



## **IP Routing: GRE Configuration Guide, Cisco IOS XE 16 (Cisco ASR 900 Series)**

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# IPv4 Unicast Generic Routing Encapsulation Tunnel Overview

IPv4 unicast Generic Routing Encapsulation Tunnel (GRE) tunneling protocol provides a simple generic approach to transport packets of one protocol over another protocol by means of encapsulation. The term GRE tunnels in this document implies only unicast IPv4 GRE tunnel that supports IPv4 payload.

GRE encapsulates a payload, that is, an inner packet that needs to be delivered to a destination network inside an outer IP packet. GRE tunnel endpoints send payloads through GRE tunnels by routing encapsulated packets through intervening IP networks. Other IP routers along the way do not parse the payload (the inner packet); they only parse the outer IP packet as they forward it towards the GRE tunnel endpoint. Upon reaching the tunnel endpoint, GRE encapsulation is removed and the payload is forwarded to its ultimate destination.

Prior to Cisco IOS XE Gibraltar Release 16.12.x, GRE tunnels could provide a speed of 520 kbps for unidirectional and 250 kbps for bidirectional traffic. Starting with Cisco IOS XE Gibraltar Release 16.12.x, GRE tunnels enable the traffic to pass at a speed according to the size of the interface.

The IPv4 unicast GRE tunnels work on the following conditions:

- The unicast GRE tunnels work only with IPv4 as the transport protocol.
- The payload protocol is of type IPv4.

IPv4 unicast GRE tunnels provide support to transport multiple protocols and packet types over the core network. More importantly, GRE tunnels can be used to form VPN networks by encapsulating the private addressing packets as payload with the tunnel header to transport the packet to the remote end. In the remote end, the packet is decapsulated and then routed based on private routing table. GRE tunnels can also carry multiple packet types such as unicast and multicast.

The tunnel comprises of the following three components:

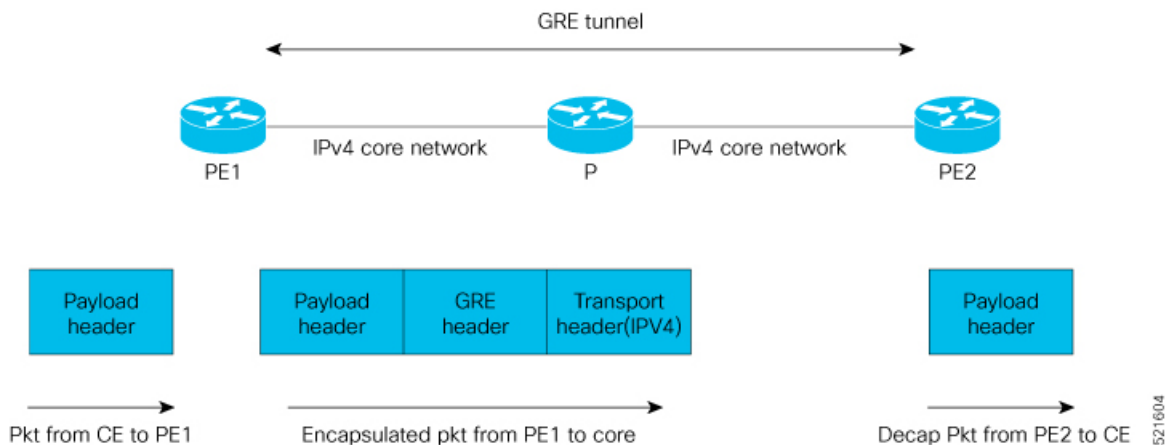
1. Payload packet or the passenger protocol
2. GRE header or the carrier protocol
3. Delivery header or the transport protocol

**Figure 1: Packet Format in GRE Network**



The following image shows a typical topology using GRE tunnel where IPv4 acts as both the transport protocol and the payload protocol.

Figure 2: Typical Unicast IPv4 GRE Topology



## Restrictions

- Tunnel destination under VRF and command **tunnel vrf** is *not* supported. Tunnel destination prefix must be in global routing table for IPV4 unicast GRE to be functional.
- Convergence lesser than 50 msec is not guaranteed.
- Maximum supported GRE scale is 510.
- Tunnel key is *not* supported. Hence, you must configure unique pair of source or destination IP address per tunnel.
- ACL and QoS are *not* supported over GRE tunnel.
- Time To Live (TTL) and Type of Service (TOS) are supported in Pipe mode.
- Tunnel Interface Statistics is *not* supported.
- Maximum Transmission Unit (MTU) is *not* supported for GRE tunnel.
- Recursive routing is *not* supported as control plane support is not available.
- Netflow and Policy-Based Routing (PBR) are *not* supported over the GRE tunnel.
- GRE over Virtual Private LAN Services (VPLS) or PW is *not* supported.
- GRE with indirection LB, Prefix Independent Convergence (PIC) core or PIC Edge, is *not* supported.
- GRE over Traffic Engineering (TE) tunnel core (mid-chain pointing to mid-chain support) is *not* supported.
- Equal-Cost Multi-Path Routing (ECMP or load balancing between GRE tunnels is *not* supported. But, when you can configure LB paths for a single GRE tunnel, the tunnel uses only one of the paths.
- Bidirectional Forwarding Detection (BFD) over IPv4 unicast tunnel is *not* supported.
- MPLS over GRE tunnel is *not* supported.

The following restrictions apply only to Cisco RSP3 module:

- GRE over BDI core is *not* supported.

- GRE over MPLS core is *not* supported.
- Tunnel checksum is *not* supported.
- System-to-Intermediate System (IS-IS) over tunnel is *not* supported.
- ECMP for GRE tunnels is *not* supported.
- QoS over tunnel is *not* supported.
- Path MTU discovery is *not* supported for GRE tunnel.
- GRE Tunnel Recursive loop formed with  

```
ip unnumbered loopback <x>
```

is *not* supported. The router crashes with core link flaps.

## How to Configure IPv4 GRE Tunnel

- Each IP address should be learned in global routing table.
- The IPv4 GRE tunnel can be established using any routing protocols enabled between Provider Edge 1 (PE1) router and PE2 router.
- Tunnel number should be identical in both the nodes.

## Configure IPv4 Unicast Generic Routing Encapsulation Tunnel

To configure GRE over IGP path:

```
configure terminal
interface tunnel101
ip vrf forwarding vrf name
ip address x.x.x.x x.x.x.x
 tunnel source Loopback ip/int ip
 tunnel Destination Loopback ip/int ip
```

## Verification of IPv4 Unicast Generic Routing Encapsulation Tunnel Configuration

Use **show interface tunnel101** command to verify IPv4 unicast GRE tunnel configuration.

```
PE1#show interface tunnel101
Tunnel1 is up, line protocol is up
  Hardware is Tunnel
  Internet address is 192.168.1.1/24
  MTU 17916 bytes, BW 100 Kbit/sec, DLY 50000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation TUNNEL, loopback not set
  Keepalive not set
  Tunnel linestate evaluation up
  Tunnel source 2.2.2.2 (Loopback0), destination 3.3.3.3
  Tunnel Subblocks:
    src-track:
```

```
Tunnell source tracking subblock associated with Loopback0
  Set of tunnels with source Loopback0, 1 member (includes iterators), on interface <OK>
Tunnel protocol/transport GRE/IP
  Key disabled, sequencing disabled
  Checksumming of packets disabled
Tunnel TTL 255, Fast tunneling enabled
Tunnel transport MTU 1476 bytes
Tunnel transmit bandwidth 8000 (kbps)
Tunnel receive bandwidth 8000 (kbps)
Last input 00:00:03, output 00:00:02, output hang never
Last clearing of "show interface" counters 20:25:52
Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/0 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  19671 packets input, 1659853 bytes, 0 no buffer
  Received 0 broadcasts (0 IP multicasts)
  0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  19665 packets output, 1659405 bytes, 0 underruns
  Output 0 broadcasts (0 IP multicasts)
  0 output errors, 0 collisions, 0 interface resets
  0 unknown protocol drops
  0 output buffer failures, 0 output buffers swapped out
```



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