IPv6 Configuration Guide, Cisco IOS Release 15.2(7)E (Catalyst Micro Switch Series)

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CHAPTER 1

IPv6 Network Management

HTTP(S) IPv6 Support

This feature allows the HTTP(S) client and server to support IPv6 addresses.

The HTTP server in Cisco software can service requests from both IPv6 and IPv4 HTTP clients. When the HTTP(S) server accepts a connection from a client, the server determines whether the client is an IPv4 or IPv6 host. The address family, IPv4 or IPv6, for the accept socket call is then chosen accordingly. The listening socket continues to listen for both IPv4 and IPv6 connections.

The HTTP client in Cisco software can send requests to both IPv4 and IPv6 HTTP servers.

When you use the IPv6 HTTP client, URLs with literal IPv6 addresses must be formatted using the rules listed in RFC 2732.

Disabling HTTP Access to an IPv6 Device

HTTP access over IPv6 is automatically enabled if an HTTP server is enabled and the device has an IPv6 address. If the HTTP server is not required, it should be disabled.

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.

	Command or Action	Purpose
Step 3	**no ip http server** **Example:** `Device(config)# no ip http server`	Disables HTTP access.

Example: Disabling HTTP Access to the Device

In the following example, the **show running-config** command is used to show that HTTP access is disabled on the device:

```
Device# show running-config

Building configuration...
!
Current configuration : 1490 bytes
!
version 12.2
!
hostname Device
!
no ip http server
!
line con 0
line aux 0
line vty 0 4
```

CHAPTER 2

Configuring IPv6 ACL

Information About Configuring IPv6 ACLs

You can filter IP version 6 (IPv6) traffic by creating IPv6 access control lists (ACLs) and applying them to interfaces similarly to the way that you create and apply IP version 4(IPv4) named ACLs.

Understanding IPv6 ACLs

A switch image supports the following types of IPv6 ACLs:

- IPv6 port ACLs - Supported on inbound traffic on Layer 2 interfaces only. Applied to all IPv6 packets entering the interface.

Note If you configure unsupported IPv6 ACLs, an error message appears and the configuration does not take affect.

The switch does not support VLAN ACLs (VLAN maps) for IPv6 traffic.

You can apply both IPv4 and IPv6 ACLs to an interface.

Supported ACL Features

IPv6 ACLs on the switch have these characteristics:

- Fragmented frames (the fragments keyword as in IPv4) are supported.
- The same statistics supported in IPv4 are supported for IPv6 ACLs.
- If the switch runs out of TCAM space, packets associated with the ACL label are forwarded to the CPU, and the ACLs are applied in software.

IPv6 ACL Limitations

With IPv4, you can configure standard and extended numbered IP ACLs, named IP ACLs, and MAC ACLs. IPv6 supports only named ACLs.

The switch supports most Cisco IOS-supported IPv6 ACLs with some exceptions:

- The switch does not support matching on these keywords: **flowlabel**, **routing header**, and **undetermined-transport**.
- The switch does not support reflexive ACLs (the **reflect** keyword).
- This release supports only port ACLs for IPv6; it does not support router ACLs for IPv6 and VLAN ACLs (VLAN maps).
- The switch does not apply MAC-based ACLs on IPv6 frames.
- You cannot apply IPv6 port ACLs to Layer 2 EtherChannels.
- The switch does not support output port ACLs.
- When configuring an ACL, there is no restriction on keywords entered in the ACL, regardless of whether or not they are supported on the platform. When you apply the ACL to an interface that requires hardware forwarding (physical ports), the switch checks to determine whether or not the ACL can be supported on the interface. If not, attaching the ACL is rejected.
- If an ACL is applied to an interface and you attempt to add an access control entry (ACE) with an unsupported keyword, the switch does not allow the ACE to be added to the ACL that is currently attached to the interface.

Configuring IPv6 ACLs

To filter IPv6 traffic, you perform these steps:

Procedure

Step 1 Create an IPv6 ACL, and enter IPv6 access list configuration mode.

Step 2 Configure the IPv6 ACL to block (deny) or pass (permit) traffic.

Step 3 Apply the IPv6 ACL to an interface.

Default IPv6 ACL Configuration

There are no IPv6 ACLs configured or applied.

Interaction with Other Features and Switches

- If a bridged frame is to be dropped due to a port ACL, the frame is not bridged.

- You can create both IPv4 and IPv6 ACLs on a switch, and you can apply both IPv4 and IPv6 ACLs to the same interface. Each ACL must have a unique name; an error message appears if you try to use a name that is already configured.

  You use different commands to create IPv4 and IPv6 ACLs and to attach IPv4 or IPv6 ACLs to the same Layer 2 interface. If you use the wrong command to attach an ACL (for example, an IPv4 command to attach an IPv6 ACL), you receive an error message.

- You cannot use MAC ACLs to filter IPv6 frames. MAC ACLs can only filter non-IP frames.
- If the hardware memory is full, for any additional configured ACLs, packets are processed to the CPU, and the ACLs are applied in software. When the hardware is full a message is printed to the console indicating the ACL has been unloaded and the packets will be processed in software.

  Note Only packets of the same type as the ACL that could not be added (ipv4, ipv6, MAC) will be processed in software.

- If the TCAM is full, for any additional configured ACLs, packets are forwarded to the CPU, and the ACLs are applied in software.

Creating IPv6 ACL

Follow these steps to create an IPv6 ACL:

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	**ipv6access-list***access-list-name* **Example:** `ipv6 access-list access-list-name`	Define an IPv6 access list name, and enter IPv6 access-list configuration mode.

Step 4	**{deny|permit} protocol**
	Example:
	`{deny | permit} protocol`
	`{source-ipv6-prefix/prefix-length | any`
	` | host source-ipv6-address}`
	`[operator`
		Enter deny or permit to specify whether to deny or permit the packet if conditions are matched. These are the conditions:
		• For protocol, enter the name or number of an Internet protocol: AHP, ESP, ICMP,

<table>
<tr><th></th><th>Command or Action</th><th>Purpose</th></tr>
<tr><td></td><td>[port-number]]{destination-ipv6-prefix/prefix-length
 | any |host destination-ipv6-address}
[operator [port-number]][dscp value]
[fragments][log] [log-input]
[routing][sequence value]
[time-range name]</td><td>IPv6, PCP, STCP, TCP, or UDP, or an integer in the range 0 to 255 representing an IPv6 protocol number.
• The source-ipv6-prefix/prefix-length or destination-ipv6-prefix/ prefix-length is the source or destination IPv6 network or class of networks for which to set deny or permit conditions, specified in hexadecimal and using 16-bit values between colons (see RFC 2373).
• Enter any as an abbreviation for the IPv6 prefix ::/0.
• For host source-ipv6-address or destination-ipv6-address, enter the source or destination IPv6 host address for which to set deny or permit conditions, specified in hexadecimal using 16-bit values between colons.
• (Optional) For operator, specify an operand that compares the source or destination ports of the specified protocol. Operands are lt (less than), gt (greater than), eq (equal), neq (not equal), and range.
If the operator follows the source-ipv6-prefix/prefix-length argument, it must match the source port. If the operator follows the destination-ipv6-prefix/prefix-length argument, it must match the destination port.
• (Optional) The port-number is a decimal number from 0 to 65535 or the name of a TCP or UDP port. You can use TCP port names only when filtering TCP. You can use UDP port names only when filtering UDP.
• (Optional) Enter dscp value to match a differentiated services code point value against the traffic class value in the Traffic Class field of each IPv6 packet header. The acceptable range is from 0 to 63.</td></tr>
</table>

<table>
<tr><th></th><th>Command or Action</th><th>Purpose</th></tr>
<tr><td></td><td></td><td>• (Optional) Enter fragments to check noninitial fragments. This keyword is visible only if the protocol is ipv6.
• (Optional) Enter log to cause an logging message to be sent to the console about the packet that matches the entry. Enter log-input to include the input interface in the log entry. Logging is supported only for router ACLs.
• (Optional) Enter routing to specify that IPv6 packets be routed.
• (Optional) Enter sequence value to specify the sequence number for the access list statement. The acceptable range is from 1 to 4294967295
• (Optional) Enter time-range name to specify the time range that applies to the deny or permit statement.</td></tr>
<tr><td><b>Step 5</b></td><td><b>{deny|permit} tcp</b>
<b>Example:</b>
{deny | permit} tcp
{source-ipv6-prefix/prefix-length | any
 | hostsource-ipv6-address}
[operator
[port-number]]{destination-ipv6-prefix/prefix-length
 | any |hostdestination-ipv6-address}
[operator [port-number]][ack] [dscp
value][established] [fin]
[log][log-input] [neq {port |protocol}]
 [psh] [range{port | protocol}]
[rst][routing] [sequence value]
[syn] [time-range name][urg]</td><td>(Optional) Define a TCP access list and the access conditions.
Enter tcp for Transmission Control Protocol. The parameters are the same as those described in Step 3, with these additional optional parameters:
• ack—Acknowledgment bit set.
• established—An established connection. A match occurs if the TCP datagram has the ACK or RST bits set.
• fin—Finished bit set; no more data from sender.
• neq {port | protocol}—Matches only packets that are not on a given port number.
• psh—Push function bit set.
• range {port | protocol}—Matches only packets in the port number range.
• rst—Reset bit set.
• syn—Synchronize bit set.
• urg—Urgent pointer bit set.</td></tr>
</table>

<table>
<tr><th></th><th>Command or Action</th><th>Purpose</th></tr>
<tr><td><b>Step 6</b></td><td><b>{deny|permit} udp</b>
<b>Example:</b>
{deny | permit} udp
{source-ipv6-prefix/prefix-length | any
 | hostsource-ipv6-address}
[operator
[port-number]]{destination-ipv6-prefix/prefix-length
 | any | hostdestination-ipv6-address}
[operator [port-number]][dscp value]
[log][log-input]
[neq {port |protocol}] [range {port
|protocol}] [routing][sequence
value][time-range name]</td><td>(Optional) Define a UDP access list and the access conditions.
Enter udp for the User Datagram Protocol. The UDP parameters are the same as those described for TCP, except that the operator [port]] port number or name must be a UDP port number or name, and the established parameter is not valid for UDP.</td></tr>
<tr><td><b>Step 7</b></td><td><b>{deny|permit} icmp</b>
<b>Example:</b>
{deny | permit} icmp
{source-ipv6-prefix/prefix-length | any
 | hostsource-ipv6-address}
[operator [port-number]]
{destination-ipv6-prefix/prefix-length
 | any | hostdestination-ipv6-address}
[operator [port-number]][icmp-type
[icmp-code] |icmp-message] [dscpvalue]
 [log] [log-input]
[sequence value][time-range name]</td><td>(Optional) Define an ICMP access list and the access conditions.
Enter icmp for Internet Control Message Protocol. The ICMP parameters are the same as those described for most IP protocols in Step 3a, with the addition of the ICMP message type and code parameters. These optional keywords have these meanings:
• icmp-type—Enter to filter by ICMP message type, a number from 0 to 255.
• icmp-code—Enter to filter ICMP packets that are filtered by the ICMP message code type, a number from 0 to 255.
• icmp-message—Enter to filter ICMP packets by the ICMP message type name or the ICMP message type and code name. To see a list of ICMP message type names and code names, use the ? key or see command reference for this release.</td></tr>
<tr><td><b>Step 8</b></td><td><b>end</b>
<b>Example:</b>
Device(config)# end</td><td>Returns to privileged EXEC mode.</td></tr>
<tr><td><b>Step 9</b></td><td><b>show ipv6 access-list</b>
<b>Example:</b>
Device# show ipv6 access-list</td><td>Verify the access list configuration.</td></tr>
<tr><td><b>Step 10</b></td><td><b>show running-config</b>
<b>Example:</b>
Device# show running-config</td><td>Verifies your entries.</td></tr>
</table>

	Command or Action	Purpose
Step 11	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Applying an IPv6 ACL to an Interface

This section describes how to apply IPv6 ACLs to network interfaces. You can apply an ACL to inbound traffic on Layer 2 interfaces.

Beginning in privileged EXEC mode, follow these steps to control access to an interface:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 2	**interface** `interface_id` **Example:** `Device# interface interface-id`	Identify a Layer 2 interface (for port ACLs) on which to apply an access list, and enter interface configuration mode.
Step 3	**ipv6 traffic-filter** *access-list-name* **Example:** `Device# ipv6 traffic-filter access-list-name in`	Apply the access list to incoming or outgoing traffic on the interface.

Step 4	**end**
	Example:
	`Device(config)# end`
		Returns to privileged EXEC mode.

Step 5	**show running-config** **Example:** `Device# show running-config`	Verify the access list configuration.
Step 6	**copy running-config startup-config** **Example:** `Device# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Displaying IPv6 ACLs

To display IPv6 ACLs, perform this procedure:

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	**show access-list** **Example:** `Device(config)# show access-lists`	Displays all access lists configured on the device.
Step 4	**show ipv6 access-list** *acl_name* **Example:** `Device(config)# show ipv6 access-list [access-list-name]`	Displays all configured IPv6 access list or the access list specified by name.

Configuration Examples for IPv6 ACL

Example: Creating an IPv6 ACL

This example configures the IPv6 access list named CISCO. The first deny entry in the list denies all packets that have a destination TCP port number greater than 5000. The second deny entry denies packets that have a source UDP port number less than 5000. The second deny also logs all matches to the console. The first permit entry in the list permits all ICMP packets. The second permit entry in the list permits all other traffic. The second permit entry is necessary because an implicit deny-all condition is at the end of each IPv6 access list.

```
Device(config)# ipv6 access-list CISCO
Device(config-ipv6-acl)# deny tcp any any gt 5000
Device (config-ipv6-acl)# deny ::/0 lt 5000 ::/0 log
Device(config-ipv6-acl)# permit icmp any any
Device(config-ipv6-acl)# permit any any
```

Example: Displaying IPv6 ACLs

This is an example of the output from the **show access-lists** privileged EXEC command. The output shows all access lists that are configured on the switch.

```
Device# show access-lists
Extended IP access list hello
10 permit ip any any
IPv6 access list ipv6
permit ipv6 any any sequence 10
```

This is an example of the output from the **show ipv6 access-lists** privileged EXEC command. The output shows only IPv6 access lists configured on the switch.

```
Device# show ipv6 access-list
IPv6 access list inbound
permit tcp any any eq bgp (8 matches) sequence 10
permit tcp any any eq telnet (15 matches) sequence 20
permit udp any any sequence 30
```

CHAPTER 3

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).

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:**	Logs system messages and debug output to a remote host.

	Command or Action	Purpose
	Device(config)# logging host ipv6 AAAA:BBBB:CCCC:DDDD::FFFF	

Example: Configuring Syslog over IPv6

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

CHAPTER 4

SNMP over IPv6

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.

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.

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, and entity 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** | **2c** | **3** [**auth** | **noauth** | **priv**]}] *community-string* [**udp-port** *port*] [*notification-type*] **Example:**	Specifies the recipient of an SNMP notification operation. - 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.

	Command or Action	Purpose
	`Device(config)# snmp-server host host1.com 2c vrf trap-vrf`	
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.

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 SNMP FLASH 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 flash
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
```