Applies an LLDP TLV filter list to the device sensor output. • **dhcp—**Applies a DHCP TLV filter list to the device sensor output. • **exclude—**Specifies the TLVs that must be excluded from the device sensor output. • **include—**Specifies the TLVs that must be included from the device sensor output. • **all—**Disables all notifications for the associated protocol. • **list** *list-name***—**Specifies the protocol TLV filter list name.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Tracking TLV Changes

Perform this task to enable client notifications and accounting events for all TLV changes. By default, for each supported peer protocol, client notifications and accounting events will only be generated where an incoming packet includes a TLV that has not previously been received in the context of a given session.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **device-sensor notify all-changes**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**device-sensor notify all-changes** **Example:** `Device(config)# device-sensor notify all-changes`	Enables client notifications and accounting events for all TLV changes, that is, where either a new TLV is received or a previously received TLV is received with a new value in the context of a given session. **Note** Use the **default device-sensor notify** or the **device-sensor notify new-tlvs** command to return to the default TLV.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Verifying the Device Sensor Configuration

Perform this task to verify the sensor cache entries for all devices.

SUMMARY STEPS

1. **enable**
2. **show device-sensor cache mac** *mac-address*
3. **show device-sensor cache all**

DETAILED STEPS

Step 1 **enable**
Enables privileged EXEC mode.

Example:
```
Device> enable
```

Step 2 **show device-sensor cache mac** *mac-address*
Displays sensor cache entries (the list of protocol TLVs or options received from a device) for a specific device.

Example:
```
Device# show device-sensor cache mac 0024.14dc.df4d

Device: 0024.14dc.df4d on port GigabitEthernet1/0/24
-----------------------------------------------
Proto Type:Name                          Len Value
cdp     26:power-available-type           16 00 1A 00 10 00 00 00 01 00 00 00 00 FF FF FF FF
cdp     22:mgmt-address-type              17 00 16 00 11 00 00 00 01 01 01 CC 00 04 09 1B 65
                                             0E
cdp     11:duplex-type                     5 00 0B 00 05 01
cdp      9:vtp-mgmt-domain-type            4 00 09 00 04
cdp      4:capabilities-type               8 00 04 00 08 00 00 00 28
cdp      1:device-name                    14 00 01 00 0E 73 75 70 70 6C 69 63 61 6E 74
lldp     0:end-of-lldpdu                   2 00 00
lldp     8:management-address             14 10 0C 05 01 09 1B 65 0E 03 00 00 00 01 00
lldp     7:system-capabilities             6 0E 04 00 14 00 04
lldp     4:port-description               23 08 15 47 69 67 61 62 69 74 45 74 68 65 72 6E 65
                                             74 31 2F 30 2F 32 34
lldp     5:system-name                    12 0A 0A 73 75 70 70 6C 69 63 61 6E 74
dhcp    82:relay-agent-info               20 52 12 01 06 00 04 00 18 01 18 02 08 00 06 00 24
                                             14 DC DF 80
dhcp    12:host-name                      12 0C 0A 73 75 70 70 6C 69 63 61 6E 74
dhcp    61:client-identifier              32 3D 1E 00 63 69 73 63 6F 2D 30 30 32 34 2E 31 34
                                             64 63 2E 64 66 34 64 2D 47 69 31 2F 30 2F 32 34
dhcp    57:max-message-size                4 39 02 04 80
```

Step 3 **show device-sensor cache all**
Displays sensor cache entries for all devices.

Example:
```
Device# show device-sensor cache all

Device: 001c.0f74.8480 on port GigabitEthernet2/1
-------------------------------------------------
Proto Type:Name Len Value
dhcp 52:option-overload 3 34 01 03
dhcp 60:class-identifier 11 3C 09 64 6F 63 73 69 73 31 2E 30
dhcp 55:parameter-request-list 8 37 06 01 42 06 03 43 96
dhcp 61:client-identifier 27 3D 19 00 63 69 73 63 6F 2D 30 30 31 63 2E 30 66
37 34 2E 38 34 38 30 2D 56 6C 31
dhcp 57:max-message-size 4 39 02 04 80
Device: 000f.f7a7.234f on port GigabitEthernet2/1
-------------------------------------------------
Proto Type:Name Len Value
cdp 22:mgmt-address-type 8 00 16 00 08 00 00 00 00
cdp 19:cos-type 5 00 13 00 05 00
cdp 18:trust-type 5 00 12 00 05 00
cdp 11:duplex-type 5 00 0B 00 05 01
```

```
cdp 10:native-vlan-type 6 00 0A 00 06 00 01
cdp 9:vtp-mgmt-domain-type 9 00 09 00 09 63 69 73 63 6F
```

Troubleshooting Tips

After you have configured AAA Dead-Server Detection, you should verify your configuration using the **show running-config** command. This verification is especially important if you have used the **no** form of the **radius-server dead-criteria** command. The output of the **show running-config** command must show the same values in the "Dead Criteria Details" field that you configured using the **radius-server dead-criteria** command.

Configuration Examples for the Device Sensor Feature

Examples: Configuring the Device Sensor

The following example shows how to create a Cisco Discovery Protocol filter containing a list of TLVs:

```
Device> enable
Device# configure terminal
Device(config)# device-sensor filter-list cdp list cdp-list
Device(config-sensor-cdplist)# tlv name address-type
Device(config-sensor-cdplist)# tlv name device-name
Device(config-sensor-cdplist)# tlv number 34
Device(config-sensor-cdplist)# end
```

The following example shows how to create an LLDP filter containing a list of TLVs:

```
Device> enable
Device# configure terminal
Device(config)# device-sensor filter-list lldp list lldp-list
Device(config-sensor-lldplist)# tlv name chassis-id
Device(config-sensor-lldplist)# tlv name management-address
Device(config-sensor-lldplist)# tlv number 28
Device(config-sensor-lldplist)# end
```

The following example shows how to create a DHCP filter containing a list of options:

```
Device> enable
Device# configure terminal
Device(config)# device-sensor filter-list dhcp list dhcp-list
Device(config-sensor-lldplist)# option name address-type
Device(config-sensor-lldplist)# option name device-name
Device(config-sensor-lldplist)# option number 34
Device(config-sensor-lldplist)# end
```

The following example shows how to apply a Cisco Discovery Protocol TLV filter list to the device sensor output:

```
Device> enable
Device# configure terminal
Device(config)# device-sensor filter-spec cdp include cdp-list1
```

The following example shows how to enable client notifications and accounting events for all TLV changes:

```
Device> enable
Device# configure terminal
Device(config)# device-sensor notify all-changes
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Master Command List, All Releases
Security commands	• Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

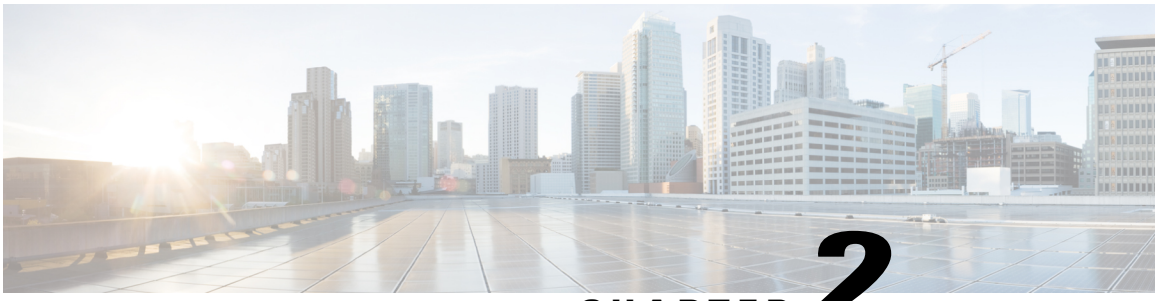
Feature Information for Device Sensor

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 1: Feature Information for Device Sensor

Feature Name	Releases	Feature Information
Device Sensor	Cisco IOS XE 3.3 SG Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The Device Sensor feature is used to gather raw endpoint data from network devices using protocols such as Cisco Discovery Protocol, Link Layer Discovery Protocol (LLDP), and DHCP. The endpoint data that is gathered is made available to registered clients in the context of an access session. The following commands were introduced or modified: **debug device-sensor**, **device-sensor accounting**, **device-sensor filter-list cdp**, **device-sensor filter-list dhcp**, **device-sensor filter-list lldp**, **device-sensor filter-spec**, **device-sensor notify**, and **show device-sensor cache**. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.



CHAPTER 2

AAA Double Authentication Secured by Absolute Timeout

The AAA Double Authentication Secured by Absolute Timeout feature allows you to secure the double authentication mechanism by protecting it with a per-user session timeout. This feature optimizes the connections to the network that are authorized by service providers and increases the security of the overall access to the network by ensuring that no unwanted sessions are connected.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for AAA Double Authentication Secured by Absolute Timeout

- You need access to a Cisco RADIUS or TACACS+ server and should be familiar with configuring RADIUS or TACACS+.
- You should be familiar with configuring authentication, authorization, and accounting (AAA) and enabling AAA automated double authentication.

Restrictions for AAA Double Authentication Secured by Absolute Timeout

- The AAA Double Authentication Secured by Absolute Timeout feature is for PPP connections only. Automated double authentication cannot be used with other protocols, such as X.25 or Serial Line Internet Protocol (SLIP).
- There may be a minimal impact on performance if a TACACS+ server is used. However, there is no performance impact if a RADIUS server is used.

Information About AAA Double Authentication Secured by Absolute Timeout

AAA Double Authentication

Use the AAA double authentication mechanism to pass the first authentication using a host username and password. The second authentication, after the Challenge Handshake Authentication Protocol (CHAP) or the Password Authentication Protocol (PAP) authentication, uses a login username and password. In the first authentication, a PPP session timeout is applied to the virtual access interface if it is configured locally or remotely.

The AAA Double Authentication Secured by Absolute Timeout feature allows you to secure the double authentication mechanism by protecting it with a per-user session timeout. The per-user session timeout, which can be customized, supersedes the generic absolute timeout value. This method works on the same principle as per-user access control lists (ACLs) in double authentication.

How to Apply AAA Double Authentication Secured by Absolute Timeout

Applying AAA Double Authentication Secured by Absolute Timeout

To apply the absolute timeout, you must configure session-timeout in the login user profile as a link control protocol (LCP) per-user attribute. Use the **access-profile** command to enable AAA double authentication. This command is used to apply your per-user authorization attributes to an interface during a PPP session. Before you use the **access-profile** command, you must first reauthorize LCP per-user attributes (for example, Session-Timeout) and then reauthorize Network Control Protocols (NCPs) to apply other necessary criteria, such as ACLs and routes. See the section "Examples for AAA Double Authentication Secured by Absolute Timeout."

Note The Timeout configuration in a TACACS+ user profile is different from the configuration in a RADIUS user profile. In a RADIUS profile, only one session-timeout is configured, along with the autocommand **access-profile**. The timeout is applied to the EXEC session and to the PPP session respectively. In TACACS+, however, the timeout must be configured under the service types "exec" and "ppp" (LCP) to apply a timeout to the EXEC session and to the PPP session. If the timeout is configured only under the service type "ppp," the timeout value will not be available during an EXEC authorization, and the timeout will not be applied to the EXEC session.

Configuration Examples for AAA Double Authentication Secured by Absolute Timeout

Example: RADIUS User Profile

The following sample output shows that a RADIUS user profile has been applied and that AAA double authentication has been secured by an absolute timeout:

```
aaapbx2 Password = "password1",
 Service-Type = Framed,
 Framed-Protocol = PPP,
 Session-Timeout = 180,
 Idle-Timeout = 180000,
 cisco-avpair = "ip:inacl#1=permit tcp any any eq telnet"
 cisco-avpair = "ip:inacl#2=permit icmp any any"
broker_default Password = "password1",
 Service-Type = Administrative,
 cisco-avpair = "shell:autocmd=access-profile",
 Session-Timeout = 360,
 cisco-avpair = "ip:inacl#1=permit tcp any any"
 cisco-avpair = "ip:inacl#2=permit icmp any any"
broker_merge Password = "password1",
 Service-Type = Administrative,
 cisco-avpair = "shell:autocmd=access-profile merge",
```

```
 Session-Timeout = 360,
 cisco-avpair = "ip:inacl#1=permit tcp any any"
 cisco-avpair = "ip:inacl#2=permit icmp any any"
 cisco-avpair = "ip:route#3=10.4.0.0 255.0.0.0"
 cisco-avpair = "ip:route#4=10.5.0.0 255.0.0.0"
 cisco-avpair = "ip:route#5=10.6.0.0 255.0.0.0"
broker_replace Password = "password1",
 Service-Type = Administrative,
 cisco-avpair = "shell:autocmd=access-profile replace",
 Session-Timeout = 360,
 cisco-avpair = "ip:inacl#1=permit tcp any any"
 cisco-avpair = "ip:inacl#2=permit icmp any any"
 cisco-avpair = "ip:route#3=10.4.0.0 255.0.0.0"
 cisco-avpair = "ip:route#4=10.5.0.0 255.0.0.0"
 cisco-avpair = "ip:route#5=10.6.0.0 255.0.0.0"
```

Example: TACACS User Profile

The following sample output shows that a TACACS+ user profile has been applied and that AAA double authentication has been secured by an absolute timeout.

Remote Host Authentication

The following example shows how to allow the remote host to be authenticated by the local host during the first-stage authentication and provides the remote host authorization profile.

```
user = aaapbx2
 chap = cleartext Cisco
 pap = cleartext cisco
 login = cleartext cisco
 service = ppp protocol = lcp
  idletime = 3000
  timeout = 3
 service = ppp protocol = ip
  inacl#1="permit tcp any any eq telnet"
 service = ppp protocol = ipx
```

Using the access-profile Command Without Any Arguments

Using the **access-profile** command without any arguments causes the removal of any access lists that are found in the old configuration (both per-user and per-interface) and ensures that the new profile contains only access-list definitions.

```
user = broker_default
 login = cleartext Cisco
 chap = cleartext "cisco"
 service = exec
  autocmd = "access-profile"
! This is the autocommand that executes when broker_default logs in.
  timeout = 6
 service = ppp protocol = lcp
  timeout = 6
 service = ppp protocol = ip
! Put access lists, static routes, and other requirements that are
! needed here. Read the software specifications for details. If you leave
! this blank, the user will have no access lists (not even the ones that were
! installed prior to the creation of this user profile)!
  inacl#1="permit tcp any any"
  inacl#2="permit icmp host 10.0.0.0 any"
 service = ppp protocol = ipx
! Put access lists, static routes, and other requirements that are
! needed here. Read the software specifications for details. If you leave
! this blank, the user will have no access lists (not even the ones that were
! installed prior to the creation of this user profile)!
```

Using the access-profile Command with the merge Keyword

The **merge** keyword in the **access-profile** command is used to remove all old access lists, and any attribute-value (AV) pair is allowed to be uploaded and installed. The use of the **merge** keyword will allow for the uploading of any custom static routes, Service Advertisement Protocol (SAP) filters, and other requirements that users may need in their profiles. Configure the **merge** keyword with care because it leaves everything open in terms of conflicting configurations.

```
user = broker_merge
 login = cleartext Cisco
 chap = cleartext "cisco"
 service = exec
  autocmd = "access-profile merge"
! This is the autocommand that executes when broker_merge logs in.
  timeout = 6
 service = ppp protocol = lcp
 timeout = 6
 service = ppp protocol = ip
! Put access lists, static routes, and other requirements that are
! needed here. Read the software specifications for details. If you leave
! this blank, the user will have no access lists (not even the ones that were
! installed prior to the creation of this user profile)!
  route#1="10.4.0.0 255.0.0.0"
  route#2="10.5.0.0 255.0.0.0"
  route#3="10.6.0.0 255.0.0.0"
  inacl#5="permit tcp any any"
  inacl#6="permit icmp host 10.60.0.0 any"
 service = ppp protocol = ipx
! Put access lists, static routes, and other requirements that are
! needed here. Read the software specifications for details. If you leave
! this blank, the user will have no access lists (not even the ones that were
! installed prior to the creation of this user profile)!
```

Using the access-profile Command with the replace Keyword

If you use the **access-profile** command with the **replace** keyword, any old configurations are removed and a new configuration is installed.

Note When the **access-profile** command is configured, the new configuration is checked for address pools and address-AV pairs. Because addresses cannot be renegotiated at this point, the command will fail to work when it encounters such an address-AV pair.

```
user = broker_replace
 login = cleartext Cisco
 chap = cleartext "cisco"
 service = exec
  autocmd = "access-profile replace"
! This is the autocommand that executes when broker_replace logs in.
  timeout = 6
 service = ppp protocol = lcp
  timeout = 6
 service = ppp protocol = ip
! Put access lists, static routes, and other requirements that are
! needed here. Read the software specifications for details. If you leave
! this blank, the user will have no access lists (not even the ones that were
! installed prior to the creation of this user profile)!
  route#1="10.7.0.0 255.0.0.0"
  route#2="10.8.0.0 255.0.0.0"
  route#3="10.9.0.0 255.0.0.0"
  inacl#4="permit tcp any any"
 service = ppp protocol = ipx
! Put access lists, static routes, and other requirements that are
! needed here. Read the software specifications for details. If you leave
```

```
! this blank, the user will have no access lists (not even the ones that were
! installed prior to the creation of this user profile)!
```

Note The Timeout configuration in a TACACS+ user profile is different from the configuration in a RADIUS user profile. In a RADIUS profile, only one session-timeout is configured, along with the autocommand **access-profile**. The timeout will be applied to the EXEC session and to the PPP session. In the TACACS+ user profile, however, the timeout must be configured under the service types “exec” and “ppp” (LCP) to apply a timeout to the EXEC session and to the PPP session respectively. If the timeout is configured only under the service type “ppp,” the timeout value will not be available during an EXEC authorization, and the timeout will not be applied to the EXEC session.

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Master Command List, All Releases
Security commands	• Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

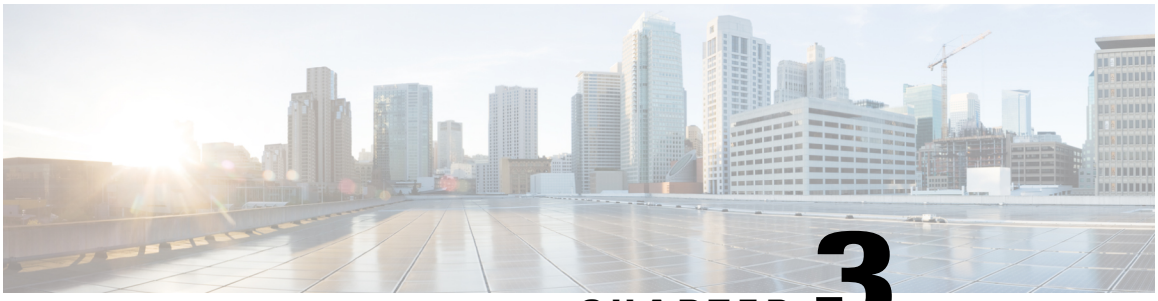
Feature Information for AAA Double Authentication Secured by Absolute Timeout

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 2: Feature Information for AAA Double Authentication Secured by Absolute Timeout

Feature Name	Releases	Feature Information
AAA Double Authentication Secured by Absolute Timeout	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The AAA Double Authentication Secured by Absolute Timeout feature allows you to secure the double authentication mechanism by protecting it with a per-user session timeout. This feature optimizes the connection to the network by service providers to only connections that are authorized, and it increases the security of the overall access to the network by ensuring that no unwanted sessions are connected. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.



CHAPTER 3

Login Password Retry Lockout

The Login Password Retry Lockout feature allows system administrators to lock out a local authentication, authorization, and accounting (AAA) user account after a configured number of unsuccessful attempts by the user to log in.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Login Password Retry Lockout

- You must be running a Cisco IOS image that contains the AAA component.

Restrictions for Login Password Retry Lockout

- Authorized users can lock themselves out because there is no distinction between an attacker who is guessing passwords and an authorized user who is entering the password incorrectly multiple times.
- A denial of service (DoS) attack is possible; that is, an authorized user could be locked out by an attacker if the username of the authorized user is known to the attacker.

Information About Login Password Retry Lockout

Lock Out of a Local AAA User Account

The Login Password Retry Lockout feature allows system administrators to lock out a local AAA user account after a configured number of unsuccessful attempts by the user to log in using the username that corresponds to the AAA user account. A locked-out user cannot successfully log in again until the user account is unlocked by the administrator.

A system message is generated when a user is either locked by the system or unlocked by the system administrator. The following is an example of such a system message:

```
%AAA-5-USER_LOCKED: User user1 locked out on authentication failure.
```

The system administrator cannot be locked out.

Note The system administrator is a special user who has been configured using the maximum privilege level (root privilege--level 15). A user who has been configured using a lesser privilege level can change the privilege level using the **enable** command. A user that can change to the root privilege (level 15) is able to act as a system administrator.

This feature is applicable to any login authentication method, such as ASCII, Challenge Handshake Authentication Protocol (CHAP), and Password Authentication Protocol (PAP).

Note No messages are displayed to users after authentication failures that are due to the locked status (that is, there is no distinction between a normal authentication failure and an authentication failure due to the locked status of the user).

How to Configure Login Password Retry Lockout

Configuring Login Password Retry Lockout

To configure the Login Password Retry Lockout feature, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **username** *name* [**privilege** *level*] **password** *encryption-type password*
4. **aaa new-model**
5. **aaa local authentication attempts max-fail** *number-of-unsuccessful-attempts*
6. **aaa authentication login default method**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**username** *name* [**privilege** *level*] **password** *encryption-type password* **Example:** `Device(config)# username user1 privilege 15 password 0 cisco`	Establishes a username-based authentication system.
Step 4	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables the AAA access control model.
Step 5	**aaa local authentication attempts max-fail** *number-of-unsuccessful-attempts* **Example:** `Device(config)# aaa local authentication attempts max-fail 3`	Specifies the maximum number of unsuccessful attempts before a user is locked out.

	Command or Action	Purpose
Step 6	**aaa authentication login default method** **Example:** `Device(config)# aaa authentication login default local`	Sets the authentication, authorization, and accounting (AAA) authentication method at login. For example, **aaa authentication login default** *local* specifies the local AAA user database.

Unlocking a Login Locked-Out User

To unlock a login locked-out user, perform the following steps.

Note This task can be performed only by users having the root privilege (level 15).

SUMMARY STEPS

1. **enable**
2. **clear aaa local user lockout** {**username** *username* | **all**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**clear aaa local user lockout** {**username** *username*	**all**} **Example:** `Device# clear aaa local user lockout username user1`	Unlocks a locked-out user.

Clearing the Unsuccessful Login Attempts of a User

This task is useful for cases in which the user configuration was changed and the unsuccessful login attempts of a user that are already logged must be cleared.

To clear the unsuccessful login attempts of a user that have already been logged, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **clear aaa local user fail-attempts** {**username** *username* | **all**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**clear aaa local user fail-attempts** {**username** *username* | **all**} **Example:** `Device# clear aaa local user fail-attempts username user1`	Clears the unsuccessful attempts of the user. • This command is useful for cases in which the user configuration was changed and the unsuccessful attempts that are already logged must be cleared.

Monitoring and Maintaining Login Password Retry Lockout Status

To monitor and maintain the status of the Login Password Retry Lockout configuration, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **show aaa local user lockout**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**show aaa local user lockout** **Example:** `Device# show aaa local user lockout`	Displays a list of the locked-out users for the current login password retry lockout configuration.

Example

The following output shows that user1 is locked out:

```
Device# show aaa local user lockout
          Local-user          Lock time
          user1               04:28:49 UTC Sat Jun 19 2004
```

Configuration Examples for Login Password Retry Lockout

Displaying the Login Password Retry Lockout Configuration Example

The following **show running-config** command output illustrates that the maximum number of failed user attempts has been set for 2 as the login password retry lockout configuration:

```
Device # show running-config
Building configuration...
Current configuration : 1214 bytes
!
version 12.3
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname LAC-2
!
boot-start-marker
boot-end-marker
!
!
username sysadmin
username sysad privilege 15 password 0 cisco
username user1 password 0 cisco
aaa new-model
aaa local authentication attempts max-fail 2
!
!
aaa authentication login default local
aaa dnis map enable
aaa session-id common
```

Additional References

The following sections provide references related to Login Password Retry Lockout.

Related Documents

Related Topic	Document Title
Cisco IOS security commands	*Cisco IOS Security Command Reference*

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Login Password Retry Lockout

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

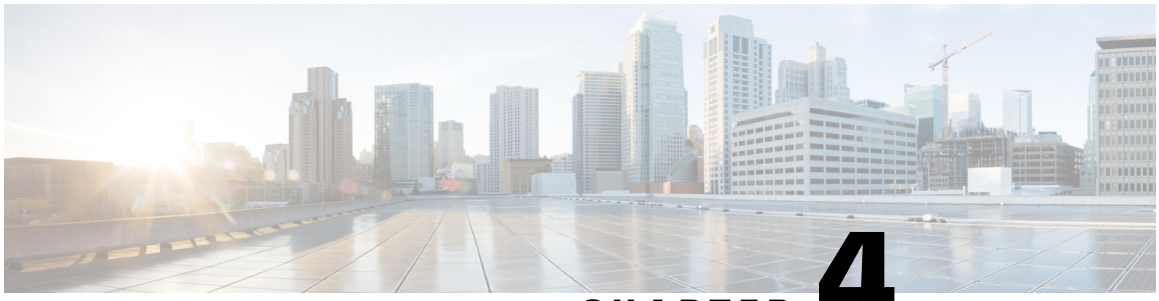
Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 3: Feature Information for Login Password Retry Lockout

Feature Name	Releases	Feature Information
Login Password Retry Lockout	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The Login Password Retry Lockout feature allows system administrators to lock out a local AAA user account after a configured number of unsuccessful attempts by the user to log in. This feature was introduced in Cisco IOS Release 12.3(14)T. This feature was integrated into Cisco IOS Release 12.2(33)SRE. The following commands were introduced or modified: **aaa local authentication attempts max-fail**, **clear aaa local user fail-attempts**, **clear aaa local user lockout**. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.

Glossary

- **local AAA method** --Method by which it is possible to configure a local user database on a router and to have AAA provision authentication or authorization of users from this database.
- **local AAA user** --User who is authenticated using the local AAA method.



CHAPTER 4

Throttling of AAA RADIUS Records

The Throttling of AAA (RADIUS) Records feature supports throttling of access (authentication and authorization) and accounting records that are sent to the RADIUS server. This feature allows a user to configure the appropriate throttling rate to avoid network congestion and instability; such as when there is insufficient bandwidth to accommodate a sudden burst of records generated from the router to the RADIUS server.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Throttling of AAA RADIUS Records

Benefits of the Throttling of AAA RADIUS Records Feature

A Network Access Server (NAS), acting as RADIUS client, can generate a burst of accounting or access requests, causing severe network congestion or causing the RADIUS server to become overloaded with a

burst of RADIUS traffic. This problem could be compounded when multiple NASs interact with the RADIUS servers.

The following conditions can trigger a sudden burst of RADIUS traffic:

- An interface flap, which in turn brings down all the subscriber sessions and generates accounting requests for each subscriber.
- The High Availability (HA) program generating a START record for every session that survived a switchover, such as the scenario described the preceding bullet.

A large number of generated requests can make the network unstable if there is insufficient bandwidth or if the RADIUS server is slow to respond. Neither the User Datagram Protocol (UDP) transport layer nor the RADIUS protocol has a flow control mechanism. The throttling mechanism provided by this feature provides a solution for these issues.

Throttling Access Requests and Accounting Records

The Throttling of AAA (RADIUS) Records feature introduces a mechanism to control packets (flow control) at the NAS level, which improves the RADIUS server performance.

Because of their specific uses, access requests and accounting records must be treated separately. Access request packets are time sensitive, while accounting record packets are not.

- If a response to an access request is not returned to the client in a timely manner, the protocol or the user will time out, impacting the device transmission rates.
- Accounting records packets are not real-time critical.

When configuring threshold values on the same server, it is important to prioritize threshold values for the handling of the time-sensitive access request packets and to place a lesser threshold value on the accounting records packets.

In some cases, when an Internet Service Provider (ISP) is using separate RADIUS servers for access requests and accounting records, only accounting records throttling may be required.

- The Throttling of AAA (RADIUS) Records is disabled, by default.
- Throttling functionality can be configured globally or at server group level.

How to Configure Throttling of AAA RADIUS Records

This section describes how to configure throttling of access (authentication and authorization) and accounting records that are sent to the RADIUS server for both, global and server groups.

Server-group configurations are used to enable or disable throttling for a particular server group and to specify the threshold value for that server group.

Note Server-group configurations override any configured global configurations.

Throttling Accounting and Access Request Packets Globally

To globally configure the throttling of accounting and access request packets, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server throttle** { [**accounting** *threshold*] [**access** *threshold* [**access-timeout** *number-of-timeouts*]]}
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**radius-server throttle** { [**accounting** *threshold*] [**access** *threshold* [**access-timeout** *number-of-timeouts*]]} **Example:** `Device(config)# radius-server throttle accounting 100 access 200 access-timeout 2`	Configures global throttling for accounting and access request packets. For this example: • The accounting threshold value (the range is 0-65536) is set to 100, and the access threshold value is set to 200. **Note** The default threshold value is 0 (throttling disabled). • The number of timeouts per transaction value (the range is 1-10) is set to 2.
Step 4	**exit** **Example:** `Device(config)# exit`	Exits global configuration mode.

Throttling Accounting and Access Request Packets Per Server Group

The following server-group configuration can be used to enable or disable throttling for a specified server group and to specify the threshold value for that server group.

To configure throttling of server-group accounting and access request packets, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa group server radius** *server-group-name*
4. **throttle** {[**accounting** *threshold*] [**access** *threshold* [**access-timeout** *number-of-timeouts*]]}
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa group server radius** *server-group-name* **Example:** `Device(config)# aaa group server radius myservergroup`	Enters server-group configuration mode.
Step 4	**throttle** {[**accounting** *threshold*] [**access** *threshold* [**access-timeout** *number-of-timeouts*]]} **Example:** `Device(config-sg-radius)# throttle accounting 100 access 200 access-timeout 2`	Configures the specified server-group throttling values for accounting and access request packets. For this example: • The accounting threshold value (the range is 0-65536) is set to 100, and the access threshold value is set to 200. **Note** The default threshold value is 0 (throttling disabled). • The number of time-outs per transaction value (the range is 1-10) is set to 2.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Device(config-sg-radius)# exit`	Exits server-group configuration mode.

Configuration Examples for Throttling of AAA RADIUS Records

Throttling Accounting and Access Request Packets Globally Example

The following example shows how to limit the number of accounting requests sent to a server to 100:

```
enable
configure terminal
radius-server throttle accounting 100
```

The following example shows how to limit the number of access requests packets sent to a server to 200 and sets the number of time-outs allowed per transactions to 2:

```
enable
configure terminal
radius-server throttle access 200
radius-server throttle access 200 access-timeout 2
```

The following example shows how to throttle both accounting and access request packets:

```
enable
configure terminal
radius-server throttle accounting 100 access 200
```

Throttling Accounting and Access Request Packets Per Server Group Example

The following example shows how to limit the number of accounting requests sent to server-group-A to 100:

```
enable
configure terminal
aaa group server radius server-group-A
throttle accounting 100
```

The following example shows how to limit the number of access requests packets sent to server-group-A to 200 and sets the number of time-outs allowed per transactions to 2:

```
enable
configure terminal
aaa group server radius server-group-A
throttle access 200 access-timeout 2
```

The following example shows how to throttle both accounting and access request packets for server-group-A:

```
enable
configure terminal
```

```
aaa group server radius server-group-A
throttle accounting 100 access 200
```

Additional References

The following sections provide references related to the Throttling of AAA (RADIUS) Records feature.

Related Documents

Related Topic	Document Title
AAA and RADIUS	*Cisco IOS Security Configuration Guide: Securing User Services*, Release 15.0.

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

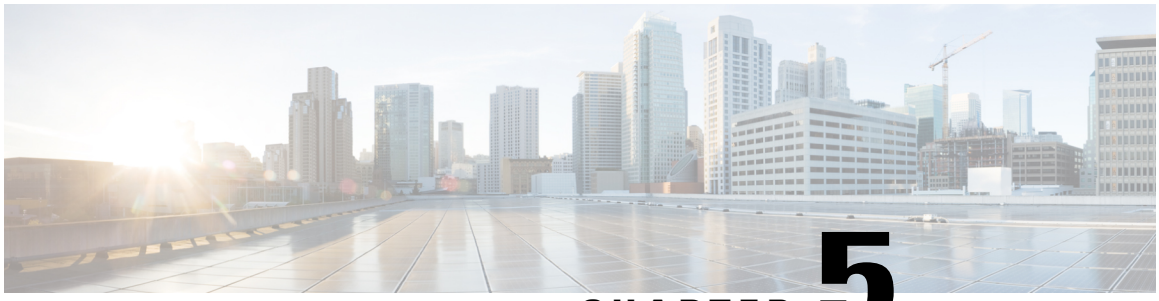
Feature Information for Throttling of AAA RADIUS Records

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 4: Feature Information for Throttling of AAA (RADIUS) Records

Feature Name	Releases	Feature Information
Throttling of AAA (RADIUS) Records	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The Throttling of AAA (RADIUS) Records feature supports throttling of access (authentication and authorization) and accounting records that are sent to the RADIUS server. This feature allows a user to configure the appropriate throttling rate to avoid network congestion and instability; such as when there is insufficient bandwidth to accommodate a sudden burst of records generated from the Cisco IOS router to the RADIUS server. The following commands were introduced or modified by this feature: **radius-server throttle, throttle** In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.



CHAPTER 5

MSCHAP Version 2

The MSCHAP Version 2 feature (introduced in Cisco IOS Release 12.2(2)XB5) allows Cisco routers to utilize Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAP V2) authentication for PPP connections between a computer using a Microsoft Windows operating system and a network access server (NAS).

For Cisco IOS Release 12.4(6)T, MSCHAP V2 now supports a new feature: AAA Support for MSCHAPv2 Password Aging. Prior to Cisco IOS Release 12.4(6)T, when Password Authentication Protocol (PAP)-based clients sent username and password values to the authentication, authorization, and accounting (AAA) subsystem, AAA generated an authentication request to the RADIUS server. If the password expired, the RADIUS server replied with an authentication failure message. The reason for the authentication failure was not passed back to AAA subsystem; thus, users were denied access because of authentication failure but were not informed why they were denied access.

The Password Aging feature, available in Cisco IOS Release 12.4(6)T, notifies crypto-based clients that the password has expired and provides a generic way for the user to change the password. The Password Aging feature supports only crypto-based clients.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for MSCHAP Version 2

- Configure an interface type and enter interface configuration mode by using the **interface** command.
- Configure the interface for PPP encapsulation by using the **encapsulation** command.
- Be sure that the client operating system supports all MSCHAP V2 capabilities.
- For Cisco IOS Release 12.4(6)T, the Password Aging feature only supports RADIUS authentication for crypto-based clients.
- To ensure that the MSCHAP Version 2 features correctly interpret the authentication failure attributes sent by the RADIUS server, you must configure the **ppp max-bad-auth** command and set the number of authentication retries at two or more.

In addition, the **radius server vsa send authentication** command must be configured, allowing the RADIUS client to send a vendor-specific attribute to the RADIUS server. The Change Password feature is supported only for RADIUS authentication.

- The Microsoft Windows 2000, Microsoft Windows XP, and Microsoft Windows NT operating systems have a known caveat that prevents the Change Password feature from working. You must download a patch from Microsoft at the following URL:

http://support.microsoft.com/default.aspx?scid=kb;en-us;Q326770

For more information on completing these tasks, see the section “PPP Configuration ” in the *Cisco IOS Dial Technologies Configuration Guide* , Release 12.4T. The RADIUS server must be configured for authentication. Refer to vendor-specific documentation for information on configuring RADIUS authentication on the RADIUS server.

Restrictions for MSCHAP Version 2

- MSCHAP V2 authentication is not compatible with MSCHAP V1 authentication.
- The change password option is supported only for RADIUS authentication and is not available for local authentication.

Information About MSCHAP Version 2

MSCHAP V2 authentication is the default authentication method used by the Microsoft Windows 2000 operating system. Cisco routers that support this authentication method enable Microsoft Windows 2000 operating system users to establish remote PPP sessions without configuring an authentication method on the client.

MSCHAP V2 authentication introduced an additional feature not available with MSCHAP V1 or standard CHAP authentication: the Change Password feature. This features allows the client to change the account password if the RADIUS server reports that the password has expired.

Note MSCHAP V2 authentication is an updated version of MSCHAP that is similar to but incompatible with MSCHAP Version 1 (V1). MSCHAP V2 introduces mutual authentication between peers and a Change Password feature.

How to Configure MSCHAP Version 2

Configuring Password Aging for Crypto-Based Clients

The AAA security services facilitate a variety of login authentication methods. Use the **aaa authentication login**command to enable AAA authentication no matter which of the supported login authentication methods you decide to use. With the **aaa authentication login**command, you create one or more lists of authentication methods that are tried at login. These lists are applied using the **login authentication** line configuration command.

After the RADIUS server requests a new password, AAA queries the crypto client, which in turn prompts the user to enter a new password.

To configure login authentication and password aging for crypto-based clients, use the following commands beginning in global configuration mode.

Note The AAA Password Expiry infrastructure notifies the Easy VPN client that the password has expired and provides a generic way for the user to change the password. Please use RADIUS-server domain-stripping feature wisely in combination with AAA password expiry support.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa authentication login** {**default** | *list-name*} **passwd-expiry** *method1* [*method2...*]
5. **crypto map** *map-name* **client authentication list** *list-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables AAA globally.
Step 4	**aaa authentication login** {**default** | *list-name*} **passwd-expiry** *method1* [*method2...*] **Example:** `Device(config)# aaa authentication login userauthen passwd-expiry group radius`	Enables password aging for crypto-based clients on a local authentication list.
Step 5	**crypto map** *map-name* **client authentication list** *list-name* **Example:** **Example:** `Device(config)# crypto map clientmap client authentication list userauthen`	Configures user authentication (a list of authentication methods) on an existing crypto map.

Configuration Examples

Configuring Local Authentication Example

The following example configures PPP on an asynchronous interface and enables MSCHAP V2 authentication locally:

```
interface Async65
  ip address 10.0.0.2 255.0.0.0
  encapsulation ppp
  async mode dedicated
  no peer default ip address
  ppp max-bad-auth 3
  ppp authentication ms-chap-v2
  username client password secret
```

Configuring RADIUS Authentication Example

The following example configures PPP on an asynchronous interface and enables MSCHAP V2 authentication via RADIUS:

```
interface Async65
  ip address 10.0.0.2 255.0.0.0
  encapsulation ppp
  async mode dedicated
  no peer default ip address
  ppp max-bad-auth 3
  ppp authentication ms-chap-v2
  exit
aaa authentication ppp default group radius
 radius-server host 10.0.0.2 255.0.0.0
 radius-server key secret
 radius-server vsa send authentication
```

Configuring Password Aging with Crypto Authentication Example

The following example configures password aging by using AAA with a crypto-based client:

```
aaa authentication login userauthen passwd-expiry group radius
!
aaa session-id common
!
crypto isakmp policy 3
 encr 3des
 authentication pre-share
 group 2
!
crypto isakmp client configuration group 3000client
 key cisco123
 dns 10.1.1.10
 wins 10.1.1.20
 domain cisco.com
 pool ippool
 acl 153
!
crypto ipsec transform-set myset esp-3des esp-sha-hmac
!
crypto dynamic-map dynmap 10
 set transform-set myset
!
crypto map clientmap client authentication list userauthen
!
radius-server host 10.140.15.203 auth-port 1645 acct-port 1646
radius-server domain-stripping prefix-delimiter $
radius-server key cisco123
radius-server vsa send authentication
radius-server vsa send authentication 3gpp2
!
end
```

Additional References

The following sections provide references related to the MSCHAP Version 2 feature.

Related Documents

Related Topic	Document Title
Configuring PPP interfaces	PPP Configuration in the *Cisco IOS Dial Technologies Configuration Guide* , Release 12.4T.
Descriptions of the tasks and commands necessary to configure and maintain Cisco networking devices	*Cisco IOS Dial Technologies Command Reference*
Lists of IOS Security Commands	*Cisco IOS Security Command Reference*
Configuring PPP authentication using AAA	Configuring PPP Authentication Using AAA in the Configuring Authentication module in the *Cisco IOS Security Configuration Guide: Securing User Services* , Release 12.4T.
Configuring RADIUS Authentication	Configuring RADIUS module in the *Cisco IOS Security Configuration Guide: Securing User Services*, Release 12.4T.

Standards

Standard	Title
No new or modified standards are supported by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 1661	*Point-to-Point Protocol (PPP)*
RFC 2548	*Microsoft Vendor-specific RADIUS Attributes*
RFC 2759	*Microsoft PPP CHAP Extensions, Version 2*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

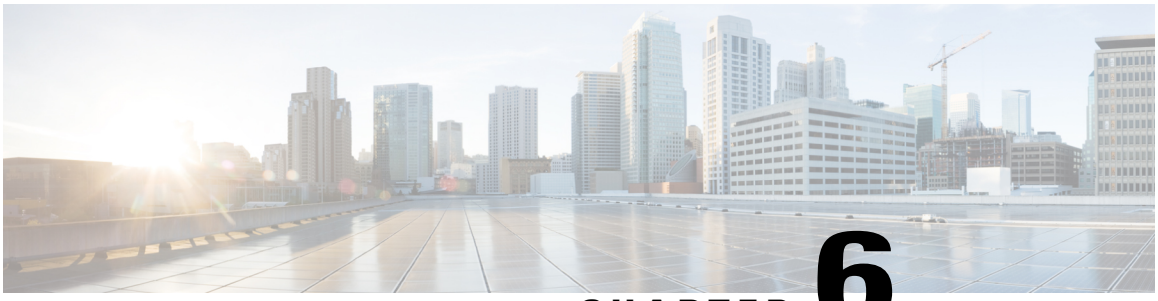
Feature Information for MSCHAP Version 2

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 5: Feature Information for MSCHAP Version 2

Feature Name	Releases	Feature Information
MSCHAP Version 2	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The MSCHAP Version 2 feature (introduced in Cisco IOS Release 12.2(2)XB5) allows Cisco routers to utilize Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAP V2) authentication for PPP connections between a computer using a Microsoft Windows operating system and a network access server (NAS). In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **aaa authentication login**, and **ppp authentication ms-chap-v2.**



CHAPTER 6

MAC Authentication Bypass

The MAC Authentication Bypass feature is a MAC-address-based authentication mechanism that allows clients in a network to integrate with the Cisco Identity Based Networking Services (IBNS) and Network Admission Control (NAC) strategy using the client MAC address. The MAC Authentication Bypass feature is applicable to the following network environments:

- Network environments in which a supplicant code is not available for a given client platform.
- Network environments in which the end client configuration is not under administrative control, that is, the IEEE 802.1X requests are not supported on these networks.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring MAC Authentication Bypass

IEEE 802.1x—Port-Based Network Access Control

You should understand the concepts of port-based network access control and have an understanding of how to configure port-based network access control on your Cisco platform. For more information, see the *Securing User Services Configuration Guide Library*.

RADIUS and ACLs

You should understand the concepts of the RADIUS protocol and have an understanding of how to create and apply access control lists (ACLs). For more information, see the documentation for your Cisco platform and the *Securing User Services Configuration Guide Library*.

The device must have a RADIUS configuration and be connected to the Cisco secure access control server (ACS). For more information, see the *User Guide for Secure ACS Appliance 3.2*.

Information About Configuring MAC Authentication Bypass

Overview of the Cisco IOS Auth Manager

The capabilities of devices connecting to a given network can be different, thus requiring that the network support different authentication methods and authorization policies. The Cisco IOS Auth Manager handles network authentication requests and enforces authorization policies regardless of authentication method. The Auth Manager maintains operational data for all port-based network connection attempts, authentications, authorizations, and disconnections and, as such, serves as a session manager.

The possible states for Auth Manager sessions are as follows:

- Idle—In the idle state, the authentication session has been initialized, but no methods have yet been run. This is an intermediate state.
- Running—A method is currently running. This is an intermediate state.
- Authc Success—The authentication method has run successfully. This is an intermediate state.
- Authc Failed—The authentication method has failed. This is an intermediate state.
- Authz Success—All features have been successfully applied for this session. This is a terminal state.
- Authz Failed—At least one feature has failed to be applied for this session. This is a terminal state.
- No methods—There were no results for this session. This is a terminal state.

How to Configure MAC Authentication Bypass

Enabling MAC Authentication Bypass

Perform this task to enable the MAC Authentication Bypass feature on an 802.1X port.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot* / *port*
4. **mab**
5. **end**
6. **show authentication sessions interface** *type slot* / *port* **details**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type slot* / *port* **Example:** `Device(config)# interface Gigabitethernet 1/2/1`	Enters interface configuration mode.
Step 4	**mab** **Example:** `Device(config-if)# mab`	Enables MAB.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 6	**show authentication sessions interface** *type slot* / *port* **details** **Example:** `Device# show authentication session interface Gigabitethernet 1/2/1 details`	Displays the interface configuration and the authenticator instances on the interface.

Enabling Reauthentication on a Port

By default, ports are not automatically reauthenticated. You can enable automatic reauthentication and specify how often reauthentication attempts are made.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot* / *port*
4. **switchport**
5. **switchport mode access**
6. **authentication port-control auto**
7. **mab** [**eap**]
8. **authentication periodic**
9. **authentication timer reauthenticate** {*seconds* | **server**}
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**interface** *type slot / port* **Example:** `Device(config)# interface Gigabitethernet 1/2/1`	Enters interface configuration mode.
Step 4	**switchport** **Example:** `Device(config-if)# switchport`	Places interface in Layer 2 switched mode.
Step 5	**switchport mode access** **Example:** `Device(config-if)# switchport mode access`	Sets the interface type as a nontrunking, nontagged single VLAN Layer 2 interface.
Step 6	**authentication port-control auto** **Example:** `Device(config-if)# authentication port-control auto`	Configures the authorization state of the port.
Step 7	**mab** [**eap**] **Example:** `Device(config-if)# mab`	Enables MAB.
Step 8	**authentication periodic** **Example:** `Device(config-if)# authentication periodic`	Enables reauthentication.
Step 9	**authentication timer reauthenticate** {*seconds* | **server**} **Example:** `Device(config-if)# authentication timer reauthenticate 900`	Configures the time, in seconds, between reauthentication attempts.
Step 10	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Specifying the Security Violation Mode

When there is a security violation on a port, the port can be shut down or traffic can be restricted. By default, the port is shut down. You can configure the period of time for which the port is shut down.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot* / *port*
4. **switchport**
5. **switchport mode access**
6. **authentication port-control auto**
7. **mab** [**eap**]
8. **authentication violation** {**restrict** | **shutdown**}
9. **authentication timer restart** *seconds*
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type slot* / *port* **Example:** `Device(config)# interface Gigabitethernet 1/2/1`	Enters interface configuration mode.
Step 4	**switchport** **Example:** `Device(config-if)# switchport`	Places interface in Layer 2 switched mode.

	Command or Action	Purpose
Step 5	**switchport mode access** **Example:** `Device(config-if)# switchport mode access`	Sets the interface type as a nontrunking, nontagged single VLAN Layer 2 interface.
Step 6	**authentication port-control auto** **Example:** `Device(config-if)# authentication port-control auto`	Configures the authorization state of the port.
Step 7	**mab** [**eap**] **Example:** `Device(config-if)# mab`	Enables MAB.
Step 8	**authentication violation** {**restrict** | **shutdown**} **Example:** `Device(config-if)# authentication violation shutdown`	Configures the action to be taken when a security violation occurs on the port.
Step 9	**authentication timer restart** *seconds* **Example:** `Device(config-if)# authentication timer restart 30`	Configures the period of time, in seconds, after which an attempt is made to authenticate an unauthorized port.
Step 10	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuration Examples for MAC Authentication Bypass

Example: MAC Authentication Bypass Configuration

In the following example, the **mab** command has been configured to enable the MAC Authorization Bypass (MAB) feature on the specified interface. The optional **show authentication sessions** command has been enabled to display the interface configuration and the authentication instances on the interface.

```
Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet 1/2/1
Device(config-if)# mab
Device(config-if)# end
Device# show authentication sessions interface GigabitEthernet 1/2/1 details
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Authentication commands	*Cisco IOS Security Command Reference*
IEEE 802.1x—Flexible Authentication	*Securing User Services Configuration Library*

MIBs

MIB	MIBs Link
• CISCO-AUTH-FRAMEWORK-MIB • CISCO-MAC-AUTH-BYPASS-MIB • CISCO-PAE-MIB • IEEE8021-PAE-MIB	To locate and download MIBs for selected platforms, Cisco IOS software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 3580	*IEEE 802.1x Remote Authentication Dial In User Service (RADIUS)*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

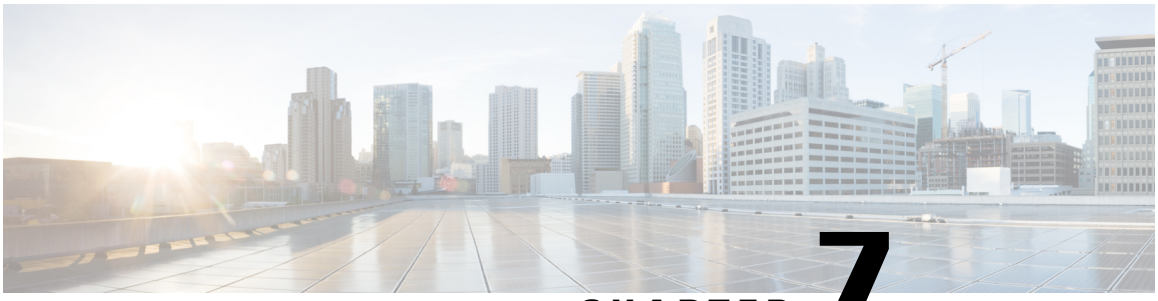
Feature Information for MAC Authentication Bypass

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 6: Feature Information for MAC Authentication Bypass

Feature Name	Releases	Feature Information
MAC Authentication Bypass (MAB)	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The MAC Authentication Bypass feature is a MAC-address-based authentication mechanism that allows clients in a network to integrate with the Cisco IBNS and NAC strategy using the client MAC address. In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **dot1x mac-auth-bypass**, **show dot1x interface**.



CHAPTER 7

Standalone MAB Support

Standalone MAC Authentication Bypass (MAB) is an authentication method that grants network access to specific MAC addresses regardless of 802.1X capability or credentials. As a result, devices such as cash registers, fax machines, and printers can be readily authenticated, and network features that are based on authorization policies can be made available.

Before standalone MAB support was available, MAB could be configured only as a failover method for 802.1x authentication. Standalone MAB is independent of 802.1x authentication.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Configuring Standalone MAB

Standalone MAB

MAC Authentication Bypass (MAB) uses the MAC address of the connecting device to grant or deny network access. To support MAB, the RADIUS authentication server maintains a database of MAC addresses for devices that require access to the network. MAB generates a RADIUS request with a MAC address in the Calling-Station-Id (attribute 31) and with a Service-Type (attribute 6) 10. After a successful authentication, the Auth Manager enables various authorization features specified by the authorization policy, such as ACL assignment and VLAN assignment.

How to Configure Standalone MAB Support

Enabling Standalone MAB

Ports enabled with the Standalone MAB feature can use the MAC address of connecting devices to grant or deny network access. Perform the steps described in this section to enable standalone MAB on individual ports.

Before You Begin

Before you can configure standalone MAB, the device must be connected to a Cisco Secure ACS server and RADIUS authentication, authorization, and accounting (AAA) must be configured.

Note Standalone MAB can be configured on devices with switched ports only; it cannot be configured on devices with routed ports.

Note If you are unsure whether MAB or MAB Extensible Authentication Protocol (EAP) is enabled or disabled on the switched port, use the **default mab**or **default mab eap** commands in interface configuration mode to configure MAB or MAB EAP.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot / port*
4. **switchport**
5. **switchport mode access**
6. **authentication port-control auto**
7. **mab**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type slot / port* **Example:** `Device(config)# interface Gigabitethernet 1/2/1`	Enters interface configuration mode.
Step 4	**switchport** **Example:** `Switch(config-if)# switchport`	Places interface in Layer 2 switched mode.
Step 5	**switchport mode access** **Example:** `Device(config-if)# switchport mode access`	Sets the interface type a as nontrunking, nontagged single VLAN Layer 2 interface.
Step 6	**authentication port-control auto** **Example:** `Device(config-if)# authentication port-control auto`	Configures the authorization state of the port.

	Command or Action	Purpose
Step 7	**mab** **Example:** `Device(config-if)# mab`	Enables MAB.
Step 8	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

The following commands can help troubleshoot standalone MAB:

- **debug authentication**
- **debug mab all**
- **show authentication registrations**
- **show authentication sessions**
- **show mab**

Configuration Examples for Standalone MAB Support

Example: Standalone MAB Configuration

The following example shows how to configure standalone MAB on a port. In this example, the client is reauthenticated every 1200 seconds and the connection is dropped after 600 seconds of inactivity.

```
Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet 1/2/1
Device(config-if)# switchport
Device(config-if)# switchport mode access
Device(config-if)# switchport access vlan 2
Device(config-if)# authentication port-control auto
Device(config-if)# mab
Device(config-if)# authentication violation shutdown
Device(config-if)# authentication timer restart 30
Device(config-if)# authentication periodic
Device(config-if)# authentication timer reauthenticate 1200
Device(config-if)# authentication timer inactivity 600
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Authentication commands	*Cisco IOS Security Command Reference*
IEEE 802.1x—Flexible Authentication	*Securing User Services Configuration Library*

MIBs

MIB	MIBs Link
• CISCO-AUTH-FRAMEWORK-MIB • CISCO-MAC-AUTH-BYPASS-MIB • CISCO-PAE-MIB • IEEE8021-PAE-MIB	To locate and download MIBs for selected platforms, Cisco IOS software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 3580	*IEEE 802.1x Remote Authentication Dial In User Service (RADIUS)*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

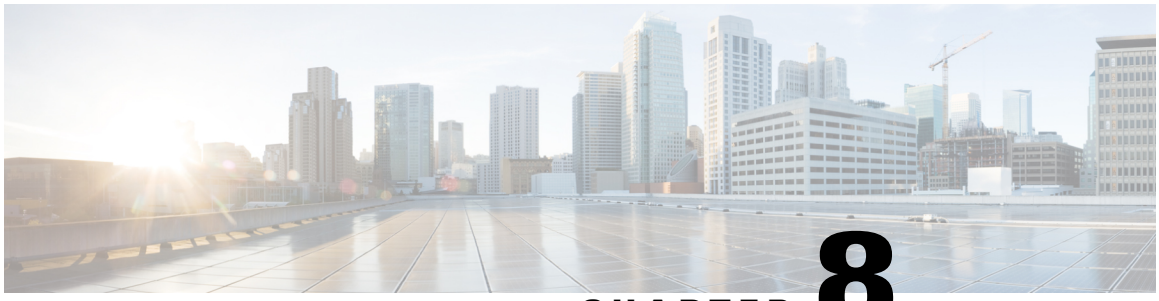
Feature Information for Standalone MAB Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 7: Feature Information for Standalone MAB Support

Feature Name	Releases	Feature Information
Standalone MAB Support	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE Cisco IOS XE Release 3.6E	This feature grants network access to devices based on MAC address regardless of 802.1x capability or credentials. In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **authentication periodic**, **authentication port-control**, **authentication timer inactivity**, **authentication timer reauthenticate**, **authentication timer restart**, **authentication violation**, **debug authentication**, **mab**, **show authentication interface**, **show authentication registrations**, **show authentication sessions**, and **show mab**.



CHAPTER 8

Configuring Accounting

The AAA Accounting feature allows the services that users are accessing and the amount of network resources that users are consuming to be tracked. When AAA Accounting is enabled, the network access server reports user activity to the TACACS+ or RADIUS security server (depending on which security method is 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, and auditing.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring Accounting

The following tasks must be performed before configuring accounting using named method lists:

- Enable AAA on the network access server by using the **aaa new-model**command in global configuration mode.
- Define the characteristics of the RADIUS or TACACS+ security server if RADIUS or TACACS+ authorization is issued. For more information about configuring the Cisco network access server to communicate with the RADIUS security server, see the Configuring RADIUS module. For more information about configuring the Cisco network access server to communicate with the TACACS+ security server, see the Configuring TACACS+ module.

Restrictions for Configuring Accounting

- Accounting information can be sent simultaneously to a maximum of only four AAA servers.
- For Service Selection Gateway (SSG) systems, the **aaa accounting network broadcast** command broadcasts only **start-stop** accounting records. If interim accounting records are configured using the **ssg accounting interval** command, the interim accounting records are sent only to the configured default RADIUS server.

Information About Configuring Accounting

Named Method Lists for Accounting

Similar to authentication and authorization method lists, method lists for accounting define the way accounting is performed and the sequence in which these methods are performed.

Named accounting method lists allow particular security protocol to be designated and used on specific lines or interfaces for accounting services. The only exception is the default method list (which is named “default”). The default method list is automatically applied to all interfaces except those that have a named method list explicitly defined. A defined method list overrides the default method list.

A method list is simply a named list describing the accounting methods to be queried (such as RADIUS or TACACS+), in sequence. Method lists allow one or more security protocols to be designated and used for accounting, thus ensuring a backup system for accounting in case the initial method fails. Cisco IOS software uses the first method listed to support accounting; if that method fails to respond, the Cisco IOS software selects the next accounting method listed in the method list. This process continues until there is successful communication with a listed accounting method, or all methods defined are exhausted.

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

Accounting method lists are specific to the type of accounting being requested. AAA supports seven different types of accounting:

- **Network** --Provides information for all PPP, SLIP, or ARAP sessions, including packet and byte counts.

- **EXEC** --Provides information about user EXEC terminal sessions of the network access server.
- **Commands** --Provides information about the EXEC mode commands that a user issues. Command accounting generates accounting records for all EXEC mode commands, including global configuration commands, associated with a specific privilege level.
- **Connection** --Provides information about all outbound connections made from the network access server, such as Telnet, local-area transport (LAT), TN3270, packet assembler/disassembler (PAD), and rlogin.
- **System** --Provides information about system-level events.
- **Resource** --Provides "start" and "stop" records for calls that have passed user authentication, and provides "stop" records for calls that fail to authenticate.
- **VRRS** --Provides information about Virtual Router Redundancy Service (VRRS).

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

Once again, when a named method list is created, a particular list of accounting methods for the indicated accounting type are defined.

Accounting method lists must be applied to specific lines or interfaces before any of the defined methods are performed. The only exception is the default method list (which is named "default"). If the **aaa accounting** command for a particular accounting type is issued without specifying a named method list, the default method list is automatically applied to all interfaces or lines 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.

This section includes the following subsections:

Method Lists and Server Groups

A server group is a way to group existing RADIUS or TACACS+ server hosts for use in method lists. The figure below shows a typical AAA network configuration that includes four security servers: R1 and R2 are RADIUS servers, and T1 and T2 are TACACS+ servers. R1 and R2 comprise the group of RADIUS servers. T1 and T2 comprise the group of TACACS+ servers.

Cisco IOS software, RADIUS and TACACS+ server configurations are global. A subset of the configured server hosts can be specified using server groups. These server groups can be used for a particular service. For example, server groups allow R1 and R2 to be defined as separate server groups (SG1 and SG2), and T1 and T2 as separate server groups (SG3 and SG4). This means either R1 and T1 (SG1 and SG3) or R2 and T2 (SG2 and SG4) can be specified in the method list, which provides more flexibility in the way that RADIUS and TACACS+ resources are assigned.

Server groups also can include multiple host entries for the same server, as long as each entry has a unique identifier. The combination of an IP address and a UDP port number creates a unique identifier, allowing different ports to be individually defined as RADIUS hosts providing a specific AAA service. In other words, this unique identifier enables RADIUS requests to be sent to different UDP ports on a server from the same IP address. 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 tries the second

host entry configured on the same device for accounting services (The RADIUS host entries are tried in the order in which they are configured).

For more information about configuring server groups and about configuring server groups based on Dialed Number Identification Service (DNIS) numbers, see the “Configuring RADIUS” or “Configuring TACACS+” module in the Cisco IOS Security Configuration Guide: Securing User Services .

AAA Accounting Methods

The Cisco IOS software supports the following two methods for accounting:

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

Note With CSCuc32663, passwords and accounting logs are masked before being sent to the TACACS+ or RADIUS security servers. Use the **aaa accounting commands visible-keys** command to send unmasked information to the TACACS+ or RADIUS security servers.

Accounting Record Types

For minimal accounting, use the **stop-only** keyword, which instructs the specified method (**RADIUS** or **TACACS+**) to send a stop record accounting notice at the end of the requested user process. For more accounting information, use the **start-stop** keyword to send a start accounting notice at the beginning of the requested event and a stop accounting notice at the end of the event. To stop all accounting activities on this line or interface, use the **none** keyword.

Accounting Methods

The table below lists the supported accounting methods.

Table 8: AAA Accounting Methods

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

The method argument refers to the actual method the authentication algorithm tries. 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 other methods return an error, specify additional methods in the command. For example, to create a method list named acct_tac1 that specifies RADIUS as the backup method of authentication in the event that TACACS+ authentication returns an error, enter the following command:

```
aaa accounting network acct_tac1 stop-only group tacacs+ group radius
```

To create a default list that is used when a named list is not specified in the **aaa accounting**command, use the **default** keyword followed by the methods that are wanted to be used in default situations. The default method list is automatically applied to all interfaces.

For example, to specify RADIUS as the default method for user authentication during login, enter the following command:

```
aaa accounting network default stop-only group radius
```

AAA Accounting supports the following methods:

- **group tacacs** --To have the network access server send accounting information to a TACACS+ security server, use the **group tacacs+** *method* keyword.
- **group radius** --To have the network access server send accounting information to a RADIUS security server, use the **group radius** *method* keyword.

Note Accounting method lists for SLIP follow whatever is configured for PPP on the relevant interface. If no lists are defined and applied to a particular interface (or no PPP settings are configured), the default setting for accounting applies.

- **group** *group-name* --To specify a subset of RADIUS or TACACS+ servers to use as the accounting method, use the **aaa accounting**command with the **group** *group-name* method. To specify and define the group name and the members of the group, use the **aaa group server** command. For example, use the **aaa group server** command to first define the members of **group loginrad**:

```
aaa group server radius loginrad
 server 172.16.2.3
 server 172.16.2 17
 server 172.16.2.32
```

This command specifies RADIUS servers 172.16.2.3, 172.16.2.17, and 172.16.2.32 as members of the **group loginrad**.

To specify **group loginrad** as the method of network accounting when no other method list has been defined, enter the following command:

```
aaa accounting network default start-stop group loginrad
```

Before a group name can be used as the accounting method, communication with the RADIUS or TACACS+ security server must be enabled.

AAA Accounting Types

Network Accounting

Network accounting provides information for all PPP, SLIP, or ARAP sessions, including packet and byte counts.

The following example shows the information contained in a RADIUS network accounting record for a PPP user who comes in through an EXEC session:

```
Wed Jun 27 04:44:45 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 5
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “562”
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Exec-User
        Acct-Session-Id = “0000000D”
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”

Wed Jun 27 04:45:00 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 5
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “562”
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Framed
        Acct-Session-Id = “0000000E”
        Framed-IP-Address = “10.1.1.2”
        Framed-Protocol = PPP
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
Wed Jun 27 04:47:46 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 5
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “562”
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Framed
        Acct-Session-Id = “0000000E”
        Framed-IP-Address = “10.1.1.2”
        Framed-Protocol = PPP
        Acct-Input-Octets = 3075
        Acct-Output-Octets = 167
        Acct-Input-Packets = 39
        Acct-Output-Packets = 9
        Acct-Session-Time = 171
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
Wed Jun 27 04:48:45 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 5
        User-Name = “username1”
```

```
        Client-Port-DNIS = “4327528”
        Caller-ID = “408”
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Exec-User
        Acct-Session-Id = “0000000D”
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
```

The following example shows the information contained in a TACACS+ network accounting record for a PPP user who first started an EXEC session:

```
Wed Jun 27 04:00:35 2001 172.16.25.15    username1   tty4    562/4327528     starttask_id=28
      service=shell
Wed Jun 27 04:00:46 2001 172.16.25.15    username1   tty4 562/4327528     starttask_id=30
     addr=10.1.1.1   service=ppp
Wed Jun 27 04:00:49 2001 172.16.25.15    username1   tty4    408/4327528     update
task_id=30      addr=10.1.1.1   service=ppp     protocol=ip     addr=10.1.1.1
Wed Jun 27 04:01:31 2001 172.16.25.15    username1   tty4    562/4327528     stoptask_id=30
       addr=10.1.1.1   service=ppp     protocol=ip     addr=10.1.1.1   bytes_in=2844
  bytes_out=1682  paks_in=36      paks_out=24     elapsed_time=51
Wed Jun 27 04:01:32 2001 172.16.25.15    username1   tty4    562/4327528     stoptask_id=28
       service=shell   elapsed_time=57
```

Note The precise format of accounting packets records may vary depending on the security server daemon.

The following example shows the information contained in a RADIUS network accounting record for a PPP user who comes in through autoselect:

```
Wed Jun 27 04:30:52 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 3
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “562”
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Framed
        Acct-Session-Id = “0000000B”
        Framed-Protocol = PPP
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”

Wed Jun 27 04:36:49 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 3
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “562”
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Framed
        Acct-Session-Id = “0000000B”
        Framed-Protocol = PPP
        Framed-IP-Address = “10.1.1.1”
        Acct-Input-Octets = 8630
        Acct-Output-Octets = 5722
        Acct-Input-Packets = 94
        Acct-Output-Packets = 64
        Acct-Session-Time = 357
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
```

The following example shows the information contained in a TACACS+ network accounting record for a PPP user who comes in through autoselect:

```
Wed Jun 27 04:02:19 2001 172.16.25.15    username1   Async5  562/4327528     starttask_id=35
      service=ppp
Wed Jun 27 04:02:25 2001 172.16.25.15    username1   Async5  562/4327528     update
task_id=35      service=ppp     protocol=ip     addr=10.1.1.2
Wed Jun 27 04:05:03 2001 172.16.25.15    username1   Async5  562/4327528     stoptask_id=35
       service=ppp     protocol=ip     addr=10.1.1.2   bytes_in=3366   bytes_out=2149
  paks_in=42      paks_out=28     elapsed_time=164
```

EXEC Accounting

EXEC accounting provides information about user EXEC terminal sessions (user shells) on the network access server, including username, date, start and stop times, the access server IP address, and (for dial-in users) the telephone number the call originated from.

The following example shows the information contained in a RADIUS EXEC accounting record for a dial-in user:

```
Wed Jun 27 04:26:23 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 1
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “5622329483”
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Exec-User
        Acct-Session-Id = “00000006”
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
Wed Jun 27 04:27:25 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 1
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “5622329483”
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Exec-User
        Acct-Session-Id = “00000006”
        Acct-Session-Time = 62
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
```

The following example shows the information contained in a TACACS+ EXEC accounting record for a dial-in user:

```
Wed Jun 27 03:46:21 2001        172.16.25.15    username1   tty3    5622329430/4327528
start    task_id=2       service=shell
Wed Jun 27 04:08:55 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=2       service=shell   elapsed_time=1354
```

The following example shows the information contained in a RADIUS EXEC accounting record for a Telnet user:

```
Wed Jun 27 04:48:32 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 26
        User-Name = “username1”
        Caller-ID = “10.68.202.158”
```

```
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Exec-User
        Acct-Session-Id = "00000010"
        Acct-Delay-Time = 0
        User-Id = "username1"
        NAS-Identifier = "172.16.25.15"

Wed Jun 27 04:48:46 2001
        NAS-IP-Address = "172.16.25.15"
        NAS-Port = 26
        User-Name = "username1"
        Caller-ID = "10.68.202.158"
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Exec-User
        Acct-Session-Id = "00000010"
        Acct-Session-Time = 14
        Acct-Delay-Time = 0
        User-Id = "username1"
        NAS-Identifier = "172.16.25.15"
```

The following example shows the information contained in a TACACS+ EXEC accounting record for a Telnet user:

```
Wed Jun 27 04:06:53 2001        172.16.25.15    username1   tty26   10.68.202.158
starttask_id=41      service=shell
Wed Jun 27 04:07:02 2001        172.16.25.15    username1   tty26   10.68.202.158
stoptask_id=41       service=shell   elapsed_time=9
```

Command Accounting

Command accounting provides information about the EXEC shell commands for a specified privilege level that are being executed on a network access server. Each command accounting record includes a list of the commands executed for that privilege level, as well as the date and time each command was executed, and the user who executed it.

The following example shows the information contained in a TACACS+ command accounting record for privilege level 1:

```
Wed Jun 27 03:46:47 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=3       service=shell   priv-lvl=1      cmd=show version <cr>
Wed Jun 27 03:46:58 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=4       service=shell   priv-lvl=1      cmd=show interfaces Ethernet 0
<cr>
Wed Jun 27 03:47:03 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=5       service=shell   priv-lvl=1      cmd=show ip route <cr>
```

The following example shows the information contained in a TACACS+ command accounting record for privilege level 15:

```
Wed Jun 27 03:47:17 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=6       service=shell   priv-lvl=15     cmd=configure terminal <cr>
Wed Jun 27 03:47:21 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=7       service=shell   priv-lvl=15     cmd=interface Serial 0 <cr>
Wed Jun 27 03:47:29 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=8      service=shell   priv-lvl=15     cmd=ip address 10.1.1.1 255.255.255.0
 <cr>
```

Note The Cisco implementation of RADIUS does not support command accounting.

Connection Accounting

Connection accounting provides information about all outbound connections made from the network access server such as Telnet, LAT, TN3270, PAD, and rlogin.

The following example shows the information contained in a RADIUS connection accounting record for an outbound Telnet connection:

```
Wed Jun 27 04:28:00 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 2
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “5622329477”
        Acct-Status-Type = Start
        Acct-Authentic = RADIUS
        Service-Type = Login
        Acct-Session-Id = “00000008”
        Login-Service = Telnet
        Login-IP-Host = “10.68.202.158”
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”

Wed Jun 27 04:28:39 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 2
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “5622329477”
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Login
        Acct-Session-Id = “00000008”
        Login-Service = Telnet
        Login-IP-Host = “10.68.202.158”
        Acct-Input-Octets = 10774
        Acct-Output-Octets = 112
        Acct-Input-Packets = 91
        Acct-Output-Packets = 99
        Acct-Session-Time = 39
        Acct-Delay-Time = 0
        User-Id = “username1”
        NAS-Identifier = “172.16.25.15”
```

The following example shows the information contained in a TACACS+ connection accounting record for an outbound Telnet connection:

```
Wed Jun 27 03:47:43 2001        172.16.25.15    username1   tty3    5622329430/4327528
start    task_id=10     service=connection     protocol=telnet addr=10.68.202.158 cmd=telnet
 username1-sun
Wed Jun 27 03:48:38 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=10     service=connection     protocol=telnet addr=10.68.202.158 cmd=telnet
 username1-sun    bytes_in=4467   bytes_out=96    paks_in=61     paks_out=72 elapsed_time=55
```

The following example shows the information contained in a RADIUS connection accounting record for an outbound rlogin connection:

```
Wed Jun 27 04:29:48 2001
        NAS-IP-Address = “172.16.25.15”
        NAS-Port = 2
        User-Name = “username1”
        Client-Port-DNIS = “4327528”
        Caller-ID = “5622329477”
        Acct-Status-Type = Start
```

```
        Acct-Authentic = RADIUS
        Service-Type = Login
        Acct-Session-Id = "0000000A"
        Login-Service = Rlogin
        Login-IP-Host = "10.68.202.158"
        Acct-Delay-Time = 0
        User-Id = "username1"
        NAS-Identifier = "172.16.25.15"

Wed Jun 27 04:30:09 2001
        NAS-IP-Address = "172.16.25.15"
        NAS-Port = 2
        User-Name = "username1"
        Client-Port-DNIS = "4327528"
        Caller-ID = "5622329477"
        Acct-Status-Type = Stop
        Acct-Authentic = RADIUS
        Service-Type = Login
        Acct-Session-Id = "0000000A"
        Login-Service = Rlogin
        Login-IP-Host = "10.68.202.158"
        Acct-Input-Octets = 18686
        Acct-Output-Octets = 86
        Acct-Input-Packets = 90
        Acct-Output-Packets = 68
        Acct-Session-Time = 22
        Acct-Delay-Time = 0
        User-Id = "username1"
        NAS-Identifier = "172.16.25.15"
```

The following example shows the information contained in a TACACS+ connection accounting record for an outbound rlogin connection:

```
Wed Jun 27 03:48:46 2001        172.16.25.15    username1   tty3    5622329430/4327528
start    task_id=12     service=connection     protocol=rlogin addr=10.68.202.158 cmd=rlogin
 username1-sun /user username1
Wed Jun 27 03:51:37 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=12     service=connection     protocol=rlogin addr=10.68.202.158 cmd=rlogin
 username1-sun /user username1 bytes_in=659926 bytes_out=138   paks_in=2378    paks_
out=1251        elapsed_time=171
```

The following example shows the information contained in a TACACS+ connection accounting record for an outbound LAT connection:

```
Wed Jun 27 03:53:06 2001        172.16.25.15    username1   tty3    5622329430/4327528
start    task_id=18      service=connection      protocol=lat    addr=VAX        cmd=lat
VAX
Wed Jun 27 03:54:15 2001        172.16.25.15    username1   tty3    5622329430/4327528
stop     task_id=18      service=connection      protocol=lat    addr=VAX        cmd=lat
VAX  bytes_in=0      bytes_out=0     paks_in=0      paks_out=0      elapsed_time=6
```

System Accounting

System accounting provides information about all system-level events (for example, when the system reboots or when accounting is turned on or off).

The following accounting record shows a typical TACACS+ system accounting record server indicating that AAA Accounting has been turned off:

```
Wed Jun 27 03:55:32 2001        172.16.25.15    unknown unknown unknown start   task_id=25
   service=system  event=sys_acct  reason=reconfigure
```

Note The precise format of accounting packets records may vary depending on the TACACS+ daemon.

The following accounting record shows a TACACS+ system accounting record indicating that AAA Accounting has been turned on:

```
Wed Jun 27 03:55:22 2001        172.16.25.15    unknown unknown unknown stop    task_id=23
   service=system  event=sys_acct  reason=reconfigure
```

Additional tasks for measuring system resources are covered in the Cisco IOS software configuration guides. For example, IP accounting tasks are described in the Configuring IP Services chapter in the *CiscoIOS Application Services Configuration Guide* .

Resource Accounting

The Cisco implementation of AAA accounting provides “start” and “stop” record support for calls that have passed user authentication. The additional feature of generating “stop” records for calls that fail to authenticate as part of user authentication is also supported. Such records are necessary for users employing accounting records to manage and monitor their networks.

This section includes the following subsections:

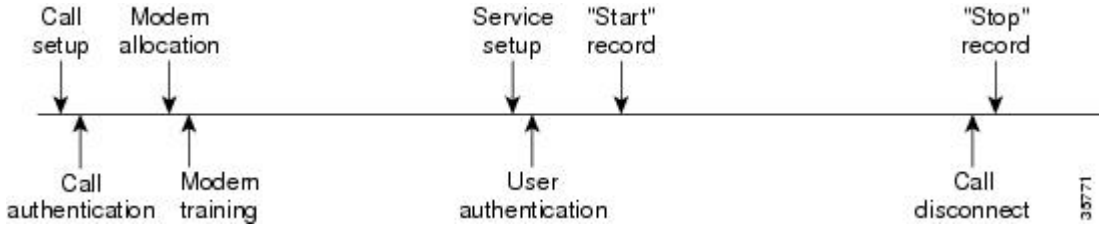
AAA Resource Failure Stop Accounting

Before AAA resource failure stop accounting, there was no method of providing accounting records for calls that failed to reach the user authentication stage of a call setup sequence. Such records are necessary for users employing accounting records to manage and monitor their networks and their wholesale customers.

This functionality generates a “stop” accounting record for any calls that do not reach user authentication; “stop” records are generated from the moment of call setup. All calls that pass user authentication behave as they did before; that is, no additional accounting records are seen.

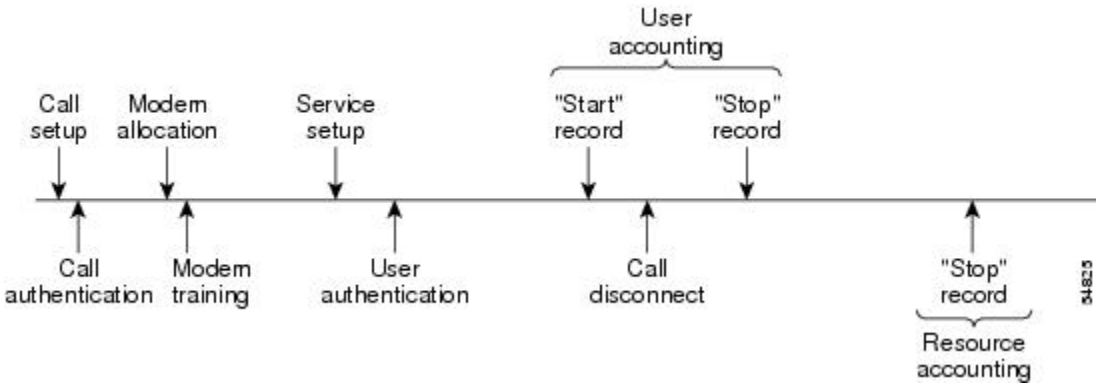
The figure below illustrates a call setup sequence with normal call flow (no disconnect) and without AAA resource failure stop accounting enabled.

Figure 1: Modem Dial-In Call Setup Sequence With Normal Flow and Without Resource Failure Stop Accounting Enabled



The figure below illustrates a call setup sequence with normal call flow (no disconnect) and with AAA resource failure stop accounting enabled.

Figure 2: Modem Dial-In Call Setup Sequence With Normal Flow and WIth Resource Failure Stop Accounting Enabled

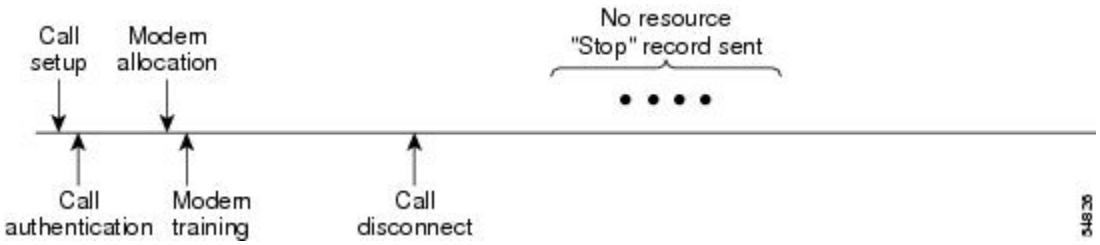


The figure below illustrates a call setup sequence with call disconnect occurring before user authentication and with AAA resource failure stop accounting enabled.

Figure 3: Modem Dial-In Call Setup Sequence With Call Disconnect Occurring Before User Authentication and With Resource Failure Stop Accounting Enabled

The figure below illustrates a call setup sequence with call disconnect occurring before user authentication and without AAA resource failure stop accounting enabled.

Figure 4: Modem Dial-In Call Setup Sequence With Call Disconnect Occurring Before User Authentication and Without Resource Failure Stop Accounting Enabled



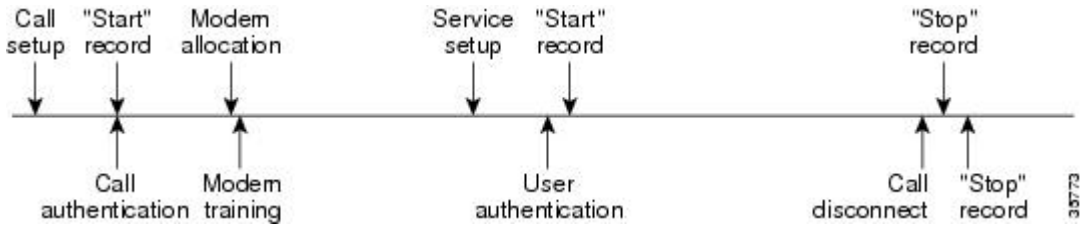
AAA Resource Accounting for Start-Stop Records

AAA resource accounting for start-stop records supports the ability to send a “start” record at each call setup, followed by a corresponding “stop” record at the call disconnect. This functionality can be used to manage and monitor wholesale customers from one source of data reporting, such as accounting records.

With this feature, a call setup and call disconnect “start-stop” accounting record tracks the progress of the resource connection to the device. A separate user authentication “start-stop” accounting record tracks the user management progress. These two sets of accounting records are interlinked by using a unique session ID for the call.

The figure below illustrates a call setup sequence with AAA resource start-stop accounting enabled.

Figure 5: Modem Dial-In Call Setup Sequence With Resource Start-Stop Accounting Enabled



VRRS Accounting

Virtual Router Redundancy Service (VRRS) provides a multiclient information abstraction and management service between a First Hop Redundancy Protocol (FHRP) and a registered client. The VRRS multiclient service provides a consistent interface with FHRP protocols by abstracting over several FHRPs and providing an idealized view of their state. VRRS manages data updates, allowing interested clients to register in one place and receive updates for named FHRP groups or all registered FHRP groups.

Virtual Router Redundancy Protocol (VRRP) is an FHRP that acts as a server that pushes FHRP status information out to all registered VRRS clients. Clients obtain status on essential information provided by the FHRP, including current and previous redundancy states, active and inactive L3 and L2 addresses, and, in some cases, information about other redundant gateways in the network. Clients can use this information to provide stateless and stateful redundancy information to clients and protocols.

VRRS Accounting Plug-in

The VRRS Accounting plug-in provides a configurable AAA method list mechanism that provides updates to a RADIUS server when a VRRS group transitions its state. The VRRS accounting plug-in is an extension of existing AAA system accounting messages. The VRRS Accounting plug-in provides accounting-on and accounting-off messages and an additional Vendor-Specific Attribute (VSA) that sends the configured VRRS name in RADIUS accounting messages. The VRRS name is configured using the **vrrp name** command in interface configuration mode.

The VRRS Accounting plug-in provides a configurable AAA method list mechanism that provides updates to a RADIUS server when a VRRS group transitions its state.

The VRRS accounting plug-in is an extension of existing AAA system accounting messages. The VRRS Accounting plug-in provides accounting-on and accounting-off messages and an additional Vendor-Specific Attribute (VSA) that sends the configured VRRS name in RADIUS accounting messages. The VRRS name is configured using the **vrrp name** command in interface configuration mode. The VRRS Accounting plug-in

sends an accounting-on message to RADIUS when a VRRS group transitions to the master state, and it sends an accounting-off message when a VRRS group transitions from the master state.

The following RADIUS attributes are included in VRRS accounting messages by default:

- Attribute 4, NAS-IP-Address
- Attribute 26, Cisco VSA Type 1, VRRS Name
- Attribute 40, Acct-Status-Type
- Attribute 41, Acct-Delay-Time
- Attribute 44, Acct-Session-Id

Accounting messages for a VRRS transitioning out of master state are sent after all PPPoE accounting stop messages for sessions that are part of that VRRS.

AAA Accounting Enhancements

AAA Broadcast Accounting

AAA broadcast accounting allows accounting information to be sent to multiple AAA servers at the same time; that is, accounting information can be broadcast to one or more AAA servers simultaneously. This functionality allows service providers to send accounting information to their own private AAA servers and to the AAA servers of their end customers. It also provides redundant billing information for voice applications.

Broadcasting is allowed among groups of RADIUS or TACACS+ servers, and each server group can define its backup servers for failover independently of other groups.

Thus, service providers and their end customers can use different protocols (RADIUS or TACACS+) for the accounting server. Service providers and their end customers can also specify their backup servers independently. As for voice applications, redundant accounting information can be managed independently through a separate group with its own failover sequence.

AAA Session MIB

The AAA session MIB feature allows customers to monitor and terminate their authenticated client connections using Simple Network Management Protocol (SNMP). The data of the client is presented so that it correlates directly to the AAA Accounting information reported by either the RADIUS or the TACACS+ server. AAA session MIB provides the following information:

- Statistics for each AAA function (when used in conjunction with the **show radius statistics** command)
- Status of servers providing AAA functions
- Identities of external AAA servers
- Real-time information (such as idle times), providing additional criteria for use by SNMP networks for assessing whether or not to terminate an active call

Note This command is supported only on Cisco AS5300 and Cisco AS5800 universal access server platforms.

The table below shows the SNMP user-end data objects that can be used to monitor and terminate authenticated client connections with the AAA session MIB feature.

Table 9: SNMP End-User Data Objects

SessionId	The session identification used by the AAA Accounting protocol (same value as reported by RADIUS attribute 44 (Acct-Session-ID)).
UserId	The user login ID or zero-length string if a login is unavailable.
IpAddr	The IP address of the session or 0.0.0.0 if an IP address is not applicable or unavailable.
IdleTime	The elapsed time in seconds that the session has been idle.
Disconnect	The session termination object used to disconnect the given client.
CallId	The entry index corresponding to this accounting session that the Call Tracker record stored.

The table below describes the AAA summary information provided by the AAA session MIB feature using SNMP on a per-system basis.

Table 10: SNMP AAA Session Summary

ActiveTableEntries	Number of sessions currently active.
ActiveTableHighWaterMark	Maximum number of sessions present at once since last system reinstallation.
TotalSessions	Total number of sessions since last system reinstallation.
DisconnectedSessions	Total number of sessions that have been disconnected using since last system reinstallation.

Accounting Attribute-Value Pairs

The network access server monitors the accounting functions defined in either TACACS+ AV pairs or RADIUS attributes, depending on which security method is implemented.

How to Configure AAA Accounting

Configuring AAA Accounting Using Named Method Lists

To configure AAA Accounting using named method lists, perform the following steps:

Note System accounting does not use named method lists. For system accounting, define only the default method list.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa accounting** {**system** | **network** | **exec** | **connection** | **commands** *level*} {**default** | *list-name*} {**start-stop** | **stop-only** | **none**} [*method1* [*method2...*]]
4. Do one of the following:
   - **line** [**aux** | **console** | **tty** | **vty**] *line-number* [*ending-line-number*]
   -
   -
   -
   - **interface** *interface-type interface-number*
5. Do one of the following:
   - **accounting** {**arap** | **commands** *level* | **connection** | **exec**} {**default** | *list-name*}
   -
   -
   -
   - **ppp accounting**{**default** | *list-name*}
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa accounting** {**system** | **network** | **exec** | **connection** | **commands** *level*} {**default** | *list-name*} {**start-stop** | **stop-only** | **none**} [*method1* [*method2...*]] **Example:** `Device(config)# aaa accounting system default start-stop`	Creates an accounting method list and enables accounting. The argument *list-name* is a character string used to name the created list.
Step 4	Do one of the following: • **line** [**aux** | **console** | **tty** | **vty**] *line-number* [*ending-line-number*] • • • • **interface** *interface-type interface-number* **Example:** `Device(config)# line aux line1`	Enters the line configuration mode for the lines to which the accounting method list is applied. or Enters the interface configuration mode for the interfaces to which the accounting method list is applied.
Step 5	Do one of the following: • **accounting** {**arap** | **commands** *level* | **connection** | **exec**} {**default** | *list-name*} • • • • **ppp accounting**{**default** | *list-name*} **Example:** `Device(config-line)# accounting arap default`	Applies the accounting method list to a line or set of lines. or Applies the accounting method list to an interface or set of interfaces.

	Command or Action	Purpose
Step 6	**end** **Example:** `Device(config-line)# end`	(Optional) Exits line configuration mode and returns to global configuration mode.

What to Do Next

This section includes the following subsection:

Configuring RADIUS System Accounting

Perform this task to configure RADIUS system accounting on the global RADIUS server:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **radius-server accounting system host-config**
5. **aaa group server radius** *server-name*
6. **server-private** {*host-name* | *ip-address*} **key** {[**0** *server-key* | **7** *server-key*] *server-key*
7. **accounting system host-config**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables AAA network security services.
Step 4	**radius-server accounting system host-config** **Example:** `Device(config)# radius-server accounting system host-config`	Enables the router to send a system accounting record for the addition and deletion of a RADIUS server.
Step 5	**aaa group server radius** *server-name* **Example:** `Device(config)# aaa group server radius radgroup1`	Adds the RADIUS server and enters server-group configuration mode. • The *server-name* argument specifies the RADIUS server group name.
Step 6	**server-private** {*host-name* | *ip-address*} **key** {[**0** *server-key* | **7** *server-key*] *server-key* **Example:** `Device(config-sg-radius)# server-private 172.16.1.11 key cisco`	Enters the hostname or IP address of the RADIUS server and hidden server key. • (Optional) **0** with the *server-key*argument specifies that an unencrypted (cleartext) hidden server key follows. • (Optional) **7** with the *server-key* argument specifies that an encrypted hidden server key follows. • The *server-key* argument specifies the hidden server key. If the *server-key*argument is configured without the **0** or **7** preceding it, it is unencrypted. **Note** Once the **server-private** command is configured, RADIUS system accounting is enabled.
Step 7	**accounting system host-config** **Example:** `Device(config-sg-radius)# accounting system host-config`	Enables the generation of system accounting records for private server hosts when they are added or deleted.
Step 8	**end** **Example:** `Device(config-sg-radius)# end`	Exits server-group (config-sg-radius) configuration mode and returns to global configuration mode.

Suppressing Generation of Accounting Records for Null Username Sessions

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. An example of this is users who come in on lines where the **aaa authentication login** *method-list* **none** command is applied. To prevent accounting records from being generated for sessions that do not have usernames associated with them, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting suppress null-username**	Prevents accounting records from being generated for users whose username string is NULL.

Generating Interim Accounting Records

To enable periodic interim accounting records to be sent to the accounting server, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting update** [**newinfo**] [**periodic**] *number*	Enables periodic interim accounting records to be sent to the accounting server.

When the **aaa accounting update**commandis activated, the Cisco IOS software issues interim accounting records for all users on the system. If the keyword **newinfo** is used, interim accounting records are sent to the accounting server every time there is new accounting information to report. An example of this would be when IPCP completes IP address negotiation with the remote peer. The interim accounting record includes 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 *number* argument. The interim accounting record contains all of the accounting information recorded for that user up to the time the interim accounting record is sent.

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

Generating Accounting Records for Failed Login or Session

When AAA Accounting is activated, the Cisco IOS software 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.

To specify that accounting stop records be generated for users who fail to authenticate at login or during session negotiation, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting send stop-record authentication failure**	Generates "stop" records for users who fail to authenticate at login or during session negotiation using PPP.
Device(config)# aaa accounting send stop-record always	Sends authentication, authorization, and accounting (AAA) stop records regardless of whether a start record was sent earlier.

Specifying Accounting NETWORK-Stop Records Before EXEC-Stop Records

For PPP users who start EXEC terminal sessions, you can specify the NETWORK records to be generated before EXEC-stop records. In cases such as billing customers for specific services, it 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.

To nest accounting records for user sessions, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting nested**	Nests network accounting records.

Configuring AAA Resource Failure Stop Accounting

To enable resource failure stop accounting, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting resource** *method-list* **stop-failure group** *server-group*	Generates a "stop" record for any calls that do not reach user authentication. **Note** Before configuring this feature, the tasks described in the Prerequisites for Configuring Accounting, on page 67 section must be performed, and SNMP must be enabled on the network access server. For more information about enabling SNMP on a Cisco router or access server, see the Configuring SNMP Support chapter in the Cisco IOS Network Management Configuration Guide.

Configuring AAA Resource Accounting for Start-Stop Records

To enable full resource accounting for start-stop records, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting resource** *method-list* **start-stop group** *server-group*	Supports the ability to send a "start" record at each call setup. followed with a corresponding "stop" record at the call disconnect. **Note** Before configuring this feature, the tasks described in the Prerequisites for Configuring Accounting, on page 67 section must be performed, and SNMP must be enabled on the network access server. For more information about enabling SNMP on a Cisco router or access server, see the Configuring SNMP Support chapter in the Cisco IOS Network Management Configuration Guide. **Note**

Configuring AAA Broadcast Accounting

To configure AAA broadcast accounting, use the aaa accounting command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa accounting** {**system** | **network** | **exec** | **connection** | **commands** *level*} {**default** | *list-name*} {**start-stop** | **stop-only** | **none**} [**broadcast**] *method1* [*method2...*]	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.

Configuring Per-DNIS AAA Broadcast Accounting

To configure AAA broadcast accounting per DNIS, use the **aaa dnis map accounting network**command in global configuration mode:

Command	Purpose
`Device(config)#` **aaa dnis map** *dnis-number* **accounting network** [**start-stop** | **stop-only** | **none**] [**broadcast**] *method1* [*method2...*]	Allows per-DNIS accounting configuration. This command has precedence over the global **aaa accounting** command. 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.

Configuring AAA Session MIB

The following tasks must be performed before configuring the AAA session MIB feature:

- Configure SNMP. For information on SNMP, see the chapter Configuring SNMP Support in the Cisco IOS Network Management Configuration Guide.
- Configure AAA.
- Define the RADIUS or TACACS+ server characteristics.

Note Overusing SNMP can affect the overall system performance; therefore, normal network management performance must be considered when this feature is used.

To configure AAA session MIB, use the following command in global configuration mode

SUMMARY STEPS

1. Device(config)# **aaa session-mib disconnect**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Device(config)# **aaa session-mib disconnect**	Monitors and terminates authenticated client connections using SNMP. To terminate the call, the **disconnect** keyword must be used.

Configuring VRRS Accounting

Perform the following task to configure Virtual Router Redundancy Service (VRRS) to send AAA Accounting messages to the AAA server:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa accounting vrrs** {**default** | *list-name*} **start-stop** *method1* [*method2...*]
4. **aaa attribute list** *list-name*
5. **attribute type** *name value* [**service** *service*] [**protocol** *protocol*][**mandatory**][**tag** *tag-value*]
6. **exit**
7. **vrrs** *vrrs-group-name*
8. **accounting delay** *seconds*
9. **accounting method** {**default** | *accounting-method-list*}
10. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**aaa accounting vrrs** {**default** | *list-name*} **start-stop** *method1* [*method2...*] **Example:** `Device(config)# aaa accounting vrrs default start-stop`	Enables AAA accounting for VRRS.
Step 4	**aaa attribute list** *list-name* **Example:** `Device(config)# aaa attribute list list1`	Defines a AAA attribute list locally on a router, and enters attribute list configuration mode.
Step 5	**attribute type** *name value* [**service** *service*] [**protocol** *protocol*][**mandatory**][**tag** *tag-value*] **Example:** `Device(config-attr-list)# attribute type example 1`	Defines an attribute type that is to be added to an attribute list locally on a router.
Step 6	**exit** **Example:** `Device(config-attr-list)# exit`	Exits attribute list configuration mode and returns to global configuration mode.
Step 7	**vrrs** *vrrs-group-name* **Example:** `Device(config)# vrrs vrrs1`	(Optional) Defines a VRRP group and configures parameters for the VRRS group, and enters VRRS configuration mode.
Step 8	**accounting delay** *seconds* **Example:** `Device(config-vrrs)# accounting delay 10`	(Optional) Specifies the delay time for sending accounting-off messages to the VRRS.
Step 9	**accounting method** {**default** | *accounting-method-list*} **Example:** `Device(config-vrrs)# accounting method default`	(Optional) Enables VRRS accounting for a VRRP group.
Step 10	**exit** **Example:** `Device(config-vrrs)# exit`	Exits VRRS configuration mode.

Establishing a Session with a Router if the AAA Server is Unreachable

To establish a console or telnet session with a router if the AAA server is unreachable, use the following command in global configuration mode:

Command	Purpose
`Device(config)#` **no aaa accounting system guarantee-first**	The **aaa accounting system guarantee-first** command guarantees system accounting as the first record, which is the default condition. In some situations, users may be prevented from starting a session on the console or terminal connection until after the system reloads, which can take more than three minutes. To resolve this problem, the **no aaa accounting system guarantee-first** command can be used.

Note Entering the **no aaa accounting system guarantee-first** command is not the only condition by which the console or telnet session can be started. For example, if the privileged EXEC session is being authenticated by TACACS and the TACACS server is not reachable, then the session cannot start.

Monitoring Accounting

No specific **show** command exists for either RADIUS or TACACS+ accounting. To obtain accounting records displaying information about users currently logged in, use the following command in privileged EXEC mode:

Command	Purpose
`Device#` **show accounting**	Allows display of the active accountable events on the network and helps collect information in the event of a data loss on the accounting server.

Troubleshooting Accounting

To troubleshoot accounting information, use the following command in privileged EXEC mode:

Command	Purpose
`Device#` **debug aaa accounting**	Displays information on accountable events as they occur.

Configuration Examples for AAA Accounting

Example Configuring Named Method List

The following example shows how to configure a Cisco AS5200 (enabled for AAA and communication with a RADIUS security server) in order for AAA services to be provided by the RADIUS server. If the RADIUS server fails to respond, then the local database is queried for authentication and authorization information, and accounting services are handled by a TACACS+ server.

```
aaa new-model
aaa authentication login admins local
aaa authentication ppp dialins group radius local
aaa authorization network blue1 group radius local
aaa accounting network red1 start-stop group radius group tacacs+
username root password ALongPassword
tacacs-server host 172.31.255.0
tacacs-server key goaway
radius-server host 172.16.2.7
radius-server key myRaDiUSpassWoRd
interface group-async 1
 group-range 1 16
 encapsulation ppp
 ppp authentication chap dialins
 ppp authorization blue1
 ppp accounting red1
line 1 16
 autoselect ppp
 autoselect during-login
 login authentication admins
 modem dialin
```

The lines in this sample RADIUS AAA configuration are defined as follows:

- The **aaa new-model** command enables AAA network security services.
- The **aaa authentication login admins local** command defines a method list “admins”, for login authentication.
- The **aaa authentication ppp dialins group radius local** command defines the authentication method list “dialins”, which specifies that first RADIUS authentication and then (if the RADIUS server does not respond) local authentication is used on serial lines using PPP.
- The **aaa authorization network blue1 group radius local** command defines the network authorization method list named “blue1”, which specifies that RADIUS authorization is used on serial lines using PPP. If the RADIUS server fails to respond, then local network authorization is performed.
- The **aaa accounting network red1 start-stop group radius group tacacs+**command defines the network accounting method list named red1, which specifies that RADIUS accounting services (in this case, start and stop records for specific events) are used on serial lines using PPP. If the RADIUS server fails to respond, accounting services are handled by a TACACS+ server.
- The **username** command defines the username and password to be used for the PPP Password Authentication Protocol (PAP) caller identification.
- The **tacacs-server host** command defines the name of the TACACS+ server host.

- The **tacacs-server key** command defines the shared secret text string between the network access server and the TACACS+ server host.
- The **radius-server host** command defines the name of the RADIUS server host.
- The **radius-server key** command defines the shared secret text string between the network access server and the RADIUS server host.
- The **interface group-async** command selects and defines an asynchronous interface group.
- The **group-range** command defines the member asynchronous interfaces in the interface group.
- The **encapsulation ppp** command sets PPP as the encapsulation method used on the specified interfaces.
- The **ppp authentication chap dialins**command selects Challenge Handshake Authentication Protocol (CHAP) as the method of PPP authentication and applies the "dialins" method list to the specified interfaces.
- The **ppp authorization blue1**command applies the blue1 network authorization method list to the specified interfaces.
- The **ppp accounting red1**command applies the red1 network accounting method list to the specified interfaces.
- The **line** command switches the configuration mode from global configuration to line configuration and identifies the specific lines being configured.
- The **autoselect ppp** command configures the Cisco IOS software to allow a PPP session to start up automatically on these selected lines.
- The **autoselect during-login** command is used to display the username and password prompt without pressing the Return key. After the user logs in, the autoselect function (in this case, PPP) begins.
- The **login authentication admins** command applies the admins method list for login authentication.
- The **modem dialin** command configures modems attached to the selected lines to only accept incoming calls.

The **show accounting**command yields the following output for the preceding configuration:

```
Active Accounted actions on tty1, User username2 Priv 1
 Task ID 5, Network Accounting record, 00:00:52 Elapsed
 task_id=5 service=ppp protocol=ip address=10.0.0.98
```

The table below describes the fields contained in the preceding output.

Table 11: show accounting Field Descriptions

Field	Description
Active Accounted actions on	Terminal line or interface name user with which the user logged in.
User	User's ID.
Priv	User's privilege level.
Task ID	Unique identifier for each accounting session.

Field	Description
Accounting record	Type of accounting session.
Elapsed	Length of time (hh:mm:ss) for this session type.
attribute=value	AV pairs associated with this accounting session.

Example Configuring AAA Resource Accounting

The following example shows how to configure the resource failure stop accounting and resource accounting for start-stop records functions:

```
!Enable AAA on your network access server.
aaa new-model
!Enable authentication at login and list the AOL string name to use for login authentication.
aaa authentication login AOL group radius local
!Enable authentication for ppp and list the default method to use for PPP authentication.
aaa authentication ppp default group radius local
!Enable authorization for all exec sessions and list the AOL string name to use for
authorization.
aaa authorization exec AOL group radius if-authenticated
!Enable authorization for all network-related service requests and list the default method
 to use for all network-related authorizations.
aaa authorization network default group radius if-authenticated
!Enable accounting for all exec sessions and list the default method to use for all start-stop
 accounting services.
aaa accounting exec default start-stop group radius
!Enable accounting for all network-related service requests and list the default method to
 use for all start-stop accounting services.
aaa accounting network default start-stop group radius
!Enable failure stop accounting.
aaa accounting resource default stop-failure group radius
!Enable resource accounting for start-stop records.
aaa accounting resource default start-stop group radius
```

Example Configuring AAA Broadcast Accounting

The following example shows how to turn on broadcast accounting using the global **aaa accounting** command:

```
aaa group server radius isp
 server 10.0.0.1
 server 10.0.0.2
aaa group server tacacs+ isp_customer
 server 172.0.0.1
aaa accounting network default start-stop broadcast group isp group isp_customer
radius-server host 10.0.0.1
radius-server host 10.0.0.2
radius-server key key1
tacacs-server host 172.0.0.1 key key2
```

The **broadcast** keyword causes “start” and “stop” accounting records for network connections to be sent simultaneously to server 10.0.0.1 in the group isp and to server 172.0.0.1 in the group isp_customer. If server 10.0.0.1 is unavailable, failover to server 10.0.0.2 occurs. If server 172.0.0.1 is unavailable, no failover occurs because backup servers are not configured for the group isp_customer.

Example Configuring Per-DNIS AAA Broadcast Accounting

The following example shows how to turn on per DNIS broadcast accounting using the global **aaa dnis map accounting network**command:

```
aaa group server radius isp
 server 10.0.0.1
 server 10.0.0.2
aaa group server tacacs+ isp_customer
 server 172.0.0.1
aaa dnis map enable
aaa dnis map 7777 accounting network start-stop broadcast group isp group isp_customer
radius-server host 10.0.0.1
radius-server host 10.0.0.2
radius-server key key_1
tacacs-server host 172.0.0.1 key key_2
```

The **broadcast** keyword causes “start” and “stop” accounting records for network connection calls having DNIS number 7777 to be sent simultaneously to server 10.0.0.1 in the group isp and to server 172.0.0.1 in the group isp_customer. If server 10.0.0.1 is unavailable, failover to server 10.0.0.2 occurs. If server 172.0.0.1 is unavailable, no failover occurs because backup servers are not configured for the group isp_customer.

Example AAA Session MIB

The following example shows how to set up the AAA session MIB feature to disconnect authenticated client connections for PPP users:

```
aaa new-model
aaa authentication ppp default group radius
aaa authorization network default group radius
aaa accounting network default start-stop group radius
aaa session-mib disconnect
```

Example Configuring VRRS Accounting

The following example shows how to configure VRRS to send AAA Accounting messages to the AAA server:

```
Device# configure terminal
Device(config)# aaa accounting vrrs vrrp-mlist-1 start-stop group radius
Device(config)# aaa attribute list vrrp-1-attr
Device(config-attr-list)# attribute type account-delay 10
Device(config-attr-list)# exit
Device(config)# vrrs vrrp-group-1
Device(config-vrrs)# accounting delay 10
Device(config-vrrs)# accounting method vrrp-mlist-1
Device(config-vrrs)# exit
```

Additional References

Related Documents

Related Topic	Document Title
Authorization	Configuring Authorization module

Related Topic	Document Title
Authentication	Configuring Authentication module
Accounting Commands	*Cisco IOS Security Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2903	*Generic AAA Architecture*
RFC 2904	*AAA Authorization Framework*
RFC 2906	*AAA Authorization Requirements*
RFC 2989	*Criteria for Evaluating AAA Protocols for Network Access*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring Accounting

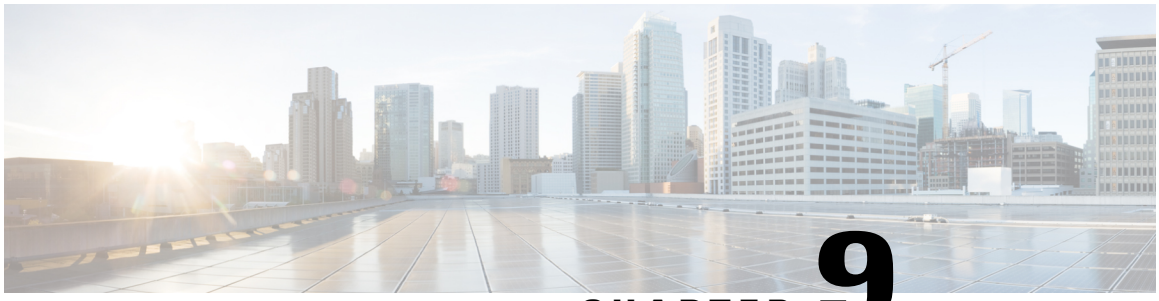
The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 12: Feature Information for Configuring Accounting

Feature Name	Releases	Feature Information
AAA Broadcast Accounting	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	AAA broadcast accounting allows accounting information to be sent to multiple AAA servers at the same time; that is, accounting information can be broadcast to one or more AAA servers simultaneously. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.

Feature Name	Releases	Feature Information
AAA Resource Accounting for Start-Stop Records	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	AAA resource accounting for start-stop records supports the ability to send a “start” record at each call setup, followed by a corresponding “stop” record at the call disconnect. This functionality can be used to manage and monitor wholesale customers from one source of data reporting, such as accounting records. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.
AAA Session MIB	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The AAA session MIB feature allows customers to monitor and terminate their authenticated client connections using SNMP. The data of the client is presented so that it correlates directly to the AAA Accounting information reported by either the RADIUS or the TACACS+ server. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.
AAA: IPv6 Accounting Delay Enhancements	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	VRRS provides a multiclient information abstraction and management service between a First Hop Redundancy Protocol (FHRP) and a registered client. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches.



CHAPTER 9

AAA-SERVER-MIB Set Operation

The AAA-SERVER-MIB Set Operation feature allows the authentication, authorization, and accounting (AAA) server configuration to be extended or expanded by using the CISCO-AAA-SERVER-MIB to create and add new AAA servers, modify the "KEY" under the CISCO-AAA-SERVER-MIB, and delete the AAA server configuration.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for AAA-SERVER-MIB Set Operation

AAA must have been enabled on the router, that is, the **aaa new-model** command must have been configured. If this configuration has not been accomplished, the set operation fails.

Restrictions for AAA-SERVER-MIB Set Operation

Currently, the CISCO SNMP set operation is supported only for the RADIUS protocol. Therefore, only RADIUS servers in global configuration mode can be added, modified, or deleted.

Information About AAA-SERVER-MIB Set Operation

CISCO-AAA-SERVER-MIB

The CISCO-AAA-SERVER-MIB provides that statistics reflect both the state of the AAA server operation with the server itself and of AAA communications with external servers. The CISCO-AAA-SERVER-MIB provides the following information:

- Statistics for each AAA operation
- Status of servers that are providing AAA functions
- Identities of external AAA servers

CISCO-AAA-SERVER-MIB Set Operation

Before Cisco IOS Release 12.4(4)T, the CISCO-AAA-SERVER-MIB supported only the “get” operation. Effective with this release, the CISCO-AAA-SERVER-MIB supports the set operation. With the set operation, you can do the following:

- Create or add a new AAA server.
- Modify the KEY under the CISCO-AAA-SERVER-MIB. This “secret key” is used for secure connectivity to the AAA server, which is present with the network access server (NAS) and the AAA server.
- Delete the AAA server configuration.

How to Configure AAA-SERVER-MIB Set Operation

Configuring AAA-SERVER-MIB Set Operations

No special configuration is required for this feature. The Simple Network Management Protocol (SNMP) framework can be used to manage MIBs. See the Additional References section for a reference to configuring SNMP.

Verifying SNMP Values

SNMP values can be verified by performing the following steps.

SUMMARY STEPS

1. **enable**
2. **show running-config | include radius-server host**
3. **show aaa servers**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show running-config | include radius-server host** **Example:** `Device# show running-config | include radius-server host`	Displays all the RADIUS servers that are configured in the global configuration mode.
Step 3	**show aaa servers** **Example:** `Device# show aaa servers`	Displays information about the number of requests sent to and received from authentication, authorization, and accounting (AAA) servers.

Configuration Examples for AAA-SERVER-MIB Set Operation

RADIUS Server Configuration and Server Statistics Example

The following sample output shows the RADIUS server configuration and server statistics before and after the set operation.

Before the Set Operation

```
Device# show running-config | include radius-server host
! The following line is for server 1.
radius-server host 172.19.192.238 auth-port 2095 acct-port 2096 key cisco2
! The following line is for server 2.
radius-server host 172.19.192.238 auth-port 1645 acct-port 1646
```

Server Statistics

```
Device# show aaa servers
```

```
RADIUS: id 2, priority 1, host 172.19.192.238, auth-port 2095, acct-port 2096
State: current UP, duration 25s, previous duration 0s
     Dead: total time 0s, count 7
Authen: request 8, timeouts 8
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 2
Author: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Account: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Elapsed time since counters last cleared: 5m
RADIUS: id 3, priority 2, host 172.19.192.238, auth-port 1645, acct-port 1646
State: current UP, duration 5s, previous duration 0s
     Dead: total time 0s, count 2
Authen: request 8, timeouts 8
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 4
Author: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Account: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Elapsed time since counters last cleared: 3m
```

SNMP Get Operation to Check the Configuration and Statistics of the RADIUS Servers

```
aaa-server5:/users/smetri> getmany 10.0.1.42 casConfigTable
casAddress.2.2 = 172.19.192.238
casAddress.2.3 = 172.19.192.238
casAuthenPort.2.2 = 2095
casAuthenPort.2.3 = 1645
casAcctPort.2.2 = 2096
casAcctPort.2.3 = 1646
casKey.2.2 =
casKey.2.3 =
! The following line shows priority for server 1.
casPriority.2.2 = 1
! The following line shows priority for server 2.
casPriority.2.3 = 2
casConfigRowStatus.2.2 = active(1)
casConfigRowStatus.2.3 = active(1)
aaa-server5:/users/smetri>
```

SNMP Set Operation

The key of the existing RADIUS server is being changed. The index “1” is being used. That index acts as a wildcard for addition, deletion, or modification of any entries.

```
Change the key for server 1:=>
aaa-server5:/users/smetri>  setany -v2c 10.0.1.42 public casAddress.2.1 -a 172.19.192.238
casAuthenPort.2.1 -i 2095 casAcctPort.2.1 -i 2096 casKey.2.1 -o king
casAddress.2.1 = 172.19.192.238
casAuthenPort.2.1 = 2095
casAcctPort.2.1 = 2096
casKey.2.1 = king
aaa-server5:/users/smetri>
```

After the Set Operation

After the above SNMP set operation, the configurations on the router change. The following output shows the output after the set operation.

```
Device# show running-config | include radius-server host
radius-server host 172.19.192.238 auth-port 1645 acct-port 1646
```

```
! The following line shows a change in the key value to “king.”
radius-server host 172.19.192.238 auth-port 2095 acct-port 2096 key king


Device# show aaa servers
RADIUS: id 3, priority 1, host 172.19.192.238, auth-port 1645, acct-port 1646
State: current UP, duration 189s, previous duration 0s
     Dead: total time 0s, count 2
Authen: request 8, timeouts 8
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 4
Author: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Account: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Elapsed time since counters last cleared: 6m

! The following line shows a new server with new statistics.
RADIUS: id 4, priority 2, host 172.19.192.238, auth-port 2095, acct-port 2096
State: current UP, duration 209s, previous duration 0s
     Dead: total time 0s, count 7
Authen: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Author: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
     Transaction: success 0, failure 0
Account: request 0, timeouts 0
     Response: unexpected 0, server error 0, incorrect 0, time 0ms
```

Additional References

The following sections provide references related to the AAA-SERVER-MIB Set Operation feature.

Related Documents

Related Topic	Document Title
Configuring SNMP	Configuring SNMP Support in the *Cisco IOS Network Management Configuration Guide*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

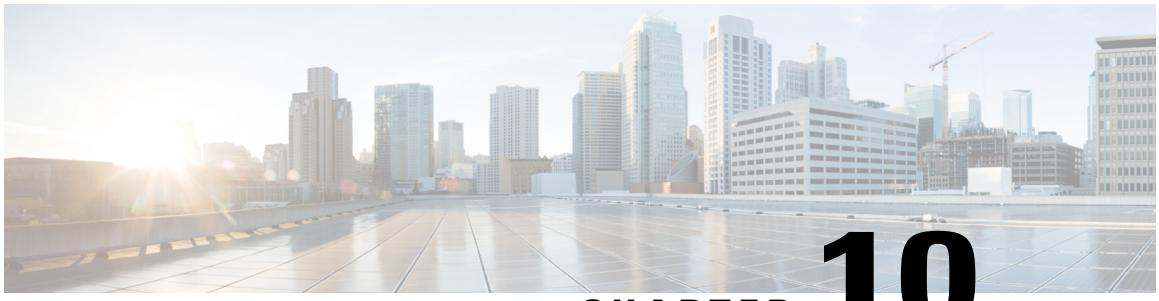
Feature Information for AAA-SERVER-MIB Set Operation

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 13: Feature Information for AAA-SERVER-MIB Set Operation

Feature Name	Releases	Feature Information
AAA-SERVER-MIB Set Operation	Cisco IOS XE 3.5E Cisco IOS XE Release 3.6E	The AAA-SERVER-MIB Set Operation feature allows the authentication, authorization, and accounting (AAA) server configuration to be extended or expanded by using the CISCO-AAA-SERVER-MIB to create and add new AAA servers, modify the "KEY" under the CISCO-AAA-SERVER-MIB, and delete the AAA server configuration. In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **show aaa servers, show running-config, show running-config vrf.**



CHAPTER 10

Message Banners for AAA Authentication

The Message Banners for AAA authentication feature is used to configure personalized login and failed-login banners for user authentication. The message banners are displayed when a user logs in to the system to be authenticated using authentication, authorization, and accounting (AAA) and when an authentication fails.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Message Banners for AAA Authentication

Login and Failed-Login Banners for AAA Authentication

Login and failed-login banners use a delimiting character that notifies the system of the exact text string that must be displayed as the banner for authorization, authentication, and accounting (AAA) authentication. The delimiting character is repeated at the end of the text string to signify the end of the login or failed-login

banner. The delimiting character can be any single character in the extended ASCII character set, but once defined as the delimiter, that character cannot be used in the text string for the banner.

You can display a maximum of 2996 characters in a login or failed-login banner.

How to Configure Message Banners for AAA Authentication

Configuring a Login Banner for AAA Authentication

Perform this task to configure a banner that is displayed when a user logs in (replacing the default message for login). Use the **no aaa authentication banner** command to disable a login banner.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa authentication banner** *delimiter-string delimiter*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables AAA globally.
Step 4	**aaa authentication banner** *delimiter-string delimiter* **Example:** `Device(config)# aaa authentication banner *Unauthorized Access Prohibited*`	Creates a personalized login banner.

	Command or Action	Purpose
Step 5	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Configuring a Failed-Login Banner for AAA Authentication

Perform this task to configure a failed-login banner that is displayed when a user login fails (replacing the default message for failed login). Use the **no aaa authentication fail-message** command to disable a failed-login banner.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa authentication banner** *delimiter-string delimiter*
5. **aaa authentication fail-message** *delimiter-string delimiter*
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enters AAA globally.

	Command or Action	Purpose
Step 4	**aaa authentication banner** *delimiter-string delimiter* **Example:** `Device(config)# aaa authentication banner *Unauthorized Access Prohibited*`	Creates a personalized login banner.
Step 5	**aaa authentication fail-message** *delimiter-string delimiter* **Example:** `Device(config)# aaa authentication fail-message *Failed login. Try again*`	Creates a message to be displayed when a user login fails.
Step 6	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Configuration Examples for Message Banners for AAA Authentication

Example: Configuring Login and Failed-Login Banners for AAA Authentication

The following example shows how to configure a login banner that is displayed when a user logs in to the system, (in this case, the phrase "Unauthorized Access Prohibited"). The asterisk (*) is used as the delimiting character. RADIUS is specified as the default login authentication method.

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa authentication banner *Unauthorized Access Prohibited*
Device(config)# aaa authentication login default group radius
```

This configuration displays the following login banner:

```
Unauthorized Access Prohibited
Username:
```

The following example shows how to configure a failed-login banner that is displayed when a user tries to log in to the system and fails, (in this case, the phrase "Failed login. Try again"). The asterisk (*) is used as the delimiting character. RADIUS is specified as the default login authentication method.

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
```

```
Device(config)# aaa authentication banner *Unauthorized Access Prohibited*
Device(config)# aaa authentication fail-message *Failed login. Try again.*
Device(config)# aaa authentication login default group radius
```

This configuration displays the following login and failed-login banner:

```
Unauthorized Access Prohibited
Username:
Password:
Failed login. Try again.
```

Additional References for Message Banners for AAA Authentication

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Security commands	• Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z
Configuring AAA	*Authentication, Authorization, and Accounting Configuration Guide*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

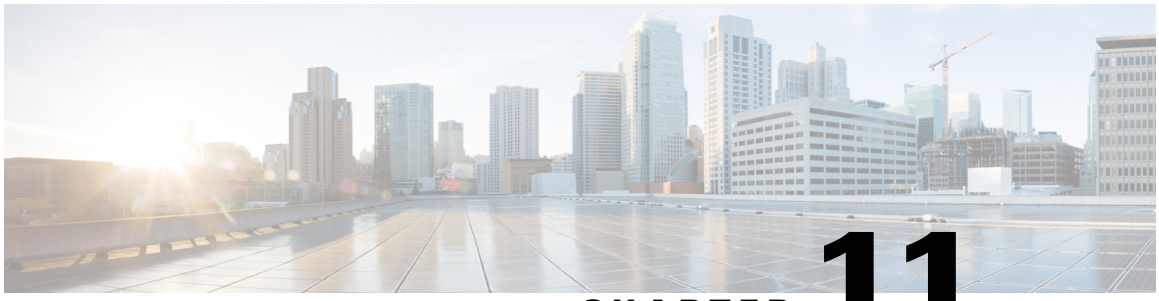
Feature Information for Message Banners for AAA Authentication

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 14: Feature Information for Message Banners for AAA Authentication

Feature Name	Releases	Feature Information
Message Banners for AAA Authentication	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE Cisco IOS XE Release 3.6E	The Message Banners for AAA Authentication feature enables you to configure personalized login and failed-login banners for user authentication. The message banners are displayed when a user logs in to the system to be authenticated using authentication, authorization, and accounting (AAA) and when an authentication fails. In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **aaa authentication banner**, **aaa authentication fail-message**, and **aaa new-model**.



CHAPTER 11

RADIUS Change of Authorization

The RADIUS Change of Authorization (CoA) feature provides a mechanism to change the attributes of an authentication, authorization, and accounting (AAA) session after it is authenticated. When a policy changes for a user or user group in AAA, administrators can send the RADIUS CoA packets from the AAA server such as a Cisco Secure Access Control Server (ACS) to reinitialize authentication and apply the new policy.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About RADIUS Change of Authorization

About RADIUS Change of Authorization

A standard RADIUS interface is typically used in a pulled model, in which the request originates from a device attached to a network and the response is sent from the queried servers. The Cisco software supports the RADIUS CoA request defined in RFC 5176 that is used in a pushed model, in which the request originates

from the external server to the device attached to the network, and enables the dynamic reconfiguring of sessions from external authentication, authorization, and accounting (AAA) or policy servers.

Use the following per-session CoA requests:

- Session reauthentication
- Session termination
- Session termination with port shutdown
- Session termination with port bounce
- Security and Password
- Accounting

CoA Requests

CoA requests, as described in RFC 5176, are used in a pushed model to allow for session identification, host reauthentication, and session termination. The model comprises one request (CoA-Request) and two possible response codes:

- CoA acknowledgment (ACK) [CoA-ACK]
- CoA non-acknowledgment (NAK) [CoA-NAK]

The request is initiated from a CoA client (typically a RADIUS or policy server) and directed to the device that acts as a listener.

RFC 5176 Compliance

The Disconnect Request message, which is also referred to as Packet of Disconnect (POD), is supported by the device for a session termination.

The following table shows the IETF attributes that are supported for the RADIUS Change of Authorization (CoA) feature.

Table 15: Supported IETF Attributes

Attribute Number	Attribute Name
24	State
31	Calling-Station-ID
44	Acct-Session-ID
80	Message-Authenticator
101	Error-Cause

The following table shows the possible values for the Error-Cause attribute.

Table 16: Error-Cause Values

Value	Explanation
201	Residual Session Context Removed
202	Invalid EAP Packet (Ignored)
401	Unsupported Attribute
402	Missing Attribute
403	NAS Identification Mismatch
404	Invalid Request
405	Unsupported Service
406	Unsupported Extension
407	Invalid Attribute Value
501	Administratively Prohibited
502	Request Not Routable (Proxy)
503	Session Context Not Found
504	Session Context Not Removable
505	Other Proxy Processing Error
506	Resources Unavailable
507	Request Initiated
508	Multiple Session Selection Unsupported

CoA Request Response Code

The CoA Request Response code can be used to issue a command to the device. The supported commands are listed in the “CoA Request Commands” section.

The packet format for a CoA Request Response code as defined in RFC 5176 consists of the following fields: Code, Identifier, Length, Authenticator, and Attributes in the Type:Length:Value (TLV) format.

The Attributes field is used to carry Cisco VSAs.

Session Identification

For disconnect and CoA requests targeted at a particular session, the device locates the session based on one or more of the following attributes:

- Acct-Session-Id (IETF attribute #44)
- Audit-Session-Id (Cisco vendor-specific attribute (VSA))
- Calling-Station-Id (IETF attribute #31, which contains the host MAC address)

Unless all session identification attributes included in the CoA message match the session, the device returns a Disconnect-NAK or CoA-NAK with the "Invalid Attribute Value" error-code attribute.

Note A CoA NAK message is not sent for all CoA requests with a key mismatch. The message is sent only for the first three requests for a client. After that, all the packets from that client are dropped. When there is a key mismatch, the response authenticator sent with the CoA NAK message is calculated from a dummy key value.

CoA ACK Response Code

If an authorization state is changed successfully, a positive acknowledgment (ACK) is sent. The attributes returned within a CoA ACK can vary based on the CoA Request.

CoA NAK Response Code

A negative acknowledgment (NAK) indicates a failure to change the authorization state and can include attributes that indicate the reason for the failure.

CoA Request Commands

The commands supported on the device are shown in the table below. All CoA commands must include the session identifier between the device and the CoA client.

Table 17: CoA Request Commands Supported on the Device

Command	Cisco VSA
Bounce host port	Cisco:Avpair="subscriber:command=bounce-host-port"
Disable host port	Cisco:Avpair="subscriber:command=disable-host-port"
Reauthenticate host	Cisco:Avpair="subscriber:command=reauthenticate"
Terminate session	This is a standard disconnect request that does not require a VSA

Session Reauthentication

To initiate session reauthentication, the authentication, authorization, and accounting (AAA) server sends a standard CoA-Request message that contains a Cisco VSA and one or more session identification attributes. The Cisco VSA is in the form of Cisco:Avpair="subscriber:command=reauthenticate".

The current session state determines the device's response to the message in the following scenarios:

- If the session is currently authenticated by IEEE 802.1*x*, the device responds by sending an Extensible Authentication Protocol over LAN (EAPoL)-RequestId message to the server.
- If the session is currently authenticated by MAC authentication bypass (MAB), the device sends an access request to the server, passing the same identity attributes used for the initial successful authentication.
- If session authentication is in progress when the device receives the command, the device terminates the process and restarts the authentication sequence, starting with the method configured to be attempted first.

Session Termination

A CoA Disconnect-Request terminates the session without disabling the host port. CoA Disconnect-Request termination causes reinitialization of the authenticator state machine for the specified host, but does not restrict the host's access to the network. If the session cannot be located, the device returns a Disconnect-NAK message with the "Session Context Not Found" error-code attribute. If the session is located, the device terminates the session. After the session has been completely removed, the device returns a Disconnect-ACK message.

To restrict a host's access to the network, use a CoA Request with the Cisco:Avpair="subscriber:command=disable-host-port" VSA. This command is useful when a host is known to cause problems on the network and network access needs to be immediately blocked for the host. If you want to restore network access on the port, reenable it using a non-RADIUS mechanism.

CoA Request Disable Host Port

The RADIUS server CoA disable port command administratively shuts down the authentication port that is hosting a session, resulting in session termination. This command is useful when a host is known to cause problems on the network and network access needs to be immediately blocked for the host. If you want to restore network access on the port, reenable it using a non-RADIUS mechanism. This command is carried in a standard CoA-Request message that has the following VSA:

Cisco:Avpair="subscriber:command=disable-host-port"

Because this command is session-oriented, it must be accompanied by one or more of the session identification attributes described in the "Session Identification" section. If the device cannot locate the session, it returns a CoA-NAK message with the "Session Context Not Found" error-code attribute. If the device locates the session, it disables the hosting port and returns a CoA-ACK message.

If the device fails before returning a CoA-ACK to the client, the process is repeated on the new active device when the request is re-sent from the client. If the device fails after returning a CoA-ACK message to the client but before the operation is complete, the operation is restarted on the new active device.

To ignore the RADIUS server CoA disable port command, see the "Configuring the Device to Ignore Bounce and Disable RADIUS CoA Requests" section.

CoA Request Bounce Port

A RADIUS server CoA bounce port sent from a RADIUS server can cause a link flap on an authentication port, which triggers DHCP renegotiation from one or more hosts connected to this port. This incident can occur when there is a VLAN change and the endpoint is a device (such as a printer) that does not have a mechanism to detect a change on this authentication port. The CoA bounce port is carried in a standard CoA-Request message that contains the following VSA:

Cisco:Avpair="subscriber:command=bounce-host-port"

Because this command is session-oriented, it must be accompanied by one or more of the session identification attributes described in the Session Identification. If the session cannot be located, the device returns a CoA-NAK message with the "Session Context Not Found" error-code attribute. If the session is located, the device disables the hosting port for a period of 10 seconds, reenables it (port-bounce), and returns a CoA-ACK.

To ignore the RADIUS server CoA bounce port, see the "Configuring the Device to Ignore Bounce and Disable RADIUS CoA Requests" section.

How to Configure RADIUS Change of Authorization

Configuring RADIUS Change of Authorization

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa server radius dynamic-author**
5. **client** {*ip-address* | *name* [**vrf** *vrf-name*]} **server-key** [**0** | **7**] *string*
6. **port** *port-number*
7. **auth-type** {**any** | **all** | **session-key**}
8. **ignore session-key**
9. **ignore server-key**
10. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables authentication, authorization, and accounting (AAA) globally.
Step 4	**aaa server radius dynamic-author** **Example:** `Device(config)# aaa server radius dynamic-author`	Enters dynamic authorization local server configuration mode and specifies a RADIUS client from which a device accepts Change of Authorization (CoA) and disconnect requests. Configures the device as a AAA server to facilitate interaction with an external policy server.
Step 5	**client** {*ip-address* | *name* [**vrf** *vrf-name*]} **server-key** [**0** | **7**] *string* **Example:** `Device(config-locsvr-da-radius)# client 10.0.0.1`	Configures the RADIUS key to be shared between a device and RADIUS clients.
Step 6	**port** *port-number* **Example:** `Device(config-locsvr-da-radius)# port 3799`	Specifies the port on which a device listens for RADIUS requests from configured RADIUS clients. **Note** The default port for packet of disconnect is 1700. Port 3799 is required to interoperate with ACS 5.1.
Step 7	**auth-type** {**any** | **all** | **session-key**} **Example:** `Device(config-locsvr-da-radius)# auth-type all`	Specifies the type of authorization that the device must use for RADIUS clients. The client must match the configured attributes for authorization.
Step 8	**ignore session-key** **Example:** `Device(config-locsvr-da-radius)# ignore session-key`	(Optional) Configures the device to ignore the session key.
Step 9	**ignore server-key** **Example:** `Device(config-locsvr-da-radius)# ignore server-key`	(Optional) Configures the device to ignore the server key.
Step 10	**exit** **Example:** `Device(config-locsvr-da-radius)# exit`	Returns to global configuration mode.

Configuring a Device to Ignore Bounce and Disable RADIUS CoA Requests

When an authentication port is authenticated with multiple hosts and there is a Change of Authorization (CoA) request for one host to flap on this port or one host session to be terminated on this port, the other hosts on this port are also affected. Thus, an authenticated port with multiple hosts can trigger a DHCP renegotiation from one or more hosts in the case of a flap, or it can administratively shut down the authentication port that is hosting the session for one or more hosts.

Perform the following steps to configure the device to ignore RADIUS server Change of Authorization (CoA) requests in the form of a bounce port command or disable port command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **authentication command bounce-port ignore**
5. **authentication command disable-port ignore**
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables authentication, authorization, and accounting (AAA) globally.
Step 4	**authentication command bounce-port ignore** **Example:** `Device(config)# authentication command bounce-port ignore`	(Optional) Configures the device to ignore a RADIUS server bounce port command that causes a host to link flap on an authentication port, which causes DHCP renegotiation from one or more hosts connected to this port.

	Command or Action	Purpose
Step 5	**authentication command disable-port ignore** **Example:** `Device(config)# authentication command disable-port ignore`	(Optional) Configures the device to ignore a RADIUS server CoA disable port command that administratively shuts down the authentication port that hosts one or more host sessions. • The shutting down of the port causes session termination.
Step 6	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.

Configuring the Dynamic Authorization Service for RADIUS CoA

Perform the following steps to enable the device as an authentication, authorization, and accounting (AAA) server for the dynamic authorization service. This service supports the Change of Authorization (CoA) functionality that pushes the policy map in an input and output direction.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa server radius dynamic-author**
5. **client** {*ip-addr* | *hostname*} [**server-key** [**0** | **7**] *string*]
6. **domain** {**delimiter** *character* | **stripping** | [**right-to-left**]}
7. **port** *port-num*
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables AAA globally.
Step 4	**aaa server radius dynamic-author** **Example:** `Device(config)# aaa server radius dynamic-author`	Sets up the local AAA server for the dynamic authorization service, which must be enabled to support the CoA functionality to push the policy map in an input and output direction, and enters dynamic authorization local server configuration mode. • In this mode, the RADIUS application commands are configured.
Step 5	**client** {*ip-addr* | *hostname*} [**server-key** [**0** | **7**] *string*] **Example:** `Device(config-locsvr-da-radius)# client 192.168.0.5 server-key cisco1`	Configures the IP address or hostname of the AAA server client. • Use the optional **server-key** keyword and *string* argument to configure the server key at the client level. **Note** Configuring the server key at the client level overrides the server key configured at the global level.
Step 6	**domain** {**delimiter** *character* | **stripping** | [**right-to-left**]} **Example:** `Device(config-locsvr-da-radius)# domain stripping right-to-left`	(Optional) Configures username domain options for the RADIUS application. • The **delimiter** keyword specifies the domain delimiter. One of the following options can be specified for the *character* argument: **@**, /, **$**, **%**, \, **#**, or **-**. • The **stripping** keyword compares the incoming username with the names oriented to the left of the **@** domain delimiter. • The **right-to-left** keyword terminates the string at the first delimiter going from right to left.
Step 7	**port** *port-num* **Example:** `Device(config-locsvr-da-radius)# port 3799`	Configures the UDP port for CoA requests.
Step 8	**end** **Example:** `Device(config-locsvr-da-radius)# end`	Returns to privileged EXEC mode.

Monitoring and Troubleshooting RADIUS Change of Authorization

The following commands can be used to monitor and troubleshoot the RADIUS Change of Authorization feature:

Table 18: Monitoring and Troubleshooting RADIUS Change of Authorization

Command	Purpose
debug aaa coa	Displays debug information for CoA processing.
debug aaa pod	Displays debug messages related to packet of disconnect (POD) packets.
debug radius	Displays information associated with RADIUS.
show aaa attributes protocol radius	Displays the mapping between an authentication, authorization, and accounting (AAA) attribute number and the corresponding AAA attribute name.

Configuration Examples for RADIUS Change of Authorization

Example: Configuring RADIUS Change of Authorization

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa server radius dynamic-author
Device(config-locsvr-da-radius)# client 10.0.0.1
Device(config-locsvr-da-radius)# server-key cisco123
Device(config-locsvr-da-radius)# port 3799
Device(config-locsvr-da-radius)# auth-type all
Device(config-locsvr-da-radius)# ignore session-key
Device(config-locsvr-da-radius)# ignore server-key
Device(config-locsvr-da-radius)# end
```

Example: Configuring a Device to Ignore Bounce and Disable a RADIUS Requests

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# authentication command bounce-port ignore
Device(config)# authentication command disable-port ignore
Device(config)# end
```

Example: Configuring the Dynamic Authorization Service for RADIUS CoA

The following example shows how to configure the device as a authentication, authorization, and accounting (AAA) server to support Change of Authorization (CoA) functionality that pushes the policy map in an input and output direction:

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa server radius dynamic-author
Device(config-locsvr-da-radius)# client 192.168.0.5 server-key cisco1
Device(config-locsvr-da-radius)# domain delimiter @
Device(config-locsvr-da-radius)# port 3799
Device(config-locsvr-da-radius)# end
```

Additional References for RADIUS Change of Authorization

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Security commands	• Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z
Configuring AAA	*Authentication, Authorization, and Accounting Configuration Guide*

Standards and RFCs

Standard/RFC	Title
RFC 2903	*Generic AAA Architecture*

Standard/RFC	Title
RFC 5176	*Dynamic Authorization Extensions to Remote Authentication Dial In User Service(RADIUS)*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

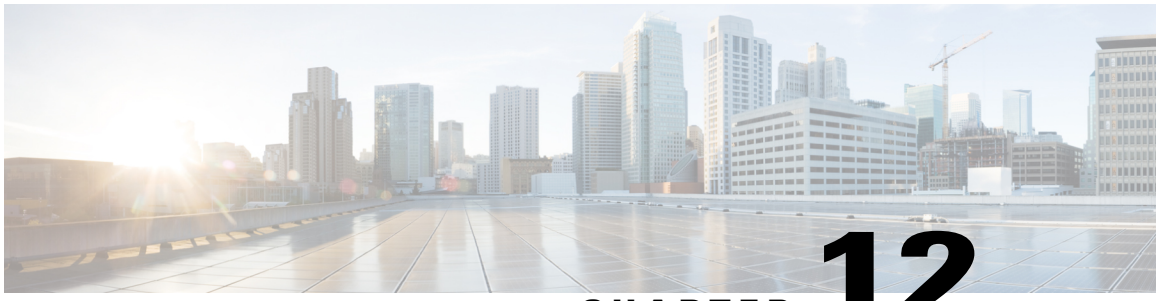
Feature Information for RADIUS Change of Authorization

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 19: Feature Information for RADIUS Change of Authorization

Feature Name	Releases	Feature Information
RADIUS Change of Authorization	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE Cisco IOS XE Release 3.6E	The RADIUS Change of Authorization (CoA) feature provides a mechanism to change the attributes of an AAA session after it is authenticated. When policy changes for a user or user group in AAA, administrators can send the RADIUS CoA packets from the AAA server, such as the Cisco Secure Access Control Server (ACS), to reinitialize authentication and apply the new policy. In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **aaa server radius dynamic-author**, **authentication command bounce-port ignore**, and **authentication command disable-port ignore**.



CHAPTER 12

TACACS+ over IPv6

An IPv6 server can be configured to be used with TACACS+.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About TACACS+ over IPv6

The Terminal Access Controller Access-Control System (TACACS+) security protocol provides centralized validation of users. TACACS+ services are maintained in a database on a TACACS+ daemon typically running on a UNIX or Windows NT workstation. You must have access to and must configure a TACACS+ server before the configured TACACS+ features on your devices are available.

TACACS+ provides for separate authentication, authorization, and accounting facilities. TACACS+ allows for a single access control server (the TACACS+ daemon) to provide each service (authentication, authorization, and accounting) independently. Each service is associated with its own database to take advantage of other services available on that server or on the network, depending on the capabilities of the daemon.

AAA over IPv6

Vendor-specific attributes (VSAs) are used to support Authentication, Authorization and Accounting(AAA) over IPv6. Cisco VSAs are inacl, outacl, prefix, and route.

You can configure prefix pools and pool names by using the AAA protocol. Customers can deploy an IPv6 RADIUS server or a TACACS+ server to communicate with Cisco devices.

TACACS+ Over an IPv6 Transport

An IPv6 server can be configured to use TACACS+. Both IPv6 and IPv4 servers can be configured to use TACACS+ using a name instead of an IPv4 or IPv6 address.

How to Configure TACACS+ over IPv6

Configuring the TACACS+ Server over IPv6

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **tacacs server** *name*
4. **address ipv6** *ipv6-address*
5. **key** [**0** | **7**] *key-string*
6. **port** [*number*
7. **send-nat-address**
8. **single-connection**
9. **timeout** *seconds*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**tacacs server** *name* **Example:** `Device(config)# tacacs server server1`	Configures the TACACS+ server for IPv6 and enters TACACS+ server configuration mode.
Step 4	**address ipv6** *ipv6-address* **Example:** `Device(config-server-tacacs)# address ipv6 2001:DB8:3333:4::5`	Configures the IPv6 address of the TACACS+ server.
Step 5	**key** [**0** | **7**] *key-string* **Example:** `Device(config-server-tacacs)# key 0 key1`	Configures the per-server encryption key on the TACACS+ server.
Step 6	**port** [*number* **Example:** `Device(config-server-tacacs)# port 12`	Specifies the TCP port to be used for TACACS+ connections.
Step 7	**send-nat-address** **Example:** `Device(config-server-tacacs)# send-nat-address`	Sends a client's post-NAT address to the TACACS+ server.
Step 8	**single-connection** **Example:** `Device(config-server-tacacs)# single-connection`	Enables all TACACS packets to be sent to the same server using a single TCP connection.
Step 9	**timeout** *seconds* **Example:** `Device(config-server-tacacs)# timeout 10`	Configures the time to wait for a reply from the specified TACACS server.

Specifying the Source Address in TACACS+ Packets

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 tacacs source-interface** *type number*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ipv6 tacacs source-interface** *type number* **Example:** `Device(config)# ipv6 tacacs source-interface Gigabitethernet 1/2/1`	Specifies an interface to use for the source address in TACACS+ packets.

Configuring TACACS+ Server Group Options

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa group server tacacs+** *group-name*
4. **server name** *server-name*
5. **server-private** {*ip-address* | *name* | *ipv6-address*} [**nat**] [**single-connection**] [**port** *port-number*] [**timeout** *seconds*] [**key** [**0** | **7**] *string*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**aaa group server tacacs+** *group-name* **Example:** `Device(config)# aaa group server tacacs+ group1`	Groups different TACACS+ server hosts into distinct lists and distinct methods.
Step 4	**server name** *server-name* **Example:** `Device(config-sg-tacacs+)# server name server1`	Specifies an IPv6 TACACS+ server.
Step 5	**server-private** {*ip-address* | *name* | *ipv6-address*} [**nat**] [**single-connection**] [**port** *port-number*] [**timeout** *seconds*] [**key** [**0** | **7**] *string*] **Example:** `Device(config-sg-tacacs+)# server-private 2001:DB8:3333:4::5 port 19 key key1`	Configures the IPv6 address of the private TACACS+ server for the group server.

Configuration Examples for TACACS+ over IPv6

Example: Configuring TACACS+ Server over IPv6

```
Device# show tacacs

          Tacacs+ Server:          server1
          Server Address:          FE80::200:F8FF:FE21:67CF
            Socket opens:          0
           Socket closes:          0
           Socket aborts:          0
           Socket errors:          0
        Socket Timeouts:           0
  Failed Connect Attempts:         0
```

```
Total Packets Sent:          0
Total Packets Recv:          0
```

Additional References

Related Documents

Related Topic	Document Title
IPv6 addressing and connectivity	*IPv6 Configuration Guide*
Commands	Cisco IOS Master Command List, All Releases
IPv6 commands	Cisco IOS IPv6 Command Reference
IPv6 features	CiscoIOS_IPv6_Feature_Mapping

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for TACACS+ over IPv6

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 20: Feature Information for TACACS+ over IPv6

Feature Name	Releases	Feature Information
TACACS+ over IPv6	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE Cisco IOS XE Release 3.6E	The TACACS+ over IPv6 feature allows you to configure an IPv6 server to use the TACACS+ security protocol. In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches In Cisco IOS XE Release 3.6E, this feature is supported on Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **aaa group server tacacs+**, **address ipv6 (TACACS+)**, **ipv6 tacacs source-interface**, **key (TACACS+)**, **port (TACACS+)**, **send-nat-address**, **server name (IPv6 TACACS+)**, **server-private (TACACS+)**, **single-connection**, **tacacs server**, **timeout (TACACS+)**.