Configuring SNMP

This chapter contains the following sections:

Information About SNMP

The Simple Network Management Protocol (SNMP) is an application-layer protocol that provides a message format for communication between SNMP managers and agents. SNMP provides a standardized framework and a common language used for the monitoring and management of devices in a network.

SNMP Functional Overview

The SNMP framework consists of three parts:

- An SNMP manager—The system used to control and monitor the activities of network devices using SNMP.
- An SNMP agent—The software component within the managed device that maintains the data for the device and reports these data, as needed, to managing systems. Cisco NX-OS supports the agent and MIB. To enable the SNMP agent, you must define the relationship between the manager and the agent.
- A managed information base (MIB)—The collection of managed objects on the SNMP agent.

SNMP is defined in RFCs 3411 to 3418.

Note SNMP Role Based Access Control (RBAC) is not supported.

Cisco NX-OS supports SNMPv1, SNMPv2c, and SNMPv3. Both SNMPv1 and SNMPv2c use a community-based form of security.

SNMP Notifications

A key feature of SNMP is the ability to generate notifications from an SNMP agent. These notifications do not require that requests be sent from the SNMP manager. Notifications can indicate improper user authentication, restarts, the closing of a connection, loss of a connection to a neighbor router, or other significant events.

Cisco NX-OS generates SNMP notifications as either traps or informs. A trap is an asynchronous, unacknowledged message sent from the agent to the SNMP managers listed in the host receiver table. Informs are asynchronous messages sent from the SNMP agent to the SNMP manager which the manager must acknowledge receipt of.

Traps are less reliable than informs because the SNMP manager does not send any acknowledgment when it receives a trap. The Cisco NX-OS cannot determine if the trap was received. An SNMP manager that receives an inform request acknowledges the message with an SNMP response protocol data unit (PDU). If the Cisco NX-OS never receives a response, it can send the inform request again.

You can configure Cisco Nexus NX-OS to send notifications to multiple host receivers.

SNMPv3

SNMPv3 provides secure access to devices by a combination of authenticating and encrypting frames over the network. The security features provided in SNMPv3 are as follows:

- Message integrity—Ensures that a packet has not been tampered with while it was in-transit.
- Authentication—Determines the message is from a valid source.
- Encryption—Scrambles the packet contents to prevent it from being seen by unauthorized sources.

SNMPv3 provides for both security models and security levels. A security model is an authentication strategy that is set up for a user and the role in which the user resides. A security level is the permitted level of security within a security model. A combination of a security model and a security level determines which security mechanism is employed when handling an SNMP packet.

Security Models and Levels for SNMPv1, v2, v3

The security level determines if an SNMP message needs to be protected from disclosure and if the message needs to be authenticated. The various security levels that exist within a security model are as follows:

- noAuthNoPriv—Security level that does not provide authentication or encryption.
- authNoPriv—Security level that provides authentication but does not provide encryption.

- authPriv—Security level that provides both authentication and encryption.

Three security models are available: SNMPv1, SNMPv2c, and SNMPv3. The security model combined with the security level determine the security mechanism applied when the SNMP message is processed.

The following table identifies what the combinations of security models and levels mean.

Model	Level	Authentication	Encryption	What Happens
v1	noAuthNoPriv	Community string	No	Uses a community string match for authentication.
v2c	noAuthNoPriv	Community string	No	Uses a community string match for authentication.
v3	noAuthNoPriv	Username	No	Uses a username match for authentication.
v3	authNoPriv	HMAC-MD5 or HMAC-SHA	No	Provides authentication based on the Hash-Based Message Authentication Code (HMAC) Message Digest 5 (MD5) algorithm or the HMAC Secure Hash Algorithm (SHA).
v3	authPriv	HMAC-MD5 or HMAC-SHA	DES	Provides authentication based on the HMAC-MD5 or HMAC-SHA algorithms. Provides Data Encryption Standard (DES) 56-bit encryption in addition to authentication based on the Cipher Block Chaining (CBC) DES (DES-56) standard.

User-Based Security Model

SNMPv3 User-Based Security Model (USM) refers to SNMP message-level security and offers the following services:

- Message integrity—Ensures that messages have not been altered or destroyed in an unauthorized manner and that data sequences have not been altered to an extent greater than can occur nonmaliciously.
- Message origin authentication—Ensures that the claimed identity of the user on whose behalf received data was originated is confirmed.
- Message confidentiality—Ensures that information is not made available or disclosed to unauthorized individuals, entities, or processes.

SNMPv3 authorizes management operations only by configured users and encrypts SNMP messages

Cisco NX-OS uses two authentication protocols for SNMPv3:

- HMAC-MD5-96 authentication protocol
- HMAC-SHA-96 authentication protocol

The Cisco NX-OS uses Advanced Encryption Standard (AES) as one of the privacy protocols for SNMPv3 message encryption and conforms with RFC 3826.

The priv option offers a choice of DES or 128-bit AES encryption for SNMP security encryption. The priv option along with the aes-128 token indicates that this privacy password is for generating a 128-bit AES key.The AES priv password can have a minimum of eight characters. If the passphrases are specified in clear text, you can specify a maximum of 64 case-sensitive alphanumeric characters. If you use the localized key, you can specify a maximum of 130 characters.

Note For an SNMPv3 operation that uses the external AAA server, you must use AES for the privacy protocol in the user configuration on the external AAA server.

CLI and SNMP User Synchronization

SNMPv3 user management can be centralized at the Access Authentication and Accounting (AAA) server level. This centralized user management allows the SNMP agent in Cisco NX-OS to leverage the user authentication service of the AAA server. Once user authentication is verified, the SNMP PDUs are processed further. Additionally, the AAA server is also used to store user group names. SNMP uses the group names to apply the access/role policy that is locally available in the switch.

Any configuration changes made to the user group, role, or password results in database synchronization for both SNMP and AAA.

Cisco Nexus 1000V NX-OS synchronizes user configuration in the following ways:

- The authentication passphrase specified in the **snmp-server user** command becomes the password for the CLI user.
- The password specified in the **username** command becomes as the authentication and privacy passphrases for the SNMP user.
- If you delete a user using either SNMP or the CLI, the user is deleted for both SNMP and the CLI.
- User-role mapping changes are synchronized in SNMP and the CLI.
- Role changes (deletions or modifications) from the CLI are synchronized to SNMP.

Note When you configure passphrase/password in localized key/encrypted format, Cisco NX-OS does not synchronize the user information (password, roles, and so on).

Cisco NX-OS holds the synchronized user configuration for 60 minutes by default. See Modifying the AAA Synchronization Time, on page 12 for information on how to modify this default value.

Group-Based SNMP Access

Note Because group is a standard SNMP term used industry-wide, we refer to roles as groups in this SNMP section.

SNMP access rights are organized by groups. Each group in SNMP is similar to a role through the CLI. Each group is defined with read access or read-write access.

You can begin communicating with the agent once your username is created, your roles are set up by your administrator, and you are added to the roles.

High Availability

Stateless restarts for SNMP are supported. After a reboot or supervisor switchover, the running configuration is applied.

Guidelines and Limitations for SNMP

- Read-only access to some SNMP MIBs is supported. See the Cisco NX-OS MIB support list at the following URL for more information:

  http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

- SNMP Role Based Access Control (RBAC) is not supported.
- The SNMP set command is supported by the following Cisco MIBs:
  - CISCO-IMAGE-UPGRADE-MIB
  - CISCO-CONFIG-COPY-MIB
- The recommended SNMP polling interview time is 5 minutes.

Default Settings for SNMP

Parameters	Default
license notifications	enabled

Configuring SNMP

This section includes the following topics:

- Configuring SNMP
- Users Enforcing SNMP Message Encryption
- Creating SNMP Communities
- Configuring SNMP Notification Receivers
- Configuring the Notification Target User
- Enabling SNMP Notifications

- Disabling LinkUp/LinkDown Notifications on an Interface
- Enabling a One-time Authentication for SNMP over TCP
- Assigning the SNMP Switch Contact and Location Information
- Disabling SNMP
- Modifying the AAA Synchronization Time

Configuring SNMP Users

Before You Begin

Before beginning this procedure, you must be logged in to the CLI in EXEC mode.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Places you in global configuration mode.
Step 2	switch(config)# **snmp-server user** *name* [**auth** {**md5** | **sha**} *passphrase* [**auto**] [**priv** [**aes-128**] *passphrase*] [**engineID** *id*] [**localizedkey**]]	Configures an SNMP user with authentication and privacy parameters. The *passphrase* can be any case-sensitive, alphanumeric string up to 64 characters. If you use the **localizekey** keyword, the *passphrase* can be any case-sensitive, alphanumeric string up to 130 characters. The *name* argument is the name of a user who can access the SNMP engine. The **auth** keyword enables one-time authentication for SNMP over a TCP session. It is optional. The **md5** keyword specifies HMAC MD5 algorithm for authentication. It is optional. The **sha** keyword specifies HMAC SHA algorithm for authentication. It is optional. The **priv** keyword specifies encryption parameters for the user. It is optional. The **aes-128** keyword specifies a 128-byte AES algorithm for privacy. It is optional. The **engineID** keyword specifies the engineID for configuring the notification target user (for V3 informs). It is optional. The *id* is a 12-digit colon-separated decimal number.
Step 3	switch(config-callhome)# **show snmp user**	(Optional) Displays information about one or more SNMP users.

	Command or Action	Purpose
Step 4	switch(config-callhome)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# snmp-server user Admin auth sha abcd1234 priv abcdefgh
```

Enforcing SNMP Message Encryption for All Users

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server globalEnforcePriv**	Enforces SNMP message encryption for all users.

```
switch(config)# snmp-server globalEnforcePriv
```

Creating SNMP Communities

You can create SNMP communities for SNMPv1 or SNMPv2c.

Before You Begin

You must be in global configuration mode.

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server community** *name* {**ro** | **rw**}	Creates an SNMP community string.

```
switch(config)# snmp-server community public ro
```

Configuring SNMP Notification Receivers

Configuring the Notification Target User

You must configure a notification target user on the device to send SNMPv3 inform notifications to a notification host receiver

TheCisco Nexus 1000V uses the credentials of the notification target user to encrypt the SNMPv3 inform notification messages to the configured notification host receiver.

Note For authenticating and decrypting the received INFORM PDU, the notification host receiver should have the same user credentials as configured in Cisco Nexus 1000V to authenticate and decrypt the inform s

Before You Begin

You must be in global configuration mode.

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server user** *name* [**auth** {**md5** | **sha**} *passphrase* [**auto**] [**priv** [**aes-128**] *passphrase*] [**engineID** *id*]	Configures the notification target user with the specified engine ID for notification host receiver. The *id* is a 12-digit colon-separated decimal number.

```
switch(config)# snmp-server user NMS auth sha abcd1234 priv abcdefgh engineID
00:00:00:63:00:01:00:10:20:15:10:03
```

Enabling SNMP Notifications

You can enable or disable notifications. If you do not specify a notification name, Cisco Nexus 1000V enables all notifications.

The following table lists the commands that enable the notifications for Cisco Nexus 1000V MIBs.

Note The snmp-server enable traps command enables both traps and informs, depending on the configured notification host receivers.

MIB	Related Commands
All notifications	**snmp-server enable traps**
CISCO-AAA-SERVER-MIB	**snmp-server enable traps aaa**

MIB	Related Commands
ENITY-MIB	**snmp-server enable traps entity**
CISCO-ENTITY-FRU-CONTROL-MIB	**snmp-server enable traps entity fru**
CISCO-LICENSE-MGR-MIB	**snmp-server enable traps license**
IF-MIB	**snmp-server enable traps link**
CISCO-PSM-MIB	**snmp-server enable traps port-security**
SNMPv2-MIB	**snmp-server enable traps snmp** **snmp-server enable traps snmp authentication**

The license notifications are enabled by default. All other notifications are disabled by default.

Before You Begin

You must be in global configuration mode to enable the specified notification

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server enable traps**	Enables all SNMP notifications.
Step 2	switch(config)# **snmp-server enable traps aaa** [**server-state-change**]	Enables the AAA SNMP notifications.
Step 3	switch(config)# **snmp-server enable traps entity** [**fru**]	Enables the ENTITY-MIB SNMP notifications.
Step 4	switch(config)# **snmp-server enable traps license**	Enables the license SNMP notification.
Step 5	switch(config)# **snmp-server enable traps link**	Enables the link SNMP notifications.
Step 6	switch(config)# **snmp-server enable traps port-security**	Enables the port security SNMP notifications
Step 7	switch(config)# **snmp-server enable traps snmp** [**authentication**]	Enables the SNMP agent notifications.

Disabling LinkUp/LinkDown Notifications on an Interface

You can disable linkUp and linkDown notifications on an individual interface. You can use this limit notifications on flapping interface (an interface that transitions between up and down repeatedly).

Before You Begin

You must be in interface configuration mode to disable linkUp/linkDown notifications for the interface.

Procedure

	Command or Action	Purpose
Step 1	switch(config-if)# **no snmp trap link-status**	Disables SNMP link-state traps for the interface. This command is enabled by default.

```
switch(config-if)# no snmp trap link-status
```

Enabling a One-time Authentication for SNMP over TCP

Before You Begin

You must be in global configuration mode to enable one-time authentication for SNMP over TCP

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server tcp-session** [**auth**]	Enables a one-time authentication for SNMP over a TCP session. The default is disabled.

```
switch(config)# snmp-server tcp-session
```

Assigning the SNMP Switch Contact and Location Information

You can assign the switch contact information, which is limited to 32 characters (without spaces) and the switch location.

Before You Begin

Before beginning this procedure, you must be logged in to the CLI in EXEC mode.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **snmp-server contact** *name*	Configures sysContact, which is the SNMP contact name.

	Command or Action	Purpose
Step 3	switch(config)# **snmp-server location** *name*	Configures sysLocation, which is the SNMP location.
Step 4	switch(config)# **show snmp**	(Optional) Displays information about one or more destination profiles.
Step 5	switch(config)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switch(config)# snmp contact Admin
switch(config)# snmp location Lab-7
switch(config)# show snmp
switch(config)# copy running-config startup-config
```

Configuring a Host Receiver for SNMPv1 Traps

Before You Begin

You must be in global configuration mode.

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server host** *ip-address* **traps version 1** *community* [**udp_port** *number*]	Configures a host receiver for SNMPv1 traps. The community can be any alphanumeric string up to 255 characters. The UDP port number range is from 0 to 65535.

```
switch(config)# snmp-server host 192.0.2.1 traps version 1 public
```

Disabling SNMP

Before You Begin

You must be in global configuration mode to disable the SNMP protocol on a device.

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **no snmp-server protocol enable**	Disables the SNMP protocol. This command is enabled by default.

```
switch(config)# no snmp-server protocol enable
```

Modifying the AAA Synchronization Time

You can modify how long Cisco NX-OS holds the synchronized user configuration.

Before You Begin

You must be in global configuration mode.

Procedure

	Command or Action	Purpose
Step 1	switch(config)# **snmp-server aaa-user cache-timeout** *seconds*	Configures how long the AAA synchronized user configuration stays in the local cache. The range is from 1 to 86400 seconds. The default is 3600.

```
switch(config)# snmp-server aaa-user cache-timeout 1200
```

Verifying the SNMP Configuration

Use one of the following commands to verify the configuration:

Command	Purpose
show running-config snmp [**all**]	Displays the SNMP running configuration.
show snmp	Displays the SNMP status.
show snmp community	Displays the SNMP community strings.
show snmp context	Displays the SNMP context mapping.
show snmp engineID	Displays the SNMP engineID.
show snmp group	Displays SNMP roles.
show snmp session	Displays SNMP sessions.

Command	Purpose
show snmp trap	Displays the SNMP notifications enabled or disabled.
show snmp user	Displays SNMPv3 users.

Configuration Example for SNMP

This example shows how to configure sending the Cisco linkUp/Down notifications to one notification host receiver using the Blue VRF and define two SNMP users, Admin and NMS

```
switch# configure terminal
 switch(config)# snmp-server contact Admin@company.com
 switch(config)# snmp-server user Admin auth sha abcd1234 priv abcdefgh
 switch(config)# snmp-server user NMS auth sha abcd1234 priv abcdefgh engineID
00:00:00:63:00:01:00:22:32:15:10:03
 switch(config)# snmp-server host 192.0.2.1 informs version 3 auth NMS
 switch(config)# snmp-server host 192.0.2.1 use-vrf Blue
 switch(config)# snmp-server enable traps link cisco
```

Related Documents for SNMP

Related Topic	Document Title
MIBs	http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

MIBs

• CISCO-TC • SNMPv2-MIB • SNMP-COMMUNITY-MIB • SNMP-FRAMEWORK-MIB • SNMP-NOTIFICATION-MIB • SNMP-TARGET-MIB • ENTITY-MIB • IF-MIB • CISCO-ENTITY-EXT-MIB • CISCO-ENTITY-FRU-CONTROL-MIB • CISCO-FLASH-MIB • CISCO-IMAGE-MIB • CISCO-VIRTUAL-NIC-MIB • CISCO-ENTITY-VENDORTYPE-OID-MIB • NOTIFICATION-LOG-MIB • IANA-ADDRESS-FAMILY-NUMBERS-MIB • IANAifType-MIB • IANAiprouteprotocol-MIB • HCNUM-TC	To locate and download MIBs, go to the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

• CISCO-VLAN-MEMBERSHIP-MIB • CISCO-SYSTEM-MIB • CISCO-SYSTEM-EXT-MIB • CISCO-IMAGE-MIB • CISCO-IMAGE-UPGRADE-MIB • CISCO-BRIDGE-MIB • CISCO-CONFIG-COPY-MIB • CISCO-SYSLOG-EXT-MIB • CISCO-PROCESS-MIB • CISCO-AAA-SERVER-MIB • CISCO-AAA-SERVER-EXT-MIB • CISCO-COMMON-ROLES-MIB • CISCO-COMMON-MGMT-MIB	

Feature History for SNMP

Feature Name	Releases	Feature Information
SNMP	Release 5.2(1)IC1(1.1)	This feature was introduced.