

IPv6 Network Management Configuration Guide, Cisco IOS XE 17 (Cisco ASR 900 Series)

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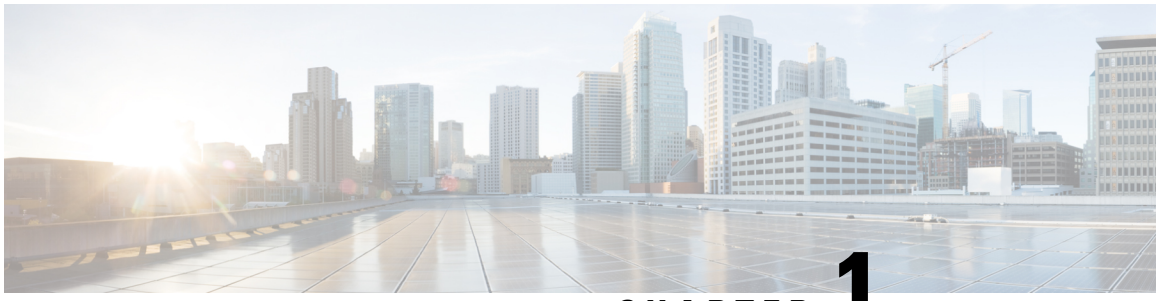
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CHAPTER 1

Telnet Access over IPv6

The Telnet client and server in the Cisco software support IPv6 connections.

- Prerequisites for Telnet Access over IPv6, on page 1
- Information About Telnet Access over IPv6, on page 1
- How to Enable Telnet Access over IPv6, on page 1
- Configuration Examples for Telnet Access over IPv6, on page 3
- Additional References for IPv6 Source Guard and Prefix Guard, on page 4
- Feature Information for Telnet Access over IPv6, on page 5

Prerequisites for Telnet Access over IPv6

To enable Telnet access over IPv6 to a device, you must create a vty interface and password.

Information About Telnet Access over IPv6

Telnet Access over IPv6

The Telnet client and server in Cisco software support IPv6 connections. A user can establish a Telnet session directly to the device using an IPv6 Telnet client, or an IPv6 Telnet connection can be initiated from the device. A vty interface and password must be created in order to enable Telnet access to an IPv6 device.

How to Enable Telnet Access over IPv6

Enabling Telnet Access to an IPv6 Device and Establishing a Telnet Session

Procedure

	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	**ipv6 host** *name* [*port*] *ipv6-address* **Example:** `Device(config)# ipv6 host cisco-sj 2001:DB8:20:1::12`	Defines a static hostname-to-address mapping in the hostname cache.
Step 4	**line** [**aux** | **console** | **tty** | **vty**] *line-number* [*ending-line-number*] **Example:** `Device(config)# line vty 0 4`	Creates a vty interface.
Step 5	**password** *password* **Example:** `Device(config)# password hostword`	Creates a password that enables Telnet.
Step 6	**login** [**local** | **tacacs**] **Example:** `Device(config)# login tacacs`	(Optional) Enables password checking at login.
Step 7	**ipv6 access-class** *ipv6-access-list-name* {**in** | **out**] **Example:** `Device(config)# ipv6 access-list hostlist`	(Optional) Adds an IPv6 access list to the line interface. • Using this command restricts remote access to sessions that match the access list.
Step 8	**telnet** *host* [*port*] [*keyword*] **Example:** `Device(config)# telnet cisco-sj`	Establishes a Telnet session from a device to a remote host using either the hostname or the IPv6 address. • The Telnet session can be established to a device name or to an IPv6 address.

Configuration Examples for Telnet Access over IPv6

Examples: Enabling Telnet Access to an IPv6 Device

The following examples provide information on how to enable Telnet and start a session to or from an IPv6 device. In the following example, the IPv6 address is specified as 2001:DB8:20:1::12, and the hostname is specified as cisco-sj. The **show host** command is used to verify this information.

```
Device# configure terminal
Device(config)# ipv6 host cisco-sj 2001:DB8:20:1::12
Device(config)# end
Device# show host
Default domain is not set
Name/address lookup uses static mappings
Codes:UN - unknown, EX - expired, OK - OK, ?? - revalidate
       temp - temporary, perm - permanent
       NA - Not Applicable None - Not defined
Host                 Port  Flags      Age Type   Address(es)
cisco-sj             None  (perm, OK)  0  IPv6 2001:DB8:20:1::12
```

To enable Telnet access to a device, create a vty interface and password:

```
Device(config)# line vty 0 4
password lab
login
```

To use Telnet to access the device, you must enter the password:

```
Device# telnet cisco-sj
Trying cisco-sj (2001:DB8:20:1::12)... Open
User Access Verification
Password:
cisco-sj
.
.
.
verification
```

It is not necessary to use the **telnet** command. Specifying either the hostname or the address is sufficient, as shown in the following examples:

```
Device# cisco-sj
```

or

```
Device# 2001:DB8:20:1::12
```

To display the IPv6 connected user (line 130) on the device to which you are connected, use the **show users** command:

```
Device# show users
    Line       User       Host(s)              Idle       Location
*  0 con 0                 idle                 00:00:00
 130 vty 0                 idle                 00:00:22   8800::3
```

Note that the address displayed is the IPv6 address of the source of the connection. If the hostname of the source is known (either through a domain name server [DNS] or locally in the host cache), then it is displayed instead:

```
Device# show users
    Line       User       Host(s)              Idle       Location
*  0 con 0                 idle                 00:00:00
 130 vty 0                 idle                 00:02:47   cisco-sj
```

If the user at the connecting device suspends the session with ^6x and then enters the **show sessions** command, the IPv6 connection is displayed:

```
Device# show sessions
Conn Host                Address              Byte  Idle Conn Name
*  1 cisco-sj 2001:DB8:20:1::12      0     0 cisco-sj
```

The Conn Name field shows the hostname of the destination only if it is known. If it is not known, the output might look similar to the following:

```
Device# show sessions
Conn Host                Address              Byte  Idle Conn Name
*  1 2001:DB8:20:1::12 2001:DB8:20:1::12      0     0 2001:DB8:20:1::12
```

Additional References for IPv6 Source Guard and Prefix Guard

Related Documents

Related Topic	Document Title
IPv6 addressing and connectivity	*IPv6 Configuration Guide*
IPv4 addressing	*IP Addressing: IPv4 Addressing Configuration Guide*
Cisco IOS commands	*Cisco IOS Master Command List, All Releases*
IPv6 commands	*Cisco IOS IPv6 Command Reference*
Cisco IOS IPv6 features	*Cisco IOS IPv6 Feature Mapping*

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

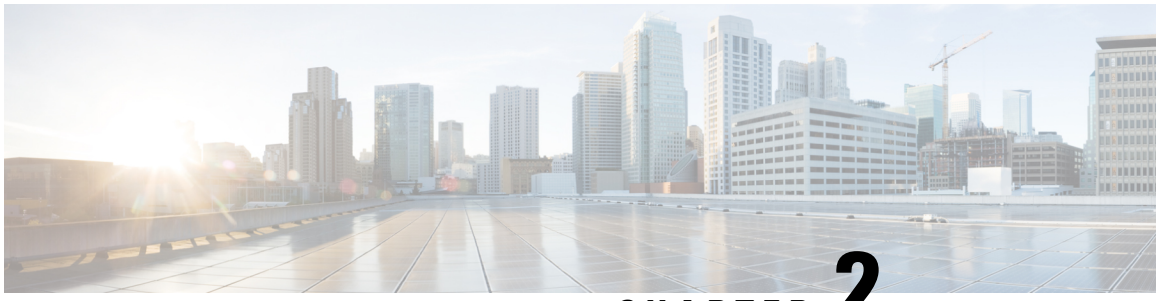
Feature Information for Telnet Access over IPv6

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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 1: Feature Information for Telnet Access over IPv6

Feature Name	Releases	Feature Information
Telnet Access over IPv6	12.2(2)T 12.2(18)SXE 12.2(25)SEA 12.2(25)SG 12.2(33)SRA 15.0(2)SG Cisco IOS XE Release 2.1 Cisco IOS XE Release 3.2SG	Telnet access over IPv6 is supported. The following commands were introduced or modified: **ipv6 access-class**, **ipv6 host**.



CHAPTER 2

IPv6 Support for TFTP

TFTP uses UDP over IPv4 or IPv6 as its transport and can work over IPv4 and IPv6 network layers.

- Information About IPv6 Support for TFTP, on page 7
- Additional References, on page 7
- Feature Information for IPv6 Support for TFTP, on page 8

Information About IPv6 Support for TFTP

TFTP IPv6 Support

TFTP is designed to transfer files over the network from one host to another using the most minimal set of functionality possible. TFTP uses a client/server model in which clients can request to copy files to or from a server. TFTP uses UDP over IPv4 or IPv6 as its transport, and it can work over IPv4 and IPv6 network layers.

TFTP File Downloading for IPv6

IPv6 supports TFTP file downloading and uploading using the **copy** command. The **copy** command accepts a destination IPv6 address or IPv6 hostname as an argument and saves the running configuration of the device to an IPv6 TFTP server, as follows:

```
Device# copy running-config tftp://[3ffe:xxxx:c18:1:290:27ff:fe3a:9e9a]/running-config
```

Additional References

Related Documents

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

Related Topic	Document Title
IPv6 commands	*Cisco IOS IPv6 Command Reference*
Cisco IOS IPv6 features	*Cisco IOS IPv6 Feature Mapping*

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

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

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

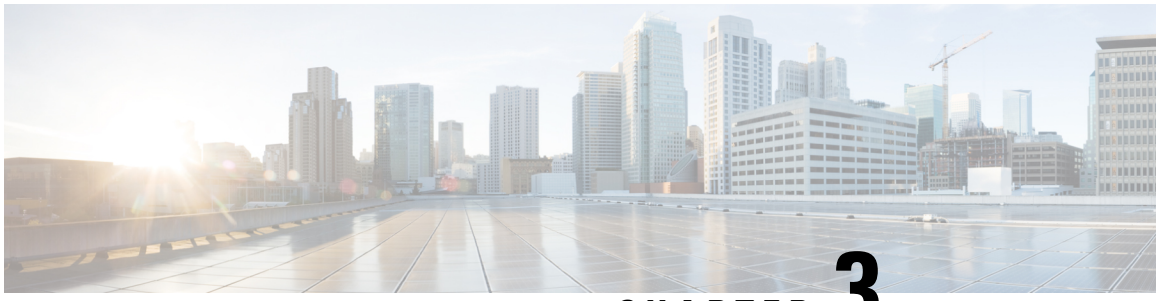
Feature Information for IPv6 Support for TFTP

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.

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Table 2: Feature Information for IPv6 Support for TFTP

Feature Name	Releases	Feature Information
TFTP IPv6 Support		IPv6 support for TFTP is supported. No commands were introduced or modified.



CHAPTER 3

SSH Support Over IPv6

Secure Shell (SSH) provides support for IPv6 addresses that enable a Cisco device to accept and establish secure, encrypted connections with remote IPv6 nodes over an IPv6 transport.

- Prerequisites for SSH Support over IPv6, on page 11
- Information About SSH Support over IPv6, on page 11
- How to Enable SSH Support over IPv6, on page 12
- Configuration Examples for SSH Support over IPv6, on page 13
- Additional References, on page 13
- Feature Information for SSH Support over IPv6, on page 14

Prerequisites for SSH Support over IPv6

- An IPsec (Data Encryption Standard [DES] or 3DES) encryption software image is loaded on your device. IPv6 transport for the SSH server and SSH client requires an IPsec encryption software image.
- A hostname and host domain are configured for your device.
- A Rivest, Shamir, and Adelman (RSA) key pair, which automatically enables SSH, is generated for your device.
- A user authentication mechanism for local or remote access is configured on your device.
- To authenticate SSH clients, configure TACACS+ or RADIUS over an IPv4 transport and then connect to an SSH server over an IPv6 transport.

The basic restrictions for SSH over an IPv4 transport apply to SSH over an IPv6 transport. The use of locally stored usernames and passwords is the only user authentication mechanism supported by SSH over an IPv6 transport. TACACS+ and RADIUS user authentication mechanisms are not supported over an IPv6 transport.

Information About SSH Support over IPv6

SSH over an IPv6 Transport

Secure shell (SSH) SSH in IPv6 functions the same and offers the same benefits as SSH in IPv4. The SSH server feature enables an SSH client to make a secure, encrypted connection to a Cisco device, and the SSH

client feature enables a Cisco device to make a secure, encrypted connection to another Cisco device or to any other device running an SSH server. IPv6 enhancements to SSH consist of support for IPv6 addresses that enable a Cisco device to accept and establish secure, encrypted connections with remote IPv6 nodes over an IPv6 transport.

How to Enable SSH Support over IPv6

Enabling SSH on an IPv6 Device

This task is optional. If you do not configure SSH parameters, then the default values will be used.

Procedure

	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	**ip ssh** [**timeout** *seconds* | **authentication-retries** *integer*] **Example:** `Device(config)# IP ssh timeout 100 authentication-retries 2`	Configures SSH control variables on your device.
Step 4	**exit** **Example:** `Device(config)# exit`	Exits configuration mode, and returns the device to privileged EXEC mode.
Step 5	**ssh** [**-v** { **1** | **2** } | **c** { **3des** | **aes128-cbc** | **aes192-cbc** | **aes256-cbc** } | **-l** *userid* | **-l** *userid:vrfname number ip-address ip-address* | **-l** *userid:rotary number ip-address* | **-m** { **hmac-md5** | **hmac-md5-96** | **hmac-sha1** | **hmac-sha1-96** } | **-o** **numberofpasswordprompts** *n* | **-p** *port-num*] { **ip-addr** | **hostname**} [**command** | **-vrf**] **Example:**	Starts an encrypted session with a remote networking device.

	Command or Action	Purpose
	`Device# ssh -l userid1 2001:db8:2222:1044::72`	

Configuration Examples for SSH Support over IPv6

Example: Enabling SSH on an IPv6 Device

```
Device# configure terminal
Device(config)# ip ssh
Device(config)# exit
Device(config)# ssh -l userid1 2001:db8:2222:1044::72
```

Additional References

Related Documents

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

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

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

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

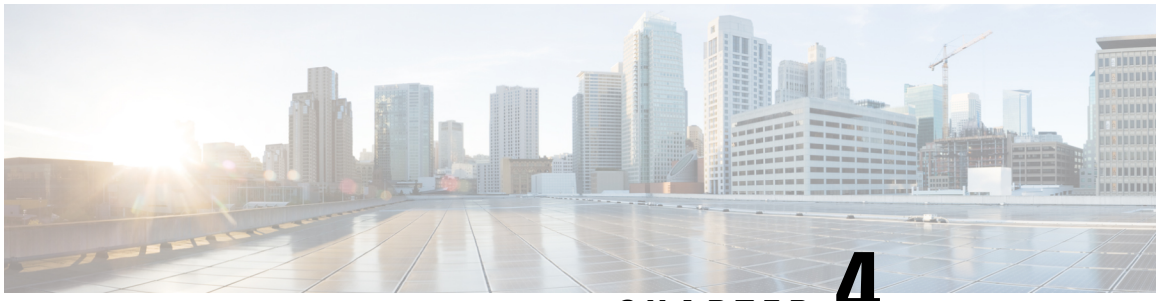
Feature Information for SSH Support over IPv6

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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 3: Feature Information for SSH Support over IPv6

Feature Name	Releases	Feature Information
SSH Support over IPv6	12.2(8)T 12.2(17a)SX1 12.2(25)SEE 12.2(25)SG 12.2(33)SRA 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	SSH provides support for IPv6 addresses that enable a Cisco device to accept and establish secure, encrypted connections with remote IPv6 nodes over an IPv6 transport. The following commands were introduced or modified: **ip ssh**, **ssh**.



CHAPTER 4

SNMP over IPv6

Simple Network Management Protocol (SNMP) can be configured over IPv6 transport so that an IPv6 host can perform SNMP queries and receive SNMP notifications from a device running IPv6.

- Information About SNMP over IPv6, on page 15
- How to Configure SNMP over IPv6, on page 15
- Configuration Examples for SNMP over IPv6, on page 17
- Additional References, on page 18
- Feature Information for SNMP over IPv6, on page 19

Information About SNMP over IPv6

SNMP over an IPv6 Transport

Simple Network Management Protocol (SNMP) can be configured over IPv6 transport so that an IPv6 host can perform SNMP queries and receive SNMP notifications from a device running IPv6 software. The SNMP agent and related MIBs have been enhanced to support IPv6 addressing. This feature uses the data encryption standard (3DES) and advanced encryption standard (AES) message encryption.

How to Configure SNMP over IPv6

Configuring an SNMP Notification Server over IPv6

Use an SNMP community string to define the relationship between the SNMP manager and the agent. The community string acts like a password to regulate access to the agent on the device. Optionally, you can specify one or more of the following 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.

You can configure one or more community strings. To remove a specific community string, use the **no snmp-server community** command.

The **snmp-server host** command specifies which hosts will receive SNMP notifications, and whether you want the notifications sent as traps or inform requests. The **snmp-server enable traps** command globally enables the production mechanism for the specified notification types (such as Border Gateway Protocol [BGP] traps, config traps, entity traps, and Hot Standby Router Protocol [HSRP] traps).

Procedure

	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	**snmp-server community** *string* [**view** *view-name*] [**ro** | **rw**] [**ipv6** *nacl*] [*access-list-number*] **Example:** `Device(config)# snmp-server community mgr view restricted rw ipv6 mgr2`	Defines the community access string.
Step 4	**snmp-server engineID remote** {*ipv4-ip-address* | *ipv6-address*} [**udp-port** *udp-port-number*] [**vrf** *vrf-name*] *engineid-string* **Example:** `Device(config)# snmp-server engineID remote 3ffe:b00:c18:1::3/127 remotev6`	(Optional) Specifies the name of the remote SNMP engine (or copy of SNMP).
Step 5	**snmp-server group** *group-name* {**v1** | **v2c** | **v3** {**auth** | **noauth** | **priv**}} [**context** *context-name*] [**read** *read-view*] [**write** *write-view*] [**notify** *notify-view*] [**access** [**ipv6** *named-access-list*] {*acl-number* | *acl-name*}] **Example:** `Device(config)# snmp-server group public v2c access ipv6 public2`	(Optional) Configures a new SNMP group, or a table that maps SNMP users to SNMP views.
Step 6	**snmp-server host** {*hostname* | *ip-address*} [**vrf** *vrf-name*] [**traps** | **informs**] [**version** {**1** |	Specifies the recipient of an SNMP notification operation.

	Command or Action	Purpose
	2c | **3** [**auth** | **noauth** | **priv**]}] *community-string* [**udp-port** *port*] [*notification-type*] **Example:** `Device(config)# snmp-server host host1.com 2c vrf trap-vrf`	• Specifies whether you want the SNMP notifications sent as traps or informs, the version of SNMP to use, the security level of the notifications (for SNMPv3), and the recipient (host) of the notifications.
Step 7	**snmp-server user** *username group-name* [**remote** *host* [**udp-port** *port*]] {**v1** | **v2c** | **v3** [**encrypted**] [**auth** {**md5** | **sha**} *auth-password*]} [**access** [**ipv6** *nacl*] [**priv** {**des** | **3des** | **aes** {**128** | **192** | **256**}} *privpassword*] {*acl-number* | *acl-name*}] **Example:** `Device(config)# snmp-server user user1 bldg1 remote 3ffe:b00:c18:1::3/127 v2c access ipv6 public2`	(Optional) Configures a new user to an existing SNMP group. **Note** You cannot configure a remote user for an address without first configuring the engine ID for that remote host. This is a restriction imposed in the design of these commands; if you try to configure the user before the host, you will receive a warning message, and the command will not be executed.
Step 8	**snmp-server enable traps** [*notification-type*] [**vrrp**] **Example:** `Device(config)# snmp-server enable traps bgp`	Enables sending of traps or informs, and specifies the type of notifications to be sent. • If a value for the *notification-type* argument is not specified, all supported notification will be enabled on the device. • To discover which notifications are available on your device, enter the **snmp-server enable traps ?** command.

Configuration Examples for SNMP over IPv6

Examples: Configuring an SNMP Notification Server over IPv6

The following example permits any SNMP to access all objects with read-only permission using the community string named public. The device also will send Border Gateway Protocol (BGP) traps to the IPv4 host 172.16.1.111 and IPv6 host 3ffe:b00:c18:1::3/127 using SNMPv1 and to the host 172.16.1.27 using SNMPv2c. The community string named public will be sent with the traps.

```
Device(config)# snmp-server community public
Device(config)# snmp-server enable traps bgp
Device(config)# snmp-server host 172.16.1.27 version 2c public
Device(config)# snmp-server host 172.16.1.111 version 1 public
Device(config)# snmp-server host 3ffe:b00:c18:1::3/127 public
```

Example: Associate an SNMP Server Group with Specified Views

In the following example, the SNMP context A is associated with the views in SNMPv2c group GROUP1 and the IPv6 named access list public2:

```
Device(config)# snmp-server context A
Device(config)# snmp mib community-map commA context A target-list commAVpn
Device(config)# snmp mib target list commAVpn vrf CustomerA
Device(config)# snmp-server view viewA ciscoPingMIB included
Device(config)# snmp-server view viewA ipForward included
Device(config)# snmp-server group GROUP1 v2c context A read viewA write viewA notify
access ipv6 public2
```

Example: Create an SNMP Notification Server

The following example configures the IPv6 host as the notification server:

```
Device> enable
Device# configure terminal
Device(config)# snmp-server community mgr view restricted rw ipv6 mgr2
Device(config)# snmp-server engineID remote 3ffe:b00:c18:1::3/127 remotev6
Device(config)# snmp-server group public v2c access ipv6 public2
Device(config)# snmp-server host host1.com 2c vrf trap-vrf
Device(config)# snmp-server user user1 bldg1 remote 3ffe:b00:c18:1::3/127 v2c access ipv6
public2
Device(config)# snmp-server enable traps bgp
Device(config)# exit
```

Additional References

Related Documents

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

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

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

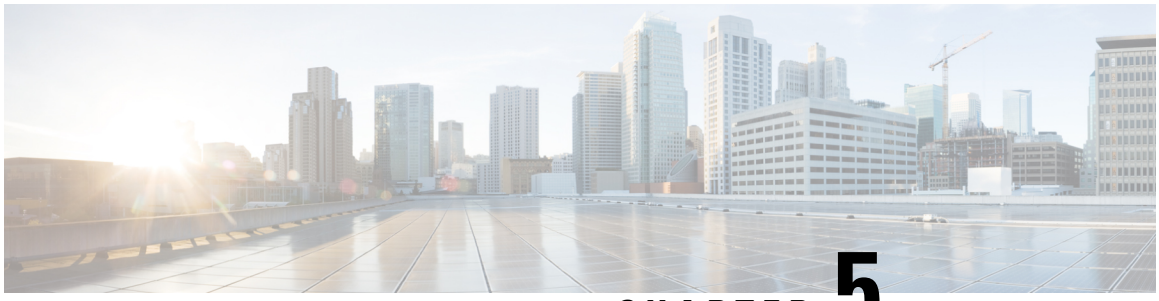
Feature Information for SNMP over IPv6

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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 4: Feature Information for SNMP over IPv6

Feature Name	Releases	Feature Information
SNMP over IPv6	12.2(33)SRB 12.2(33)SXI 12.2(44)SE 12.2(44)SG 12.3(14)T 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	SNMP can be configured over IPv6 transport so that an IPv6 host can perform SNMP queries and receive SNMP notifications from a device running IPv6. The following commands were introduced or modified: **snmp-server community**, **snmp-server enable traps**, **snmp-server engineID remote**, **snmp-server group**, **snmp-server host**, **snmp-server user**.
SNMPv3--3DES and AES Encryption Support	12.2(33)SRB 12.2(33)SXI 12.2(50)SG 12.2(52)SE 12.4(2)T 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	IPv6 supports the SNMPv3 - 3DES and AES Encryption Support feature. No commands were introduced or modified.



CHAPTER 5

IPv6 MIBs

This document is about MIBs that are implemented for IPv6. Cisco has long supported IP-MIB and IP-FORWARD-MIB in IPv4. CISCO-IETF-IP-MIB and CISCO-IETF-IP-FORWARDING-MIB are IPv6 MIBs that are defined as being protocol-independent, but they are implemented only for IPv6 objects and tables.

- Information About IPv6 MIBs, on page 21
- Additional References, on page 22
- Feature Information for IPv6 MIBs, on page 23

Information About IPv6 MIBs

Cisco IPv6 MIBs

Cisco has long supported IP-MIB and IP-FORWARD-MIB in IPv4. CISCO-IETF-IP-MIB and CISCO-IETF-IP-FORWARDING-MIB are IPv6 MIBs that are defined as being protocol-independent, but are implemented only for IPv6 objects and tables. IP-MIB and IP-FORWARD-MIB adhere to RFC 4293 and RFC 4292 standards, as follows:

- The upgrade is backward-compatible; all IP-MIB and IP-FORWARD-MIB objects and tables still appear.
- IP-MIB and IP-FORWARD-MIB include definitions of new IPv6-only, IPv4-only, and protocol-version independent (PVI) objects and tables.

CISCO-IETF-IP-MIB and CISCO-IETF-IP-FORWARDING-MIB were removed from the Cisco releases in which CISCO-IETF-IP-MIB and CISCO-IETF-IP-FORWARDING-MIB were applied. Information in CISCO-IETF-IP-MIB and CISCO-IETF-IP-FORWARDING-MIB is included IP-MIB and IP-FORWARD-MIB.

MIBs Supported for IPv6

The following MIBs are supported for IPv6:

- CISCO-CONFIG-COPY-MIB
- CISCO-CONFIG-MAN-MIB
- CISCO-DATA-COLLECTION-MIB

- CISCO-FLASH-MIB
- CISCO-SNMP-TARGET-EXT-MIB
- ENTITY-MIB
- IP-FORWARD-MIB
- IP-MIB
- NOTIFICATION-LOG-MIB
- SNMP-TARGET-MIB

CISCO-CONFIG-COPY-MIB and CISCO-FLASH-MIB support IPv6 addressing when TFTP, remote copy protocol (rcp), or FTP is used.

Additional References

Related Documents

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

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

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

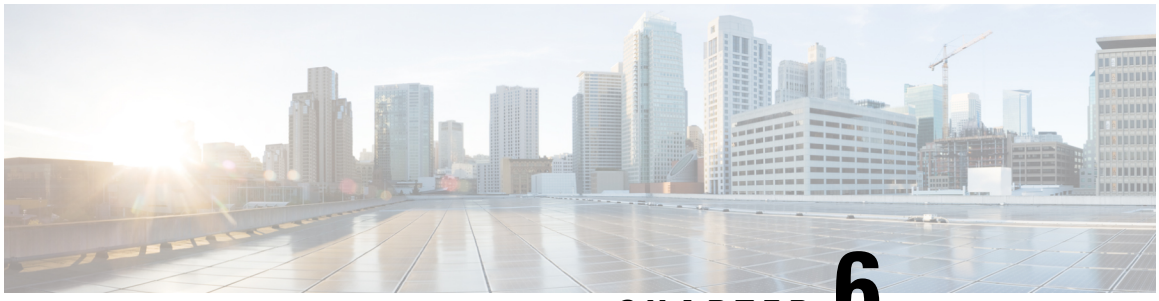
Feature Information for IPv6 MIBs

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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 5: Feature Information for IPv6 MIBs

Feature Name	Releases	Feature Information
IPv6 MIBs	12.0(22)S 12.2(14)S 12.2(15)T 12.2(28)SB 12.2(33)SRA 12.2(50)SY 15.0(1)SY Cisco IOS XE Release 2.1 Cisco IOS XE Release 3.9S	This feature is supported in IPv6. No commands were introduced or modified. In Cisco IOS XE Release 3.9S, support was added for the Cisco ISR 4400 Series Routers.
IPv6 Services: RFC 4293 IP-MIB (IPv6 Only) and RFC 4292 IP-FORWARD-MIB (IPv6 Only)	12.2(33)SRC 12.2(50)SY 12.2(54)SG 12.2(58)SE 15.0(2)SG 15.0(1)SY 15.1(3)T Cisco IOS XE Release 2.1 3.2SG	IP-FORWARD-MIB and IP-MIB were updated to RFC 4292 and RFC 4293 standards, respectively. No commands were introduced or modified.



CHAPTER 6

IPv6 Embedded Management Components

Cisco IPv6 embedded management components have IPv6-compliant operability in IPv6 and hybrid IPv6 and IPv4 networks. This document describes the following embedded management components: syslog, config logger, TCL, NETCONF, and the SOAP message format.

- Information About IPv6 Embedded Management Components, on page 25
- How to Configure IPv6 Embedded Management Components, on page 26
- Configuration Examples for IPv6 Embedded Management Components, on page 27
- Additional References for IPv6 Embedded Management Components, on page 27
- Feature Information for IPv6 Embedded Management Components, on page 28

Information About IPv6 Embedded Management Components

Syslog

The Cisco system message logging (syslog) process in IPv6 allows users to log syslog messages to external syslog servers and hosts with IPv6 addresses. This implementation allows user to specify an IPv4-based logging host (syslog server) by providing the host's IP address in IPv4 format (for example, 192.168.0.0) or IPv6 format (for example, 2001:DB8:A00:1::1/64).

Config Logger

Config logger tracks and reports configuration changes. Config logger supports two content types:

- Plain text--With plain-text format, the config logger reports configuration changes only.
- XML--The config logger uses XML to report the configuration change details (for example, what changed, who changed it, when changes were made, parser return code [PRC] values, and incremental NVGEN results).

TCL

Tool command language (TCL) is used in Cisco software for IPv6 to support features such as embedded syslog manager (ESM), embedded event manager (EEM), interactive voice response (IVR), and tclsh parser mode. TCL supports both initiating (client) and listening (server) sockets.

NETCONF

The Network Configuration Protocol (NETCONF) defines a mechanism through which a network device can be managed, configuration data information can be retrieved, and new configuration data can be uploaded and manipulated. NETCONF uses XML-based data encoding for the configuration data and protocol messages.

SOAP Message Format

Using the Service-Oriented Access Protocol (SOAP) provides a way to format the layout of Cisco Networking Services (CNS) messages in a consistent manner. SOAP is intended for exchanging structured information in a decentralized, distributed environment. SOAP uses XML technologies to define an extensible messaging framework that provides a message format that can be exchanged over a variety of underlying protocols.

Within the SOAP message structure, there is a security header that enables CNS notification messages to authenticate user credentials.

How to Configure IPv6 Embedded Management Components

Configuring Syslog over IPv6

Procedure

	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	**logging host** {{*ip-address* | *hostname*} | {**ipv6** *ipv6-address* | *hostname*}} [**transport** {**udp** [**port** *port-number*] | **tcp** [**port** *port-number*] [**audit**]}] [**xml** | **filtered** [**stream** *stream-id*]] [**alarm** [*severity*]] **Example:** `Device(config)# logging host ipv6 AAAA:BBBB:CCCC:DDDD::FFFF`	Logs system messages and debug output to a remote host.

Configuration Examples for IPv6 Embedded Management Components

Example: Configuring Syslog over IPv6

```
Device(config)# logging host ipv6 AAAA:BBBB:CCCC:DDDD::FFFF transport tcp port 1470
```

Additional References for IPv6 Embedded Management Components

Related Documents

Related Topic	Document Title
IPv6 addressing and connectivity	*IPv6 Configuration Guide*
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
IPv6 commands	Cisco IOS IPv6 Command Reference
Cisco IOS IPv6 features	*Cisco_IOS_IPv6_Feature_Mapping*

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

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

Feature Information for IPv6 Embedded Management Components

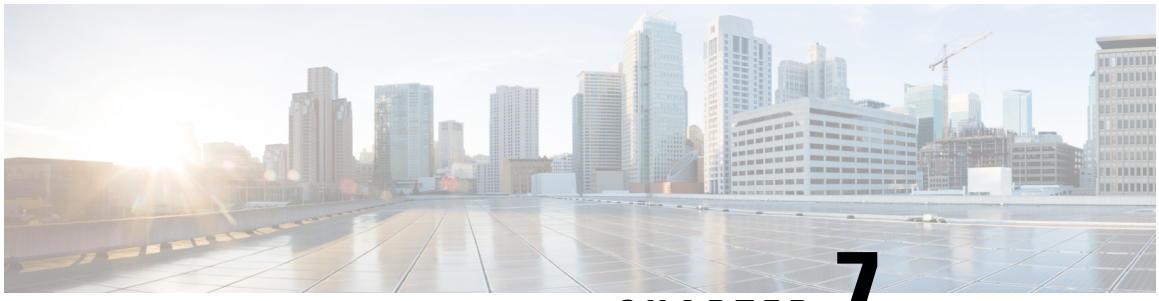
The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train 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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 6: Feature Information for IPv6 Embedded Management Components

Feature Name	Releases	Feature Information
IPv6: Config Logger	12.2(33)SB 12.2(33)SRC 12.2(50)SG 12.2(50)SY 12.4(20)T 15.0(1)SY 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	IPv6 supports this feature. No commands were introduced or modified.
IPv6: NETCONF	12.2(33)SB 12.2(33)SRC 12.2(50)SG 12.2(50)SY 12.4(20)T 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	IPv6 supports this feature. No commands were introduced or modified.

Feature Name	Releases	Feature Information
IPv6 Support in SOAP	12.2(33)SB 12.2(33)SRC 12.2(50)SG 12.2(50)SY 12.4(20)T 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	IPv6 supports this feature. No commands were introduced or modified.
IPv6: TCL	12.2(33)SB 12.2(33)SRC 12.2(50)SG 12.2(50)SY 12.4(20)T 15.0(1)SY 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	IPv6 supports this feature. No commands were introduced or modified.
Syslog over IPv6	12.2(33)SB 12.2(33)SRC 12.2(33)SXI 12.2(44)SE 12.2(44)SG 12.4(4)T 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	The Cisco syslog process in IPv6 allows users to log syslog messages to external syslog servers and hosts with IPv6 addresses. The following command was introduced: **logging host**.



CHAPTER 7

IPv6 CNS Agents

IPv6 addressing is supported in the Cisco Networking Services (CNS) subsystem. CNS is a foundation technology for linking users to networking services and provides the infrastructure for the automated configuration of large numbers of network devices. The document describes CNS agents supported in IPv6.

- Information About IPv6 CNS Agents, on page 31
- Additional References for IPv6 IOS Firewall, on page 32
- Feature Information for IPv6 CNS Agents, on page 33

Information About IPv6 CNS Agents

CNS Agents

IPv6 addressing is supported in the Cisco Networking Services (CNS) subsystem. CNS is a foundation technology for linking users to networking services, and it provides the infrastructure for the automated configuration of large numbers of network devices. Many IPv6 networks are complex, with many devices, and each device must be configured individually. When standard configurations do not exist or have been modified, the time involved in initial installation and subsequent upgrading is considerable. ISPs need a method for sending out partial configurations to introduce new services.

To address all these issues, CNS was designed to provide "plug-and-play" network services using a central directory service and distributed agents. CNS features include CNS agents and a flow-through provisioning structure. CNS flow-through provisioning uses the CNS configuration and event agents to provide an automated workflow, eliminating the need for an onsite technician.

IPv6 addressing supports the CNS agents described in the following sections:

CNS Configuration Agent

The CNS configuration agent is involved in the initial configuration and subsequent partial configurations on a Cisco device. The configuration agent uses a CNS configuration engine to provide methods for automating initial Cisco device configurations, incremental configurations, and synchronized configuration updates, and the configuration engine reports the status of the configuration load as an event to which a network monitoring or workflow application can subscribe.

CNS Event Agent

The CNS event agent provides a transport connection to the CNS event bus for all other CNS agents. No event can be sent to the device by the configuration engine until the CNS event agent is operational and has successfully built a connection between the configuration engine and the device.

The event agent uses a CNS configuration engine to provide methods for automating initial Cisco device configurations, incremental configurations, and synchronized configuration updates.

CNS EXEC Agent

The CNS EXEC agent allows a remote application to execute a CLI command in EXEC mode on a Cisco device by sending an event message that contains the command.

CNS Image Agent

Administrators maintaining large networks of Cisco devices need an automated mechanism to load image files onto large numbers of remote devices. Network management applications are useful to determine which images to run and how to manage images received from the Cisco online software center. Other image distribution solutions do not scale to cover thousands of devices and cannot distribute images to devices behind a firewall or using Network Address Translation (NAT). The CNS image agent enables the managed device to initiate a network connection and request an image download allowing devices using NAT, or behind firewalls, to access the image server.

The CNS image agent can be configured to use the CNS event bus. To use the CNS event bus, the CNS event agent must be enabled and connected to the CNS event gateway in the CNS Configuration Engine. The CNS image agent can also use an HTTP server that understands the CNS image agent protocol. Deployment of CNS image agent operations can use both the CNS event bus and an HTTP server.

Additional References for IPv6 IOS Firewall

Related Documents

Related Topic	Document Title
Security commands	• *Cisco IOS Security Command Reference: Commands A to C* • *Cisco IOS Security Command Reference: Commands D to L* • *Cisco IOS Security Command Reference: Commands M to R* • *Cisco IOS Security Command Reference: Commands S to Z*
IPv6 commands	*Cisco IOS IPv6 Command Reference*
IPv6 addressing and connectivity	*IPv6 Configuration Guide*
Cisco IOS IPv6 features	*Cisco IOS IPv6 Feature Mapping*

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

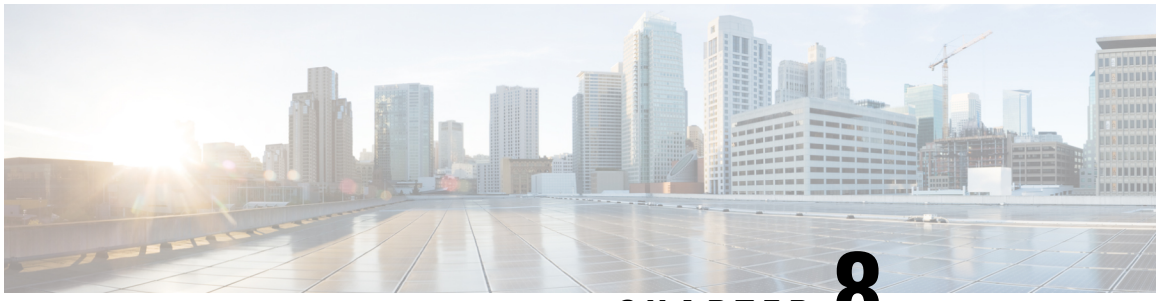
Feature Information for IPv6 CNS Agents

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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 7: Feature Information for IPv6 CNS Agents

Feature Name	Releases	Feature Information
IPv6 CNS Agents	12.2(33)SB 12.2(33)SRC 12.2(50)SY 12.4(20)T Cisco IOS XE Release 3.9S	CNS configuration and event agents use a CNS configuration engine to provide methods for automating initial device configurations, incremental configurations, and synchronized configuration updates, and the configuration engine reports the status of the configuration load as an event to which a network monitoring or workflow application can subscribe. No commands were introduced or modified. In Cisco IOS XE Release 3.9S, support was added for the Cisco CSR 1000V.



CHAPTER 8

IP SLAs for IPv6

Cisco IP Service Level Agreements (SLAs) are a portfolio of technology embedded in most devices that run Cisco software. SLAs allow Cisco customers to analyze IPv6 service levels for IPv6 applications and services, increase productivity, lower operational costs, and reduce the frequency of network outages.

- Information About IP SLAs for IPv6, on page 35
- Additional References, on page 36
- Feature Information for IP SLAs for IPv6, on page 36

Information About IP SLAs for IPv6

Cisco IPv6 Embedded Management Components

Cisco embedded management components have IPv6-compliant operability in IPv6 and dual-stack IPv6 and IPv4 networks.

IP SLAs for IPv6

Cisco IP Service Level Agreements (SLAs) are a portfolio of technology embedded in most devices that run Cisco software that allows Cisco customers to analyze IPv6 service levels for IPv6 applications and services, increase productivity, lower operational costs, and reduce the frequency of network outages. IP SLAs uses active traffic monitoring--the generation of traffic in a continuous, reliable, and predictable manner--for measuring network performance.

The following Cisco IP SLAs are supported for IPv6:

- Internet Control Message Protocol (ICMP) echo operation--Used to monitor end-to-end response time between a Cisco device and other devices using IPv4 or IPv6. ICMP echo is useful for troubleshooting network connectivity issues.
- TCP connect operation--Used to measure the response time taken to perform a TCP Connect operation between a Cisco device and other devices using IPv4 or IPv6.
- User Datagram Protocol (UDP) echo operation--Used to monitor end-to-end response time between a Cisco router and devices using IPv4 or IPv6 .
- UDP jitter operation--Used to analyze round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic in IPv4 or IPv6 networks.

- UDP jitter operation--Used to monitor VoIP quality levels in your network, allowing you to guarantee VoIP quality levels to your users in IPv4 or IPv6 networks.

Additional References

Related Documents

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

Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	*IPv6 RFCs*

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

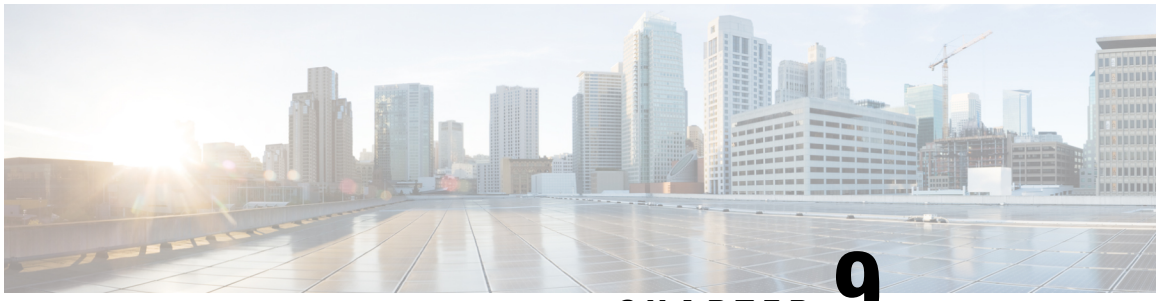
Feature Information for IP SLAs for IPv6

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 https://cfnng.cisco.com/. An account on Cisco.com is not required.

Table 8: Feature Information for IP SLAs for IPv6

Feature Name	Releases	Feature Information
IP SLAs for IPv6	12.2(33)SRC 12.2(50)SG 12.2(50)SY 12.4(20)T 15.0(2)SG Cisco IOS XE Release 2.1 3.2SG	IPv6 supports this feature. No commands were introduced or modified.



CHAPTER 9

IPv6 RFCs

Standards and RFCs

RFCs	Title
RFC 1195	*Use of OSI IS-IS for Routing in TCP/IP and Dual Environments*
RFC 1267	*A Border Gateway Protocol 3 (BGP-3)*
RFC 1305	*Network Time Protocol (Version 3) Specification, Implementation and Analysis*
RFC 1583	*OSPF version 2*
RFC 1772	*Application of the Border Gateway Protocol in the Internet*
RFC 1886	*DNS Extensions to Support IP version 6*
RFC 1918	*Address Allocation for Private Internets*
RFC 1981	*Path MTU Discovery for IP version 6*
RFC 2080	*RIPng for IPv6*
RFC 2281	*Cisco Hot Standby Router Protocol (HSRP)*
RFC 2332	*NBMA Next Hop Resolution Protocol (NHRP)*
RFC 2373	*IP Version 6 Addressing Architecture*
RFC 2374	*An Aggregatable Global Unicast Address Format*
RFC 2375	*IPv6 Multicast Address Assignments*
RFC 2401	*Security Architecture for the Internet Protocol*
RFC 2402	*IP Authentication Header*
RFC 2404	*The Use of Hash Message Authentication Code Federal Information Processing Standard 180-1 within Encapsulating Security Payload and Authentication Header*
RFC 2406	*IP Encapsulating Security Payload (ESP)*

RFCs	Title
RFC 2407	*The Internet Security Domain of Interpretation for ISAKMP*
RFC 2408	*Internet Security Association and Key Management Protocol*
RFC 2409	*Internet Key Exchange (IKE)*
RFC 2427	*Multiprotocol Interconnect over Frame Relay*
RFC 2428	*FTP Extensions for IPv6 and NATs*
RFC 2460	*Internet Protocol, Version 6 (IPv6) Specification*
RFC 2461	*Neighbor Discovery for IP Version 6 (IPv6)*
RFC 2462	*IPv6 Stateless Address Autoconfiguration*
RFC 2463	*Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*
RFC 2464	*Transmission of IPv6 Packets over Ethernet*
RFC 2467	*Transmission of IPv6 Packets over FDDI*
RFC 2472	*IP Version 6 over PPP*
RFC 2473	*Generic Packet Tunneling in IPv6 Specification*
RFC 2474	*Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*
RFC 2475	*An Architecture for Differentiated Services Framework*
RFC 2492	*IPv6 over ATM*
RFC 2545	*Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing*
RFC 2590	*Transmission of IPv6 Packets over Frame Relay Specification*
RFC 2597	*Assured Forwarding PHB*
RFC 2598	*An Expedited Forwarding PHB*
RFC 2640	*Internet Protocol, Version 6 Specification*
RFC 2684	*Multiprotocol Encapsulation over ATM Adaptation Layer 5*
RFC 2697	*A Single Rate Three Color Marker*
RFC 2698	*A Two Rate Three Color Marker*
RFC 2710	*Multicast Listener Discovery (MLD) for IPv6*
RFC 2711	*IPv6 Router Alert Option*
RFC 2732	*Format for Literal IPv6 Addresses in URLs*

RFCs	Title
RFC 2765	*Stateless IP/ICMP Translation Algorithm (SIIT)*
RFC 2766	*Network Address Translation-Protocol Translation (NAT-PT)*
RFC 2858	*Multiprotocol Extensions for BGP-4*
RFC 2893	*Transition Mechanisms for IPv6 Hosts and Routers*
RFC 3056	*Connection of IPv6 Domains via IPv4 Clouds*
RFC 3068	*An Anycast Prefix for 6to4 Relay Routers*
RFC 3095	*RObust Header Compression (ROHC): Framework and Four Profiles: RTP, UDP, ESP, and Uncompressed*
RFC 3107	*Carrying Label Information in BGP-4*
RFC 3137	*OSPF Stub Router Advertisement*
RFC 3147	*Generic Routing Encapsulation over CLNS*
RFC 3152	*Delegation of IP6.ARPA*
RFC 3162	*RADIUS and IPv6*
RFC 3315	*Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*
RFC 3319	*Dynamic Host Configuration Protocol (DHCPv6) Options for Session Initiated Protocol (SIP) Servers*
RFC 3392	*Capabilities Advertisement with BGP-4*
RFC 3414	*User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*
RFC 3484	*Default Address Selection for Internet Protocol version 6 (IPv6)*
RFC 3513	*Internet Protocol Version 6 (IPv6) Addressing Architecture*
RFC 3576	*Change of Authorization*
RFC 3587	*IPv6 Global Unicast Address Format*
RFC 3590	*Source Address Selection for the Multicast Listener Discovery (MLD) Protocol*
RFC 3596	*DNS Extensions to Support IP Version 6*
RFC 3633	*DHCP IPv6 Prefix Delegation*
RFC 3646	*DNS Configuration options for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*
RFC 3697	*IPv6 Flow Label Specification*
RFC 3736	*Stateless DHCP Service for IPv6*

RFCs	Title
RFC 3756	*IPv6 Neighbor Discovery (ND) Trust Models and Threats*
RFC 3759	*RObust Header Compression (ROHC): Terminology and Channel Mapping Examples*
RFC 3775	*Mobility Support in IPv6*
RFC 3810	*Multicast Listener Discovery Version 2 (MLDv2) for IPv6*
RFC 3846	*Mobile IPv4 Extension for Carrying Network Access Identifiers*
RFC 3879	*Deprecating Site Local Addresses*
RFC 3898	*Network Information Service (NIS) Configuration Options for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*
RFC 3954	*Cisco Systems NetFlow Services Export Version 9*
RFC 3956	*Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address*
RFC 3963	*Network Mobility (NEMO) Basic Support Protocol*
RFC 3971	*SEcure Neighbor Discovery (SEND)*
RFC 3972	*Cryptographically Generated Addresses (CGA)*
RFC 4007	*IPv6 Scoped Address Architecture*
RFC 4075	*Simple Network Time Protocol (SNTP) Configuration Option for DHCPv6*
RFC 4087	*IP Tunnel MIB*
RFC 4091	*The Alternative Network Address Types (ANAT) Semantics for the Session Description Protocol (SDP) Grouping Framework*
RFC 4092	*Usage of the Session Description Protocol (SDP) Alternative Network Address Types (ANAT) Semantics in the Session Initiation Protocol (SIP)*
RFC 4109	*Algorithms for Internet Key Exchange version 1 (IKEv1)*
RFC 4191	*Default Router Preferences and More-Specific Routes*
RFC 4193	*Unique Local IPv6 Unicast Addresses*
RFC 4214	*Intra-Site Automatic Tunnel Addressing Protocol (ISATAP)*
RFC 4242	*Information Refresh Time Option for Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*
RFC 4282	*The Network Access Identifier*
RFC 4283	*Mobile Node Identifier Option for Mobile IPv6*
RFC 4285	*Authentication Protocol for Mobile IPv6*
RFC 4291	*IP Version 6 Addressing Architecture*

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RFC 4292	*IP Forwarding Table MIB*
RFC 4293	*Management Information Base for the Internet Protocol (IP)*
RFC 4302	*IP Authentication Header*
RFC 4306	*Internet Key Exchange (IKEv2) Protocol*
RFC 4308	*Cryptographic Suites for IPsec*
RFC 4364	*BGP MPLS/IP Virtual Private Networks (VPNs)*
RFC 4382	*MPLS/BGP Layer 3 Virtual Private Network (VPN) Management Information Base*
RFC 4443	*Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*
RFC 4552	*Authentication/Confidentiality for OSPFv3*
RFC 4594	*Configuration Guidelines for DiffServ Service Classes*
RFC 4601	*Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification*
RFC 4610	*Anycast-RP Using Protocol Independent Multicast (PIM)*
RFC 4649	*Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Relay Agent Remote-ID Option*
RFC 4659	*BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN*
RFC 4724	*Graceful Restart Mechanism for BGP*
RFC 4798	*Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE)*
RFC 4818	*RADIUS Delegated-IPv6-Prefix Attribute*
RFC 4861	*Neighbor Discovery for IP version 6 (IPv6)*
RFC 4862	*IPv6 Stateless Address Autoconfiguration*
RFC 4884	*Extended ICMP to Support Multi-Part Messages*
RFC 4885	*Network Mobility Support Terminology*
RFC 4887	*Network Mobility Home Network Models*
RFC 5015	*Bidirectional Protocol Independent Multicast (BIDIR-PIM)*
RFC 5059	*Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM)*
RFC 5072	*IPv6 over PPP*
RFC 5095	*Deprecation of Type 0 Routing Headers in IPv6*
RFC 5120	*M-ISIS: Multi Topology (MT) Routing in Intermediate System to Intermediate Systems (IS-ISs)*

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RFC 5130	*A Policy Control Mechanism in IS-IS Using Administrative Tags*
RFC 5187	*OSPFv3 Graceful Restart*
RFC 5213	*Proxy Mobile IPv6*
RFC 5308	*Routing IPv6 with IS-IS*
RFC 5340	*OSPF for IPv6*
RFC 5460	*DHCPv6 Bulk Leasequery*
RFC 5643	*Management Information Base for OSPFv3*
RFC 5838	*Support of Address Families in OSPFv3*
RFC 5844	*IPv4 Support for Proxy Mobile IPv6*
RFC 5845	*Generic Routing Encapsulation (GRE) Key Option for Proxy Mobile IPv6*
RFC 5846	*Binding Revocation for IPv6 Mobility*
RFC 5881	*Bidirectional Forwarding Detection (BFD) for IPv4 and IPv6 (Single Hop)*
RFC 5905	*Network Time Protocol Version 4: Protocol and Algorithms Specification*
RFC 5969	*IPv6 Rapid Deployment on IPv4 Infrastructures (6RD) -- Protocol Specification*
RFC 6105	*IPv6 Router Advertisement Guard*
RFC 6620	*FCFS SAVI: First-Come, First-Served Source Address Validation Improvement for Locally Assigned IPv6 Addresses*