



Configuring Simple Network Management Protocol

- [Prerequisites for SNMP, on page 1](#)
- [Restrictions for SNMP, on page 3](#)
- [Information About SNMP, on page 3](#)
- [How to Configure SNMP, on page 7](#)
- [Monitoring SNMP Status, on page 24](#)
- [SNMP Examples, on page 24](#)
- [Additional References, on page 25](#)
- [Feature History and Information for Simple Network Management Protocol, on page 26](#)

Prerequisites for SNMP

Supported SNMP Versions

This software release supports the following SNMP versions:

- **SNMPv1**—The Simple Network Management Protocol, a Full Internet Standard, defined in RFC 1157.
- **SNMPv2C** replaces the Party-based Administrative and Security Framework of SNMPv2Classic with the community-string-based Administrative Framework of SNMPv2C while retaining the bulk retrieval and improved error handling of SNMPv2Classic. It has these features:
 - **SNMPv2**—Version 2 of the Simple Network Management Protocol, a Draft Internet Standard, defined in RFCs 1902 through 1907.
 - **SNMPv2C**—The community-string-based Administrative Framework for SNMPv2, an Experimental Internet Protocol defined in RFC 1901.
- **SNMPv3**—Version 3 of the SNMP is an interoperable standards-based protocol defined in RFCs 2273 to 2275. SNMPv3 provides secure access to devices by authenticating and encrypting packets over the network and includes these security features:
 - **Message integrity**—Ensures that a packet was not tampered with in transit.
 - **Authentication**—Determines that the message is from a valid source.

- Encryption—Mixes the contents of a package to prevent it from being read by an unauthorized source.



Note To select encryption, enter the **priv** keyword.

Both SNMPv1 and SNMPv2C use a community-based form of security. The community of managers able to access the agent's MIB is defined by an IP address access control list and password.

SNMPv2C includes a bulk retrieval function and more detailed error message reporting to management stations. The bulk retrieval function retrieves tables and large quantities of information, minimizing the number of round-trips required. The SNMPv2C improved error-handling includes expanded error codes that distinguish different kinds of error conditions; these conditions are reported through a single error code in SNMPv1. Error return codes in SNMPv2C report the error type.

SNMPv3 provides for both security models and security levels. A security model is an authentication strategy set up for a user and the group within which the user resides. A security level is the permitted level of security within a security model. A combination of the security level and the security model determine which security method is used when handling an SNMP packet. Available security models are SNMPv1, SNMPv2C, and SNMPv3.

The following table identifies characteristics and compares different combinations of security models and levels:

Table 1: SNMP Security Models and Levels

| Model | Level | Authentication | Encryption | Result |
|---------|--------------|---|------------|---|
| SNMPv1 | noAuthNoPriv | Community string | No | Uses a community string match for authentication. |
| SNMPv2C | noAuthNoPriv | Community string | No | Uses a community string match for authentication. |
| SNMPv3 | noAuthNoPriv | Username | No | Uses a username match for authentication. |
| SNMPv3 | authNoPriv | Message Digest 5 (MD5) or Secure Hash Algorithm (SHA) | No | Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms. |

| Model | Level | Authentication | Encryption | Result |
|--------|----------|----------------|--|---|
| SNMPv3 | authPriv | MD5 or SHA | Data Encryption Standard (DES) or Advanced Encryption Standard (AES) | <p>Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms.</p> <p>Allows specifying the User-based Security Model (USM) with these encryption algorithms:</p> <ul style="list-style-type: none"> • DES 56-bit encryption in addition to authentication based on the CBC-DES (DES-56) standard. • 3DES 168-bit encryption • AES 128-bit, 192-bit, or 256-bit encryption |

You must configure the SNMP agent to use the SNMP version supported by the management station. Because an agent can communicate with multiple managers, you can configure the software to support communications using SNMPv1, SNMPv2C, or SNMPv3.

Restrictions for SNMP

Version Restrictions

- SNMPv1 does not support informs.

Information About SNMP

SNMP Overview

SNMP is an application-layer protocol that provides a message format for communication between managers and agents. The SNMP system consists of an SNMP manager, an SNMP agent, and a management information

base (MIB). The SNMP manager can be part of a network management system (NMS) such as Cisco Prime Infrastructure. The agent and MIB reside on the device. To configure SNMP on the device, you define the relationship between the manager and the agent.

The SNMP agent contains MIB variables whose values the SNMP manager can request or change. A manager can get a value from an agent or store a value into the agent. The agent gathers data from the MIB, the repository for information about device parameters and network data. The agent can also respond to a manager's requests to get or set data.

An agent can send unsolicited traps to the manager. Traps are messages alerting the SNMP manager to a condition on the network. Traps can mean improper user authentication, restarts, link status (up or down), MAC address tracking, closing of a TCP connection, loss of connection to a neighbor, or other significant events.

SNMP Manager Functions

The SNMP manager uses information in the MIB to perform the operations described in the following table:

Table 2: SNMP Operations

| Operation | Description |
|-------------------------------|---|
| get-request | Retrieves a value from a specific variable. |
| get-next-request | Retrieves a value from a variable within a table. ¹ |
| get-bulk-request ² | Retrieves large blocks of data, such as multiple rows in a table, that would otherwise require the transmission of many small blocks of data. |
| get-response | Replies to a get-request, get-next-request, and set-request sent by an NMS. |
| set-request | Stores a value in a specific variable. |
| trap | An unsolicited message sent by an SNMP agent to an SNMP manager when some event has occurred. |

¹ With this operation, an SNMP manager does not need to know the exact variable name. A sequential search is performed to find the needed variable from within a table.

² The get-bulk command only works with SNMPv2 or later.

SNMP Agent Functions

The SNMP agent responds to SNMP manager requests as follows:

- Get a MIB variable—The SNMP agent begins this function in response to a request from the NMS. The agent retrieves the value of the requested MIB variable and responds to the NMS with that value.
- Set a MIB variable—The SNMP agent begins this function in response to a message from the NMS. The SNMP agent changes the value of the MIB variable to the value requested by the NMS.

The SNMP agent also sends unsolicited trap messages to notify an NMS that a significant event has occurred on the agent. Examples of trap conditions include, but are not limited to, when a port or module goes up or down, when spanning-tree topology changes occur, and when authentication failures occur.

SNMP Community Strings

SNMP community strings authenticate access to MIB objects and function as embedded passwords. In order for the NMS to access the device, the community string definitions on the NMS must match at least one of the three community string definitions on the device.

A community string can have one of the following attributes:

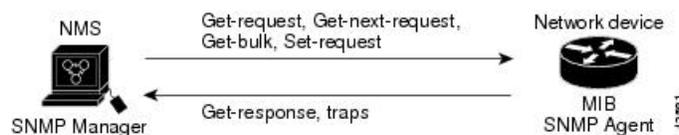
- Read-only (RO)—Gives all objects in the MIB except the community strings read access to authorized management stations, but does not allow write access.
- Read-write (RW)—Gives all objects in the MIB read and write access to authorized management stations, but does not allow access to the community strings.
- When a cluster is created, the command device manages the exchange of messages among member devices and the SNMP application. The Network Assistant software appends the member device number (@esN, where N is the device number) to the first configured RW and RO community strings on the command device and propagates them to the member devices.

SNMP MIB Variables Access

An example of an NMS is the Cisco Prime Infrastructure network management software. Cisco Prime Infrastructure 2.0 software uses the device MIB variables to set device variables and to poll devices on the network for specific information. The results of a poll can be displayed as a graph and analyzed to troubleshoot internetworking problems, increase network performance, verify the configuration of devices, monitor traffic loads, and more.

As shown in the figure, the SNMP agent gathers data from the MIB. The agent can send traps, or notification of certain events, to the SNMP manager, which receives and processes the traps. Traps alert the SNMP manager to a condition on the network such as improper user authentication, restarts, link status (up or down), MAC address tracking, and so forth. The SNMP agent also responds to MIB-related queries sent by the SNMP manager in *get-request*, *get-next-request*, and *set-request* format.

Figure 1: SNMP Network



SNMP Notifications

SNMP allows the device to send notifications to SNMP managers when particular events occur. SNMP notifications can be sent as traps or inform requests. In command syntax, unless there is an option in the command to select either traps or informs, the keyword traps refers to either traps or informs, or both. Use the **snmp-server host** command to specify whether to send SNMP notifications as traps or informs.



Note SNMPv1 does not support informs.

Traps are unreliable because the receiver does not send an acknowledgment when it receives a trap, and the sender cannot determine if the trap was received. When an SNMP manager receives an inform request, it acknowledges the message with an SNMP response protocol data unit (PDU). If the sender does not receive a response, the inform request can be sent again. Because they can be resent, informs are more likely than traps to reach their intended destination.

The characteristics that make informs more reliable than traps also consume more resources in the device and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request is held in memory until a response is received or the request times out. Traps are sent only once, but an inform might be resent or retried several times. The retries increase traffic and contribute to a higher overhead on the network. Therefore, traps and informs require a trade-off between reliability and resources. If it is important that the SNMP manager receive every notification, use inform requests. If traffic on the network or memory in the device is a concern and notification is not required, use traps.

SNMP ifIndex MIB Object Values

The SNMP agent's IF-MIB module comes up shortly after reboot. As various physical interface drivers are initialized they register with the IF-MIB module, essentially saying "Give me an ifIndex number". The IF-MIB module assigns the next available ifIndex number on a first-come-first-served basis. That is, minor differences in driver initialization order from one reboot to another can result in the same physical interface getting a different ifIndex number than it had before the reboot (unless ifIndex persistency is enabled of course).

Default SNMP Configuration

| Feature | Default Setting |
|------------------------|---|
| SNMP agent | Disabled ³ . |
| SNMP trap receiver | None configured. |
| SNMP traps | None enabled except the trap for TCP connections (tty). |
| SNMP version | If no version keyword is present, the default is Version 1. |
| SNMPv3 authentication | If no keyword is entered, the default is the noauth (noAuthNoPriv) security level. |
| SNMP notification type | If no type is specified, all notifications are sent. |

³ This is the default when the device starts and the startup configuration does not have any **snmp-server** global configuration commands.

SNMP Configuration Guidelines

If the device starts and the device startup configuration has at least one **snmp-server** global configuration command, the SNMP agent is enabled.

An SNMP *group* is a table that maps SNMP users to SNMP views. An SNMP *user* is a member of an SNMP group. An SNMP *host* is the recipient of an SNMP trap operation. An SNMP *engine ID* is a name for the local or remote SNMP engine.

When configuring SNMP, follow these guidelines:

- When configuring an SNMP group, do not specify a notify view. The **snmp-server host** global configuration command auto-generates a notify view for the user and then adds it to the group associated with that user. Modifying the group's notify view affects all users associated with that group.
- To configure a remote user, specify the IP address or port number for the remote SNMP agent of the device where the user resides.
- Before you configure remote users for a particular agent, configure the SNMP engine ID, using the **snmp-server engineID** global configuration command with the **remote** option. The remote agent's SNMP engine ID and user password are used to compute the authentication and privacy digests. If you do not configure the remote engine ID first, the configuration command fails.
- When configuring SNMP informs, you need to configure the SNMP engine ID for the remote agent in the SNMP database before you can send proxy requests or informs to it.
- If a local user is not associated with a remote host, the device does not send informs for the **auth** (authNoPriv) and the **priv** (authPriv) authentication levels.
- Changing the value of the SNMP engine ID has significant results. A user's password (entered on the command line) is converted to an MD5 or SHA security digest based on the password and the local engine ID. The command-line password is then destroyed, as required by RFC 2274. Because of this deletion, if the value of the engine ID changes, the security digests of SNMPv3 users become invalid, and you need to reconfigure SNMP users by using the **snmp-server user** *username* global configuration command. Similar restrictions require the reconfiguration of community strings when the engine ID changes.

How to Configure SNMP

Disabling the SNMP Agent

The **no snmp-server** global configuration command disables all running versions (Version 1, Version 2C, and Version 3) of the SNMP agent on the device. You reenables all versions of the SNMP agent by the first **snmp-server** global configuration command that you enter. There is no Cisco IOS command specifically designated for enabling SNMP.

Follow these steps to disable the SNMP agent.

Before you begin

The SNMP Agent must be enabled before it can be disabled. The SNMP agent is enabled by the first **snmp-server** global configuration command entered on the device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no snmp-server**
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | no snmp-server Example: Device(config)# no snmp-server | Disables the SNMP agent operation. |
| Step 4 | end Example: Device(config)# end | Returns to privileged EXEC mode. |
| Step 5 | show running-config Example: Device# show running-config | Verifies your entries. |
| Step 6 | copy running-config startup-config Example: Device# copy running-config startup-config | (Optional) Saves your entries in the configuration file. |

Configuring Community Strings

You use the SNMP community string to define the relationship between the SNMP manager and the agent. The community string acts like a password to permit access to the agent on the device. Optionally, you can specify one or more of these characteristics associated with the string:

- An access list of IP addresses of the SNMP managers that are permitted to use the community string to gain access to the agent
- A MIB view, which defines the subset of all MIB objects accessible to the given community
- Read and write or read-only permission for the MIB objects accessible to the community

Follow these steps to configure a community string on the device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server community** *string* [**view** *view-name*] [**ro** | **rw**] [*access-list-number*]
4. **access-list** *access-list-number* {**deny** | **permit**} *source* [*source-wildcard*]
5. **end**
6. **show running-config**
7. **copy running-config startup-config**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | snmp-server community <i>string</i> [view <i>view-name</i>] [ro rw] [<i>access-list-number</i>] Example: Device(config)# snmp-server community comaccess ro 4 | Configures the community string. <p>Note The @ symbol is used for delimiting the context information. Avoid using the @ symbol as part of the SNMP community string when configuring this command.</p> <ul style="list-style-type: none"> • For <i>string</i>, specify a string that acts like a password and permits access to the SNMP protocol. You can configure one or more community strings of any length. • (Optional) For view, specify the view record accessible to the community. • (Optional) Specify either read-only (ro) if you want authorized management stations to retrieve MIB objects, or specify read-write (rw) if you want authorized management stations to retrieve and modify MIB objects. By default, the community string permits read-only access to all objects. • (Optional) For <i>access-list-number</i>, enter an IP standard access list numbered from 1 to 99 and 1300 to 1999. |

| | Command or Action | Purpose |
|---------------|---|---|
| Step 4 | <p>access-list <i>access-list-number</i> {deny permit} <i>source</i> [<i>source-wildcard</i>]</p> <p>Example:</p> <pre>Device(config)# access-list 4 deny any</pre> | <p>(Optional) If you specified an IP standard access list number in Step 3, then create the list, repeating the command as many times as necessary.</p> <ul style="list-style-type: none"> For <i>access-list-number</i>, enter the access list number specified in Step 3. The deny keyword denies access if the conditions are matched. The permit keyword permits access if the conditions are matched. For <i>source</i>, enter the IP address of the SNMP managers that are permitted to use the community string to gain access to the agent. (Optional) For <i>source-wildcard</i>, enter the wildcard bits in dotted decimal notation to be applied to the source. Place ones in the bit positions that you want to ignore. <p>Recall that the access list is always terminated by an implicit deny statement for everything.</p> |
| Step 5 | <p>end</p> <p>Example:</p> <pre>Device(config)# end</pre> | Returns to privileged EXEC mode. |
| Step 6 | <p>show running-config</p> <p>Example:</p> <pre>Device# show running-config</pre> | Verifies your entries. |
| Step 7 | <p>copy running-config startup-config</p> <p>Example:</p> <pre>Device# copy running-config startup-config</pre> | (Optional) Saves your entries in the configuration file. |

What to do next

To disable access for an SNMP community, set the community string for that community to the null string (do not enter a value for the community string).

To remove a specific community string, use the **no snmp-server** community string global configuration command.

You can specify an identification name (engine ID) for the local or remote SNMP server engine on the device. You can configure an SNMP server group that maps SNMP users to SNMP views, and you can add new users to the SNMP group.

Configuring SNMP Groups and Users

You can specify an identification name (engine ID) for the local or remote SNMP server engine on the device. You can configure an SNMP server group that maps SNMP users to SNMP views, and you can add new users to the SNMP group.

Follow these steps to configure SNMP groups and users on the device.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server engineID** { *local engineid-string* | *remote ip-address* [**udp-port** *port-number*] *engineid-string* }
4. **snmp-server group** *group-name* { **v1** | **v2c** | **v3** { **auth** | **noauth** | **priv** } } [**read** *readview*] [**write** *writeview*] [**notify** *notifyview*] [**access** *access-list*]
5. **snmp-server user** *username* *group-name* { **remote** *host* [**udp-port** *port*] } { **v1** [**access** *access-list*] | **v2c** [**access** *access-list*] | **v3** [**encrypted**] [**access** *access-list*] [**auth** { **md5** | **sha** } *auth-password*] } [**priv** { **des** | **3des** | **aes** { **128** | **192** | **256** } } *priv-password*]
6. **end**
7. **show running-config**
8. **copy running-config startup-config**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | snmp-server engineID { <i>local engineid-string</i> <i>remote ip-address</i> [udp-port <i>port-number</i>] <i>engineid-string</i> } Example: Device(config)# snmp-server engineID local 1234 | Configures a name for either the local or remote copy of SNMP. <ul style="list-style-type: none"> • The <i>engineid-string</i> is a 24-character ID string with the name of the copy of SNMP. You need not specify the entire 24-character engine ID if it has trailing zeros. Specify only the portion of the engine ID up to the point where only zeros remain in the value. The Step Example configures an engine ID of 123400000000000000000000. • If you select remote, specify the <i>ip-address</i> of the device that contains the remote copy of SNMP and the |

| | Command or Action | Purpose |
|---------------|--|--|
| | | optional User Datagram Protocol (UDP) port on the remote device. The default is 162. |
| Step 4 | <p>snmp-server group <i>group-name</i> { v1 v2c v3 { auth noauth priv } } [read <i>readview</i>] [write <i>writeview</i>] [notify <i>notifyview</i>] [access <i>access-list</i>]</p> <p>Example:</p> <pre>Device(config)# snmp-server group public v2c access lmnop</pre> | <p>Configures a new SNMP group on the remote device.</p> <p>For <i>group-name</i>, specify the name of the group.</p> <p>Specify one of the following security models:</p> <ul style="list-style-type: none"> • v1 is the least secure of the possible security models. • v2c is the second least secure model. It allows transmission of informs and integers twice the normal width. • v3, the most secure, requires you to select one of the following authentication levels: <ul style="list-style-type: none"> auth—Enables the Message Digest 5 (MD5) and the Secure Hash Algorithm (SHA) packet authentication. noauth—Enables the noAuthNoPriv security level. This is the default if no keyword is specified. priv—Enables Data Encryption Standard (DES) packet encryption (also called privacy). <p>(Optional) Enter read <i>readview</i> with a string (not to exceed 64 characters) that is the name of the view in which you can only view the contents of the agent.</p> <p>(Optional) Enter write <i>writeview</i> with a string (not to exceed 64 characters) that is the name of the view in which you enter data and configure the contents of the agent.</p> <p>(Optional) Enter notify <i>notifyview</i> with a string (not to exceed 64 characters) that is the name of the view in which you specify a notify, inform, or trap.</p> <p>(Optional) Enter access <i>access-list</i> with a string (not to exceed 64 characters) that is the name of the access list.</p> |
| Step 5 | <p>snmp-server user <i>username</i> <i>group-name</i> { remote <i>host</i> [udp-port <i>port</i>] } { v1 [access <i>access-list</i>] v2c [access <i>access-list</i>] v3 [encrypted] [access <i>access-list</i>] [auth { md5 sha } <i>auth-password</i>] } [priv { des 3des aes { 128 192 256 } } <i>priv-password</i>]</p> <p>Example:</p> <pre>Device(config)# snmp-server user Pat public v2c</pre> | <p>Adds a new user for an SNMP group.</p> <p>The <i>username</i> is the name of the user on the host that connects to the agent.</p> <p>The <i>group-name</i> is the name of the group to which the user is associated.</p> <p>Enter remote to specify a remote SNMP entity to which the user belongs and the hostname or IP address of that entity with the optional UDP port number. The default is 162.</p> <p>Enter the SNMP version number (v1, v2c, or v3). If you enter v3, you have these additional options:</p> |

| | Command or Action | Purpose |
|--------|---|---|
| | | <ul style="list-style-type: none"> • encrypted specifies that the password appears in encrypted format. This keyword is available only when the v3 keyword is specified. • auth is an authentication level setting session that can be either the HMAC-MD5-96 (md5) or the HMAC-SHA-96 (sha) authentication level and requires a password string <i>auth-password</i> (not to exceed 64 characters). <p>If you enter v3 you can also configure a private (priv) encryption algorithm and password string <i>priv-password</i> using the following keywords (not to exceed 64 characters):</p> <ul style="list-style-type: none"> • priv specifies the User-based Security Model (USM). • des specifies the use of the 56-bit DES algorithm. • 3des specifies the use of the 168-bit DES algorithm. • aes specifies the use of the DES algorithm. You must select either 128-bit, 192-bit, or 256-bit encryption. <p>(Optional) Enter access <i>access-list</i> with a string (not to exceed 64 characters) that is the name of the access list.</p> |
| Step 6 | end Example: <pre>Device(config)# end</pre> | Returns to privileged EXEC mode. |
| Step 7 | show running-config Example: <pre>Device# show running-config</pre> | Verifies your entries. |
| Step 8 | copy running-config startup-config Example: <pre>Device# copy running-config startup-config</pre> | (Optional) Saves your entries in the configuration file. |

Configuring SNMP Notifications

A trap manager is a management station that receives and processes traps. Traps are system alerts that the device generates when certain events occur. By default, no trap manager is defined, and no traps are sent. Devices running this Cisco IOS release can have an unlimited number of trap managers.



Note Many commands use the word **traps** in the command syntax. Unless there is an option in the command to select either traps or informs, the keyword **traps** refers to traps, informs, or both. Use the **snmp-server host** global configuration command to specify whether to send SNMP notifications as traps or informs.

You can use the **snmp-server enable traps** global configuration command combined with the **snmp-server host** global configuration command for a specific host to receive the notification types listed in the following table. You can enable any or all of these traps and configure a trap manager to receive them.



Note The **snmp-server enable traps** command does not support traps for local-authentication on your device.

Table 3: Device Notification Types

| Notification Type Keyword | Description |
|---------------------------|---|
| bridge | Generates STP bridge MIB traps. |
| cluster | Generates a trap when the cluster configuration changes. |
| config | Generates a trap for SNMP configuration changes. |
| copy-config | Generates a trap for SNMP copy configuration changes. |
| cpu threshold | Allow CPU-related traps. |
| entity | Generates a trap for SNMP entity changes. |
| envmon | Generates environmental monitor traps. You can enable any or all of these environmental traps: fan, shutdown, status, supply, temperature. |
| flash | Generates SNMP FLASH notifications. In a device stack, you can optionally enable notification for flash insertion or removal, which would cause a trap to be issued whenever a device in the stack is removed or inserted (physical removal, power cycle, or reload). |
| fru-ctrl | Generates entity field-replaceable unit (FRU) control traps. In the device stack, this trap refers to the insertion or removal of a device in the stack. |
| hsrp | Generates a trap for Hot Standby Router Protocol (HSRP) changes. |
| ipmulticast | Generates a trap for IP multicast routing changes. |
| mac-notification | Generates a trap for MAC address notifications. |
| ospf | Generates a trap for Open Shortest Path First (OSPF) changes. You can enable any or all of these traps: Cisco specific, errors, link-state advertisement, rate limit, retransmit, and state changes. |
| pim | Generates a trap for Protocol-Independent Multicast (PIM) changes. You can enable any or all of these traps: invalid PIM messages, neighbor changes, and rendezvous point (RP)-mapping changes. |

| Notification Type Keyword | Description |
|---------------------------|--|
| port-security | Generates SNMP port security traps. You can also set a maximum trap rate per second. The range is from 0 to 1000; the default is 0, which means that there is no rate limit. Note When you configure a trap by using the notification type port-security , configure the port security trap first, and then configure the port security trap rate: 1. snmp-server enable traps port-security 2. snmp-server enable traps port-security trap-rate rate |
| snmp | Generates a trap for SNMP-type notifications for authentication, cold start, warm start, link up or link down. |
| storm-control | Generates a trap for SNMP storm-control. You can also set a maximum trap rate per minute. The range is from 0 to 1000; the default is 0 (no limit is imposed; a trap is sent at every occurrence). |
| stp | Generates SNMP STP Extended MIB traps. |
| syslog | Generates SNMP syslog traps. |
| tty | Generates a trap for TCP connections. This trap is enabled by default. |
| vlan-membership | Generates a trap for SNMP VLAN membership changes. |
| vlancreate | Generates SNMP VLAN created traps. |
| vlandelete | Generates SNMP VLAN deleted traps. |
| vtp | Generates a trap for VLAN Trunking Protocol (VTP) changes. |

Follow these steps to configure the device to send traps or informs to a host.

SUMMARY STEPS

- enable**
- configure terminal**
- snmp-server engineID remote ip-address engineid-string**
- snmp-server user username group-name {remote host [udp-port port]} {v1 [access access-list] | v2c [access access-list] | v3 [encrypted] [access access-list] [auth {md5 | sha} auth-password]}**
- snmp-server group group-name {v1 | v2c | v3 {auth | noauth | priv}} [read readview] [write writeview] [notify notifyview] [access access-list]**
- snmp-server host host-addr [informs | traps] [version {1 | 2c | 3 {auth | noauth | priv}}] community-string [notification-type]**
- snmp-server enable traps notification-types**
- snmp-server trap-source interface-id**
- snmp-server queue-length length**
- snmp-server trap-timeout seconds**
- end**
- show running-config**

13. copy running-config startup-config

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | snmp-server engineID remote ip-address engineid-string Example: Device (config)# snmp-server engineID remote 192.180.1.27 00000063000100a1c0b4011b | Specifies the engine ID for the remote host. |
| Step 4 | snmp-server user username group-name {remote host [udp-port port]} {v1 [access access-list] v2c [access access-list] v3 [encrypted] [access access-list] [auth {md5 sha} auth-password]} Example: Device (config)# snmp-server user Pat public v2c | Configures an SNMP user to be associated with the remote host created in Step 3. Note You cannot configure a remote user for an address without first configuring the engine ID for the remote host. Otherwise, you receive an error message, and the command is not executed. |
| Step 5 | snmp-server group group-name {v1 v2c v3 {auth noauth priv}} [read readview] [write writeview] [notify notifyview] [access access-list] Example: Device (config)# snmp-server group public v2c access lmnop | Configures an SNMP group. |
| Step 6 | snmp-server host host-addr [informs traps] [version {1 2c 3 {auth noauth priv}}] community-string [notification-type] Example: Device (config)# snmp-server host 203.0.113.1 comaccess snmp | Specifies the recipient of an SNMP trap operation. For <i>host-addr</i> , specify the name or Internet address of the host (the targeted recipient). (Optional) Specify traps (the default) to send SNMP traps to the host. (Optional) Specify informs to send SNMP informs to the host. (Optional) Specify the SNMP version (1, 2c, or 3). SNMPv1 does not support informs. |

| | Command or Action | Purpose |
|----------------|---|--|
| | | <p>(Optional) For Version 3, select authentication level auth, noauth, or priv.</p> <p>Note The priv keyword is available only when the cryptographic software image is installed.</p> <p>For <i>community-string</i>, when version 1 or version 2c is specified, enter the password-like community string sent with the notification operation. When version 3 is specified, enter the SNMPv3 username.</p> <p>The @ symbol is used for delimiting the context information. Avoid using the @ symbol as part of the SNMP community string when configuring this command.</p> <p>(Optional) For <i>notification-type</i>, use the keywords listed in the table above. If no type is specified, all notifications are sent.</p> |
| Step 7 | <p>snmp-server enable traps <i>notification-types</i></p> <p>Example:</p> <pre>Device(config)# snmp-server enable traps snmp</pre> | <p>Enables the device to send traps or informs and specifies the type of notifications to be sent. For a list of notification types, see the table above, or enter snmp-server enable traps ?</p> <p>To enable multiple types of traps, you must enter a separate snmp-server enable traps command for each trap type.</p> <p>Note When you configure a trap by using the notification type port-security, configure the port security trap first, and then configure the port security trap rate:</p> <ol style="list-style-type: none"> a. snmp-server enable traps port-security b. snmp-server enable traps port-security trap-rate <i>rate</i> |
| Step 8 | <p>snmp-server trap-source <i>interface-id</i></p> <p>Example:</p> <pre>Device(config)# snmp-server trap-source gigabitethernet 1/0/1</pre> | <p>(Optional) Specifies the source interface, which provides the IP address for the trap message. This command also sets the source IP address for informs.</p> |
| Step 9 | <p>snmp-server queue-length <i>length</i></p> <p>Example:</p> <pre>Device(config)# snmp-server queue-length 20</pre> | <p>(Optional) Establishes the message queue length for each trap host. The range is 1 to 5000; the default is 10.</p> |
| Step 10 | <p>snmp-server trap-timeout <i>seconds</i></p> <p>Example:</p> <pre>Device(config)# snmp-server trap-timeout 60</pre> | <p>(Optional) Defines how often to resend trap messages. The range is 1 to 1000; the default is 30 seconds.</p> |

| | Command or Action | Purpose |
|---------|---|--|
| Step 11 | end Example: Device(config)# end | Returns to privileged EXEC mode. |
| Step 12 | show running-config Example: Device# show running-config | Verifies your entries. |
| Step 13 | copy running-config startup-config Example: Device# copy running-config startup-config | (Optional) Saves your entries in the configuration file. |

What to do next

The **snmp-server host** command specifies which hosts receive the notifications. The **snmp-server enable traps** command globally enables the method for the specified notification (for traps and informs). To enable a host to receive an inform, you must configure an **snmp-server host informs** command for the host and globally enable informs by using the **snmp-server enable traps** command.

To remove the specified host from receiving traps, use the **no snmp-server host** *host* global configuration command. The **no snmp-server host** command with no keywords disables traps, but not informs, to the host. To disable informs, use the **no snmp-server host informs** global configuration command. To disable a specific trap type, use the **no snmp-server enable traps** *notification-types* global configuration command.

Setting the Agent Contact and Location Information

Follow these steps to set the system contact and location of the SNMP agent so that these descriptions can be accessed through the configuration file.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server contact** *text*
4. **snmp-server location** *text*
5. **end**
6. **show running-config**
7. **copy running-config startup-config**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|--|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | snmp-server contact <i>text</i> Example: Device(config)# snmp-server contact Dial System Operator at beeper 21555 | Sets the system contact string. |
| Step 4 | snmp-server location <i>text</i> Example: Device(config)# snmp-server location Building 3/Room 222 | Sets the system location string. |
| Step 5 | end Example: Device(config)# end | Returns to privileged EXEC mode. |
| Step 6 | show running-config Example: Device# show running-config | Verifies your entries. |
| Step 7 | copy running-config startup-config Example: Device# copy running-config startup-config | (Optional) Saves your entries in the configuration file. |

Limiting TFTP Servers Used Through SNMP

Follow these steps to limit the TFTP servers used for saving and loading configuration files through SNMP to the servers specified in an access list.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server tftp-server-list** *access-list-number*
4. **access-list** *access-list-number* {**deny** | **permit**} *source* [*source-wildcard*]
5. **end**
6. **show running-config**
7. **copy running-config startup-config**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | snmp-server tftp-server-list <i>access-list-number</i> Example: Device(config)# snmp-server tftp-server-list 44 | Limits the TFTP servers used for configuration file copies through SNMP to the servers in the access list. For <i>access-list-number</i> , enter an IP standard access list numbered from 1 to 99 and 1300 to 1999. |
| Step 4 | access-list <i>access-list-number</i> { deny permit } <i>source</i> [<i>source-wildcard</i>] Example: Device(config)# access-list 44 permit 10.1.1.2 | Creates a standard access list, repeating the command as many times as necessary. For <i>access-list-number</i> , enter the access list number specified in Step 3. The deny keyword denies access if the conditions are matched. The permit keyword permits access if the conditions are matched. For <i>source</i> , enter the IP address of the TFTP servers that can access the device. (Optional) For <i>source-wildcard</i> , enter the wildcard bits, in dotted decimal notation, to be applied to the source. Place ones in the bit positions that you want to ignore. The access list is always terminated by an implicit deny statement for everything. |
| Step 5 | end Example: | Returns to privileged EXEC mode. |

| | Command or Action | Purpose |
|---------------|---|--|
| | Device(config)# end | |
| Step 6 | show running-config Example: Device# show running-config | Verifies your entries. |
| Step 7 | copy running-config startup-config Example: Device# copy running-config startup-config | (Optional) Saves your entries in the configuration file. |

Configuring Trap Flags for SNMP

SUMMARY STEPS

1. **configure terminal**
2. **trapflags ap { interfaceup | register }**
3. **trapflags client { dot11 | excluded }**
4. **trapflags dot11-security { ids-sig-attack | wep-decrypt-error }**
5. **trapflags mesh**
6. **trapflags rogueap**
7. **trapflags rrm-params { channels | tx-power }**
8. **trapflags rrm-profile { coverage | interference | load | noise }**
9. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 2 | trapflags ap { interfaceup register } Example: Device(config)# trapflags ap interfaceup | Enables sending AP-related traps. Use the no form of the command to disable the trap flags. <ul style="list-style-type: none"> • interfaceup– Enables trap when a Cisco AP interface (A or B) comes up. • register– Enables trap when a Cisco AP registers with a Cisco device. |

| | Command or Action | Purpose |
|---------------|--|--|
| Step 3 | trapflags client {dot11 excluded} Example: <pre>Device(config)# trapflags client excluded</pre> | Enables sending client-related dot11 traps. Use the no form of the command to disable the trap flags. <ul style="list-style-type: none"> • dot11– Enables Dot11 traps for clients. • excluded– Enables excluded traps for clients. |
| Step 4 | trapflags dot11-security {ids-sig-attack wep-decrypt-error} Example: <pre>Device(config)# trapflags dot11-security wep-decrypt-error</pre> | Enables sending 802.11 security-related traps. Use the no form of the command to disable the trap flags. <ul style="list-style-type: none"> • ids-sig-attack– Enables IDS signature attack traps. • wep-decrypt-error– Enables traps for WEP decrypt error for clients. |
| Step 5 | trapflags mesh Example: <pre>Device(config)# trapflags mesh</pre> | Enables trap for the mesh. Use the no form of the command to disable the trap flags. |
| Step 6 | trapflags rogueap Example: <pre>Device(config)# trapflags rogueap</pre> | Enables trap for rogue AP detection. Use the no form of the command to disable the trap flags. |
| Step 7 | trapflags rrm-params {channels tx-power} Example: <pre>Device(config)# trapflags rrm-params tx-power</pre> | Enables sending RRM-parameter update-related traps. Use the no form of the command to disable the trap flags. <ul style="list-style-type: none"> • channels– Enables trap when RF Manager automatically changes a channel number for the Cisco AP interface. • tx-power– Enables the trap when RF Manager automatically changes Tx-Power level for the Cisco AP interface. |
| Step 8 | trapflags rrm-profile {coverage interference load noise} Example: <pre>Device(config)# trapflags rrm-profile interference</pre> | Enables sending RRM-profile-related traps. Use the no form of the command to disable the trap flags. <ul style="list-style-type: none"> • coverage– Enables the trap when the coverage profile maintained by RF Manager fails. • interference– Enables the trap when the interference profile maintained by RF Manager fails. • load– Enables trap when the load profile maintained by RF Manager fails. • noise– Enables trap when the noise profile maintained by RF Manager fails. |

| | Command or Action | Purpose |
|--------|---|----------------------------------|
| Step 9 | <p>end</p> <p>Example:</p> <pre>Device(config)# end</pre> | Returns to privileged EXEC mode. |

Enabling SNMP Wireless Trap Notification

SUMMARY STEPS

1. **configure terminal**
2. **snmp-server enable traps wireless [AP | RRM | bsn80211SecurityTrap | bsnAPPParamUpdate | bsnAPPProfile | bsnAccessPoint | bsnMobileStation | bsnRogue | client | mfp | rogue]**
3. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | <p>configure terminal</p> <p>Example:</p> <pre>Device# configure terminal</pre> | Enters global configuration mode. |
| Step 2 | <p>snmp-server enable traps wireless [AP RRM bsn80211SecurityTrap bsnAPPParamUpdate bsnAPPProfile bsnAccessPoint bsnMobileStation bsnRogue client mfp rogue]</p> <p>Example:</p> <pre>Device(config)# snmp-server enable traps wireless AP</pre> | <p>Enables SNMP wireless trap notification.</p> <ul style="list-style-type: none"> • AP– Enables access point traps. • RRM– Enables RRM traps. • bsn80211SecurityTrap– Enables the security-related trap. • bsnAPPParamUpdate– Enables the trap for AP parameters that get updated. • bsnAPPProfile– Enables BSN AP profile traps. • bsnAccessPoint– Enables BSN access point traps. • bsnMobileStation– Controls wireless client traps. • bsnRogue– Enables BSN rogue-related traps. • client– Enables client traps. • mfp– Enables MFP traps. • rogue– Enables rogue-related traps. |

| | Command or Action | Purpose |
|--------|--|----------------------------------|
| Step 3 | end Example: Device(config) # end | Returns to privileged EXEC mode. |

Monitoring SNMP Status

To display SNMP input and output statistics, including the number of illegal community string entries, errors, and requested variables, use the **show snmp** privileged EXEC command. You also can use the other privileged EXEC commands listed in the table to display SNMP information.

Table 4: Commands for Displaying SNMP Information

| Command | Purpose |
|---------------------------|---|
| show snmp | Displays SNMP statistics. |
| | Displays information on the local SNMP engine and all remote engines that have been configured on the device. |
| show snmp group | Displays information on each SNMP group on the network. |
| show snmp pending | Displays information on pending SNMP requests. |
| show snmp sessions | Displays information on the current SNMP sessions. |
| show snmp user | Displays information on each SNMP user name in the SNMP users table. Note You must use this command to display SNMPv3 configuration information for auth noauth priv mode. This information is not displayed in the show running-config output. |

SNMP Examples

This example shows how to enable all versions of SNMP. The configuration permits any SNMP manager to access all objects with read-only permissions using the community string *public*. This configuration does not cause the device to send any traps.

```
Device(config) # snmp-server community public
```

This example shows how to permit any SNMP manager to access all objects with read-only permission using the community string *public*. The device also sends VTP traps to the hosts 192.180.1.111 and 192.180.1.33

using SNMPv1 and to the host 192.180.1.27 using SNMPv2C. The community string *public* is sent with the traps.

```
Device(config)# snmp-server community public
Device(config)# snmp-server enable traps vtp
Device(config)# snmp-server host 192.180.1.27 version 2c public
Device(config)# snmp-server host 192.180.1.111 version 1 public
Device(config)# snmp-server host 192.180.1.33 public
```

This example shows how to allow read-only access for all objects to members of access list 4 that use the *comaccess* community string. No other SNMP managers have access to any objects. SNMP Authentication Failure traps are sent by SNMPv2C to the host *cisco.com* using the community string *public*.

```
Device(config)# snmp-server community comaccess ro 4
Device(config)# snmp-server enable traps snmp authentication
Device(config)# snmp-server host cisco.com version 2c public
```

This example shows how to send Entity MIB traps to the host *cisco.com*. The community string is restricted. The first line enables the device to send Entity MIB traps in addition to any traps previously enabled. The second line specifies the destination of these traps and overwrites any previous **snmp-server** host commands for the host *cisco.com*.

```
Device(config)# snmp-server enable traps entity
Device(config)# snmp-server host cisco.com restricted entity
```

This example shows how to enable the device to send all traps to the host *myhost.cisco.com* using the community string *public*:

```
Device(config)# snmp-server enable traps
Device(config)# snmp-server host myhost.cisco.com public
```

This example shows how to associate a user with a remote host and to send **auth** (authNoPriv) authentication-level informs when the user enters global configuration mode:

```
Device(config)# snmp-server engineID remote 192.180.1.27 00000063000100a1c0b4011b
Device(config)# snmp-server group authgroup v3 auth
Device(config)# snmp-server user authuser authgroup remote 192.180.1.27 v3 auth md5 mypassword
Device(config)# snmp-server user authuser authgroup v3 auth md5 mypassword
Device(config)# snmp-server host 192.180.1.27 informs version 3 auth authuser config
Device(config)# snmp-server enable traps
Device(config)# snmp-server inform retries 0
```

Additional References

Related Documents

| Related Topic | Document Title |
|---------------|--|
| SNMP Commands | <i>Network Management Command Reference, Cisco IOS XE Release 3E</i> |

Error Message Decoder

| Description | Link |
|---|---|
| To help you research and resolve system error messages in this release, use the Error Message Decoder tool. | https://www.cisco.com/cgi-bin/Support/Errordecoder/index.cgi |

Standards and RFCs

| Standard/RFC | Title |
|--------------|-------|
| None | - |

MIBs

| MIB | MIBs Link |
|--------------------------------------|--|
| All supported MIBs for this release. | 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 |

Technical Assistance

| Description | Link |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | http://www.cisco.com/support |

Feature History and Information for Simple Network Management Protocol

| Release | Modification |
|--------------------|------------------------------|
| Cisco IOS XE 3.3SE | This feature was introduced. |