

IP over IPv6 Tunnels

IPv6 supports IP over IPv6 tunnels, which includes the following:

- Generic routing encapsulation (GRE) IPv4 tunnel support for IPv6 traffic—IPv6 traffic can be carried over IPv4 GRE tunnels using the standard GRE tunneling technique that is designed to provide the services to implement any standard point-to-point encapsulation scheme. The primary use of GRE tunnels is for stable connections that require regular secure communication between two edge devices or between an edge device and an end system. The edge devices and the end systems must be dual-stack implementations.
- GRE support over IPv6 transport—GRE has a protocol field that identifies the passenger protocol. GRE tunnels allow Intermediate System-to-Intermediate System (IS-IS) or IPv6 to be specified as a passenger protocol, which allows both IS-IS and IPv6 traffic to run over the same tunnel.
- VRF-aware IPv4/IPv6 over IPv6 tunnels - Virtual Routing and Forwarding (VRF)-aware tunnels are used to connect customer networks separated by untrusted core networks or core networks with different infrastructures (IPv4 or IPv6).

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Information About IP over IPv6 Tunnels

GRE IPv4 Tunnel Support for IPv6 Traffic

IPv6 traffic can be carried over IPv4 GRE tunnels using the standard GRE tunneling technique that is designed to provide the services to implement any standard point-to-point encapsulation scheme. As in IPv6 manually configured tunnels, GRE tunnels are links between two points, with a separate tunnel for each link. The tunnels are not tied to a specific passenger or transport protocol but, in this case, carry IPv6 as the passenger protocol with the GRE as the carrier protocol and IPv4 or IPv6 as the transport protocol.

The primary use of GRE tunnels is for stable connections that require regular secure communication between two edge devices or between an edge device and an end system. The edge devices and the end systems must be dual-stack implementations.

GRE Support over IPv6 Transport

GRE has a protocol field that identifies the passenger protocol. GRE tunnels allow Intermediate System-to-Intermediate System (IS-IS) or IPv6 to be specified as a passenger protocol, which allows both IS-IS and IPv6 traffic to run over the same tunnel. If GRE did not have a protocol field, it would be impossible to distinguish whether the tunnel was carrying IS-IS or IPv6 packets. The GRE protocol field makes it desirable to tunnel IS-IS and IPv6 inside GRE.

How to Configure IP over IPv6 Tunnels

The following tasks describe how to configure an IPv6 tunnel. IPv6 or IPv4 packets can be forwarded on this tunnel.

Configure CDP Over GRE IPv6 Tunnels

Perform this task to configure a GRE tunnel on an IPv6 network. GRE tunnels can be configured to run over an IPv6 network layer and transport IPv6 and IPv4 packets through IPv6 tunnels.



Note You must enable IPv6 or configure IPv6 MTU size more than 1500 on a tunnel's exit interface to avoid receiving warning messages.

Before you begin

When GRE IPv6 tunnels are configured, IPv6 addresses are assigned to the tunnel source and the tunnel destination. The tunnel interface can have either IPv4 or IPv6 addresses. The host or device at each end of the configured tunnel must support both IPv4 and IPv6 protocol stacks.

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	**interface tunnel** *tunnel-number* **Example:** `Device(config)# interface tunnel 0`	Specifies a tunnel interface and number and enters interface configuration mode.
Step 4	**CDP enable** **Example:**	Enables Cisco Discovery Protocol on the interface.

	Command or Action	Purpose
	`Device(config)# CDP enable`	
Step 5	**tunnel source** {*ipv6-address* | *interface-type* |*interface-number* } **Example:** `Device(config-if)# tunnel source ethernet 0`	Specifies the source IPv6 address or the source interface type and number for the tunnel interface. • If an interface type and number are specified, the interface must be configured with an IPv6 address. **Note** For more information on the tunnel source command, refer to the IPv6 command reference guide.
Step 6	**tunnel destination** *ipv6-address* **Example:** `Device(config-if)# tunnel destination 2001:0DB8:0C18:2::300`	Specifies the destination IPv6 address for the tunnel interface. **Note** For more information on the tunnel destination command, refer to the IPv6 command reference guide.
Step 7	**tunnel mode gre ipv6** **Example:** `Device(config-if)# tunnel mode gre ipv6`	Specifies a GRE IPv6 tunnel. **Note** The **tunnel mode gre ipv6** command specifies GRE as the encapsulation protocol for the tunnel interface. Only the syntax used in this context is displayed. For more details, see the IPv6 Command Reference.
Step 8	**end** **Example:** `Device(config-if)# end`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuration Examples for IP over IPv6 Tunnels

Example: IPv6 over IPv6 Tunnel

Example: Configuring CE1

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet0/0
 no ipv6 address
 ipv6 address 2001:DB8:2:1::1/64
 no shutdown
 exit
!
```

```
ipv6 route 2001:DB8:2:5::/64 2001:DB8:2:1::2
ipv6 route 2001:DB8:2:9::/64 2001:DB8:2:1::2
!
```

Example: Configuring PE1

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Tunnel0
 no ipv6 address
 ipv6 address 2001:DB8:2:9::1/64
 tunnel source 2001:DB8:2:2::1
 tunnel mode ipv6
 tunnel destination 2001:DB8:2:4::2
 exit
!
interface Ethernet0/0
 no ipv6 address
 ipv6 address 2001:DB8:2:1::2/64
 no shutdown
 exit
!
!
interface Ethernet1/1
 no ipv6 address
 ipv6 address 2001:DB8:2:2::1/64
 no shutdown
 exit
!

ipv6 route 2001:DB8:2:3::/64 2001:DB8:2:2::2
ipv6 route 2001:DB8:2:4::/64 2001:DB8:2:2::2
ipv6 route 2001:DB8:2:5::/64 Tunnel0 2001:DB8:2:9::2
```

Example: Configuring PE2

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Tunnel0
 no ipv6 address
 ipv6 address 2001:DB8:2:9::2/64
 tunnel source 2001:DB8:2:4::2
 tunnel mode ipv6
 tunnel destination 2001:DB8:2:2::1
 exit
!
interface Ethernet0/0
 no ipv6 address
 ipv6 address 2001:DB8:2:5::1/64
 no shutdown
 exit
!
```

```
interface Ethernet0/1
 no ipv6 address
 ipv6 address 2001:DB8:2:4::2/64
 no shutdown
 exit
!
!
ipv6 route 2001:DB8:2:2::/64 2001:DB8:2:4::1
ipv6 route 2001:DB8:2:3::/64 2001:DB8:2:4::1
ipv6 route 2001:DB8:2:1::/64 Tunnel0 2001:DB8:2:9::1
```

Example: Configuring CE2

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet0/0
 no ipv6 address
 ipv6 address 2001:DB8:2:5::2/64
 no shutdown
 exit
!
ipv6 route 2001:DB8:2:1::/64 2001:DB8:2:5::1
ipv6 route 2001:DB8:2:9::/64 2001:DB8:2:5::1
!
```

Example: Configuring Core Device 1

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet1/0
 no ipv6 address
 no shutdown
 ipv6 address 2001:DB8:2:3::1/64
 exit
!
interface Ethernet1/1
 no ipv6 address
 ipv6 address 2001:DB8:2:2::2/64
 no shutdown
 exit
!
ipv6 route 2001:DB8:2:4::/64 2001:DB8:2:3::2
```

Example: Configuring Core Device 2

```
!
ipv6 unicast-routing
ipv6 cef
```

```
!
interface Ethernet0/1
 no ip address
 ipv6 address 2001:DB8:2:4::1/64
 no shutdown
 exit
!
interface Ethernet1/0
 no ip address
 ipv6 address 2001:DB8:2:3::2/64
 no shutdown
 exit
!
ipv6 route 2001:DB8:2:2::/64 2001:DB8:2:3::1
```

Example: IPv4 over IPv6 Tunnel

Example: Configuring CE1

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet0/0
 no ip address
 ip address 192.168.1.1 255.255.255.0
 no shutdown
 exit
!
ip route 192.168.5.0 255.255.255.0 192.168.1.2
ip route 192.168.9.0 255.255.255.0 192.168.1.2
!
```

Example: Configuring PE1

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Tunnel0
 no ip address
 ip address 192.168.9.1 255.255.255.0
 tunnel source 2001:DB8:2:2::1
 tunnel destination 2001:DB8:2:4::2
 tunnel mode ipv6
 exit
!
interface Ethernet0/0
 no ip address
 ip address 192.168.1.2 255.255.255.0
 no shutdown
 exit
!
!
```

```
interface Ethernet1/1
 no ipv6 address
 ipv6 address 2001:DB8:2:2::1/64
 no shutdown
 exit
!

ipv6 route 2001:DB8:2:3::/64 2001:DB8:2:2::2
ipv6 route 2001:DB8:2:4::/64 2001:DB8:2:2::2
ip route 192.168.5.0 255.255.255.0 Tunnel 0 192.168.9.2
```

Example: Configuring PE2

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Tunnel0
 no ip address
 ip address 192.168.9.2 255.255.255.0
 tunnel source 2001:DB8:2:4::2
 tunnel destination 2001:DB8:2:2::1
 tunnel mode ipv6
 exit
!
interface Ethernet0/0
 no ip address
 ip address 192.168.5.1 255.255.255.0
 no shutdown
 exit
!
interface Ethernet0/1
 no ipv6 address
 ipv6 address 2001:DB8:2:4::2/64
 no shutdown
 exit
!
!
ipv6 route 2001:DB8:2:2::/64 2001:DB8:2:4::1
ipv6 route 2001:DB8:2:3::/64 2001:DB8:2:4::1
ip route 192.168.1.0 255.255.255.0 Tunnel 0 192.168.9.1
```

Example: Configuring CE2

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet0/0
 no ip address
 ip address 192.168.5.2 255.255.255.0
 no shutdown
 exit
!
ip route 192.168.1.0 255.255.255.0 192.168.1.2
```

```
ip route 192.168.9.0 255.255.255.0 192.168.1.2

!
```

Example: Configuring Core Device 1

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet1/0
 no ipv6 address
 no shutdown
 ipv6 address 2001:DB8:2:3::1/64
 exit
!
interface Ethernet1/1
 no ipv6 address
 ipv6 address 2001:DB8:2:2::2/64
 no shutdown
 exit
!
ipv6 route 2001:DB8:2:4::/64 2001:DB8:2:3::2
```

Example: Configuring Core Device 2

```
!
ipv6 unicast-routing
ipv6 cef
!
interface Ethernet0/1
 no ip address
 ipv6 address 2001:DB8:2:4::1/64
 no shutdown
 exit
!
interface Ethernet1/0
 no ip address
 ipv6 address 2001:DB8:2:3::2/64
 no shutdown
 exit
!
ipv6 route 2001:DB8:2:2::/64 2001:DB8:2:3::1
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
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 RFC*

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 IP over IPv6 Tunnels

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 IP over IPv6 Tunnels

Feature Name	Releases	Feature Information
IP over IPv6 Tunnels	12.2(30)S 12.2(33)SRA 12.3(7)T 12.4 12.4(2)T 15.0(1)S Cisco IOS XE Release 2.1 15.1(1)SY	IP over IPv6 Tunnels feature is supported. The following commands were introduced or modified: **tunnel destination**, **tunnel mode ipv6**, **tunnel mode gre ipv6**, **tunnel source**.