VPN(GRE)

Virtual Private Network

Private IP address

10.0.0.0/8 main A 172.16.0.0/16 – 172.31.0.0/16 main B 192.168.0.0/24 – 192.168.255.0/24 main C

Overlay VPN

PPTP L2TP IPSec SSLVPN GETVPN GRE VPN DMVPN/DSVPN

GRE Generic Routing Encapsulation (not safe but easy)

Tunnel interface(**a virtual logical interface doing overlay** on Router), this interface does not have the capability to transmit data, the interface that transmit data is still through a physical interface.

Boarder devices will do overlay operation, to let original 3 layer package add the public address header. Tunnel Source IP addr(SIP) & Tunnel Destination IP addr(DIP)

Ethernet2	Tunnel IPv4	GRE	Private IPv4	TCP	HTTP	FCS

Default router ip 0.0.0.0/0

PC(A)-Router 1-----ISP----Router 2-PC(B)

Logically directly connect: Tunnel IP on Router 1 and 2 must be in the same subnetwork(same NetID)

Steps

1. Two sides' boaders public net interfaces connect(static default)
2. Tunnel interfaces of R1 and R2 configure Tunnel Source and Tunnel Destination
3. Set Tunnel interfaces in the same subnet, and run IGP route between R1 and R2

Config

R1

% Please answer 'yes' or 'no'.

Would you like to enter the initial configuration dialog? [yes/no]: no

Router>en

Router#conf t

Router(config)#hostname R1

R1(config)#interface ethernet 0/1

R1(config-if)#no shutdown

R1(config-if)#ip address 13.1.1.1 255.255.255.0

R1(config-if)#no shutdown

R1(config-if)#exit

R1(config)#interface ethernet 0/0

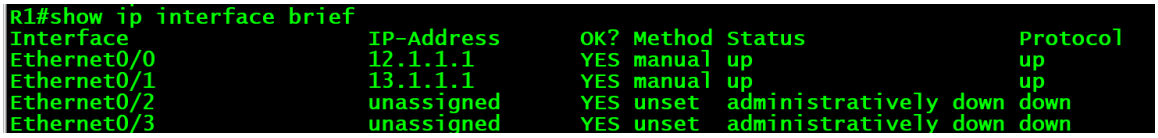
R1(config-if)#no shutdown

R1(config-if)#ip address 12.1.1.1 255.255.255.0

R1(config-if)#no shutdown

R1(config-if)#exit

R1#show ip interface brief



R2

Router>en

Router#conf t

Router(config)#hostname R2

R2(config)#interface ethernet 0/1

R2(config-if)#ip address 12.1.1.2 255.255.255.0

R2(config-if)#no shutdown

R2(config-if)#exit

R2(config)#ip route 0.0.0.0 0.0.0.0 ethernet 0/1 12.1.1.1

R2(config)#interface ethernet 0/1

R2(config-if)#no shutdown

R2(config-if)#exit

R2(config)#interface ethernet 0/0

R2(config-if)#no shutdown

R2(config-if)#ip address 172.16.24.2 255.255.255.0

R2(config-if)#no shutdown

R2(config-if)#exit

R2(config)#end

R2#show ip interface brief

```
R2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                172.16.24.2     YES manual up                    up
Ethernet0/1                12.1.1.2        YES manual up                    up
Ethernet0/2                unassigned      YES unset  administratively down down
Ethernet0/3                unassigned      YES unset  administratively down down
```

R3

% Please answer 'yes' or 'no'.

Would you like to enter the initial configuration dialog? [yes/no]: no

Router>en

Router#conf t

Router(config)#hostname R3

R3(config)#interface ethernet 0/0

R3(config-if)#no shutdown

R3(config-if)#ip address 13.1.1.3 255.255.255.0

R3(config-if)#no shutdown

R3(config-if)#exit

R3(config)#interface ethernet 0/1

R3(config-if)#no shutdown

R3(config-if)#ip address 192.168.35.3 255.255.255.0

R3(config-if)#no shutdown

R3(config-if)#exit

R3(config)#ip route 0.0.0.0 0.0.0.0 ethernet 0/0 13.1.1.1

R3(config)#end

R3#show ip interface brief

```
R3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                13.1.1.3        YES manual up                    up
Ethernet0/1                192.168.35.3    YES manual up                    up
Ethernet0/2                unassigned      YES unset  administratively down down
Ethernet0/3                unassigned      YES unset  administratively down down
```

R4

Router>en

Router#conf t

Router(config)#hostname R4

R4(config)#interface ethernet 0/1

R4(config-if)#no shutdown

R4(config-if)#ip address 172.16.24.4 255.255.255.0

R4(config-if)#exit

R4(config)#interface loopback 0

R4(config-if)#ip address 172.16.4.4 255.255.255.255

R4(config-if)#exit

R4(config)#end

R4#show ip interface brief

```
R4#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protoco
Ethernet0/0                unassigned      YES unset  administratively down down
Ethernet0/1                172.16.24.4     YES manual up                    up
Ethernet0/2                unassigned      YES unset  administratively down down
Ethernet0/3                unassigned      YES unset  administratively down down
Loopback0                  172.16.4.4      YES manual up                    up
```

R5

% Please answer 'yes' or 'no'.

Would you like to enter the initial configuration dialog? [yes/no]: no

Router>en

Router#conf t

Router(config)#hostname R5

R5(config)#interface ethernet 0/0

R5(config-if)#no shutdown

R5(config-if)#ip address 192.168.35.5 255.255.255.0

R5(config-if)#no shutdown

R5(config-if)#exit

R5(config)#interface loopback 0

R5(config-if)#ip address 192.168.5.5 255.255.255.255

R5(config-if)#exit

R5(config)#end

R5#show ip interface brief

```
R5#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                192.168.35.5    YES manual up                    up
Ethernet0/1                unassigned      YES unset  administratively down down
Ethernet0/2                unassigned      YES unset  administratively down down
Ethernet0/3                unassigned      YES unset  administratively down down
Loopback0                  192.168.5.5     YES manual up                    up
```

EIGRP

R2&R4

R2

R2(config)#router eigrp 90

R2(config-router)#eigrp router-id 2.2.2.2

R2(config-router)#network 172.16.24.2 0.0.0.0

R2(config-router)#exit

R2(config)#end

R4

R4(config)#router eigrp 90

R4(config-router)#eigrp router-id 4.4.4.4

R4(config-router)#network 172.16.24.4 0.0.0.0

R4(config-router)#network 172.16.4.4 0.0.0.0

R4(config-router)#exit

R4(config)#end

R3&R5

R3

R3(config)#router eigrp 90

R3(config-router)#eigrp router-id 3.3.3.3

R3(config-router)#network 192.168.35.3 0.0.0.0

R3(config-router)#end

R5

R5(config)#router eigrp 90

R5(config-router)#eigrp router-id 5.5.5.5

R5(config-router)#network 192.168.35.5 0.0.0.0

R5(config-router)#network 192.168.5.5 0.0.0.0

R5(config-router)#exit

Tunnel

At this time, try to let R2 ping R2, it is successful, because use a default route ip 0.0.0.0

```
R3#show run | section eigrp
router eigrp 90
 network 192.168.35.3 0.0.0.0
 eigrp router-id 3.3.3.3
R3#ping 12.1.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 12.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

```
R2#ping 13.1.1.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 13.1.1.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

```
R3#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is 13.1.1.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 13.1.1.1, Ethernet0/0
      13.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        13.1.1.0/24 is directly connected, Ethernet0/0
L        13.1.1.3/32 is directly connected, Ethernet0/0
      192.168.5.0/32 is subnetted, 1 subnets
D        192.168.5.5 [90/409600] via 192.168.35.5, 00:11:20, Ethernet0/1
      192.168.35.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.35.0/24 is directly connected, Ethernet0/1
L        192.168.35.3/32 is directly connected, Ethernet0/1
```

R2

R2#conf t

R2(config)#interface tunnel 23

R2(config-if)#tunnel source 12.1.1.2

R2(config-if)#tunnel destination 13.1.1.3

R2(config-if)#ip address 10.1.23.2 255.255.255.0

R3

R3#conf t

R3(config)#interface tunnel 23

R3(config-if)#tunnel source 13.1.1.3

R3(config-if)#tunnel destination 12.1.1.2

R3(config-if)#ip address 10.1.23.3 255.255.255.0

R3(config-if)#end

Tunnel itself has a ip address, and this ip must be in a same subnet with R3, so that they can communicate, 10.1.23.x

```
R3#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            13.1.1.3        YES manual up                    up
Ethernet0/1            192.168.35.3    YES manual up                    up
Ethernet0/2            unassigned      YES unset  administratively down down
Ethernet0/3            unassigned      YES unset  administratively down down
Tunnel23               10.1.23.3       YES manual up                    up
R3#ping 10.1.23.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.23.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
R3#
```

```
R2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                172.16.24.2     YES manual up                    up
Ethernet0/1                12.1.1.2        YES manual up                    up
Ethernet0/2                unassigned      YES unset  administratively down down
Ethernet0/3                unassigned      YES unset  administratively down down
Loopback0                  172.16.2.2      YES manual up                    up
Tunnel23                   10.1.23.2       YES manual up                    up
R2#ping 10.1.23.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.23.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Claim tunnel interface

R2

R2(config)#router ei

R2(config)#router eigrp 90

R2(config-router)#net

R2(config-router)#network 10.1.23.2 0.0.0.0

R3

R3(config)#router ei

R3(config)#router eigrp 90

R3(config-router)#net

R3(config-router)#network 10.1.23.3 0.0.0.0

```
R3#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is 13.1.1.1 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 13.1.1.1, Ethernet0/0
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        10.1.23.0/24 is directly connected, Tunnel23
L        10.1.23.3/32 is directly connected, Tunnel23
      13.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        13.1.1.0/24 is directly connected, Ethernet0/0
L        13.1.1.3/32 is directly connected, Ethernet0/0
      172.16.0.0/16 is variably subnetted, 3 subnets, 2 masks
D        172.16.2.2/32 [90/27008000] via 10.1.23.2, 00:01:26, Tunnel23
D        172.16.4.4/32 [90/27033600] via 10.1.23.2, 00:01:26, Tunnel23
D        172.16.24.0/24 [90/26905600] via 10.1.23.2, 00:01:26, Tunnel23
      192.168.5.0/32 is subnetted, 1 subnets
D        192.168.5.5 [90/409600] via 192.168.35.5, 00:32:47, Ethernet0/1
      192.168.35.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.35.0/24 is directly connected, Ethernet0/1
L        192.168.35.3/32 is directly connected, Ethernet0/1
```

R3 learned the 172.16 ip through Tunnel23

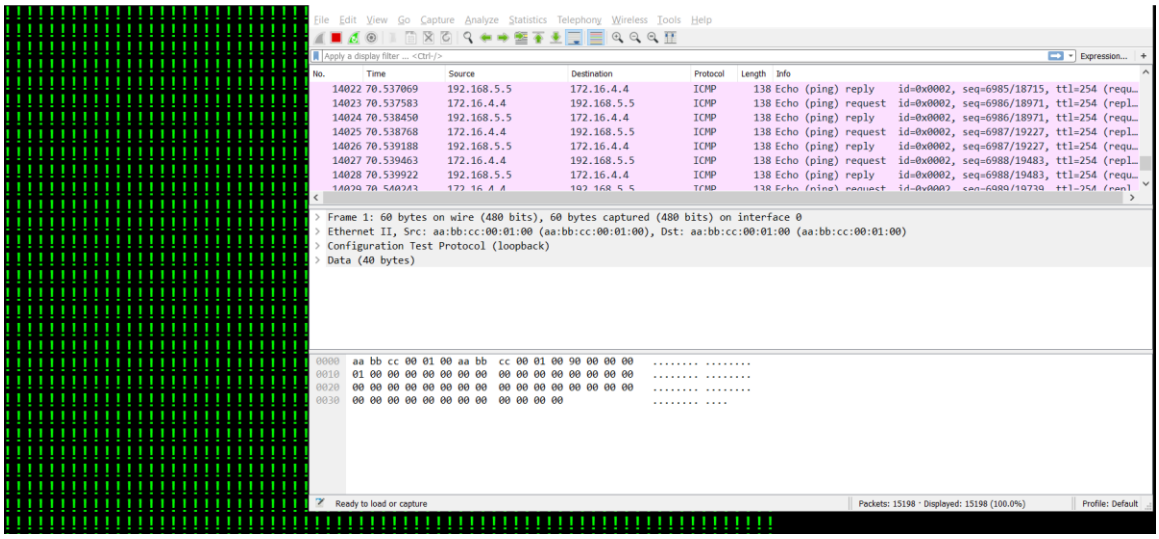
```
R2#show run interface tunnel 23
Building configuration...

Current configuration : 115 bytes
!
interface Tunnel23
 ip address 10.1.23.2 255.255.255.0
 tunnel source 12.1.1.2
 tunnel destination 13.1.1.3
end
```

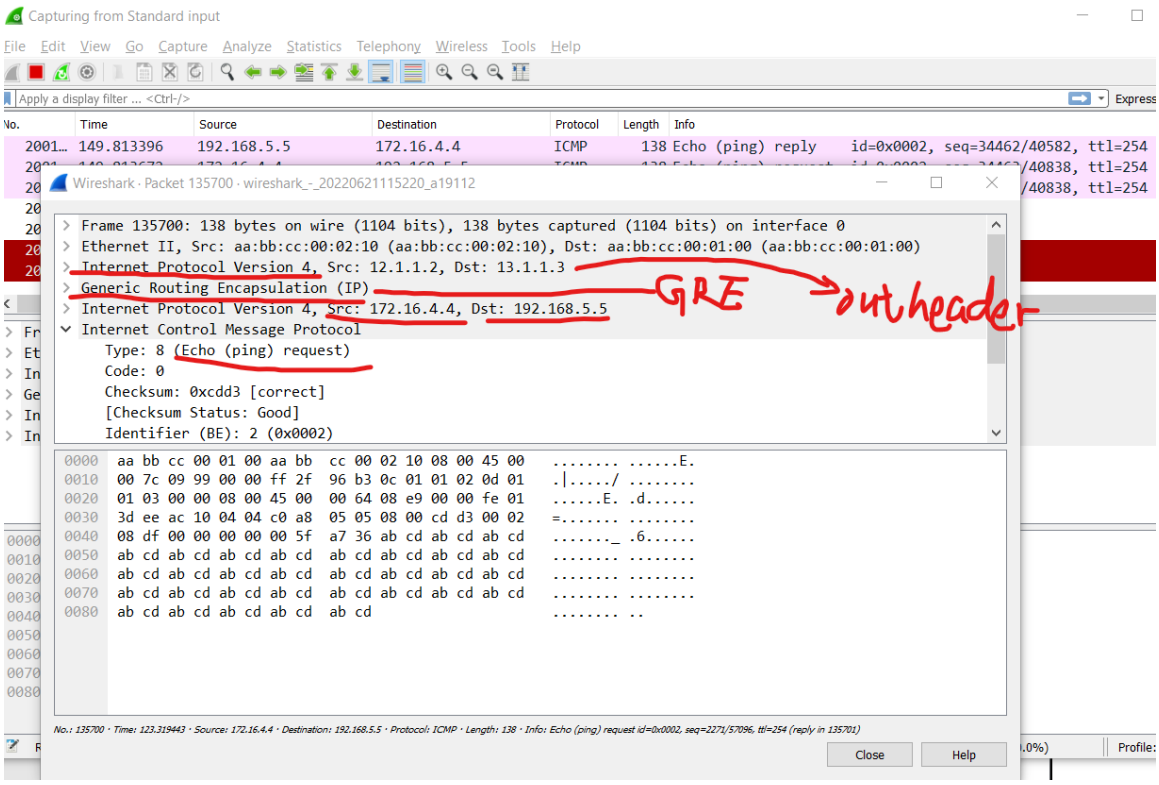
AGAIN!!!! Tunnel interface does not have the capability of transmitting data package.

```
R4#ping 192.168.5.5 source 172.16.4.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.5.5, timeout is 2 seconds:
Packet sent with a source address of 172.16.4.4
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Capture package

R4#ping 192.168.5.5 source 172.16.4.4 repeat 100000



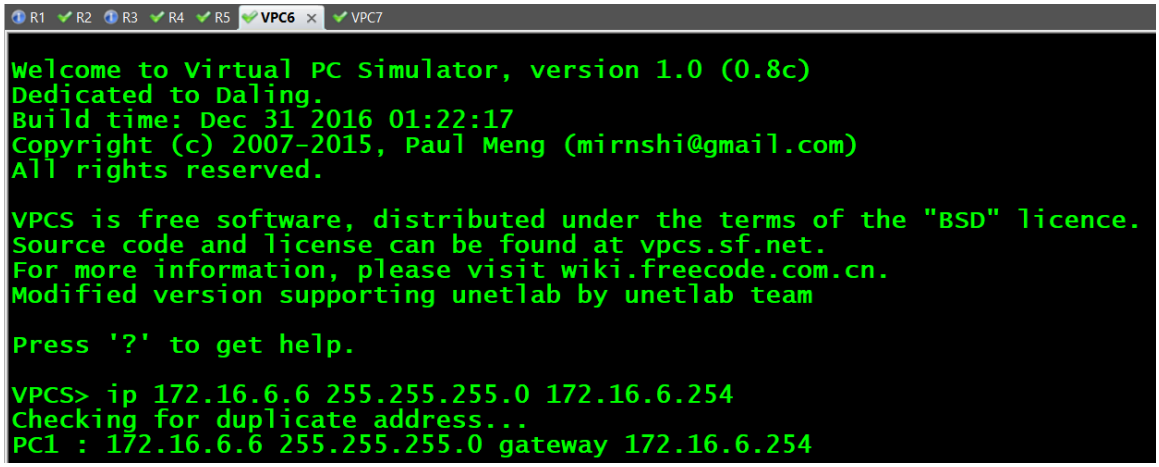


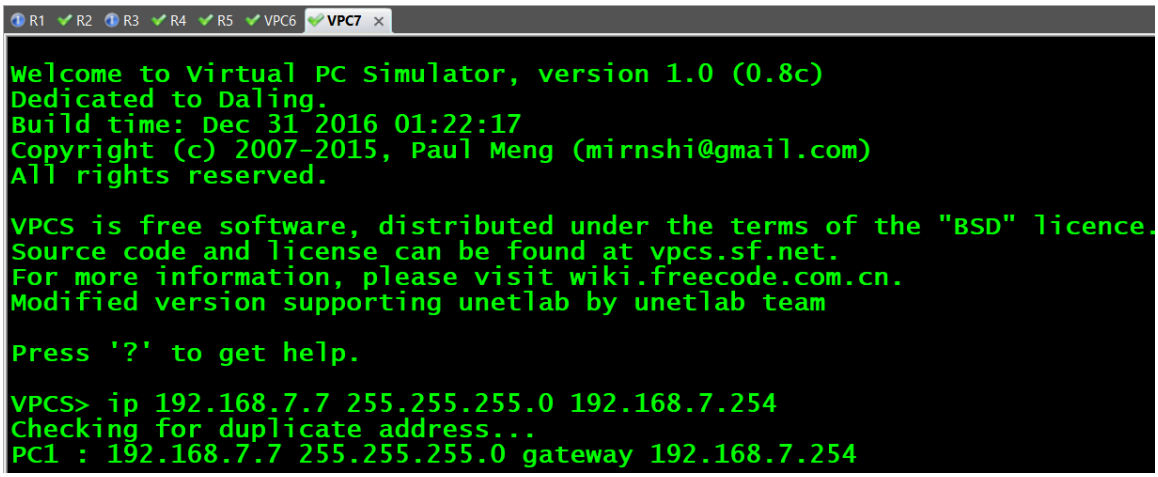
Can see that the outer header is using the public ip, cheating ISP.

And have a GRE 4 bit between the inner ip and outer ip

Config the PCv

PCV6 and 7





R4

R4#conf t

R4(config)#interface ethernet 0/0

R4(config-if)#no shutdown

R4(config-if)#ip address 172.16.6.254 255.255.255.0

R4(config-if)#no shutdown

R4(config-if)#exit

R4(config)#router eigrp 90

R4(config-router)#network 172.16.6.254 0.0.0.0

R4(config-router)#end

R5

R5>en

R5#conf t

R5(config)#interface ethernet 0/1

R5(config-if)#no shutdown

R5(config-if)#ip address 192.168.7.254 255.255.255.0

R5(config-if)#no shutdown

R5(config-if)#exit

R5(config)#router eigrp 90

R5(config-router)#network 192.168.7.254 0.0.0.0

R5(config-router)#exit

R5(config)#end

Result