Implementing ADSL and Deploying Dial Access for IPv6

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This module describes the implementation of prefix pools and per-user Remote Access Dial-In User Service (RADIUS) attributes in IPv6. It also describes the deployment of IPv6 in Digital Subscriber Line (DSL) and dial-access environments. Asymmetric Digital Subscriber Line (ADSL) and dial deployment provide the extensions that make large-scale access possible for IPv6 environments, including IPv6 RADIUS attributes, stateless address configuration on Point-to-Point Protocol (PPP) links, per-user static routes, and access control lists (ACLs).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 for Implementing ADSL and Deploying Dial Access for IPv6" section on page 17.

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

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Prerequisites for Implementing ADSL and Dial Access for IPv6

This document assumes that you are familiar with IPv4. Refer to the publications referenced in the "Additional References" section for IPv4 configuration and command reference information.

Restrictions for Implementing ADSL and Deploying Dial Access for IPv6

ADSL and Dial Deployment is available for interfaces with PPP encapsulation enabled, including PPP over ATM (PPPoA), PPP over Ethernet (PPPoE), PPP over async, and PPP over ISDN.

Information About Implementing ADSL and Deploying Dial Access for IPv6

To implement ADSL and deploy dial access for IPv6, you need to understand the following concepts:

Address Assignment for IPv6

A Cisco router configured with IPv6 will advertise its IPv6 prefixes on one or more interfaces, allowing IPv6 clients to automatically configure their addresses. In IPv6, address assignment is performed at the network layer, in contrast to IPv4 where a number of functions are handled in the PPP layer. The only function handled in IPv6 Control Protocol (IPv6CP) is the negotiation of a unique interface identifier. Everything else, including DNS server discovery, is done within the IPv6 protocol itself.

Contrary to IPv4 address assignment, an IPv6 user will be assigned a prefix, not a single address. Typically the Internet Service Provider (ISP) assigns a 64- or 48-bit prefix.

In the IPv6 world, Internet service providers (ISPs) assign long-lived prefixes to users, which has some impact on the routing system. In typical IPv4 environments, each network access server (NAS) has a pool of 24-bit addresses and users get addresses from this pool when dialing in. If a user dials another POP or is connected to another NAS at the same POP, a different IPv4 address is assigned.

Addresses for IPv6 are assigned by two different methods.

Stateless Address Autoconfiguration

Assigning addresses using the stateless address autoconfiguration method can only be used to assign 64-bit prefixes. Each user is assigned a 64-bit prefix, which is advertised to the user in a router advertisement (RA). All addresses are automatically configured based on the assigned prefix.

A typical scenario is to assign a separate 64-bit prefix per user; however, users can also be assigned a prefix from a shared pool of addresses. Using the shared limits addresses to only one address per user.

This solution works best for the cases where the customer provider edge router (CPE) is a single PC or is limited to only one subnet. If the user has multiple subnets, Layer 2 (L2) bridging, multilink subnets or proxy RA can be used. The prefix advertised in the RA can come from an authorization, authentication, and accounting (AAA) server, which also provides the prefix attribute, can be manually configured, or can be allocated from a prefix pool.

The Framed-Interface-Id AAA attribute influences the choice of interface identifier for peers and, in combination with the prefix, the complete IPv6 address can be determined.

Prefix Delegation

Prefix delegation uses Dynamic Host Configuration Protocol (DHCP). When the user requests a prefix from the prefix delegator, typically the NAS, the prefix is allocated as described in the "Stateless Address Autoconfiguration" section on page 3.

An IPv6 prefix delegating router selects IPv6 prefixes to be assigned to a requesting router upon receiving a request from the client. The delegating router might select prefixes for a requesting router in the following ways:

- Static assignment based on subscription to an ISP
- Dynamic assignment from a pool of available prefixes
- Selection based on an external authority such as a RADIUS server using the Framed-IPv6-Prefix attribute (see the "Framed-IPv6-Prefix" section on page 4).

DHCP SIP Server Options

Two DHCP for IPv6 Session Initiation Protocol (SIP) server options describe a local outbound SIP proxy: one carries a list of domain names, the other a list of IPv6 addresses. These two options can be configured in a DHCPv6 configuration pool.

AAA Attributes for IPv6

Vendor-specific attributes (VSAs) have been developed to support AAA for IPv6. The Cisco VSAs are inacl, outacl, route, and prefix.

Prefix pools and pool names are configurable through AAA.

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

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

These attributes can be configured on a RADIUS server and downloaded to access servers where they can be applied to access connections.

AAA attributes are described in the following sections:

- RADIUS Per-User Attributes for Virtual Access in IPv6 Environments, page 4
- IPv6 Prefix Pools, page 6

Prerequisites for Using AAA Attributes for IPv6

The 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, page 4
- Framed-IPv6-Prefix, page 4
- Login-IPv6-Host, page 5
- Framed-IPv6-Route, page 5
- Framed-IPv6-Pool, page 5
- IPv6 Route, page 5
- IPv6 ACL, page 5
- IPv6 Prefix#, page 5
- IPv6 Pool, page 5

Apart from the new IPv6 prefix and IPv6 pool attributes, these are all existing Cisco VSAs extended to support the IPv6 protocol.

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-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 user name 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.

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.

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.

Framed-IPv6-Pool

The 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.

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=2001:0DB8:cc00:1::/48",
cisco-avpair = "ipv6:route#2=2001::0DB8:cc00:2::/48",
```

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 2001:0DB8:cc00:1::/48",
cisco-avpair = "ipv6:outacl#1=deny 2001:0DB8::/10",
```

IPv6 Prefix#

The IPv6 prefix# attribute lets you indicate which prefixes to advertise in Neighbor Discovery Router Advertisement messages. When the 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=2001:0db8::/64",
cisco-avpair = "ipv6:prefix#2=2001:0db8::/64",
```

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 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 for IPv4, a pool or a pool definition 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 ADSL and Deploy Dial Access in IPv6

The configuration guidelines contained in this section show how to configure ADSL and dial access in IPv6 environments.

- Configuring the NAS, page 6 (required)
- Configuring the Remote CE Router, page 9 (required)
- Configuring the DHCP for IPv6 Server to Obtain Prefixes from RADIUS Servers, page 11 (optional)
- Configuring DHCP for IPv6 AAA and SIP Options, page 12 (optional)

Configuring the NAS

The first step in setting up dial access is to configure the NAS. All of the dialer groups, access lists, and routes are known to the NAS. This task shows how to configure the NAS to implement ADSL and deploy dial access for IPv6 environments.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **hostname** *name*
4. **aaa new-model**
5. **aaa authentication ppp** {**default** | *list-name*} *method1* [*method2*...]
6. **aaa authorization configuration default** {**radius** | **tacacs+**}
7. **show ipv6 route** [*ipv6-address* | *ipv6-prefix*/*prefix-length* | *protocol* | *interface-type interface-number*]
8. **virtual-profile virtual-template** *number*
9. **interface serial** *controller-number*:*timeslot*
10. **encapsulation** *encapsulation-type*
11. **exit**
12. **dialer-group** *group-number*

13. **ppp authentication** {*protocol1* [*protocol2...*]} [**if-needed**] [*list-name* | **default**] [**callin**] [**one-time**] [**optional**]
14. **interface virtual-template** *number*
15. **ipv6 enable**
16. **dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | *access-group*}
17. **radius-server host** {*hostname* | *ip-address*} [**test username** *user-name*] [**auth-port** *port-number*] [**ignore-auth-port**] [**acct-port** *port-number*] [**ignore-acct-port**] [**timeout** *seconds*] [**retransmit** *retries*] [**key** *string*] [**alias** {*hostname* | *ip-address*}] [**idle-time** *seconds*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**hostname** *name* **Example:** `Router(config)# hostname cust1-53a`	Specifies the host name for the network server.
Step 4	**aaa new-model** **Example:** `Router(config)# aaa new-model`	Enables the AAA server.
Step 5	**aaa authentication ppp** {**default** | *list-name*} *method1* [*method2...*] **Example:** `Router(config)# aaa authentication ppp default if-needed group radius`	Specifies one or more AAA authentication methods for use on serial interfaces that are running PPP.
Step 6	**aaa authorization configuration default** {**radius** | **tacacs+**} **Example:** `Router(config)# aaa authorization network default group radius`	Downloads configuration information from the AAA server.

	Command or Action	Purpose
Step 7	**show ipv6 route** [*ipv6-address* | *ipv6-prefix*/*prefix-length* | *protocol* | *interface-type interface-number*] **Example:** `Router(config)# show ipv6 route`	Shows the routes installed by the previous commands.
Step 8	**virtual-profile virtual-template** *number* **Example:** `Router(config)# virtual-profile virtual-template 1`	Enables virtual profiles by virtual interface template.
Step 9	**interface serial** *controller-number*:*timeslot* **Example:** `Router(config)# interface Serial0:15`	Specifies a serial interface created on a channelized E1 or channelized T1 controller (for ISDN PRI, channel-associated signaling, or robbed-bit signaling).
Step 10	**encapsulation** *encapsulation-type* **Example:** `Router(config-if)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 11	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.
Step 12	**dialer-group** *group-number* **Example:** `Router(config)# dialer-group 1`	Control access by configuring an interface to belong to a specific dialing group.
Step 13	**ppp authentication** {*protocol1* [*protocol2...*]} [**if-needed**] [*list-name* | **default**] [**callin**] [**one-time**] [**optional**] **Example:** `Router(config)# ppp authentication chap`	Enables Challenge Handshake Authentication Protocol (CHAP) or Password Authentication Protocol (PAP) or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
Step 14	**interface virtual-template** *number* **Example:** `Router(config)# interface virtual-template1`	Creates a virtual template interface that can be configured and applied dynamically in creating virtual access interfaces.
Step 15	**ipv6 enable** **Example:** `Router(config)# ipv6 enable`	Enables IPv6 processing on an interface that has not been configured with an explicit IPv6 address.

	Command or Action	Purpose
Step 16	**dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | *access-group*} **Example:** `Router(config)# dialer-list 1 protocol ipv6 permit`	Defines a dial-on-demand routing (DDR) dialer list for dialing by protocol or by a combination of a protocol and a previously defined access list.
Step 17	**radius-server host** {*hostname* | *ip-address*} [**test username** *user-name*] [**auth-port** *port-number*] [**ignore-auth-port**] [**acct-port** *port-number*] [**ignore-acct-port**] [**timeout** *seconds*] [**retransmit** *retries*] [**key** *string*] [**alias** {*hostname* | *ip-address*}] [**idle-time** *seconds*] **Example:** `Router(config)# radius-server host 172.17.250.8 auth-port 1812 acct-port 1813 key testing123`	Specifies a RADIUS server host.

Troubleshooting Tips

Verify that the access list is installed correctly before proceeding with the next task. Use the **show ipv6 access-list** and **show ipv6 interface** commands.

Configuring the Remote CE Router

The following task describes how to configure each remote CE router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **hostname** *name*
4. **interface bri** *number.subinterface-number* [**multipoint** | **point-to-point**]
5. **encapsulation** *encapsulation-type*
6. **ipv6 address autoconfig** [**default**]
7. **isdn switch-type** *switch-type*
8. **ppp authentication** {*protocol1* [*protocol2...*]} [**if-needed**] [*list-name* | **default**] [**callin**] [**one-time**]
9. **ppp multilink** [**bap** | **required**]
10. **exit**
11. **dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | *access-group*}
12. **ipv6 route** *ipv6-prefix/prefix-length* {*ipv6-address* | *interface-type interface-number* [*ipv6-address*]} [*administrative-distance*] [*administrative-multicast-distance* | **unicast** | **multicast**] [**tag** *tag*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**hostname** *name* **Example:** `Router(config)# hostname cust1-36a`	Specifies the host name for the network server.
Step 4	**interface bri** *number.subinterface-number* **[multipoint | point-to-point]** **Example:** `Router(config)# interface BRI1/0`	Configures a BRI interface and enters interface configuration mode.
Step 5	**encapsulation** *encapsulation-type* **Example:** `Router(config-if)# encapsulation ppp`	Sets the encapsulation method used by the interface.
Step 6	**ipv6 address autoconfig** [**default**] **Example:** `Router(config-if)# ipv6 address autoconfig`	Indicates that the IPv6 address will be generated automatically.
Step 7	**isdn switch-type** *switch-type* **Example:** `Router(config-if)# isdn switch-type basic-net3`	Specifies the central office switch type on the ISDN interface.
Step 8	**ppp authentication** {*protocol1* [*protocol2...*]} [**if-needed**] [*list-name* | **default**] [**callin**] [**one-time**] **Example:** `Router(config-if)# ppp authentication chap optional`	Enables Challenge Handshake Authentication Protocol (CHAP) or Password Authentication Protocol (PAP) or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
Step 9	**ppp multilink** [**bap** | **required**] **Example:** `Router(config-if)# ppp multilink`	Enables Multilink PPP (MLP) on an interface and, optionally, enables Bandwidth Allocation Control Protocol (BACP) and Bandwidth Allocation Protocol (BAP) for dynamic bandwidth allocation.

	Command or Action	Purpose
Step 10	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 11	**dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | *access-group*} **Example:** `Router(config)# dialer-list 1 protocol ipv6 permit`	Defines a dial-on-demand routing (DDR) dialer list for dialing by protocol or by a combination of a protocol and a previously defined access list.
Step 12	**ipv6 route** *ipv6-prefix/prefix-length* {*ipv6-address* | *interface-type interface-number* [*ipv6-address*]} [*administrative-distance*] [*administrative-multicast-distance* | **unicast** | **multicast**] [**tag** *tag*] **Example:** `Router(config)# ipv6 route 2001:0db8:1/128 BRI1/0`	Establishes static IPv6 routes. Use one command for each route.

What to Do Next

Once you have configured the NAS and CE router, configure RADIUS to establish the AV pairs for callback. Callback allows remote network users to dial in to the NAS without being charged. When callback is required, the NAS hangs up the current call and dials the caller back. When the NAS performs the callback, only information for the outgoing connection is applied. The rest of the attributes from the preauthentication access-accept message are discarded.

The following example shows a RADIUS profile configuration for a local campus:

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

The RADIUS AV pairs for IPv6 are described in RADIUS Per-User Attributes for Virtual Access in IPv6 Environments, page 4.

Configuring the DHCP for IPv6 Server to Obtain Prefixes from RADIUS Servers

The following task describes how to configure the DHCP for IPv6 server to obtain prefixes from RADIUS servers.

Prerequisites

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
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface ethernet 0/0`	Specifies an interface type and number, and places the router in interface configuration mode.
Step 4	**ipv6 nd prefix framed-ipv6-prefix** **Example:** `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.

Configuring DHCP for IPv6 AAA and SIP Options

This optional task allows users to enable the router to support AAA and SIP options.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 dhcp pool** *poolname*
4. **prefix-delegation aaa** [**method-list** *method-list*] [*lifetime*]
5. **sip address** *ipv6-address*
6. **sip domain-name** *domain-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ipv6 dhcp pool** *poolname* **Example:** `Router(config)# ipv6 dhcp pool pool1`	Configures a DHCP for IPv6 configuration information pool and enters DHCP for IPv6 pool configuration mode.
Step 4	**prefix-delegation aaa** [**method-list** *method-list*] [*lifetime*] **Example:** `Router(config-dhcp)# prefix-delegation aaa method-list list1`	Specifies that prefixes are to be acquired from AAA servers.
Step 5	**sip address** *ipv6-address* **Example:** `Router(config-dhcp)# sip address 2001:0DB8::2`	Configures a SIP server IPv6 address to be returned in the SIP server's IPv6 address list option to clients.
Step 6	**sip domain-name** *domain-name* **Example:** `Router(config-dhcp)# sip domain sip1.cisco.com`	Configures a SIP server domain name to be returned in the SIP server's domain name list option to clients.

Configuration Examples for Implementing ADSL and Deploying Dial Access for IPv6

This section provides the following configuration example:

• Implementing ADSL and Deploying Dial Access for IPv6: Example, page 13

Implementing ADSL and Deploying Dial Access for IPv6: Example

This example shows a typical configuration for ADSL and dial access. The following three separate configurations are required:

- NAS Configuration
- Remote CE Router Configuration
- RADIUS Configuration

NAS Configuration

This configuration for the ISP NAS shows the configuration that supports access from the remote CE router.

```
hostname cust1-53a
  aaa new-model
  aaa authentication ppp default if-needed group radius
  aaa authorization network default group radius
  virtual-profile virtual-template 1
  interface Serial0:15
   encapsulation ppp
   dialer-group 1
   ppp authentication chap
  !
  interface Virtual-Template1
   ipv6 enable
  !
  dialer-list 1 protocol ipv6 permit
  radius-server host 172.17.250.8 auth-port 1812 acct-port 1813 key testing123
```

Remote CE Router Configuration

This configuration for the remote customer edge router shows PPP encapsulation and IPv6 routes defined.

```
hostname cust-36a
  interface BRI1/0
   encapsulation ppp
   ipv6 enable
   isdn switch-type basic-net3
   ppp authentication chap optional
   ppp multilink
  !
  dialer-list 1 protocol ipv6 permit
  ipv6 route 2001:0DB8:1/128 BRI1/0
  ipv6 route ::/0 2001:0db8:1
```

RADIUS Configuration

This RADIUS configuration shows the definition of AV pairs to establish the static routes.

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

Where to Go Next

For information about implementing routing protocols for IPv6, refer to the *Implementing RIP for IPv6*, *Implementing IS-IS for IPv6*, or the *Implementing Multiprotocol BGP for IPv6* module. For information about implementing security for IPv6 environments, refer to the *Implementing IPsec in IPv6 Security* and *Implementing Traffic Filters and Firewalls for IPv6 Security* modules.

Additional References

The following sections provide references related to the Implementing ADSL and Deploying Dial Access for IPv6 feature.

Related Documents

Related Topic	Document Title
IPv6 supported feature list	"Start Here: Cisco IOS Software Release Specifics for IPv6 Features," *Cisco IOS IPv6 Configuration Guide*
IPv6 basic connectivity	"Implementing IPv6 Addressing and Basic Connectivity," *Cisco IOS IPv6 Configuration Guide*
IPv6 commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IPv6 Command Reference*
Certification authority and interoperability, RA proxy	"Security Overview," *Cisco IOS Security Configuration Guide*
RADIUS server configuration	"Security Overview," *Cisco IOS Security Configuration Guide*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	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

RFCs

RFCs	Title
RFC 3162	*RADIUS and IPv6*
RFC 3177	*IAB/IESG Recommendations on IPv6 Address*
RFC 3319	*Dynamic Host Configuration Protocol (DHCPv6) Options for Session Initiated Protocol (SIP) Servers*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Implementing ADSL and Deploying Dial Access for IPv6

Table 15 lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Release 12.2(13)T or a later release appear in the table.

For information on a feature in this technology that is not documented here, see the *Start Here: Cisco IOS Software Release Specifies for IPv6 Features* roadmap.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 15 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 15 identifies the earliest release for each early-deployment train in which each feature became available.

Table 15 Feature Information for Implementing ADSL and Deploying Dial Access for IPv6

Feature Name	Releases	Feature Information
Enhanced IPv6 features for ADSL and dial deployment	12.2(13)T 12.3 12.3(2)T 12.4 12.4(2)T	Several features were enhanced to enable IPv6 to use ADSL and dial deployment. The following sections provide information about these features: • Address Assignment for IPv6, page 2 • Stateless Address Autoconfiguration, page 3 • Configuring the NAS, page 6 • Configuring the Remote CE Router, page 9
AAA support for Cisco VSA IPv6 attributes	12.2(13)T 12.3 12.3(2)T 12.4 12.4(2)T	Vendor-specific attributes (VSAs) were developed to support AAA for IPv6. The following section provides information about this feature: • AAA Attributes for IPv6, page 3

Table 15 Feature Information for Implementing ADSL and Deploying Dial Access for IPv6 (continued)

Feature Name	Releases	Feature Information
PPPoA	12.2(13)T 12.3 12.3(2)T 12.4 12.4(2)T	ADSL and dial deployment is available for interfaces with PPP encapsulation enabled, including PPPoA. The following sections provide information about these features: • Address Assignment for IPv6, page 2 • Configuring the NAS, page 6 • Configuring the Remote CE Router, page 9
PPPoE	12.2(13)T 12.3 12.3(2)T 12.4 12.4(2)T	ADSL and dial deployment is available for interfaces with PPP encapsulation enabled, including PPPoE. The following sections provide information about these features: • Address Assignment for IPv6, page 2 • Configuring the NAS, page 6 • Configuring the Remote CE Router, page 9
IPv6 prefix pools	12.2(13)T 12.3 12.3(2)T 12.4 12.4(2)T	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. The following sections provide information about these features: • AAA Attributes for IPv6, page 3 • Stateless Address Autoconfiguration, page 3 • IPv6 Prefix Pools, page 6 • Configuring the NAS, page 6 • Configuring the Remote CE Router, page 9

Table 15 Feature Information for Implementing ADSL and Deploying Dial Access for IPv6 (continued)

Feature Name	Releases	Feature Information
AAA support for RFC 3162 IPv6 RADIUS attributes	12.3(4)T 12.4 12.4(2)T	The AAA attributes for IPv6 are compliant with RFC 3162 and require a RADIUS server capable of supporting RFC 3162. The following sections provide information about these features: • AAA Attributes for IPv6, page 3 • Prerequisites for Using AAA Attributes for IPv6, page 4 • RADIUS Per-User Attributes for Virtual Access in IPv6 Environments, page 4 • Configuring the DHCP for IPv6 Server to Obtain Prefixes from RADIUS Servers, page 11 • Configuring DHCP for IPv6 AAA and SIP Options, page 12
DHCP for IPv6 prefix delegation via AAA	12.2(18)SXE 12.3(14)T 12.4 12.4(2)T	The following sections provide information about these features: • Stateless Address Autoconfiguration, page 3 • Prefix Delegation, page 3 • IPv6 Prefix Pools, page 6 • Prerequisites for Using AAA Attributes for IPv6, page 4 • Configuring DHCP for IPv6 AAA and SIP Options, page 12