



## AAA Support for IPv6

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Authentication, authorization, and accounting (AAA) support for IPv6 is in compliance with RFC 3162. This module provides information about how to configure AAA options for IPv6.

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## Finding Feature Information

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

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

## Information About AAA Support for IPv6

### AAA over IPv6

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

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

## AAA Support for IPv6 RADIUS Attributes

The following RADIUS attributes, as described in RFC 3162, are supported for IPv6:

- Framed-Interface-Id
- Framed-IPv6-Pool
- Framed-IPv6-Prefix
- Framed-IPv6-Route
- Login-IPv6-Host

The following RADIUS attributes are also supported for IPv6:

- Delegated-IPv6-Prefix (RFC 4818)
- Delegated-IPv6-Prefix-Pool
- DNS-Server-IPv6-Address
- IPv6 ACL
- IPv6\_DNS\_Servers
- IPv6 Pool
- IPv6 Prefix#
- IPv6 Route

The attributes listed above can be configured on a RADIUS server and downloaded to access servers, where they can be applied to access connections.

### Prerequisites for Using AAA Attributes for IPv6

AAA attributes for IPv6 are compliant with RFC 3162 and require a RADIUS server capable of supporting RFC 3162.

### RADIUS Per-User Attributes for Virtual Access in IPv6 Environments

The following IPv6 attributes for RADIUS attribute-value (AV) pairs are supported for virtual access:

#### **Framed-Interface-Id**

The Framed-Interface-Id attribute indicates the IPv6 interface identifier to be configured. This per-user attribute is used during the IPv6CP negotiations and may be used in access-accept packets. If the Interface-Identifier IPv6CP option has been successfully negotiated, this attribute must be included in an Acc-0Request packet as a hint by the NAS to the server that it would prefer that value.

#### **Framed-IPv6-Pool**

The Framed-IPv6-Pool attribute is a per-user attribute that contains the name of an assigned pool that should be used to assign an IPv6 prefix for the user. This pool should either be defined locally on the router or defined on a RADIUS server from which pools can be downloaded.

### Framed-IPv6-Prefix

The Framed-IPv6-Prefix attribute performs the same function as the Cisco VSA--it is used for virtual access only and indicates an IPv6 prefix (and corresponding route) to be configured. This attribute is a per-user attribute and lets the user specify which prefixes to advertise in Neighbor Discovery Router Advertisement messages. The Framed-IPv6-Prefix attribute may be used in access-accept packets and can appear multiple times. The NAS will create a corresponding route for the prefix.

To use this attribute for DHCP for IPv6 prefix delegation, create a profile for the same user on the RADIUS server. The username associated with the second profile has the suffix "-dhcpv6."

The Framed-IPv6-Prefix attribute in the two profiles is treated differently. If a NAS needs both to send a prefix in router advertisements (RAs) and delegate a prefix to a remote user's network, the prefix for RA is placed in the Framed-IPv6-Prefix attribute in the user's regular profile, and the prefix used for prefix delegation is placed in the attribute in the user's separate profile.

### Framed-IPv6-Route

The Framed-IPv6-Route attribute performs the same function as the Cisco VSA: It is a per-user attribute that provides routing information to be configured for the user on the NAS. This attribute is a string attribute and is specified using the **ipv6 route** command.

### IPv6 ACL

You can specify a complete IPv6 access list. The unique name of the access list is generated automatically. The access list is removed when its user logs out. The previous access list on the interface is reapplied.

The `inacl` and `outacl` attributes allow you to a specific existing access list configured on the router. The following example shows ACL number 1 specified as the access list:

```
cisco-avpair = "ipv6:inacl#1=permit 2001:DB8:cc00:1::/48",  
cisco-avpair = "ipv6:outacl#1=deny 2001:DB8::/10",
```

### IPv6 Pool

For RADIUS authentication, the IPv6 Pool attribute extends the IPv4 address pool attributed to support the IPv6 protocol. It specifies the name of a local pool on the NAS from which to get the prefix and is used whenever the service is configured as PPP and whenever the protocol is specified as IPv6. Note that the address pool works in conjunction with local pooling. It specifies the name of the local pool that has been preconfigured on the NAS.

### IPv6 Prefix

The IPv6 Prefix# attribute lets you indicate which prefixes to advertise in Neighbor Discovery Router Advertisement messages. When the IPv6 Prefix# attribute is used, a corresponding route (marked as a per-user static route) is installed in the routing information base (RIB) tables for the given prefix.

```
cisco-avpair = "ipv6:prefix#1=2001:DB8::/64",  
cisco-avpair = "ipv6:prefix#2=2001:DB8::/64",
```

### IPv6 Route

The IPv6 route attribute allows you to specify a per-user static route. A static route is appropriate when the Cisco IOS software cannot dynamically build a route to the destination. See the description of the **ipv6 route** command for more information about building static routes.

The following example shows the IPv6 route attribute used to define a static route:

```
cisco-avpair = "ipv6:route#1=2001:DB8:cc00:1::/48",
cisco-avpair = "ipv6:route#2=2001:DB8:cc00:2::/48",
```

### Login-IPv6-Host

The Login-IPv6-Host attribute is a per-user attribute that indicates the IPv6 system with which to connect the user when the Login-Service attribute is included.

## IPv6 Prefix Pools

The function of prefix pools in IPv6 is similar to that of address pools in IPv4. The main difference is that IPv6 assigns prefixes rather than single addresses.

As in IPv4, a pool or a pool definition in IPv6 can be configured locally or it can be retrieved from an AAA server. Overlapping membership between pools is not permitted.

Once a pool is configured, it cannot be changed. If you change the configuration, the pool will be removed and re-created. All prefixes previously allocated will be freed.

Prefix pools can be defined so that each user is allocated a 64-bit prefix or so that a single prefix is shared among several users. In a shared prefix pool, each user may receive only one address from the pool.

# How to Configure AAA Support for IPv6

## Configuring the RADIUS Server over IPv6

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **radius server** *name*
5. **address ipv6** {*hostname* | *ipv6address*} [**acct-port** *port* | **alias** {*hostname* | *ipv6address*} | **auth-port** *port* [**acct-port** *port*]]
6. **key** {*0 string* | *7 string*} *string*
7. **timeout** *seconds*
8. **retransmit** *retries*
9. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>aaa new-model</b>  <b>Example:</b> Device(config)# aaa new-model	Configures the RADIUS server for IPv6 and enters RADIUS server configuration mode.
<b>Step 4</b>	<b>radius server <i>name</i></b>  <b>Example:</b> Device(config)# radius server myserver	Configures the RADIUS server for IPv6 and enters RADIUS server configuration mode.
<b>Step 5</b>	<b>address ipv6 {<i>hostname</i>   <i>ipv6address</i>} [<b>acct-port</b> <i>port</i>   <b>alias</b> {<i>hostname</i>   <i>ipv6address</i>}   <b>auth-port</b> <i>port</i> [<b>acct-port</b> <i>port</i>]]</b>  <b>Example:</b> Device(config-radius-server)# address ipv6 2001:DB8:1::1 acct-port 1813 auth-port 1812	Configures the IPv6 address for the RADIUS server accounting and authentication parameters.
<b>Step 6</b>	<b>key {<i>0 string</i>   <i>7 string</i>} <i>string</i></b>  <b>Example:</b> Device(config-radius-server)# key 0 key1	Specifies the authentication and encryption key for all RADIUS communications between the router and the RADIUS server.
<b>Step 7</b>	<b>timeout <i>seconds</i></b>  <b>Example:</b> Device(config-radius-server)# timeout 10	Specifies the time interval (in seconds) that the router waits for the RADIUS server to reply before retransmitting.
<b>Step 8</b>	<b>retransmit <i>retries</i></b>  <b>Example:</b> Device(config-radius-server)# retransmit 5	Specifies the number of times a RADIUS request is re-sent to a server when that server is not responding or responding slowly.

	Command or Action	Purpose
<b>Step 9</b>	<b>end</b>  <b>Example:</b> Device(config-radius-server)# end	Exits RADIUS server configuration mode and returns to privileged EXEC mode.

## Specifying the Source Address in RADIUS Server

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 radius source-interface *type number***
4. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>ipv6 radius source-interface <i>type number</i></b>  <b>Example:</b> Device(config)# ipv6 radius source-interface ethernet 0/0	Specifies an interface to use for the source address in RADIUS server.
<b>Step 4</b>	<b>end</b>  <b>Example:</b> Device(config)# end	Exits global configuration mode and returns to privileged EXEC mode.

## Configuring RADIUS Server Group Options

### SUMMARY STEPS

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

### DETAILED STEPS

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

	Command or Action	Purpose
<b>Step 6</b>	<b>ipv6 radius source-interface</b> <i>type number</i>  <b>Example:</b> <pre>Device(config-sg-radius)# ipv6 radius source-interface ethernet 0/0</pre>	Specifies an interface to use for the source address in RADIUS server under the RADIUS group server configuration.
<b>Step 7</b>	<b>end</b>  <b>Example:</b> <pre>Device(config-sg-radius)# end</pre>	Exits RADIUS group server configuration mode and returns to privileged EXEC mode.

## Configuring the DHCPv6 Server to Obtain Prefixes from RADIUS Servers

### Before You Begin

Before you perform this task, you must configure the AAA client and PPP on the router.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ipv6 nd prefix framed-ipv6-prefix**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<b>interface</b> <i>type number</i>  <b>Example:</b> Router(config)# interface ethernet 0/0	Specifies an interface type and number, and places the router in interface configuration mode.
Step 4	<b>ipv6 nd prefix</b> <b>framed-ipv6-prefix</b>  <b>Example:</b> Router(config-if)# ipv6 nd prefix framed-ipv6-prefix	Adds the prefix in a received RADIUS framed IPv6 prefix attribute to the interface's neighbor discovery prefix queue.

## Configuration Examples for AAA Support for IPv6

### Example: Configuring RADIUS Server over IPv6

```

Device> enable
Device# show radius server-group all

Server group radius
  Sharecount = 1 sg_unconfigured = FALSE
  Type = standard Memlocks = 1
  Server(2001:DB8:3333:4::5,6) Transactions:
  Authen: 0 Author: 0 Acct: 0
  Server_auto_test_enabled: FALSE
  Keywrap enabled: FALSE
Server group rad_ser1
  Sharecount = 1 sg_unconfigured = FALSE
  Type = standard Memlocks = 1
  Server(2001:DB8:3333:4::5,6) Transactions:
  Authen: 0 Author: 0 Acct: 0
  Server_auto_test_enabled: FALSE
  Keywrap enabled: FALSE

```

### Example: RADIUS Configuration

The following sample RADIUS configuration shows the definition of AV pairs to establish static routes:

```

campus1 Auth-Type = Local, Password = "mypassword"
  User-Service-Type = Framed-User,
  Framed-Protocol = PPP,
  cisco-avpair = "ipv6:inacl#1=permit 2001:DB8:1::/64 any",
  cisco-avpair = "ipv6:route=2001:DB8:2::/64",
  cisco-avpair = "ipv6:route=2001:DB8:3::/64",
  cisco-avpair = "ipv6:prefix=2001:DB8:2::/64 0 0 onlink autoconfig",
  cisco-avpair = "ipv6:prefix=2001:DB8:3::/64 0 0 onlink autoconfig",
  cisco-avpair = "ip:route=10.0.0.0 255.0.0.0",

```

## Additional References

### Related Documents

Related Topic	Document Title
IPv6 addressing and connectivity	<i>IPv6 Configuration Guide</i>
Cisco IOS commands	<a href="#">Cisco IOS Master Commands List, All Releases</a>
IPv6 commands	<a href="#">Cisco IOS IPv6 Command Reference</a>
Cisco IOS IPv6 features	<a href="#">Cisco IOS IPv6 Feature Mapping</a>

### Standards and RFCs

Standard/RFC	Title
RFCs for IPv6	<i>IPv6 RFCs</i>

### 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.	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

## Feature Information for AAA Support 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.

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**Table 1: Feature Information for AAA Support for IPv6**

Feature Name	Releases	Feature Information
AAA Support for Cisco VSA IPv6 Attributes	12.2(33)SRC 12.2(13)T 12.3 12.3(2)T 12.4 12.4(2)T	VSA's were developed to support AAA for IPv6.
IPv6 Access Services: AAA Support for RFC 3162 IPv6 RADIUS Attributes	12.3(4)T 12.4 12.2(58)SE 12.2(33)SRC	The AAA attributes for IPv6 are compliant with RFC 3162 and require a RADIUS server capable of supporting RFC 3162.  The following commands were introduced or modified: <b>ipv6 nd prefix framed-ipv6-prefix</b> .
IPv6 Access Services: Prefix Pools	12.2(13)T	This feature is supported.
RADIUS over IPv6	15.2(1)T 12.2(58)SE 15.1(1)SY	Authentication, authorization, and accounting (AAA) support for IPv6 is in compliance with RFC 3162. This feature provides information about how to configure AAA options for IPv6.

