Configuring MPLS over GRE

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Prerequisites for MPLS over GRE

Ensure that the following routing protocols are configured and working properly.

- Label Distribution Protocol (LDP)—for MPLS label distribution.
- Routing protocol (ISIS or OSFP) between the core devices P1-P-P2
- MPLS between PE1-P1 and PE2-P2
- Since the ingress traffic enters the IP core from MPLS network and egress traffic leaves the IP core to enter the MPLS network, it is recommended to use QoS group value for defining QoS policies as we traverse the protocol boundary.

Restrictions for MPLS over GRE

- GRE Tunneling :
  - L2VPN over mGRE and L3VPN over mGRE is not supported.
  - The tunnel source can only be a loopback or a Layer 3 interface. These interfaces could either be physical interfaces or etherchannels.
  - Tunnel interface supports Static Routes, Enhanced Interior Gateway Routing Protocol (EIGRP) and Open Shortest Path First (OSPF) routing protocols.
  - GRE Options - Sequencing, Checksum and Source Route are not supported.

- IPv6 generic routing encapsulation (GRE) is not supported.
- Carrier Supporting Carrier (CSC) is not supported.
- Tunnel source cannot be a subinterface.

Information About MPLS over GRE

The MPLS over GRE feature provides a mechanism for tunneling Multiprotocol Label Switching (MPLS) packets over a non-MPLS network. This feature allows you to create a generic routing encapsulation (GRE) tunnel across a non-MPLS network. The MPLS packets are encapsulated within the GRE tunnel packets, and the encapsulated packets traverse the non-MPLS network through the GRE tunnel. When GRE tunnel packets are received at the other side of the non-MPLS network, the GRE tunnel packet header is removed and the inner MPLS packet is forwarded to its final destination. The core network between the end-points of the GRE tunnel uses ISIS or OSPF routing protocol whereas the GRE tunnel uses OSPF or EIGRP.

PE-to-PE Tunneling

The provider-edge-to-provider-edge (PE-to-PE) tunneling configuration provides a scalable way to connect multiple customer networks across a non-MPLS network. With this configuration, traffic that is destined to multiple customer networks is multiplexed through a single generic routing encapsulation (GRE) tunnel.

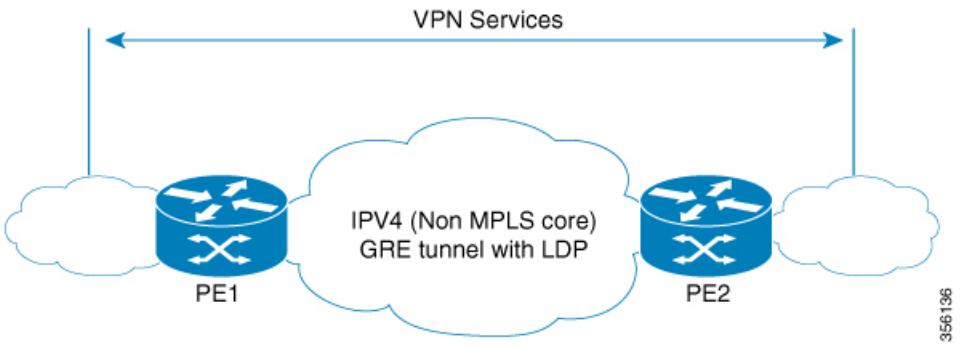
Note A similar nonscalable alternative is to connect each customer network through separate GRE tunnels (for example, connecting one customer network to each GRE tunnel).

The PE device on one side of the non-MPLS network uses the routing protocols (that operate within the non-MPLS network) to learn about the PE device on the other side of the non-MPLS network. The learned routes that are established between the PE devices are then stored in the main or default routing table.

The opposing PE device uses OSPF or EIGRP to learn about the routes that are associated with the customer networks that are behind the PE devices. These learned routes are not known to the non-MPLS network.

The following figure shows an end-to-end IP core from one PE device to another through the GRE tunnel that spans the non-MPLS network.

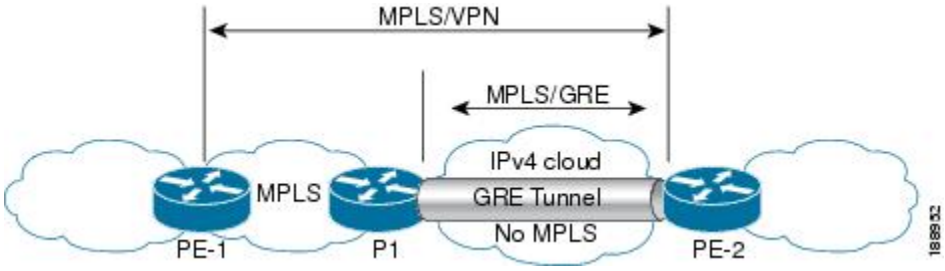
Figure 1: PE-to-PE Tunneling



P-to-PE Tunneling

The provider-to-provider-edge (P-to-PE) tunneling configuration provides a way to connect a PE device (P1) to a Multiprotocol Label Switching (MPLS) segment (PE-2) across a non-MPLS network. In this configuration, MPLS traffic that is destined to the other side of the non-MPLS network is sent through a single generic routing encapsulation (GRE) tunnel.

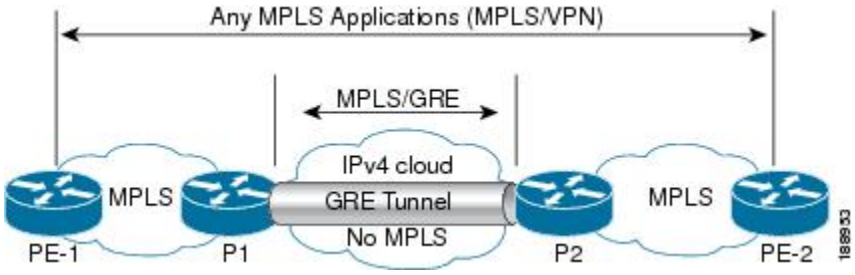
Figure 2: P-to-PE Tunneling



P-to-P Tunneling

As shown in the figure below, the provider-to-provider (P-to-P) configuration provides a method of connecting two Multiprotocol Label Switching (MPLS) segments (P1 to P2) across a non-MPLS network. In this configuration, MPLS traffic that is destined to the other side of the non-MPLS network is sent through a single generic routing encapsulation (GRE) tunnel.

Figure 3: P-to-P Tunneling



How to Configure MPLS over GRE

The following section provides the various configuration steps for MPLS over GRE:

Configuring the MPLS over GRE Tunnel Interface

To configure the MPLS over GRE feature, you must create a generic routing encapsulation (GRE) tunnel to span the non-MPLS networks. You must perform the following procedure on the devices located at both ends of the GRE tunnel.

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 1`	Creates a tunnel interface and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip address 10.0.0.1 255.255.255.0`	Assigns an IP address to the tunnel interface.
Step 5	**tunnel source** *source-address* **Example:** `Device(config-if)# tunnel source 10.1.1.1`	Specifies the tunnel's source IP address.
Step 6	**tunnel destination** *destination-address* **Example:** `Device(config-if)# tunnel destination 10.1.1.2`	Specifies the tunnel's destination IP address.
Step 7	**mpls ip** **Example:** `Device(config-if)# mpls ip`	Enables Multiprotocol Label Switching (MPLS) on the tunnel's physical interface.
Step 8	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

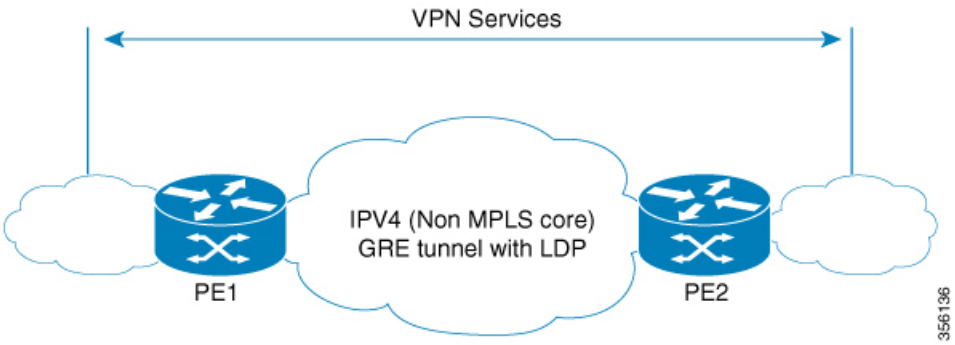
Configuration Examples for MPLS over GRE

The following section provides configuration examples for MPLS over GRE:

Example: PE-to-PE Tunneling

The following shows basic MPLS configuration on two Provider Edge (PE) devices, PE-to-PE tunneling, which use GRE tunnel to send traffic over non-MPLS network.

Figure 4: Topology for PE-to-PE Tunneling



PE1 Configuration

```
!
mpls ip
!
interface loopback 10
ip address 11.2.2.2 255.255.255.255
ip router isis
!
interface GigabitEthernet 1/1/1
ip address 1.1.1.1 255.255.255.0
ip router isis
!
interface Tunnel 1
ip address 10.0.0.1 255.255.255.0
ip ospf 1 are 0
tunnel source 11.2.2.2
tunnel destination 11.1.1.1
mpls ip
!
interface Vlan701
ip address 65.1.1.1 255.255.255.0
ip ospf 1 area 0
!
```

PE2 Configuration

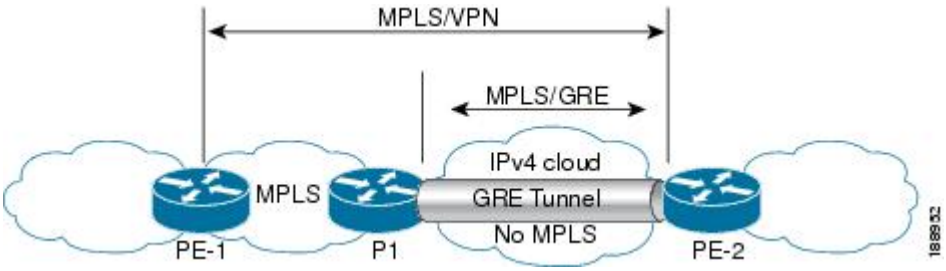
```
!
mpls ip
!
interface loopback 10
```

```
ip address 11.1.1.1 255.255.255.255
ip router isis
!
interface GigabitEthernet 1/1/1
ip address 2.1.1.1 255.255.255.0
ip router isis
!
interface Tunnel 1
ip address 10.0.0.2 255.255.255.0
ip ospf 1 are 0
tunnel source 11.1.1.1
tunnel destination 11.2.2.2
mpls ip
!
interface Vlan701
ip address 75.1.1.1 255.255.255.0
ip ospf 1 area 0
!
```

Example: P-to-PE Tunneling

The following shows basic MPLS configuration on two Provider (P) devices, P-to-PE tunneling, which use GRE tunnel to send traffic over non-MPLS network.

Figure 5: Topology for P-to-PE Tunneling



PE1 Configuration

```
!
mpls ip
!
interface GigabitEthernet 1/1/1
ip address 3.1.1.2 255.255.255.0
ip ospf 1 are 0
mpls ip
!
interface Vlan701
ip address 75.1.1.1 255.255.255.0
ip ospf 1 area 0
!
```

P1 Configuration

```
!
mpls ip
!
interface loopback 10
ip address 11.2.2.2 255.255.255.255
```

```
ip router isis
!
interface GigabitEthernet 1/1/1
ip address 1.1.1.1 255.255.255.0
ip router isis
!
interface GigabitEthernet 1/1/2
ip address 3.1.1.1 255.255.255.0
ip ospf 1 are 0
mpls ip
!
interface Tunnel 1
ip address 10.0.0.1 255.255.255.0
ip ospf 1 are 0
tunnel source 11.2.2.2
tunnel destination 11.1.1.1
mpls ip
!
```

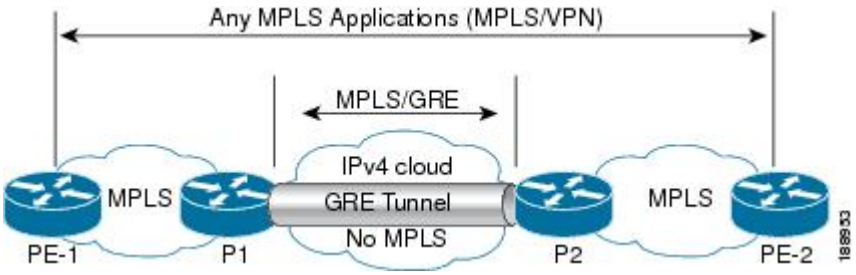
PE2 Configuration

```
!
mpls ip
!
interface loopback 10
ip address 11.1.1.1 255.255.255.255
ip router isis
!
interface GigabitEthernet 1/1/1
ip address 2.2.1.1 255.255.255.0
ip router isis
!
interface Tunnel 1
ip address 10.0.0.2 255.255.255.0
ip ospf 1 are 0
tunnel source 11.1.1.1
tunnel destination 11.2.2.2
mpls ip
!
interface Vlan701
ip address 75.1.1.1 255.255.255.0
ip ospf 1 area 0
!
```

Example: P-to-P Tunneling

The following example shows basic MPLS configuration on two Provider (P) devices, P-to-P tunneling, which use GRE tunnel to send traffic over non-MPLS network.

Figure 6: Topology for P-to-P Tunneling



P1 Configuration

```
!
interface Loopback10
 ip address 10.1.1.1 255.255.255.255
 ip router isis
!
interface Tunnel10
 ip address 10.10.10.1 255.255.255.252
 ip ospf 1 area 0
 mpls ip
 tunnel source 10.1.1.1
 tunnel destination 10.2.1.1
```

P2 Configuration

```
!
interface Tunnel10
 ip address 10.10.10.2 255.255.255.252
 ip ospf 1 area 0
 mpls ip
 tunnel source 10.2.1.1
 tunnel destination 10.1.1.1
!
interface Loopback10
 ip address 10.2.1.1 255.255.255.255
 ip router isis
```

Additional References for MPLS over GRE

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	See the MPLS Commands section of the *Command Reference (Catalyst 9400 Series Switches)*

Feature History for MPLS over GRE

This table provides release and related information for the features explained in this module.

These features are available in all the releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Gibraltar 16.11.1	MPLS over GRE	MPLS over GRE feature provides a mechanism for tunneling Multiprotocol Label Switching (MPLS) packets over non-MPLS networks by creating a generic routing encapsulation (GRE) tunnel. The MPLS packets are encapsulated within the GRE tunnel packets, and the encapsulated packets traverse the non-MPLS network through the GRE tunnel. When GRE tunnel packets are received at the other side of the non-MPLS network, the GRE tunnel packet header is removed and the inner MPLS packet is forwarded to its final destination.
Cisco IOS XE Cupertino 17.7.1	MPLS over GRE	This feature was implemented on supervisor modules C9400X-SUP-2 and C9400X-SUP-2XL, which were introduced in this release.

Use the Cisco Feature Navigator to find information about platform and software image support.