



Generic Routing Encapsulation



Foreword

- Limitations within IPsec VPN restrict the ability for routes to be carried between disparate site-to-site based networks, and allowing only for static route solutions. GRE provides a mechanism for the encapsulation of packets of one protocol into packets of another protocol. The application of GRE is as such implemented as a primary solution to the IPsec VPN limitations, for which knowledge of GRE is necessary to complement the existing knowledge of IPsec VPN.



Objectives

- Upon completion of this section, you will be able to:
 - Explain how GRE can be applied to provide various solutions.
 - Describe the principle behavior of GRE.
 - Configure GRE over IPSec.



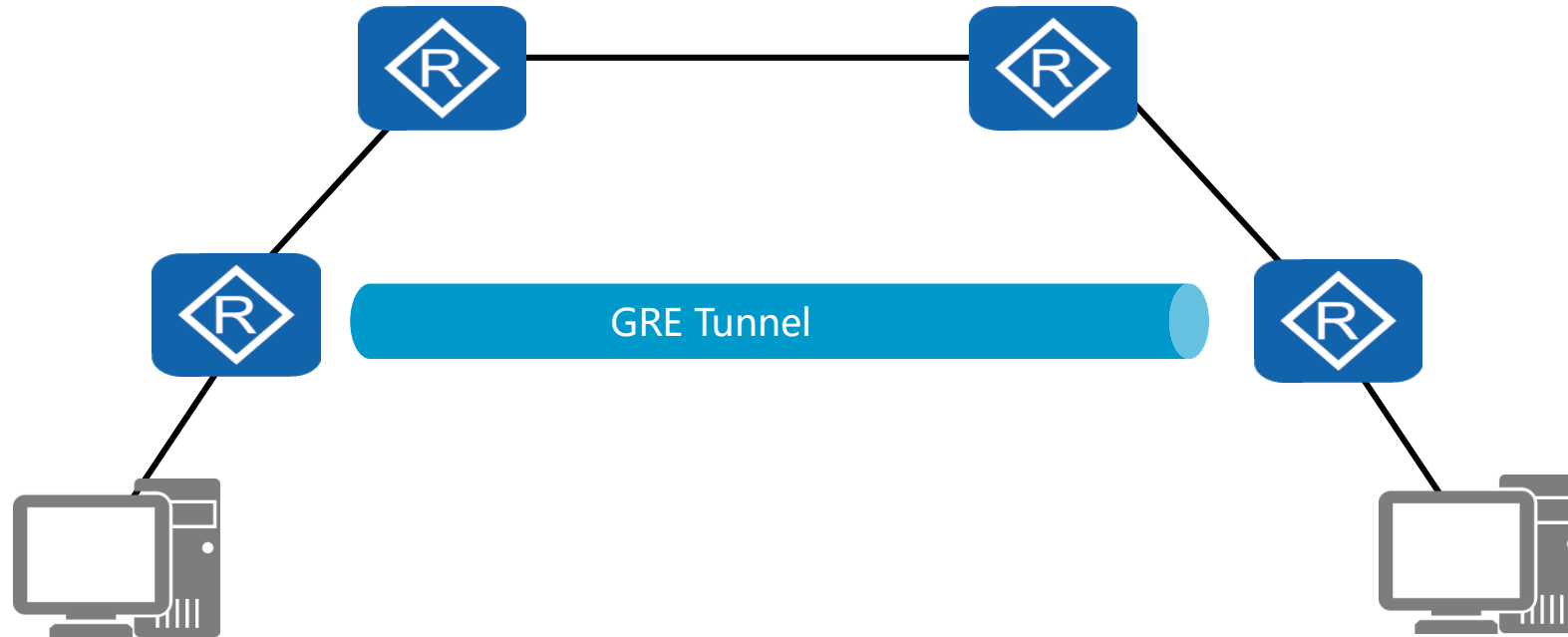
GRE Application



- Supports encapsulation of protocols over other protocols.
- Enables routing between remote and disparate networks.



GRE Scaling Solution for IGP



- Application allows for increased scalability of IGP networks.
- Capable of building a tunnel to resolve hop count limitations.



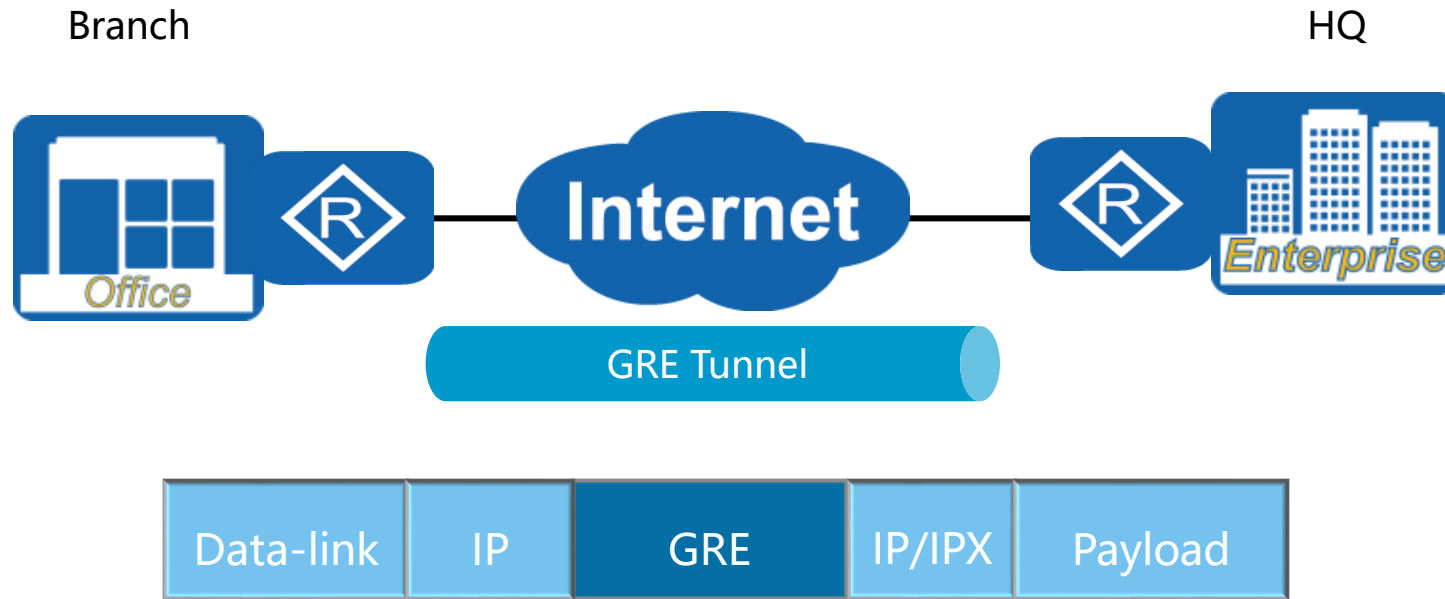
IPSec VPN support for GRE



- GRE contains no means for confidentiality of GRE payloads.
- IPSec can be employed to provide confidentiality to GRE.



GRE Packet Encapsulation & Decapsulation



- A GRE header is inserted into the packet to build a tunnel.
- A virtual network is built over the physical network.



GRE Packet Encapsulation & Decapsulation

```
▼ Internet Protocol Version 4, Src: 172.16.31.6, Dst: 172.16.31.1
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
    Total Length: 24
    Identification: 0x00cc (204)
  > Flags: 0x00
    Fragment offset: 0
    Time to live: 254
    Protocol: Generic Routing Encapsulation (47)
    Header checksum: 0x2503 [validation disabled]
    [Header checksum status: Unverified]
    Source: 172.16.31.6
    Destination: 172.16.31.1
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
```

[Topology Base](#)

GRE Packet Encapsulation & Decapsulation

8	5.343000	172.16.31.1	172.16.31.6	GRE	60 Encapsulated Po
9	5.906000	10.0.0.2	224.0.0.5	OSPF	106 Hello Packet
10	6.515000	10.0.0.1	224.0.0.5	OSPF	106 Hello Packet
11	10.093000	172.16.31.6	172.16.31.1	GRE	62 Encapsulated Po

>	Frame 9: 106 bytes on wire (848 bits), 106 bytes captured (848 bits) on interface 0
>	Ethernet II, Src: HuaweiTe_83:25:51 (00:e0:fc:83:25:51), Dst: HuaweiTe_6d:76:c7 (00:e0:fc:6d:76:c7)
>	Internet Protocol Version 4, Src: 172.16.31.6, Dst: 172.16.31.1
>	Generic Routing Encapsulation (IP)
>	Internet Protocol Version 4, Src: 10.0.0.2, Dst: 224.0.0.5
>	Open Shortest Path First

[Topology OSPF](#)



GRE Key Authentication

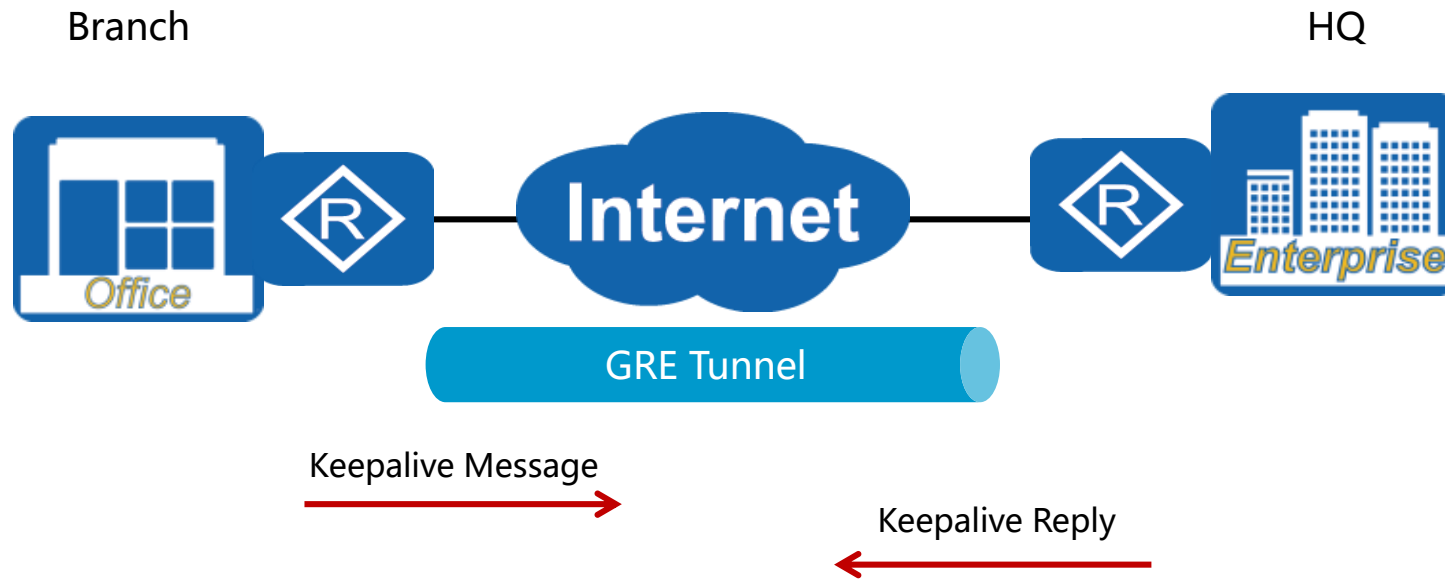


C	0	K	0	0	Recursion	Flags	Version	Protocol Type
Checksum (Optional)								0
Key (Optional)								

- Key field in GRE provides a means of optional authentication.



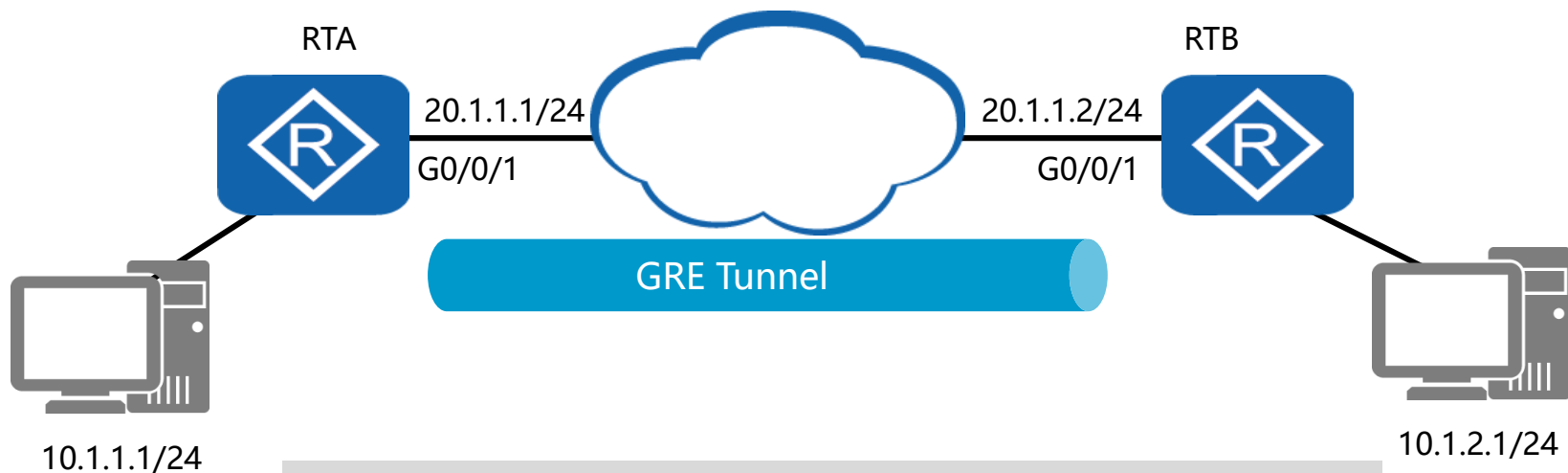
GRE Keepalive



- Allows the status of a GRE tunnel to be monitored for changes.
- Keepalives that are not replied result in GRE tunnel tear down.



GRE Configuration



```
[RTA]interface Tunnel 0/0/1
[RTA-Tunnel0/0/1]ip address 40.1.1.1 24
[RTA-Tunnel0/0/1]tunnel-protocol gre
[RTA-Tunnel0/0/1]source 20.1.1.1
[RTA-Tunnel0/0/1]destination 20.1.1.2
[RTA-Tunnel0/0/1]quit
[RTA]ip route-static 10.1.2.0 24 Tunnel 0/0/1
```



Configuration Validation

```
[RTA]display interface Tunnel 0/0/1
Tunnel0/0/1 current state : UP
Line protocol current state : UP
Last line protocol up time : 2016-03-21 13:37:38
Description:HUAWEI, AR Series, Tunnel0/0/1 Interface
Route Port, The Maximum Transmit Unit is 1476
Internet Address is 40.1.1.1/24
Encapsulation is TUNNEL, loopback not set
Tunnel source 20.1.1.1 (GigabitEthernet0/0/1), destination 20.1.1.2
Tunnel protocol/transport GRE/IP, key disabled
keepalive disabled
Checksumming of packets disabled
.....
```

- Enables confirmation of tunnel status and parameters.



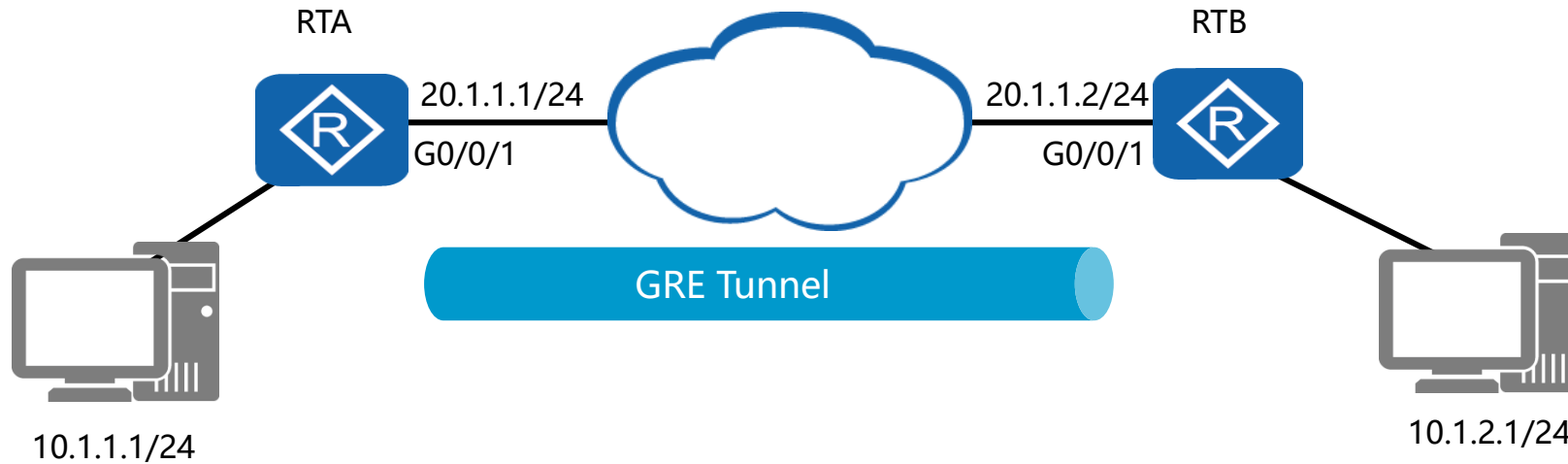
GRE Routing Table Validation

```
[RTA]display ip routing-table
Route Flags: R - relay, D - download to fib
-----
Routing Tables: Public  Destinations : 13          Routes : 14
Destination/Mask Proto  Pre Cost Flags  NextHop  Interface
.....
10.1.2.0/24      Static 60  0    RD      40.1.1.2 Tunnel 0/0/1
.....
```

- An entry in the routing table verifies the tunnel establishment.
- Routes for GRE can be static or dynamic.



Enabling the Keepalive Function



```
[RTA]interface Tunnel 0/0/1
[RTA-Tunnel0/0/1]keepalive period 3
[RTA-Tunnel0/0/1]quit
```

- Keepalives can define message interval and number of retries.
- Function only required to be configured on one tunnel interface.



Configuration Validation

```
[RTA]display interface Tunnel 0/0/1
Tunnel0/0/1 current state : UP
Line protocol current state : DOWN
Description:HUAWEI, AR Series, Tunnel0/0/1 Interface
Route Port, The Maximum Transmit Unit is 1476
Internet Address is 40.1.1.1/24
Encapsulation is TUNNEL, loopback not set
Tunnel source 20.1.1.1 (GigabitEthernet0/0/1), destination 20.1.1.2
Tunnel protocol/transport GRE/IP, key disabled
keepalive enable period 3 retry-times 3
Checksumming of packets disabled
.....
```

- Keepalive enablement can be verified from the tunnel interface.



GRE Packet Encapsulation & Decapsulation

Risolvere il problema della sicurezza di GRE:

- realizzare un tunnel IPsec che veicoli il traffico GRE:
 - acl 3000
rule 5 permit gre
 - configurazione usuale di IPsec

25	87.250000	172.16.31.6	172.16.31.1	ISAKMP	294	IKE_AUTH MID=01 Initiator Request
26	87.265000	172.16.31.1	172.16.31.6	ISAKMP	278	IKE_AUTH MID=01 Responder Response
27	90.359000	172.16.31.1	172.16.31.6	ESP	182	ESP (SPI=0x599b8f22)
28	92.844000	172.16.31.6	172.16.31.1	ESP	182	ESP (SPI=0xee38f8c8)
29	100.390000	172.16.31.1	172.16.31.6	ESP	182	ESP (SPI=0x599b8f22)
30	102.547000	172.16.31.6	172.16.31.1	ESP	182	ESP (SPI=0xee38f8c8)

[Topologia Gre over IPsec](#)



Summary

- What is the primary application for using GRE?
- What is the difference between the Internet Address and the Tunnel source in the display interface tunnel command?

The background of the slide features a blue-tinted image of a modern office interior. In the foreground, several groups of business professionals are silhouetted against the bright light coming from large windows. They appear to be in various stages of collaboration, some looking at documents or devices. The windows in the background offer a view of a dense urban skyline with numerous skyscrapers. The overall atmosphere is professional and high-tech.

Thank You
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