# 项目 24　GRE 隧道

通用路由封装协议 GRE（Generic Routing Encapsulation）是一种隧道封装技术，GRE 可以封装组播数据，但是无法加密数据，一般情况下可以与 IPsec 结合使用。

## 项目简介

两个不同的内网之间，通过配置 GRE 隧道实现网络互通，配置比较简单，最大缺点是无法数据加密。

## 一、GRE 隧道

### 1. 拓扑图

拓扑图如图 2-2-24-1 所示，实现功能：10.1.10.1 通过 GER 协议与 10.1.20.1 网络互通。

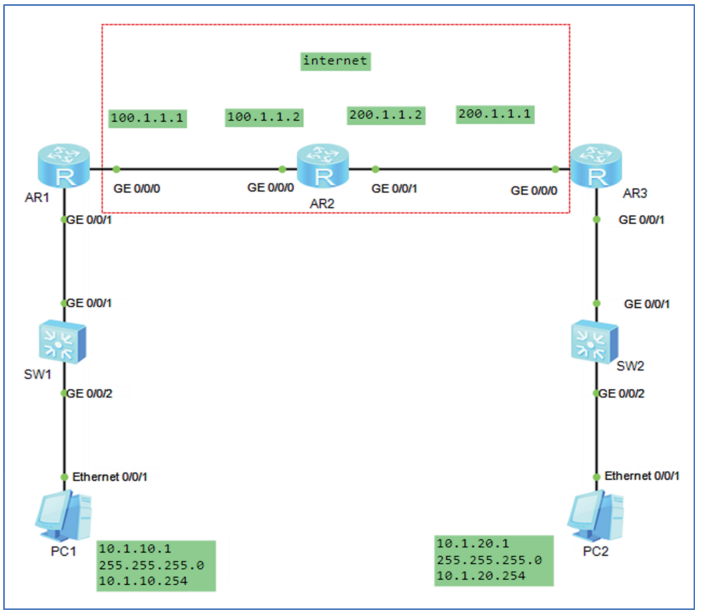


图2-2-24-1　拓扑图

PC 参数配置如表 2-2-24-1 所示。

表 2-2-24-1　PC 参数配置表

| PC | Vlan | IP | 子网掩码 | 网关 |
|---|---|---|---|---|
| PC1 | 10 | 10.1.10.1 | 255.255.255.0 | 10.1.10.254 |
| PC2 | 20 | 10.1.20.1 | 255.255.255.0 | 10.1.20.254 |

AR 路由器 IP 地址如表 2-2-24-2 所示。

表 2-2-24-2　AR 路由器 IP 地址

| AR | Port | IP | Port | IP |
|---|---|---|---|---|
| AR1 | GigabitEtherne0/0/0 | 100.1.1.1/24 | GigabitEthernet0/0/1 | 10.1.10.254/24 |
| AR2 | GigabitEtherne0/0/0 | 100.1.1.2/24 | GigabitEthernet0/0/1 | 200.1.1.2/24 |
| AR3 | GigabitEtherne0/0/0 | 200.1.1.1/24 | GigabitEthernet0/0/1 | 10.1.20.254/24 |

## 2. 项目配置步骤

步骤 1　PC 参数配置，见图 2-2-24-2 和图 2-2-24-3。


图2-2-24-2　PC1参数配置


图2-2-24-3　PC2参数配置

步骤 2　交换机 / 路由器配置。

交换机不做配置，保持默认即可。

AR1 配置。

```
<Huawei>sys
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname AR1
[AR1]interfaceGigabitEthernet 0/0/1
[AR1-GigabitEthernet0/0/1]ip address 10.1.10.254 24
[AR1-GigabitEthernet0/0/1]quit
[AR1]un in en
Info: Information center is disabled.
[AR1]interfaceGigabitEthernet 0/0/0
[AR1-GigabitEthernet0/0/0]ip address 100.1.1.1 24
[AR1-GigabitEthernet0/0/0]quit
[AR1]quit
<AR1>sa
```

AR2 配置。

```
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname AR2
[AR2]interfaceGigabitEthernet 0/0/0
[AR2-GigabitEthernet0/0/0]IP address 100.1.1.2 24
[AR2-GigabitEthernet0/0/0]quit
[AR2]interfaceGigabitEthernet 0/0/1
[AR2-GigabitEthernet0/0/1]ip address 200.1.1.2 24
[AR2-GigabitEthernet0/0/1]quit
[AR2]quit
<AR2>save
```

AR3 配置。

```
<Huawei>sys
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]un in en
[Huawei]sysname AR3
[AR3]interfaceGigabitEthernet 0/0/0
[AR3-GigabitEthernet0/0/0]ip address 200.1.1.1 24
[AR3-GigabitEthernet0/0/0]quit
[AR3]interfaceGigabitEthernet 0/0/1
[AR3-GigabitEthernet0/0/1]ip address 10.1.20.254 24
[AR3-GigabitEthernet0/0/1]quit
[AR3]quit
<AR3>sa
```

步骤 3　路由配置。

AR1 路由器。

```
[AR1]ip route-static 0.0.0.0 0 100.1.1.2
# 查询静态路由信息
```

```
[AR1]displayip routing-table protocol static
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Public routing table : Static
         Destinations : 1        Routes : 1        Configured Routes : 1
Static routing table status : <Active>
         Destinations : 1        Routes : 1
Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface
0.0.0.0/0   Static  60   0           RD   100.1.1.2 GigabitEthernet
0/0/0
Static routing table status : <Inactive>
         Destinations : 0        Routes : 0
```

AR3 路由器。

```
[AR3]ip route-static 0.0.0.0 0 200.1.1.2
# 查询静态路由信息
[AR3]displayip routing-table protocol static
Route Flags: R - relay, D - download to fib
------------------------------------------------------------------------------
Public routing table : Static
         Destinations : 1        Routes : 1        Configured Routes : 1
Static routing table status : <Active>
         Destinations : 1        Routes : 1
Destination/Mask    Proto   Pre  Cost      Flags NextHop         Interface
         0.0.0.0/0   Static  60   0           RD   200.1.1.2 GigabitEthernet
0/0/0
Static routing table status : <Inactive>
         Destinations : 0        Routes : 0
```

[AR3]

测试

```
AR1-Ping-AR3-通
<AR1>ping 200.1.1.1
  PING 200.1.1.1: 56  data bytes, press CTRL_C to break
    Reply from 200.1.1.1: bytes=56 Sequence=1 ttl=254 time=50 ms
    Reply from 200.1.1.1: bytes=56 Sequence=2 ttl=254 time=70 ms
……省略……
  --- 200.1.1.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
round-trip min/avg/max = 30/48/70 ms
AR3-Ping-AR1-通
<AR3>ping 100.1.1.1
  PING 100.1.1.1: 56  data bytes, press CTRL_C to break
    Reply from 100.1.1.1: bytes=56 Sequence=1 ttl=254 time=70 ms
    Reply from 100.1.1.1: bytes=56 Sequence=2 ttl=254 time=40 ms
……省略……
  --- 100.1.1.1 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
```

```
round-trip min/avg/max = 40/48/70 ms
<AR3>
```

步骤 4　GRE 隧道配置。

AR1 路由器。

```
# 配置隧道为 Tunnel 0/0/1
[AR1]interface Tunnel 0/0/1
# 配置隧道 IP 地址
[AR1-Tunnel0/0/1]ip address 172.16.1.1 24
# 配置隧道协议为 gre
[AR1-Tunnel0/0/1]tunnel-protocol  gre
# 配置源地址
[AR1-Tunnel0/0/1]source 100.1.1.1
# 配置目标地址
[AR1-Tunnel0/0/1]destination 200.1.1.1
[AR1-Tunnel0/0/1]quit
# 配置 10.1.20.1/32 下一条接口 Tunnel 0/0/1
[AR1]ip route-static 10.1.20.1 32 Tunnel 0/0/1
```

AR3 路由器。

```
[AR3]interface Tunnel  0/0/1
[AR3-Tunnel0/0/1]ip address 172.16.1.2 24
[AR3-Tunnel0/0/1]tunnel-protocol  gre
[AR3-Tunnel0/0/1]source 200.1.1.1
[AR3-Tunnel0/0/1]destination 100.1.1.1
[AR3-Tunnel0/0/1]quit
[AR3]ip route-static 10.1.10.1  32 Tunnel 0/0/1
[AR3]quit
<AR3>save
```

测试内网之间通信。

```
PC1（IP：10.1.10.1）-ping-PC2（IP：10.1.20.1）-通
PC>ping 10.1.20.1
Ping 10.1.20.1: 32 data bytes, Press Ctrl_C to break
From 10.1.20.1: bytes=32 seq=1 ttl=126 time=79 ms
……省略……
--- 10.1.20.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
round-trip min/avg/max = 78/84/94 ms
PC>
PC1（IP：10.1.10.1）-tracert-PC2（IP：10.1.20.1）
PC>tracert 10.1.20.1
traceroute to 10.1.20.1, 8 hops max
(ICMP), press Ctrl+C to stop
1  10.1.10.254   47 ms  47 ms  31 ms
2  172.16.1.2    63 ms  62 ms63 ms
3  10.1.20.1    109 ms  110 ms  62 ms
PC>
PC2（IP:10.1.20.1）-ping-PC1(IP:10.1.10.1) -通
PC>ping 10.1.10.1
```

```
Ping 10.1.10.1: 32 data bytes, Press Ctrl_C to break
From 10.1.10.1: bytes=32 seq=1 ttl=126 time=62 ms
From 10.1.10.1: bytes=32 seq=2 ttl=126 time=62 ms
……省略……
--- 10.1.10.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
round-trip min/avg/max = 62/71/93 ms
PC2(IP:10.1.20.1)-tracert-PC1(IP:10.1.10.1)
PC>tracert 10.1.10.1
traceroute to 10.1.10.1, 8 hops max
(ICMP), press Ctrl+C to stop
1  10.1.20.254   47 ms  62 ms  47 ms
2  172.16.1.1    78 ms  63 ms  78 ms
3  10.1.10.1     94 ms  93 ms  110 ms
```

抓取 AR1 g 0/0/0 报文，如图 2-2-24-4 所示。

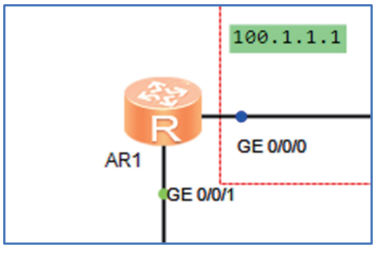


图2-2-24-4　抓取报文

当 PC1(IP：10.1.10.1)-ping-PC2（IP：10.1.20.1）时，红色框内为 GRE 协议，说明是通过 GRE 协议实现网络互通。如图 2-2-24-5 所示。

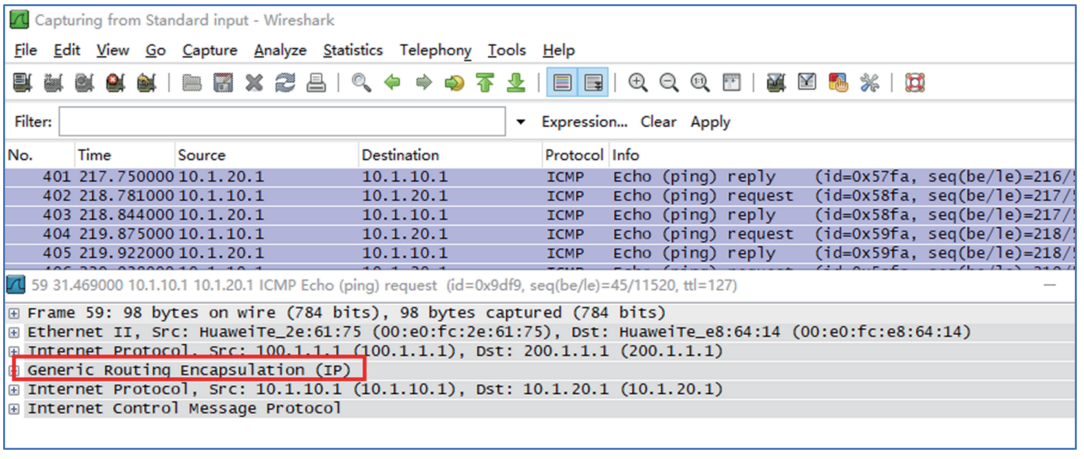


图2-2-24-5　观察报文

## 二、多 vlan 内部通信

拓扑图见图 2-2-24-6。

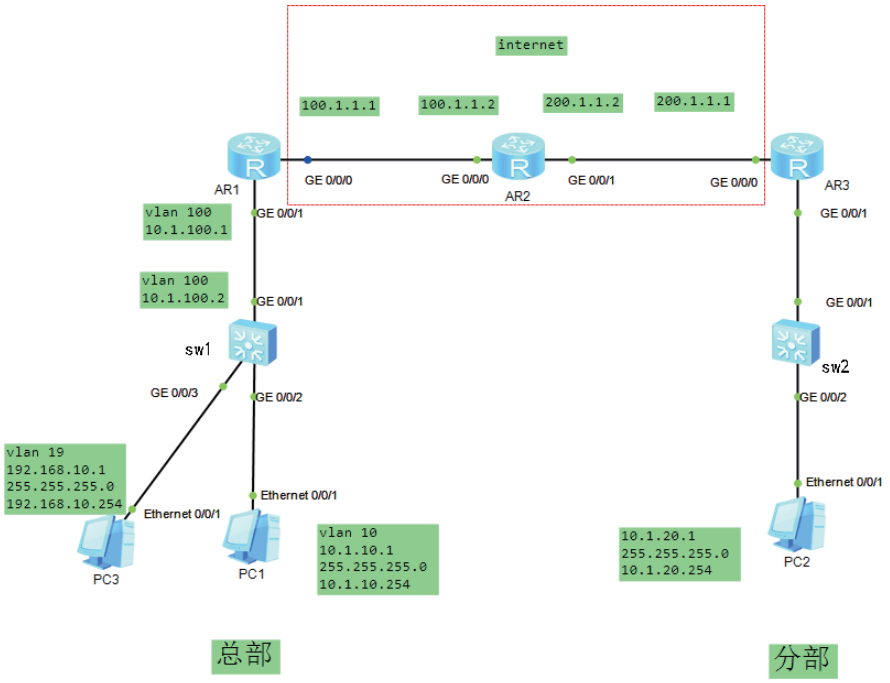


图2-2-24-6　拓扑图

AR1

```
AR1 G 0/0/1 IP 地址修改 10.1.100.1
AR1-GigabitEthernet0/0/1]ip address 10.1.100.1 24
```

Sw1

```
Please press enter to start cmd line!
<Huawei>sys
[Huawei]sysname sw1
[sw1]vlan batch 100 10 19
[sw1]interface Vlanif 100
[sw1-Vlanif100]ip address 10.1.100.2 24
[sw1-Vlanif100]quit
[sw1]interface Vlanif 19
[sw1-Vlanif19]ip address 192.168.10.254 24
[sw1-Vlanif19]quit
[sw1]interface Vlanif 10
[sw1-Vlanif10]ip address 10.1.10.254 24
[sw1-Vlanif10]quit
[sw1]interface GigabitEthernet 0/0/1
[sw1-GigabitEthernet0/0/1]port link-type access
[sw1-GigabitEthernet0/0/1]port default vlan 100
[sw1-GigabitEthernet0/0/1]quit
[sw1]interface GigabitEthernet 0/0/2
[sw1-GigabitEthernet0/0/2]port link-type access
[sw1-GigabitEthernet0/0/2]port default vlan 10
[sw1-GigabitEthernet0/0/2]quit
[sw1]interface GigabitEthernet 0/0/3
[sw1-GigabitEthernet0/0/3]port link-type access
[sw1-GigabitEthernet0/0/3]port default vlan 19
```

```
[sw1-GigabitEthernet0/0/3]quit
[sw1]quit
<sw1>sa
```
PC3 地址配置忽略。

测试。

```
PC3(IP:192.168.10.1)-ping-PC1(IP:10.1.10.1)-通
PC>ping 10.1.10.1
Ping 10.1.10.1: 32 data bytes, Press Ctrl_C to break
From 10.1.10.1: bytes=32 seq=1 ttl=127 time=31 ms
……省略……
From 10.1.10.1: bytes=32 seq=5 ttl=127 time=31 ms
--- 10.1.10.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 31/40/47 ms
PC>
```
AR1 增加两条静态路由信息。

```
[AR1]ip route-static 192.168.10.1 32 10.1.100.2
[AR1]ip route-static 10.1.10.1 32 10.1.100.2
PC1(IP:10.1.10.1)-ping-AR1(IP:10.1.100.1)-通
PC>ping 10.1.100.1
Ping 10.1.100.1: 32 data bytes, Press Ctrl_C to break
From 10.1.100.1: bytes=32 seq=1 ttl=254 time=62 ms
From 10.1.100.1: bytes=32 seq=2 ttl=254 time=47 ms
……省略……
--- 10.1.100.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 31/50/63 ms
PC3(IP:192.168.10.1)-ping-AR1(IP:10.1.100.1)-通
PC>ping 10.1.100.1
Ping 10.1.100.1: 32 data bytes, Press Ctrl_C to break
From 10.1.100.1: bytes=32 seq=1 ttl=254 time=62 ms
……省略……
--- 10.1.100.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 15/31/62 ms
PC>
```
实现总部 192.168.10.1 与 10.1.10.1 与分部 10.1.20.1 都能互相通信。

sw1 增加静态路由。

```
[sw1]ip route-static 10.1.20.1 255.255.255.255 10.1.100.1
```
AR3 增加隧道静态地址。

[AR3]ip route-static 192.168.10.1 255.255.255.255 Tunnel0/0/1

测试:

```
ping PC2-PC1 PC2-PC3。
```

```
Tracet PC2-PC1 PC2-PC3
PC>ping 10.1.10.1

Ping 10.1.10.1: 32 data bytes, Press Ctrl_C to break
From 10.1.10.1: bytes=32 seq=1 ttl=125 time=78 ms
……省略……
--- 10.1.10.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 78/84/94 ms
PC>ping 192.168.10.1
Ping 192.168.10.1: 32 data bytes, Press Ctrl_C to break
From 192.168.10.1: bytes=32 seq=1 ttl=125 time=109 ms
……省略……
--- 192.168.10.1 ping statistics ---
  5 packet(s) transmitted
  5 packet(s) received
  0.00% packet loss
  round-trip min/avg/max = 78/87/109 ms
PC>tracert 10.1.10.1
traceroute to 10.1.10.1, 8 hops max
(ICMP), press Ctrl+C to stop
 1  10.1.20.254   47 ms  47 ms  46 ms
 2  172.16.1.1    79 ms  62 ms  63 ms
 3  10.1.100.2    62 ms  94 ms  62 ms
 4  10.1.10.1    78 ms  94 ms  78 ms
PC>tracert 192.168.10.1
traceroute to 192.168.10.1, 8 hops max
(ICMP), press Ctrl+C to stop
 1  10.1.20.254   47 ms  78 ms  31 ms
 2  172.16.1.1    79 ms  62 ms  63 ms
 3  10.1.100.2    93 ms  63 ms  62 ms
 4  192.168.10.1   78 ms  94 ms  78 ms
PC>
```