Network and System Defense Project 1

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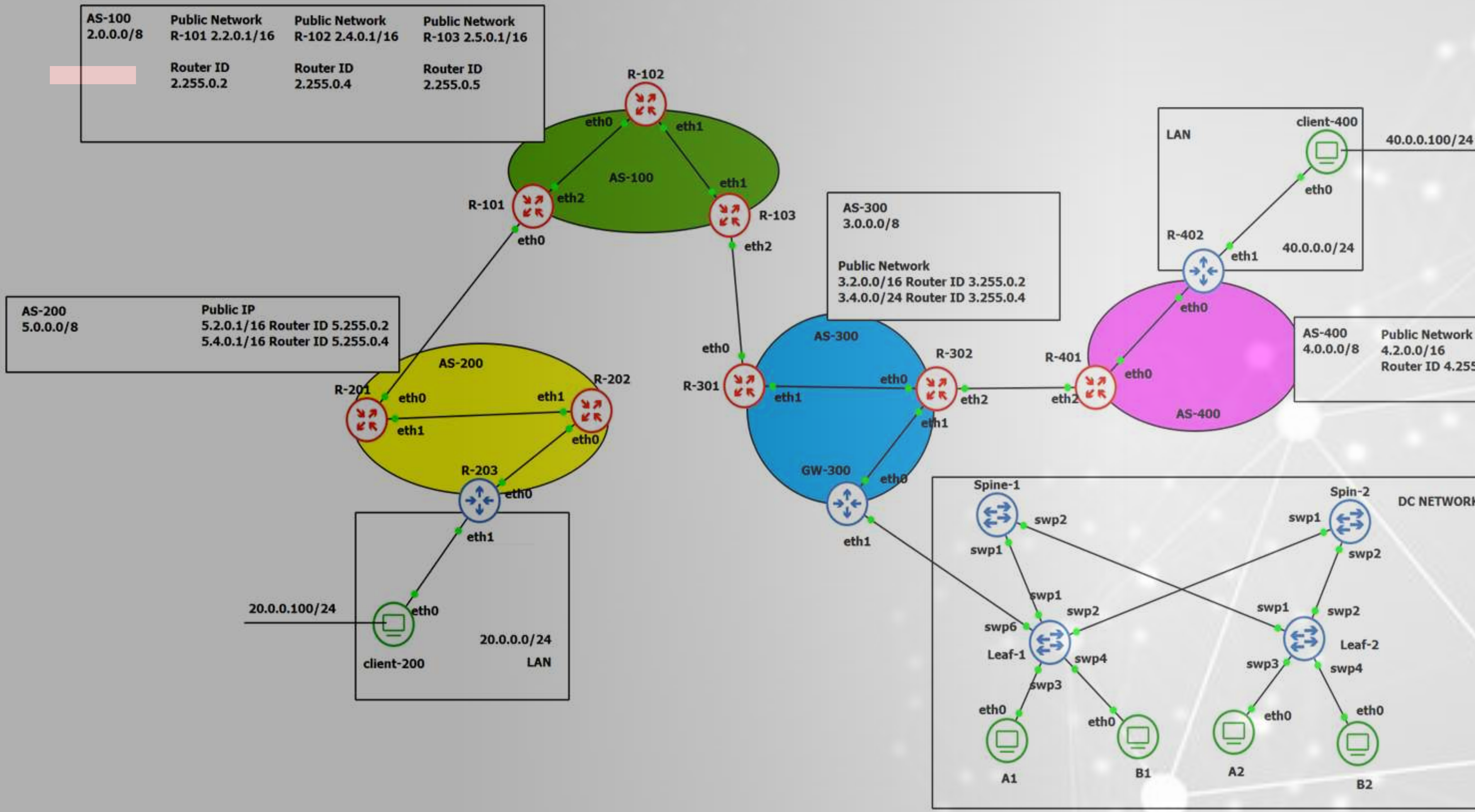
Objective of the project

The project involves designing a multi-AS network infrastructure. AS-100 serves as a transit AS, establishing eBGP peering with AS-200 and AS-300, implementing iBGP peering internally, and optimizing routing through OSPF and LDP/MPLS.

AS-200 configures eBGP peering with AS-100, while implementing dynamic NAT and a firewall on the non-BGP-router R-203. AS-300 establishes eBGP peering with AS100 and AS400, configuring iBGP internally. GW-300 server, acts as an Access Gateway for the Data Center network with dynamic NAT and an OpenVPN server.

The Data Center network adopts VXLAN/EVPN forwarding, accommodating tenants A and B. AS-400, with lateral peering with AS-300, establishes eBGP peering. The project concludes with the implementation of OpenVPN, securing connections between Client-200, R402's LAN, and the Datacenter network, enhancing overall network security and connectivity.



AS-100
2.0.0.0/8

Public Network
R-101 2.2.0.1/16

Router ID
2.255.0.2

Public Network
R-102 2.4.0.1/16

Router ID
2.255.0.4

Public Network
R-103 2.5.0.1/16

Router ID
2.255.0.5

AS-200
5.0.0.0/8

Public IP
5.2.0.1/16 Router ID 5.255.0.2
5.4.0.1/16 Router ID 5.255.0.4

AS-300
3.0.0.0/8

Public Network
3.2.0.0/16 Router ID 3.255.0.2
3.4.0.0/24 Router ID 3.255.0.4

AS-400
4.0.0.0/8

Public Network
4.2.0.0/16
Router ID 4.255

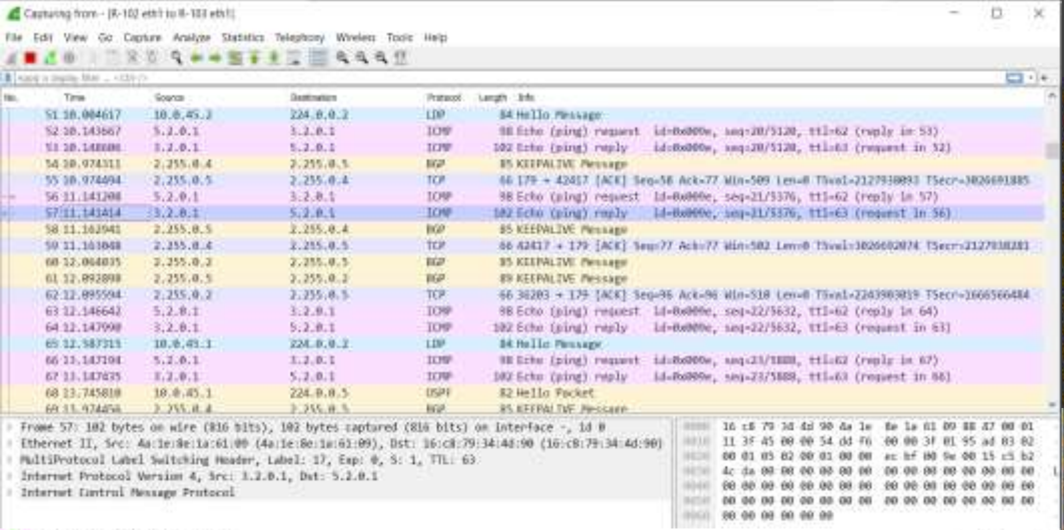
LAN
40.0.0.0/24

20.0.0.0/24
LAN

AS-100
2.0.0.0/8

- The Autonomous system 100 has 3 routers R-101 R-102 and R-103.
- R-101 has eBGP peering with AS-200 R-202.
- R-102 has iBGP peering with internal routers.
- R-103 has eBGP peering with AS-300 R-301
- All router has Multi-Protocol Packet Switching MPLS and configure Open Shortest Path First OSPF
- Public Network of R-101 2.2.0.1/16 and Router ID 2.255.0.2
- Public Network of R-102 2.4.0.1/16 and Router ID 2.255.0.4
- Public Network of R-103 2.5.0.1/16 and Router ID 2.255.0.5

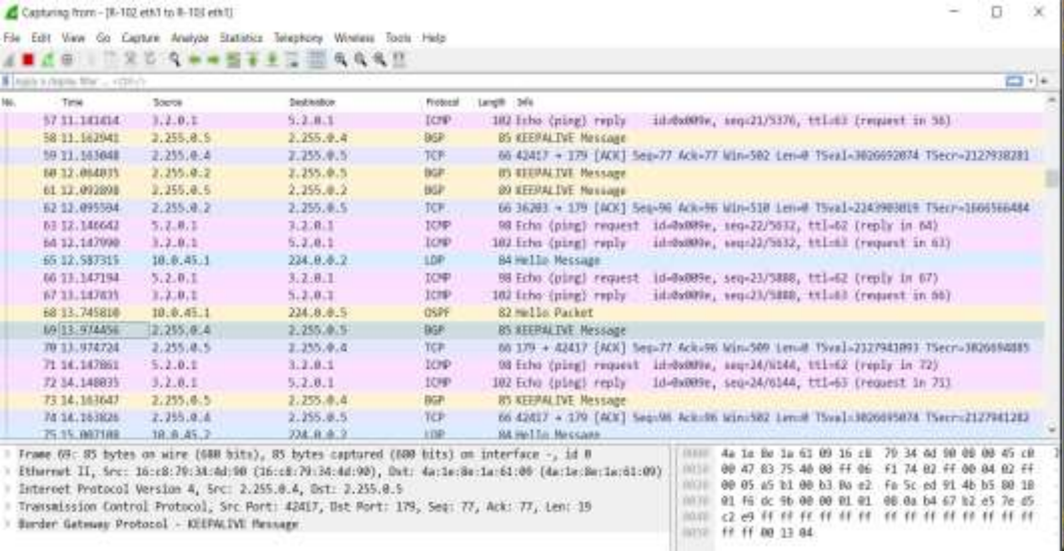
AS-100 Working


Capturing from - [R-102 eth1 to R-103 eth1]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

```
No.  Time       Source      Destination  Protocol Length Info
51 10.004617  10.0.45.2   224.0.0.2    LDP    84 Hello Message
52 10.143667  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x000e, seq=20/5120, ttl=62 (reply in 53)
53 10.148606  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x000e, seq=20/5120, ttl=63 (request in 52)
54 10.974311  2.255.0.4   2.255.0.5    BGP    85 KEEPALIVE Message
55 10.974494  2.255.0.5   2.255.0.4    TCP    66 179 → 42417 [ACK] Seq=58 Ack=77 Win=509 Len=0 TSval=2127938093 TSecr=3026691885
56 11.141208  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x000e, seq=21/5376, ttl=62 (reply in 57)
57 11.141414  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x000e, seq=21/5376, ttl=63 (request in 56)
58 11.162941  2.255.0.5   2.255.0.4    BGP    85 KEEPALIVE Message
59 11.163048  2.255.0.4   2.255.0.5    TCP    66 42417 → 179 [ACK] Seq=77 Ack=77 Win=502 Len=0 TSval=3026692074 TSecr=2127938281
60 12.064035  2.255.0.2   2.255.0.5    BGP    85 KEEPALIVE Message
61 12.092898  2.255.0.5   2.255.0.2    BGP    89 KEEPALIVE Message
62 12.095594  2.255.0.2   2.255.0.5    TCP    66 36203 → 179 [ACK] Seq=96 Ack=96 Win=510 Len=0 TSval=2243903019 TSecr=1666566484
63 12.146642  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x000e, seq=22/5632, ttl=62 (reply in 64)
64 12.147090  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x000e, seq=22/5632, ttl=63 (request in 63)
65 12.587315  10.0.45.1   224.0.0.2    LDP    84 Hello Message
66 13.147194  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x000e, seq=23/5888, ttl=62 (reply in 67)
67 13.147835  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x000e, seq=23/5888, ttl=63 (request in 66)
68 13.745810  10.0.45.1   224.0.0.5    OSPF   82 Hello Packet
69 13.974456  2.255.0.4   2.255.0.5    BGP    85 KEEPALIVE Message
```

```
> Frame 57: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface -, id 0
> Ethernet II, Src: 4a:1e:8e:1a:61:09 (4a:1e:8e:1a:61:09), Dst: 16:c8:79:34:4d:90 (16:c8:79:34:4d:90)
> MultiProtocol Label Switching Header, Label: 17, Exp: 0, S: 1, TTL: 63
> Internet Protocol Version 4, Src: 3.2.0.1, Dst: 5.2.0.1
> Internet Control Message Protocol
```

```
0000  16 c8 79 34 4d 90 4a 1e  8e 1a 61 09 88 47 00 01
0010  11 3f 45 00 00 54 dd f6  00 00 3f 01 95 ad 03 02
0020  00 01 05 02 00 01 00 00  ac bf 00 9e 00 15 c5 b2
0030  4c da 00 00 00 00 00 00  00 00 00 00 00 00 00 00
0040  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
0050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00
0060  00 00 00 00 00 00
```


Capturing from - [R-102 eth1 to R-103 eth1]
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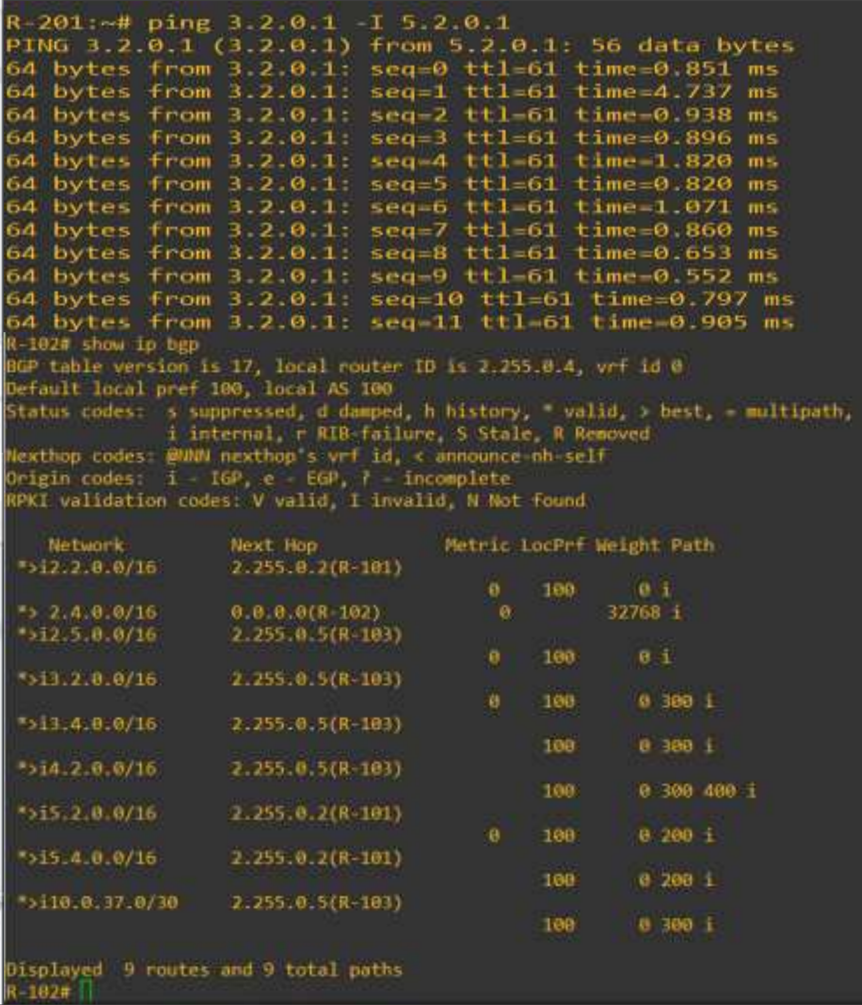
```
No.  Time       Source      Destination  Protocol Length Info
57 11.141414  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x009e, seq=21/5376, ttl=63 (request in 56)
58 11.162941  2.255.0.5   2.255.0.4    BGP    85 KEEPALIVE Message
59 11.163048  2.255.0.4   2.255.0.5    TCP    66 42417 → 179 [ACK] Seq=77 Ack=77 Win=502 Len=0 TSval=3026692074 TSecr=2127938281
60 12.064035  2.255.0.2   2.255.0.5    BGP    85 KEEPALIVE Message
61 12.092898  2.255.0.5   2.255.0.2    BGP    89 KEEPALIVE Message
62 12.095594  2.255.0.2   2.255.0.5    TCP    66 36203 → 179 [ACK] Seq=96 Ack=96 Win=510 Len=0 TSval=2243903019 TSecr=1666566484
63 12.146642  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x009e, seq=22/5632, ttl=62 (reply in 64)
64 12.147090  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x009e, seq=22/5632, ttl=63 (request in 63)
65 12.587315  10.0.45.1   224.0.0.2    LDP    84 Hello Message
66 13.147194  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x009e, seq=23/5888, ttl=62 (reply in 67)
67 13.147835  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x009e, seq=23/5888, ttl=63 (request in 66)
68 13.745810  10.0.45.1   224.0.0.5    OSPF   82 Hello Packet
69 13.974456  2.255.0.4   2.255.0.5    BGP    85 KEEPALIVE Message
70 13.974724  2.255.0.5   2.255.0.4    TCP    66 179 → 42417 [ACK] Seq=77 Ack=96 Win=509 Len=0 TSval=2127941093 TSecr=3026694885
71 14.147861  5.2.0.1     3.2.0.1      ICMP   98 Echo (ping) request  id=0x009e, seq=24/6144, ttl=62 (reply in 72)
72 14.148035  3.2.0.1     5.2.0.1      ICMP  102 Echo (ping) reply    id=0x009e, seq=24/6144, ttl=63 (request in 71)
73 14.163647  2.255.0.5   2.255.0.4    BGP    85 KEEPALIVE Message
74 14.163826  2.255.0.4   2.255.0.5    TCP    66 42417 → 179 [ACK] Seq=96 Ack=96 Win=502 Len=0 TSval=3026695074 TSecr=2127941282
75 15.007108  10.0.45.2   224.0.0.2    LDP    84 Hello Message
```

```
> Frame 69: 85 bytes on wire (680 bits), 85 bytes captured (680 bits) on interface -, id 0
> Ethernet II, Src: 16:c8:79:34:4d:90 (16:c8:79:34:4d:90), Dst: 4a:1e:8e:1a:61:09 (4a:1e:8e:1a:61:09)
> Internet Protocol Version 4, Src: 2.255.0.4, Dst: 2.255.0.5
> Transmission Control Protocol, Src Port: 42417, Dst Port: 179, Seq: 77, Ack: 77, Len: 19
> Border Gateway Protocol - KEEPALIVE Message
```

```
0000  4a 1e 8e 1a 61 09 16 c8  79 34 4d 90 08 00 45 c0
0010  00 47 83 75 40 00 ff 06  f1 74 02 ff 00 04 02 ff
0020  00 05 a5 b1 00 b3 8a e2  fa 5c ed 91 4b b5 80 18
0030  01 f6 dc 9b 00 00 01 01  08 0a b4 67 b2 e5 7e d5
0040  c2 e9 ff ff ff ff ff ff  ff ff ff ff ff ff ff ff
0050  ff ff 00 13 04
```



```
R-201:~# ping 3.2.0.1 -I 5.2.0.1
PING 3.2.0.1 (3.2.0.1) from 5.2.0.1: 56 data bytes
64 bytes from 3.2.0.1: seq=0 ttl=61 time=0.851 ms
64 bytes from 3.2.0.1: seq=1 ttl=61 time=4.737 ms
64 bytes from 3.2.0.1: seq=2 ttl=61 time=0.938 ms
64 bytes from 3.2.0.1: seq=3 ttl=61 time=0.896 ms
64 bytes from 3.2.0.1: seq=4 ttl=61 time=1.820 ms
64 bytes from 3.2.0.1: seq=5 ttl=61 time=0.820 ms
64 bytes from 3.2.0.1: seq=6 ttl=61 time=1.071 ms
64 bytes from 3.2.0.1: seq=7 ttl=61 time=0.860 ms
64 bytes from 3.2.0.1: seq=8 ttl=61 time=0.653 ms
64 bytes from 3.2.0.1: seq=9 ttl=61 time=0.552 ms
64 bytes from 3.2.0.1: seq=10 ttl=61 time=0.797 ms
64 bytes from 3.2.0.1: seq=11 ttl=61 time=0.905 ms
R-102# show ip bgp
BGP table version is 17, local router ID is 2.255.0.4, vrf id 0
Default local pref 100, local AS 100
Status codes:  s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes:  i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

   Network          Next Hop            Metric LocPrf Weight Path
 *>i2.2.0.0/16      2.255.0.2(R-101)
                                             0    100      0 i
 *> 2.4.0.0/16      0.0.0.0(R-102)
                                              0         32768 i
 *>i2.5.0.0/16      2.255.0.5(R-103)
                                             0    100      0 i
 *>i3.2.0.0/16      2.255.0.5(R-103)
                                             0    100      0 300 i
 *>i3.4.0.0/16      2.255.0.5(R-103)
                                                  100      0 300 i
 *>i4.2.0.0/16      2.255.0.5(R-103)
                                                  100      0 300 400 i
 *>i5.2.0.0/16      2.255.0.2(R-101)
                                             0    100      0 200 i
 *>i5.4.0.0/16      2.255.0.2(R-101)
                                                  100      0 200 i
 *>i10.0.37.0/30    2.255.0.5(R-103)
                                                  100      0 300 i

Displayed  9 routes and 9 total paths
R-102#
```

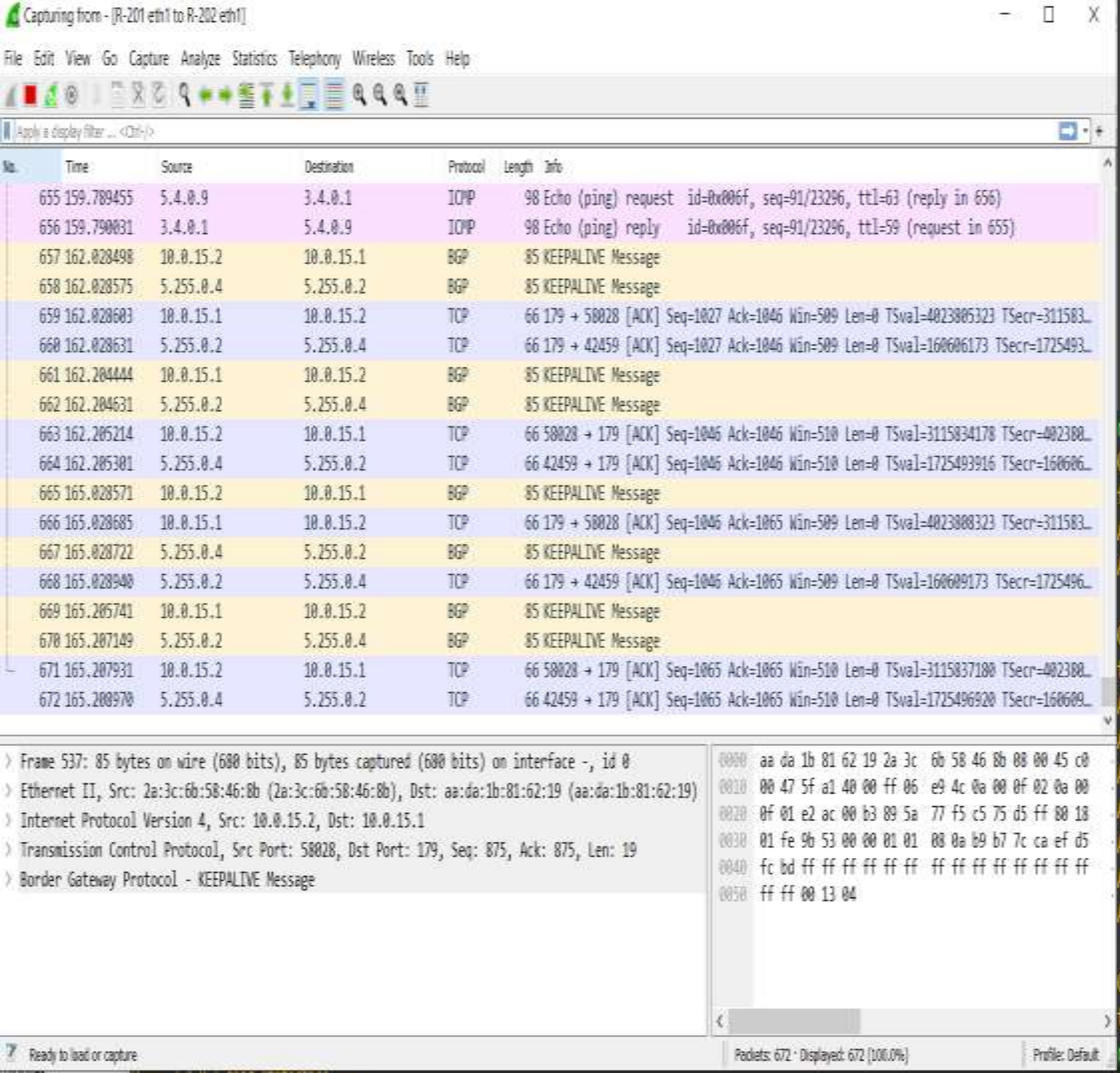
AS-200
5.0.0.0/8

- The Autonomous system 200 has 3 routers R-201 R-202 and R-203.
- R-201 has eBGP peering with AS-100 R-101.
- R-202 has iBGP peering with internal router R-201.
- R-203 is absent from the BGP
- R-201 and R-202 configure with Open Shortest Path First OSPF
- R-203 has default route with R-202, and Access gateway of LAN attached to it, configuration of Dynamic NAT and a Simple firewall.
- Public Network of R-201 5.2.0.1/16 and Router ID 5.255.0.2
- Public Network of R-202 5.4.0.1/16 and Router ID 5.255.0.4
- Public Network of R-203 of AS-200 pool 5.4.0.8/30

AS-200 Working

R-203 Dynamic NAT conf

sysctl -w net.ipv4.ip_forward=1
ip addr add 20.0.0.1/24 dev eth1
ip addr add 5.4.0.9/30 dev eth0
ip route add default via 5.4.0.10
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
echo 1 > /proc/sys/net/ipv4/ip_forward


Capturing from - [R-201 eth1 to R-202 eth1]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
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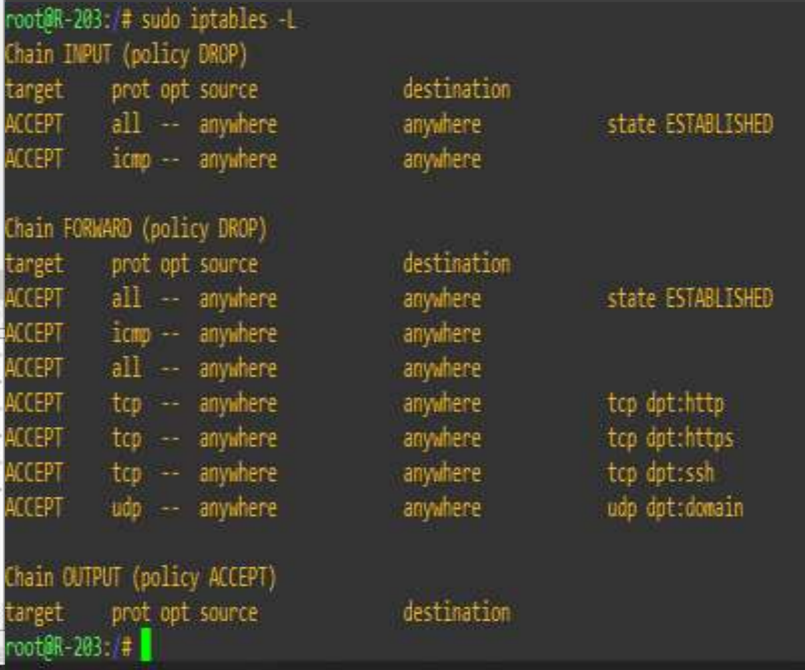
```
No.  Time          Source      Destination  Protocol  Length  Info
 655 159.789455    5.4.0.9     3.4.0.1      ICMP      98 Echo (ping) request  id=0x006f, seq=91/23296, ttl=63 (reply in 656)
 656 159.790031    3.4.0.1     5.4.0.9      ICMP      98 Echo (ping) reply    id=0x006f, seq=91/23296, ttl=59 (request in 655)
 657 162.028498    10.0.15.2   10.0.15.1    BGP       85 KEEPALIVE Message
 658 162.028575    5.255.0.4   5.255.0.2    BGP       85 KEEPALIVE Message
 659 162.028603    10.0.15.1   10.0.15.2    TCP       66 179 → 58028 [ACK] Seq=1027 Ack=1046 Win=509 Len=0 TSval=402385323 TSecr=311583…
 660 162.028631    5.255.0.2   5.255.0.4    TCP       66 179 → 42459 [ACK] Seq=1027 Ack=1046 Win=509 Len=0 TSval=160606173 TSecr=1725493…
 661 162.204444    10.0.15.1   10.0.15.2    BGP       85 KEEPALIVE Message
 662 162.204631    5.255.0.2   5.255.0.4    BGP       85 KEEPALIVE Message
 663 162.205214    10.0.15.2   10.0.15.1    TCP       66 58028 → 179 [ACK] Seq=1046 Ack=1046 Win=510 Len=0 TSval=3115834178 TSecr=402380…
 664 162.205301    5.255.0.4   5.255.0.2    TCP       66 42459 → 179 [ACK] Seq=1046 Ack=1046 Win=510 Len=0 TSval=1725493916 TSecr=160606…
 665 165.028571    10.0.15.2   10.0.15.1    BGP       85 KEEPALIVE Message
 666 165.028685    10.0.15.1   10.0.15.2    TCP       66 179 → 58028 [ACK] Seq=1046 Ack=1065 Win=509 Len=0 TSval=402388323 TSecr=311583…
 667 165.028722    5.255.0.4   5.255.0.2    BGP       85 KEEPALIVE Message
 668 165.028940    5.255.0.2   5.255.0.4    TCP       66 179 → 42459 [ACK] Seq=1046 Ack=1065 Win=509 Len=0 TSval=160609173 TSecr=1725496…
 669 165.205741    10.0.15.1   10.0.15.2    BGP       85 KEEPALIVE Message
 670 165.207149    5.255.0.2   5.255.0.4    BGP       85 KEEPALIVE Message
 671 165.207931    10.0.15.2   10.0.15.1    TCP       66 58028 → 179 [ACK] Seq=1065 Ack=1065 Win=510 Len=0 TSval=3115837180 TSecr=402380…
 672 165.208970    5.255.0.4   5.255.0.2    TCP       66 42459 → 179 [ACK] Seq=1065 Ack=1065 Win=510 Len=0 TSval=1725496920 TSecr=160609…
```

```
> Frame 537: 85 bytes on wire (680 bits), 85 bytes captured (680 bits) on interface -, id 0
> Ethernet II, Src: 2a:3c:6b:58:46:8b (2a:3c:6b:58:46:8b), Dst: aa:da:1b:81:62:19 (aa:da:1b:81:62:19)
> Internet Protocol Version 4, Src: 10.0.15.2, Dst: 10.0.15.1
> Transmission Control Protocol, Src Port: 58028, Dst Port: 179, Seq: 875, Ack: 875, Len: 19
> Border Gateway Protocol - KEEPALIVE Message
```

```
0000  aa da 1b 81 62 19 2a 3c  6b 58 46 8b 08 00 45 c0
0010  00 47 5f a1 40 00 ff 06  e9 4c 0a 00 0f 02 0a 00
0020  0f 01 e2 ac 00 b3 89 5a  77 f5 c5 75 d5 ff 80 18
0030  01 fe 9b 53 00 00 01 01  08 0a b9 b7 7c ca ef d5
0040  fc bd ff ff ff ff ff ff  ff ff ff ff ff ff ff ff
0050  ff ff 00 13 04
```

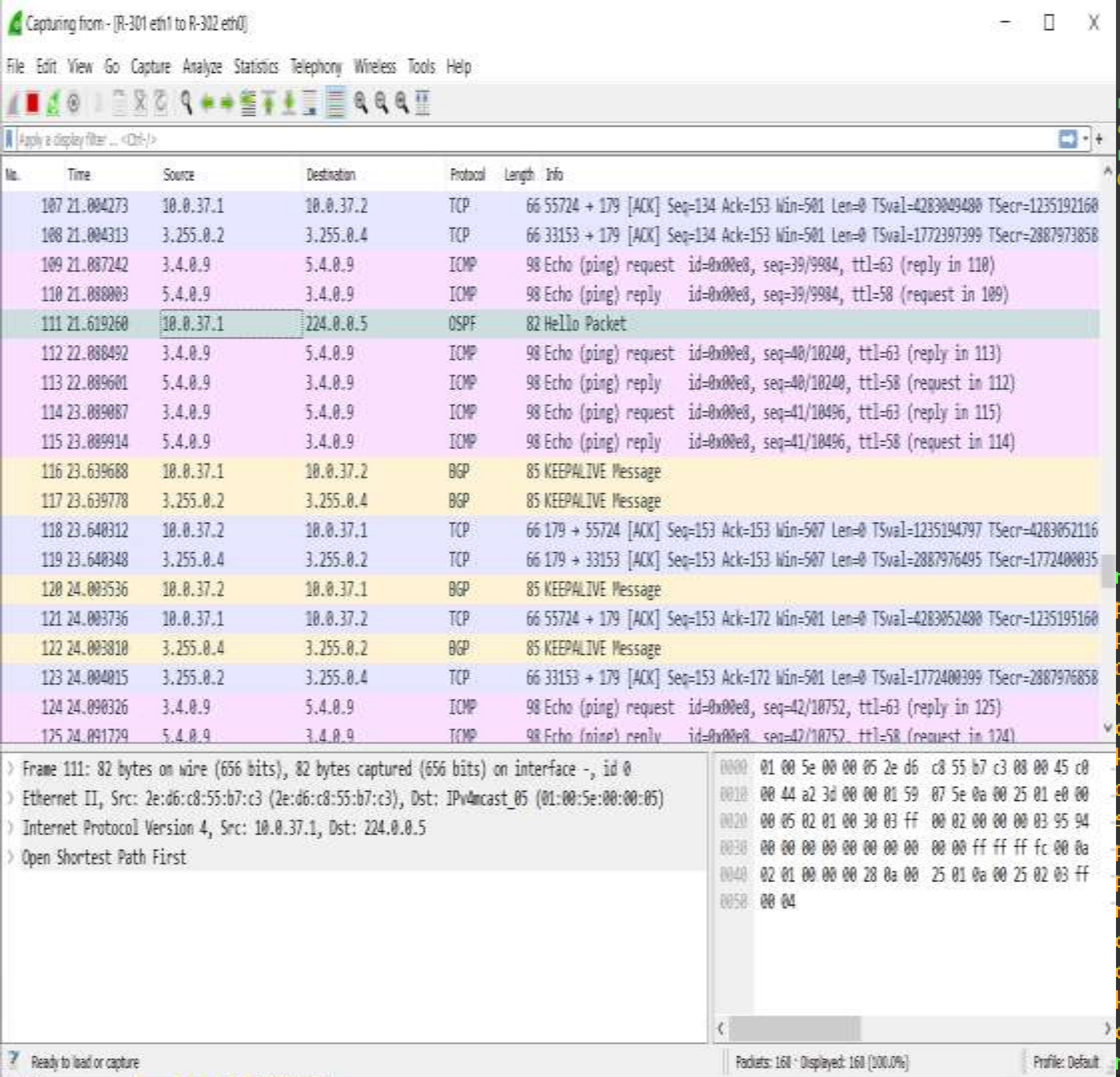


```
root@R-203:/# sudo iptables -L
Chain INPUT (policy DROP)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere             state ESTABLISHED
ACCEPT     icmp --  anywhere             anywhere

Chain FORWARD (policy DROP)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere             state ESTABLISHED
ACCEPT     icmp --  anywhere             anywhere
ACCEPT     all  --  anywhere             anywhere
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:http
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:https
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:ssh
ACCEPT     udp  --  anywhere             anywhere             udp dpt:domain

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
root@R-203:/#
```

AS-300 3.0.0.0/8

- The Autonomous system 300 has 3 routers R-301 R-302 and GW-300.
- R-301 has eBGP peering with AS-100 R-103.
- R-302 has iBGP peering with internal router R-301.
- GW-300 is absent from the BGP
- GW-300 is the OpenVPN Server, It has default route via with R-302, and Access gateway of Data Center and a configuration of Dynamic NAT,
- GW-300 has client1(client-200), client(R-203) and Server(GW-300) certificates + dh parameters + OpenVPN conf
- Public Network of R-301 3.2.0.1/16 and Router ID 3.255.0.2
- Public Network of R-302 3.4.0.1/24 and Router ID 3.255.0.4
- Public Network of GW-300 of AS-300 pool 3.4.0.9/24

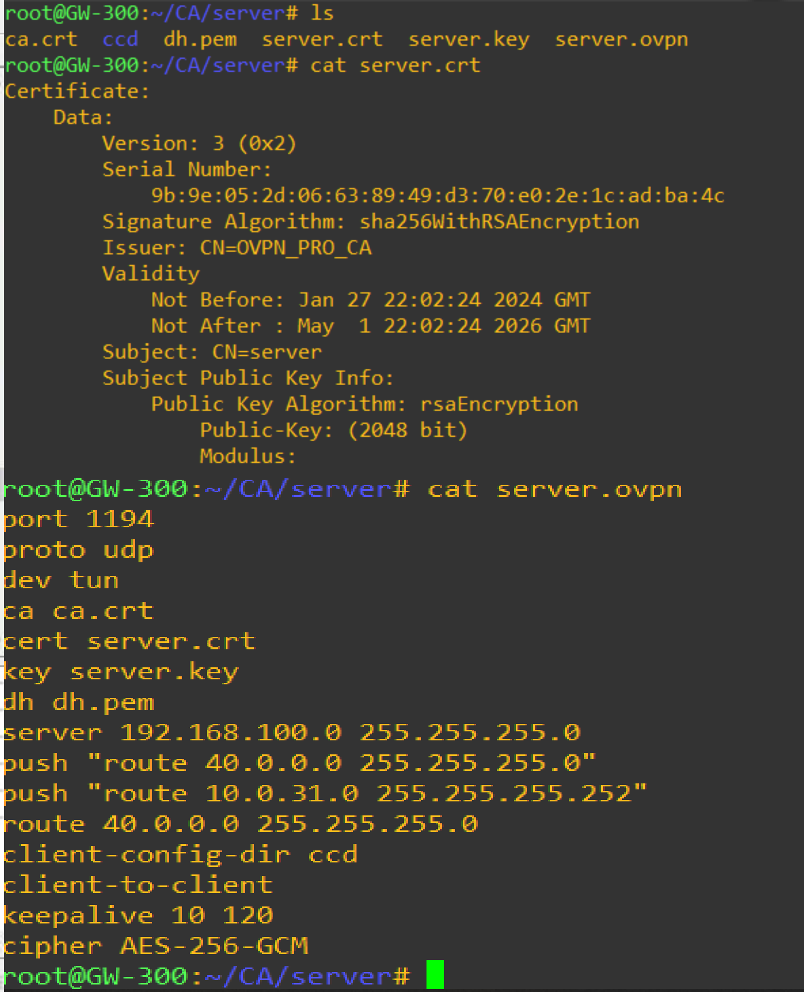
AS-300 Working


Capturing from - [R-301 eth1 to R-302 eth0]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
107	21.004273	10.0.37.1	10.0.37.2	TCP	66	55724 → 179 [ACK] Seq=134 Ack=153 Win=501 Len=0 TSval=4283049480 TSecr=1235192160
108	21.004313	3.255.0.2	3.255.0.4	TCP	66	33153 → 179 [ACK] Seq=134 Ack=153 Win=501 Len=0 TSval=1772397399 TSecr=2887973858
109	21.087242	3.4.0.9	5.4.0.9	ICMP	98	Echo (ping) request id=0x00e8, seq=39/9984, ttl=63 (reply in 110)
110	21.088003	5.4.0.9	3.4.0.9	ICMP	98	Echo (ping) reply id=0x00e8, seq=39/9984, ttl=58 (request in 109)
111	21.619260	10.0.37.1	224.0.0.5	OSPF	82	Hello Packet
112	22.088492	3.4.0.9	5.4.0.9	ICMP	98	Echo (ping) request id=0x00e8, seq=40/10240, ttl=63 (reply in 113)
113	22.089601	5.4.0.9	3.4.0.9	ICMP	98	Echo (ping) reply id=0x00e8, seq=40/10240, ttl=58 (request in 112)
114	23.089087	3.4.0.9	5.4.0.9	ICMP	98	Echo (ping) request id=0x00e8, seq=41/10496, ttl=63 (reply in 115)
115	23.089914	5.4.0.9	3.4.0.9	ICMP	98	Echo (ping) reply id=0x00e8, seq=41/10496, ttl=58 (request in 114)
116	23.639688	10.0.37.1	10.0.37.2	BGP	85	KEEPALIVE Message
117	23.639778	3.255.0.2	3.255.0.4	BGP	85	KEEPALIVE Message
118	23.640312	10.0.37.2	10.0.37.1	TCP	66	179 → 55724 [ACK] Seq=153 Ack=153 Win=507 Len=0 TSval=1235194797 TSecr=4283052116
119	23.640348	3.255.0.4	3.255.0.2	TCP	66	179 → 33153 [ACK] Seq=153 Ack=153 Win=507 Len=0 TSval=2887976495 TSecr=1772400035
120	24.003536	10.0.37.2	10.0.37.1	BGP	85	KEEPALIVE Message
121	24.003736	10.0.37.1	10.0.37.2	TCP	66	55724 → 179 [ACK] Seq=153 Ack=172 Win=501 Len=0 TSval=4283052480 TSecr=1235195160
122	24.003810	3.255.0.4	3.255.0.2	BGP	85	KEEPALIVE Message
123	24.004015	3.255.0.2	3.255.0.4	TCP	66	33153 → 179 [ACK] Seq=153 Ack=172 Win=501 Len=0 TSval=1772400399 TSecr=2887976858
124	24.090326	3.4.0.9	5.4.0.9	ICMP	98	Echo (ping) request id=0x00e8, seq=42/10752, ttl=63 (reply in 125)
125	24.091729	5.4.0.9	3.4.0.9	ICMP	98	Echo (ping) reply id=0x00e8, seq=42/10752, ttl=58 (request in 124)

```
> Frame 111: 82 bytes on wire (656 bits), 82 bytes captured (656 bits) on interface -, id 0
> Ethernet II, Src: 2e:d6:c8:55:b7:c3 (2e:d6:c8:55:b7:c3), Dst: IPv4mcast_05 (01:00:5e:00:00:05)
> Internet Protocol Version 4, Src: 10.0.37.1, Dst: 224.0.0.5
> Open Shortest Path First
```

```
0000  01 00 5e 00 00 05 2e d6  c8 55 b7 c3 08 00 45 c0
0010  00 44 a2 3d 00 00 01 59  07 5e 0a 00 25 01 e0 00
0020  00 05 02 01 00 30 03 ff  00 02 00 00 00 03 95 94
0030  00 00 00 00 00 00 00 00  00 00 ff ff ff fc 00 0a
0040  02 01 00 00 00 28 0a 00  25 01 0a 00 25 02 03 ff
0050  00 04
```

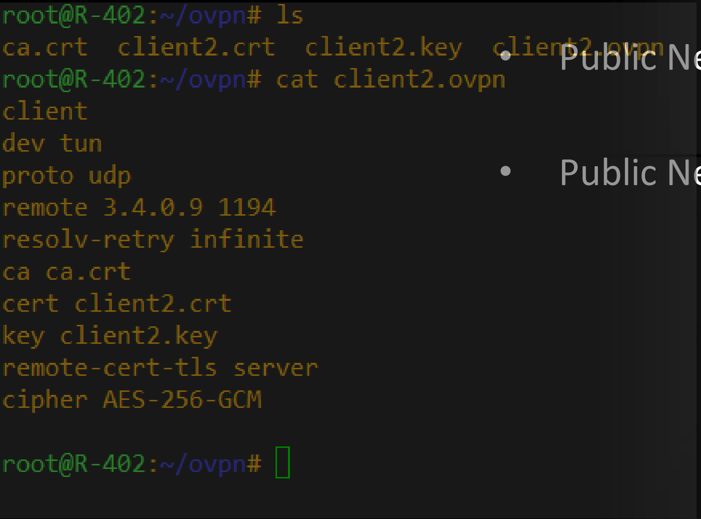


```
root@GW-300:~/CA/server# ls
ca.crt  ccd  dh.pem  server.crt  server.key  server.ovpn
root@GW-300:~/CA/server# cat server.crt
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            9b:9e:05:2d:06:63:89:49:d3:70:e0:2e:1c:ad:ba:4c
        Signature Algorithm: sha256WithRSAEncryption
        Issuer: CN=OVPN_PRO_CA
        Validity
            Not Before: Jan 27 22:02:24 2024 GMT
            Not After : May  1 22:02:24 2026 GMT
        Subject: CN=server
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
                Public-Key: (2048 bit)
                Modulus:
root@GW-300:~/CA/server# cat server.ovpn
port 1194
proto udp
dev tun
ca ca.crt
cert server.crt
key server.key
dh dh.pem
server 192.168.100.0 255.255.255.0
push "route 40.0.0.0 255.255.255.0"
push "route 10.0.31.0 255.255.255.252"
route 40.0.0.0 255.255.255.0
client-config-dir ccd
client-to-client
keepalive 10 120
cipher AES-256-GCM
root@GW-300:~/CA/server#
```

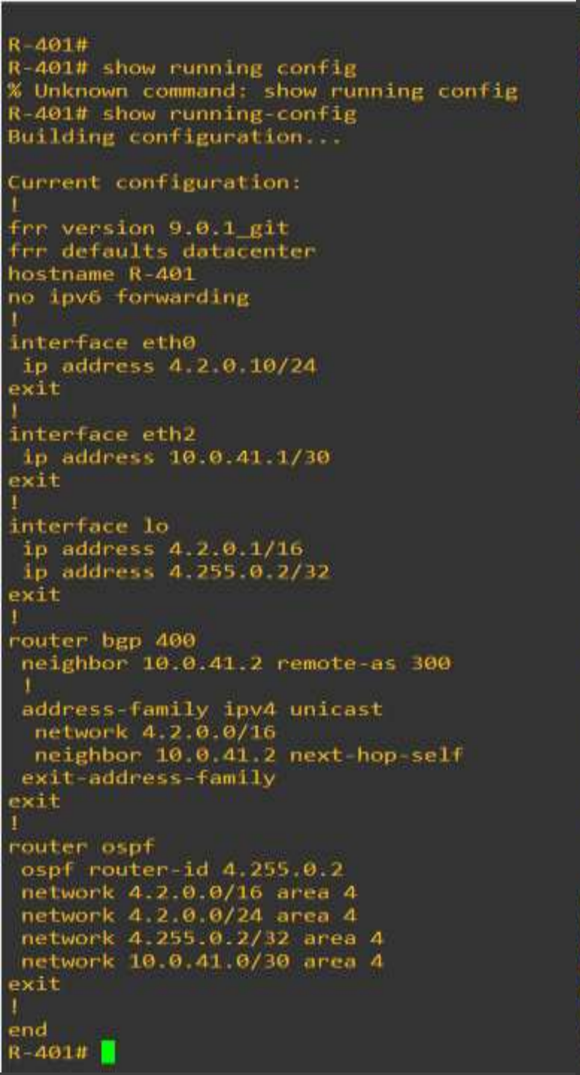
AS-400

4.0.0.0/8

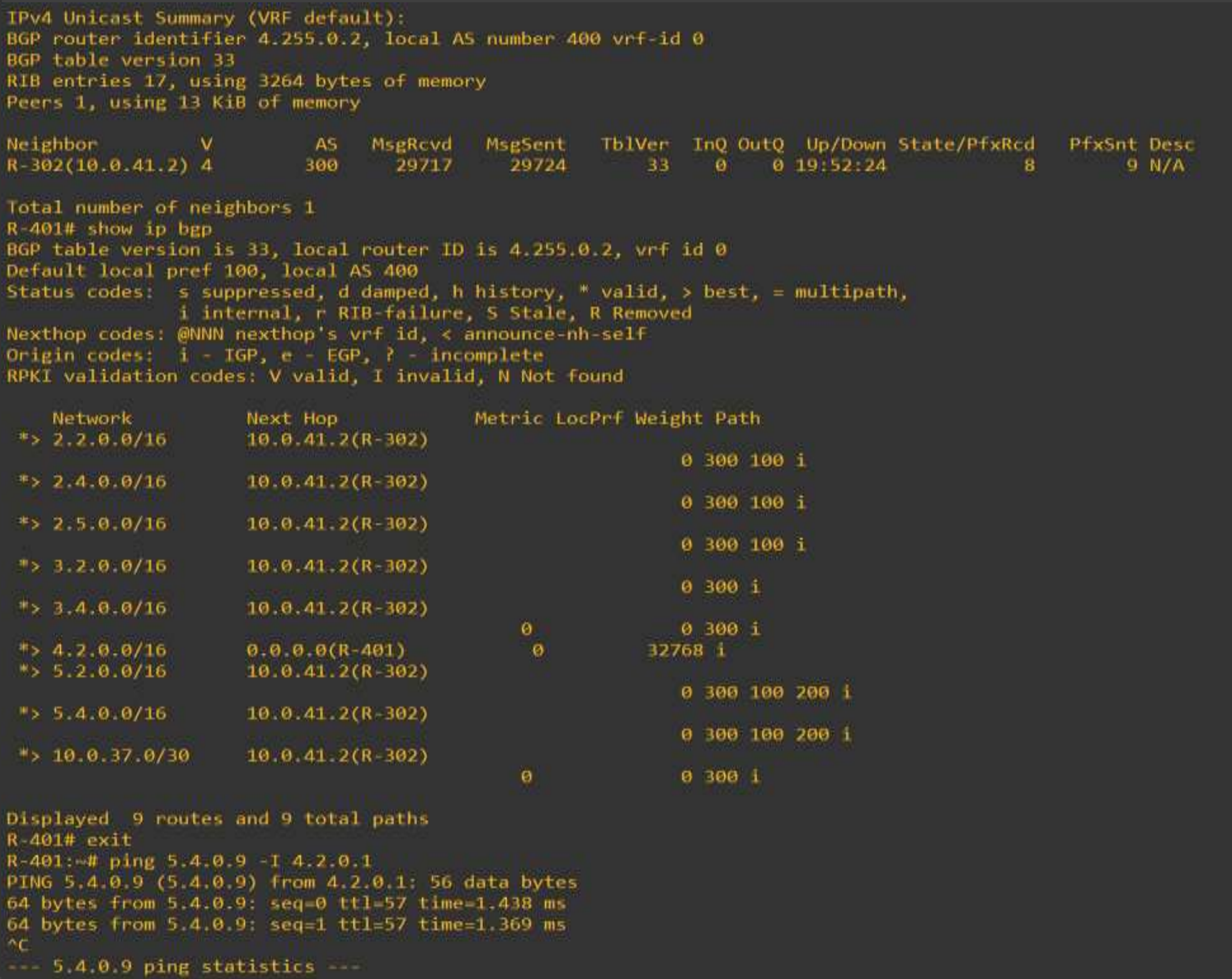
- The Autonomous system 400 has 2 routers R-401 R-402
- R-401 has eBGP peering with AS-300 R-302.
- R-402 is absent from the BGP
- R-402 is the OpenVPN Client2, It has default route via with R-401, R-402 is an OpenVPN client, providing VPN access to and from the LAN attached to it. and Access gateway of LAN with a configuration of Dynamic NAT,
- Public Network of R-401 4.2.0.1/16 and Router ID 4.255.0.2
- Public Network of R-402 of AS-400 pool 4.4.0.9/24



```
root@R-402:~/ovpn# ls
ca.crt  client2.crt  client2.key  client2.ovpn
root@R-402:~/ovpn# cat client2.ovpn
client
dev tun
proto udp
remote 3.4.0.9 1194
resolv-retry infinite
ca ca.crt
cert client2.crt
key client2.key
remote-cert-tls server
cipher AES-256-GCM

root@R-402:~/ovpn# 
```



```
R-401#
R-401# show running config
% Unknown command: show running config
R-401# show running-config
Building configuration...

Current configuration:
!
frr version 9.0.1_git
frr defaults datacenter
hostname R-401
no ipv6 forwarding
!
interface eth0
 ip address 4.2.0.10/24
exit
!
interface eth2
 ip address 10.0.41.1/30
exit
!
interface lo
 ip address 4.2.0.1/16
 ip address 4.255.0.2/32
exit
!
router bgp 400
 neighbor 10.0.41.2 remote-as 300
 !
 address-family ipv4 unicast
  network 4.2.0.0/16
  neighbor 10.0.41.2 next-hop-self
 exit-address-family
exit
!
router ospf
 ospf router-id 4.255.0.2
 network 4.2.0.0/16 area 4
 network 4.2.0.0/24 area 4
 network 4.255.0.2/32 area 4
 network 10.0.41.0/30 area 4
exit
!
end
R-401#
```



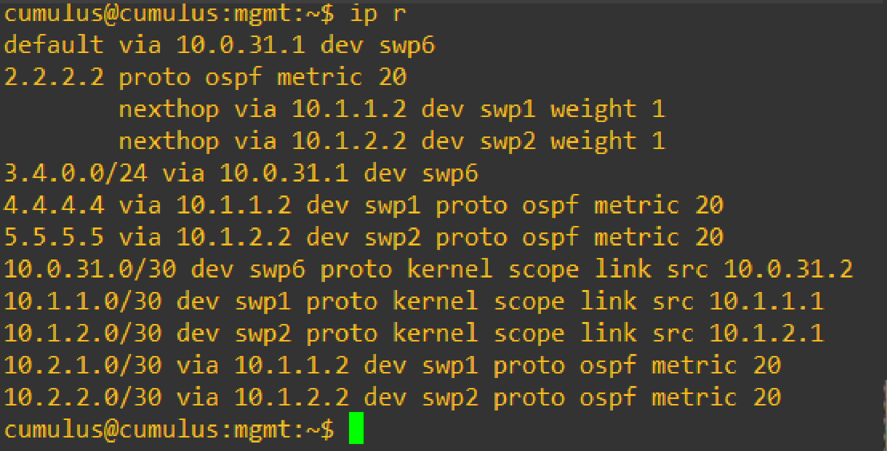
```
IPv4 Unicast Summary (VRF default):
BGP router identifier 4.255.0.2, local AS number 400 vrf-id 0
BGP table version 33
RIB entries 17, using 3264 bytes of memory
Peers 1, using 13 KiB of memory

Neighbor          V         AS   MsgRcvd   MsgSent   TblVer  InQ OutQ  Up/Down State/PfxRcd   PfxSnt Desc
R-302(10.0.41.2) 4        300     29717     29724       33    0    0 19:52:24            8        9 N/A

Total number of neighbors 1
R-401# show ip bgp
BGP table version is 33, local router ID is 4.255.0.2, vrf id 0
Default local pref 100, local AS 400
Status codes:  s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes:  i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

    Network          Next Hop            Metric LocPrf Weight Path
 *> 2.2.0.0/16       10.0.41.2(R-302)
                                                            0 300 100 i
 *> 2.4.0.0/16       10.0.41.2(R-302)
                                                            0 300 100 i
 *> 2.5.0.0/16       10.0.41.2(R-302)
                                                            0 300 100 i
 *> 3.2.0.0/16       10.0.41.2(R-302)
                                                            0 300 i
 *> 3.4.0.0/16       10.0.41.2(R-302)
                                              0             0 300 i
 *> 4.2.0.0/16       0.0.0.0(R-401)            0         32768 i
 *> 5.2.0.0/16       10.0.41.2(R-302)
                                                            0 300 100 200 i
 *> 5.4.0.0/16       10.0.41.2(R-302)
                                                            0 300 100 200 i
 *> 10.0.37.0/30     10.0.41.2(R-302)
                                              0             0 300 i

Displayed  9 routes and 9 total paths
R-401# exit
R-401:~# ping 5.4.0.9 -I 4.2.0.1
PING 5.4.0.9 (5.4.0.9) from 4.2.0.1: 56 data bytes
64 bytes from 5.4.0.9: seq=0 ttl=57 time=1.438 ms
64 bytes from 5.4.0.9: seq=1 ttl=57 time=1.369 ms
^C
--- 5.4.0.9 ping statistics ---
```

DC Network

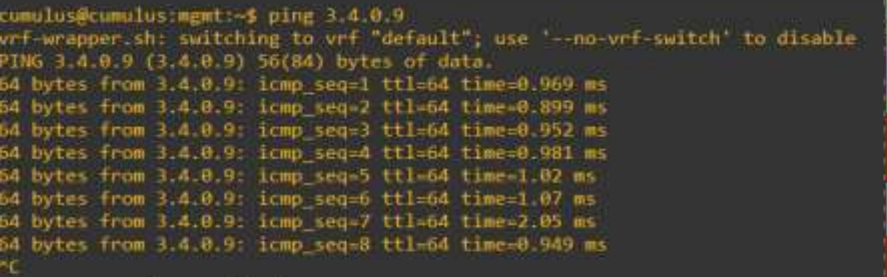
- The Data Center contain a Leaf-Spine Network. two/two-tier topologies
- Configuration of VXLAN static tunnels
- Configuration of EVPN with MP-eBGP peering
- The two tenant connected to leaf-1 and leaf-2
- L3VNI → Layer 3 VXLAN Network Identifier for each tenant, and both are different broad cast domain
- A1 and B2 are same broadcast domain and A2 and B2 same broadcast domain
- L3VNI **1020**, common to both broadcast domain **L2VNI 100** and **L2VNI 200**
- Leaf-1 has connectivity of GW-300 server, with default route.

Leaf – 1 to GW-300

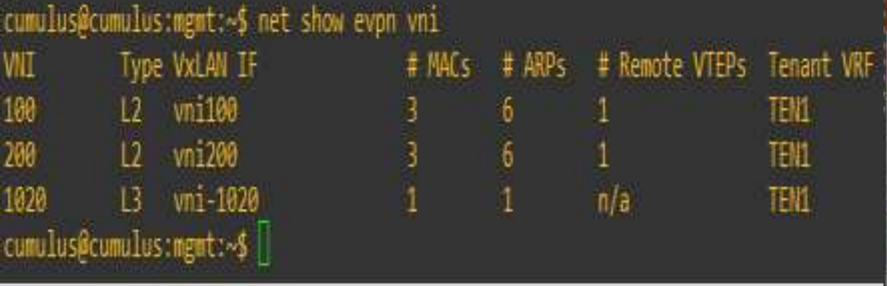
A1 to A2 and A1 to B2



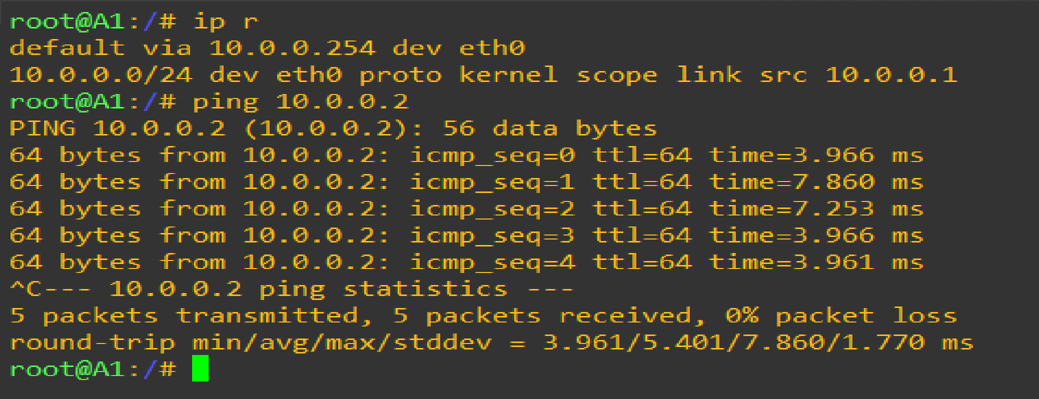
```
cumulus@cumulus:mgmt:~$ ip r
default via 10.0.31.1 dev swp6
2.2.2.2 proto ospf metric 20
        nexthop via 10.1.1.2 dev swp1 weight 1
        nexthop via 10.1.2.2 dev swp2 weight 1
3.4.0.0/24 via 10.0.31.1 dev swp6
4.4.4.4 via 10.1.1.2 dev swp1 proto ospf metric 20
5.5.5.5 via 10.1.2.2 dev swp2 proto ospf metric 20
10.0.31.0/30 dev swp6 proto kernel scope link src 10.0.31.2
10.1.1.0/30 dev swp1 proto kernel scope link src 10.1.1.1
10.1.2.0/30 dev swp2 proto kernel scope link src 10.1.2.1
10.2.1.0/30 via 10.1.1.2 dev swp1 proto ospf metric 20
10.2.2.0/30 via 10.1.2.2 dev swp2 proto ospf metric 20
cumulus@cumulus:mgmt:~$
```



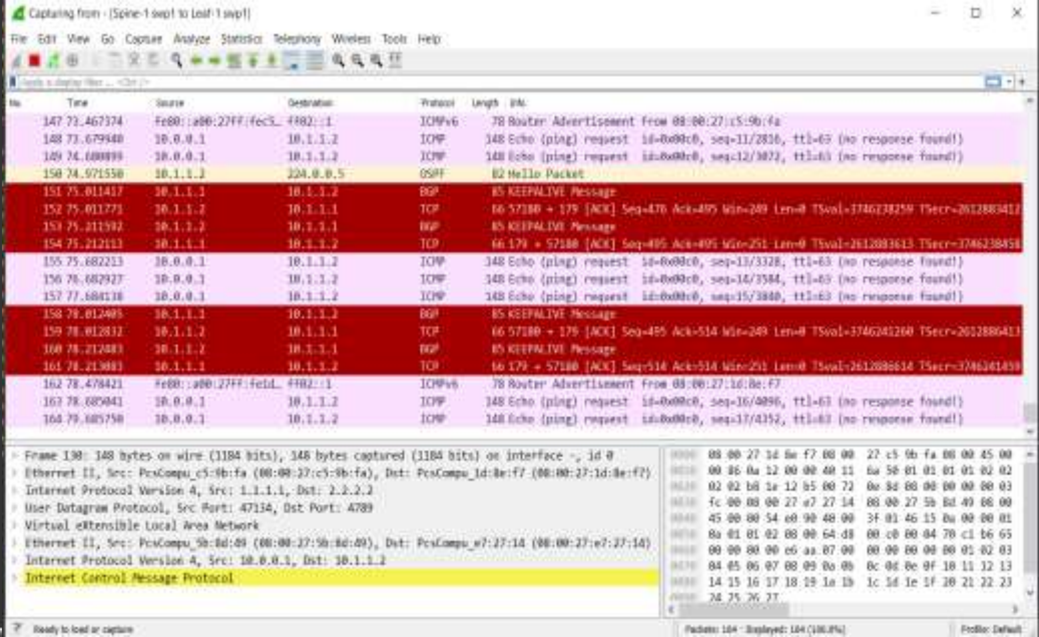
```
cumulus@cumulus:mgmt:~$ ping 3.4.0.9
vrf-wrapper.sh: switching to vrf "default"; use '--no-vrf-switch' to disable
PING 3.4.0.9 (3.4.0.9) 56(84) bytes of data.
64 bytes from 3.4.0.9: icmp_seq=1 ttl=64 time=0.969 ms
64 bytes from 3.4.0.9: icmp_seq=2 ttl=64 time=0.899 ms
64 bytes from 3.4.0.9: icmp_seq=3 ttl=64 time=0.952 ms
64 bytes from 3.4.0.9: icmp_seq=4 ttl=64 time=0.981 ms
64 bytes from 3.4.0.9: icmp_seq=5 ttl=64 time=1.02 ms
64 bytes from 3.4.0.9: icmp_seq=6 ttl=64 time=1.07 ms
64 bytes from 3.4.0.9: icmp_seq=7 ttl=64 time=2.05 ms
64 bytes from 3.4.0.9: icmp_seq=8 ttl=64 time=0.949 ms
^C
```



```
cumulus@cumulus:mgmt:~$ net show evpn vni
VNI       Type VxLAN IF          # MACs   # ARPs   # Remote VTEPs   Tenant VRF
100       L2   vni100            3        6        1                TEN1
200       L2   vni200            3        6        1                TEN1
1020      L3   vni-1020          1        1        n/a              TEN1
cumulus@cumulus:mgmt:~$
```



```
root@A1:/# ip r
default via 10.0.0.254 dev eth0
10.0.0.0/24 dev eth0 proto kernel scope link src 10.0.0.1
root@A1:/# ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2): 56 data bytes
64 bytes from 10.0.0.2: icmp_seq=0 ttl=64 time=3.966 ms
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=7.860 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=7.253 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=3.966 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=3.961 ms
^C--- 10.0.0.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 3.961/5.401/7.860/1.770 ms
root@A1:/#
```



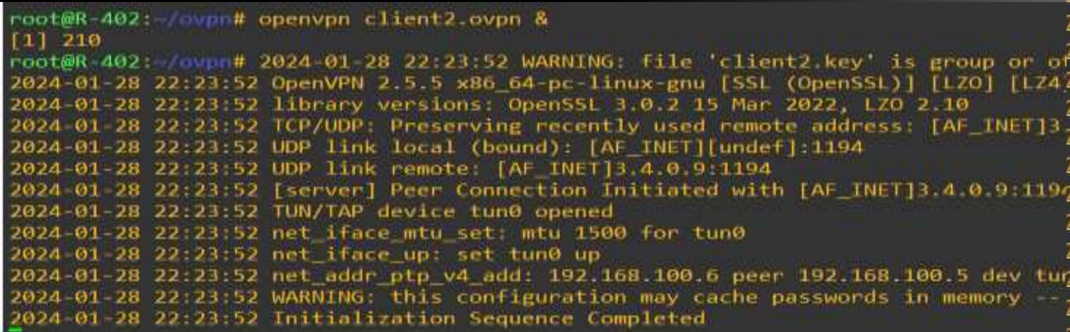
Capturing from - [Spine-1 swp1 to Leaf-1 swp1]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
Ready to load or capture
Packets: 164 · Displayed: 164 (100.0%)
Profile: Default

```
No.  Time          Source                 Destination  Protocol  Length  Info
147  73.467374     fe80::a00:27ff:fec5…   ff02::1      ICMPv6    78      Router Advertisement from 08:00:27:c5:9b:fa
148  73.679940     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=11/2816, ttl=63 (no response found!)
149  74.680899     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=12/3072, ttl=63 (no response found!)
150  74.971550     10.1.1.2               224.0.0.5    OSPF      82      Hello Packet
151  75.011417     10.1.1.1               10.1.1.2     BGP       85      KEEPALIVE Message
152  75.011771     10.1.1.2               10.1.1.1     TCP       66      57180 → 179 [ACK] Seq=476 Ack=495 Win=249 Len=0 TSval=3746238259 TSecr=2612883412
153  75.211592     10.1.1.2               10.1.1.1     BGP       85      KEEPALIVE Message
154  75.212113     10.1.1.1               10.1.1.2     TCP       66      179 → 57180 [ACK] Seq=495 Ack=495 Win=251 Len=0 TSval=2612883613 TSecr=3746238458
155  75.682213     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=13/3328, ttl=63 (no response found!)
156  76.682927     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=14/3584, ttl=63 (no response found!)
157  77.684138     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=15/3840, ttl=63 (no response found!)
158  78.012405     10.1.1.1               10.1.1.2     BGP       85      KEEPALIVE Message
159  78.012832     10.1.1.2               10.1.1.1     TCP       66      57180 → 179 [ACK] Seq=495 Ack=514 Win=249 Len=0 TSval=3746241260 TSecr=2612886413
160  78.212483     10.1.1.2               10.1.1.1     BGP       85      KEEPALIVE Message
161  78.213083     10.1.1.1               10.1.1.2     TCP       66      179 → 57180 [ACK] Seq=514 Ack=514 Win=251 Len=0 TSval=2612886614 TSecr=3746241459
162  78.478421     fe80::a00:27ff:fe1d…   ff02::1      ICMPv6    78      Router Advertisement from 08:00:27:1d:8e:f7
163  78.685041     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=16/4096, ttl=63 (no response found!)
164  79.685750     10.0.0.1               10.1.1.2     ICMP      148     Echo (ping) request  id=0x00c0, seq=17/4352, ttl=63 (no response found!)
```

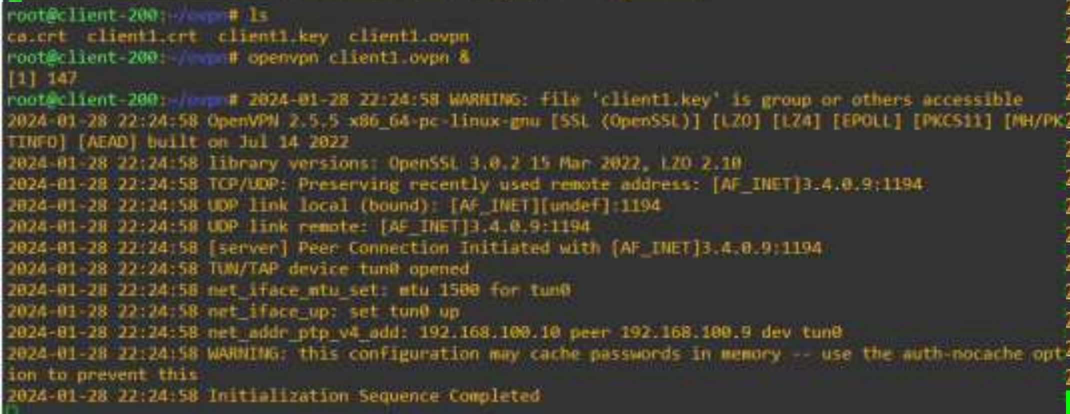
```
> Frame 130: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits) on interface -, id 0
> Ethernet II, Src: PcsCompu_c5:9b:fa (08:00:27:c5:9b:fa), Dst: PcsCompu_1d:8e:f7 (08:00:27:1d:8e:f7)
> Internet Protocol Version 4, Src: 1.1.1.1, Dst: 2.2.2.2
> User Datagram Protocol, Src Port: 47134, Dst Port: 4789
> Virtual eXtensible Local Area Network
> Ethernet II, Src: PcsCompu_5b:8d:49 (08:00:27:5b:8d:49), Dst: PcsCompu_e7:27:14 (08:00:27:e7:27:14)
> Internet Protocol Version 4, Src: 10.0.0.1, Dst: 10.1.1.2
> Internet Control Message Protocol
```

```
0000  08 00 27 1d 8e f7 08 00  27 c5 9b fa 08 00 45 00
0010  00 86 0a 12 00 00 40 11  6a 50 01 01 01 01 02 02
0020  02 02 b8 1e 12 b5 00 72  0e 8d 08 00 00 00 00 03
0030  fc 00 08 00 27 e7 27 14  08 00 27 5b 8d 49 08 00
0040  45 00 00 54 e0 90 40 00  3f 01 46 15 0a 00 00 01
0050  0a 01 01 02 08 00 64 d8  00 c0 00 04 70 c1 b6 65
0060  00 00 00 00 e6 aa 07 00  00 00 00 00 00 01 02 03
0070  04 05 06 07 08 09 0a 0b  0c 0d 0e 0f 10 11 12 13
0080  14 15 16 17 18 19 1a 1b  1c 1d 1e 1f 20 21 22 23
0090  24 25 26 27
```

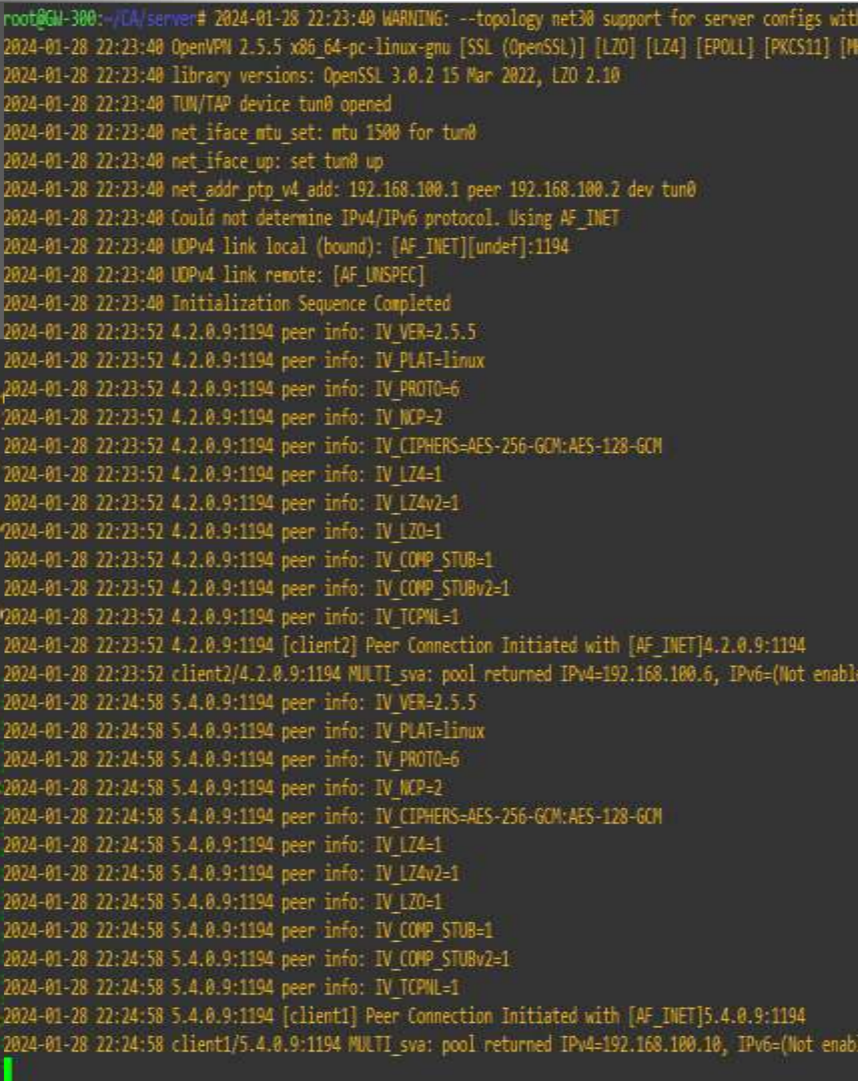
OPENVPN Client-200 GW-300 R-402



```
root@R-402:~/ovpn# openvpn client2.ovpn &
[1] 210
root@R-402:~/ovpn# 2024-01-28 22:23:52 WARNING: file 'client2.key' is group or ot
2024-01-28 22:23:52 OpenVPN 2.5.5 x86_64-pc-linux-gnu [SSL (OpenSSL)] [LZO] [LZ4
2024-01-28 22:23:52 library versions: OpenSSL 3.0.2 15 Mar 2022, LZO 2.10
2024-01-28 22:23:52 TCP/UDP: Preserving recently used remote address: [AF_INET]3
2024-01-28 22:23:52 UDP link local (bound): [AF_INET][undef]:1194
2024-01-28 22:23:52 UDP link remote: [AF_INET]3.4.0.9:1194
2024-01-28 22:23:52 [server] Peer Connection Initiated with [AF_INET]3.4.0.9:119
2024-01-28 22:23:52 TUN/TAP device tun0 opened
2024-01-28 22:23:52 net_iface_mtu_set: mtu 1500 for tun0
2024-01-28 22:23:52 net_iface_up: set tun0 up
2024-01-28 22:23:52 net_addr_ptp_v4_add: 192.168.100.6 peer 192.168.100.5 dev tu
2024-01-28 22:23:52 WARNING: this configuration may cache passwords in memory --
2024-01-28 22:23:52 Initialization Sequence Completed
```

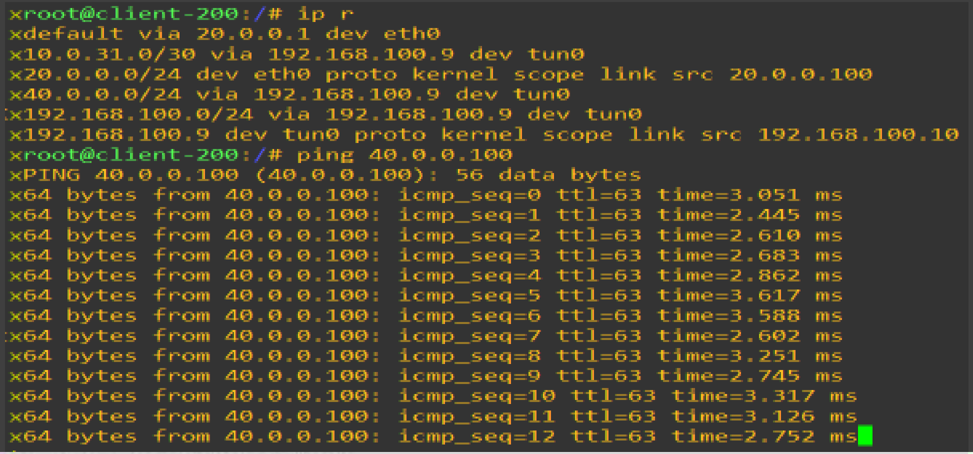


```
root@client-200:~/ovpn# ls
ca.crt  client1.crt  client1.key  client1.ovpn
root@client-200:~/ovpn# openvpn client1.ovpn &
[1] 147
root@client-200:~/ovpn# 2024-01-28 22:24:58 WARNING: file 'client1.key' is group or others accessible
2024-01-28 22:24:58 OpenVPN 2.5.5 x86_64-pc-linux-gnu [SSL (OpenSSL)] [LZO] [LZ4] [EPOLL] [PKCS11] [MH/PK
TINFO] [AEAD] built on Jul 14 2022
2024-01-28 22:24:58 library versions: OpenSSL 3.0.2 15 Mar 2022, LZO 2.10
2024-01-28 22:24:58 TCP/UDP: Preserving recently used remote address: [AF_INET]3.4.0.9:1194
2024-01-28 22:24:58 UDP link local (bound): [AF_INET][undef]:1194
2024-01-28 22:24:58 UDP link remote: [AF_INET]3.4.0.9:1194
2024-01-28 22:24:58 [server] Peer Connection Initiated with [AF_INET]3.4.0.9:1194
2024-01-28 22:24:58 TUN/TAP device tun0 opened
2024-01-28 22:24:58 net_iface_mtu_set: mtu 1500 for tun0
2024-01-28 22:24:58 net_iface_up: set tun0 up
2024-01-28 22:24:58 net_addr_ptp_v4_add: 192.168.100.10 peer 192.168.100.9 dev tun0
2024-01-28 22:24:58 WARNING: this configuration may cache passwords in memory -- use the auth-nocache opt
ion to prevent this
2024-01-28 22:24:58 Initialization Sequence Completed
```

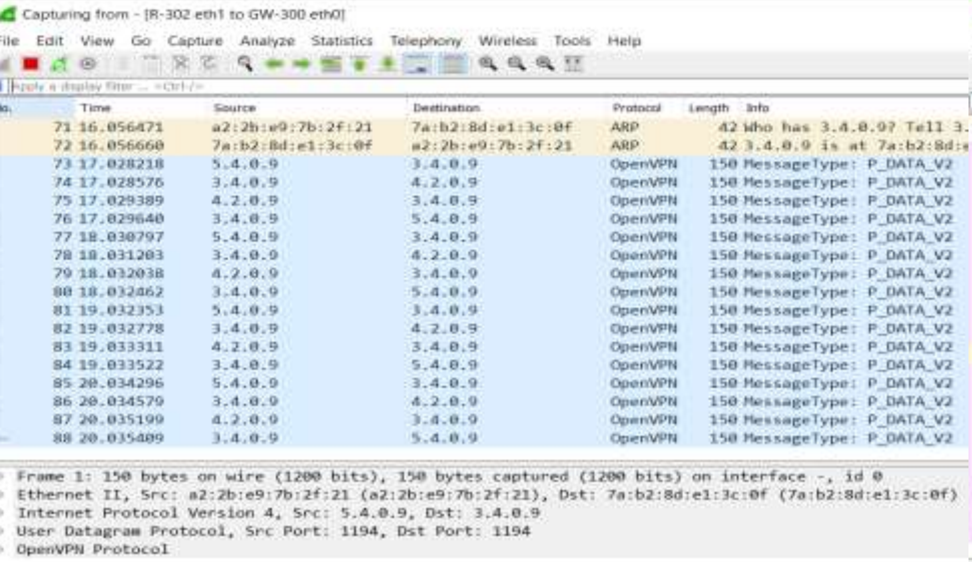


```
root@GW-300:~/CA/server# 2024-01-28 22:23:40 WARNING: --topology net30 support for server configs wit
2024-01-28 22:23:40 OpenVPN 2.5.5 x86_64-pc-linux-gnu [SSL (OpenSSL)] [LZO] [LZ4] [EPOLL] [PKCS11] [M
2024-01-28 22:23:40 library versions: OpenSSL 3.0.2 15 Mar 2022, LZO 2.10
2024-01-28 22:23:40 TUN/TAP device tun0 opened
2024-01-28 22:23:40 net_iface_mtu_set: mtu 1500 for tun0
2024-01-28 22:23:40 net_iface_up: set tun0 up
2024-01-28 22:23:40 net_addr_ptp_v4_add: 192.168.100.1 peer 192.168.100.2 dev tun0
2024-01-28 22:23:40 Could not determine IPv4/IPv6 protocol. Using AF_INET
2024-01-28 22:23:40 UDPv4 link local (bound): [AF_INET][undef]:1194
2024-01-28 22:23:40 UDPv4 link remote: [AF_UNSPEC]
2024-01-28 22:23:40 Initialization Sequence Completed
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_VER=2.5.5
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_PLAT=linux
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_PROTO=6
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_NCP=2
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_CIPHERS=AES-256-GCM:AES-128-GCM
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_LZ4=1
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_LZ4v2=1
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_LZO=1
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_COMP_STUB=1
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_COMP_STUBv2=1
2024-01-28 22:23:52 4.2.0.9:1194 peer info: IV_TCPNL=1
2024-01-28 22:23:52 4.2.0.9:1194 [client2] Peer Connection Initiated with [AF_INET]4.2.0.9:1194
2024-01-28 22:23:52 client2/4.2.0.9:1194 MULTI_sva: pool returned IPv4=192.168.100.6, IPv6=(Not enabl
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_VER=2.5.5
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_PLAT=linux
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_PROTO=6
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_NCP=2
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_CIPHERS=AES-256-GCM:AES-128-GCM
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_LZ4=1
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_LZ4v2=1
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_LZO=1
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_COMP_STUB=1
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_COMP_STUBv2=1
2024-01-28 22:24:58 5.4.0.9:1194 peer info: IV_TCPNL=1
2024-01-28 22:24:58 5.4.0.9:1194 [client1] Peer Connection Initiated with [AF_INET]5.4.0.9:1194
2024-01-28 22:24:58 client1/5.4.0.9:1194 MULTI_sva: pool returned IPv4=192.168.100.10, IPv6=(Not enab
```

Client-200 to Client-400



```
xroot@client-200:/# ip r
xdefault via 20.0.0.1 dev eth0
x10.0.31.0/30 via 192.168.100.9 dev tun0
x20.0.0.0/24 dev eth0 proto kernel scope link src 20.0.0.100
x40.0.0.0/24 via 192.168.100.9 dev tun0
x192.168.100.0/24 via 192.168.100.9 dev tun0
x192.168.100.9 dev tun0 proto kernel scope link src 192.168.100.10
xroot@client-200:/# ping 40.0.0.100
xPING 40.0.0.100 (40.0.0.100): 56 data bytes
x64 bytes from 40.0.0.100: icmp_seq=0 ttl=63 time=3.051 ms
x64 bytes from 40.0.0.100: icmp_seq=1 ttl=63 time=2.445 ms
x64 bytes from 40.0.0.100: icmp_seq=2 ttl=63 time=2.610 ms
x64 bytes from 40.0.0.100: icmp_seq=3 ttl=63 time=2.683 ms
x64 bytes from 40.0.0.100: icmp_seq=4 ttl=63 time=2.862 ms
x64 bytes from 40.0.0.100: icmp_seq=5 ttl=63 time=3.617 ms
x64 bytes from 40.0.0.100: icmp_seq=6 ttl=63 time=3.588 ms
x64 bytes from 40.0.0.100: icmp_seq=7 ttl=63 time=2.602 ms
x64 bytes from 40.0.0.100: icmp_seq=8 ttl=63 time=3.251 ms
x64 bytes from 40.0.0.100: icmp_seq=9 ttl=63 time=2.745 ms
x64 bytes from 40.0.0.100: icmp_seq=10 ttl=63 time=3.317 ms
x64 bytes from 40.0.0.100: icmp_seq=11 ttl=63 time=3.126 ms
x64 bytes from 40.0.0.100: icmp_seq=12 ttl=63 time=2.752 ms
```

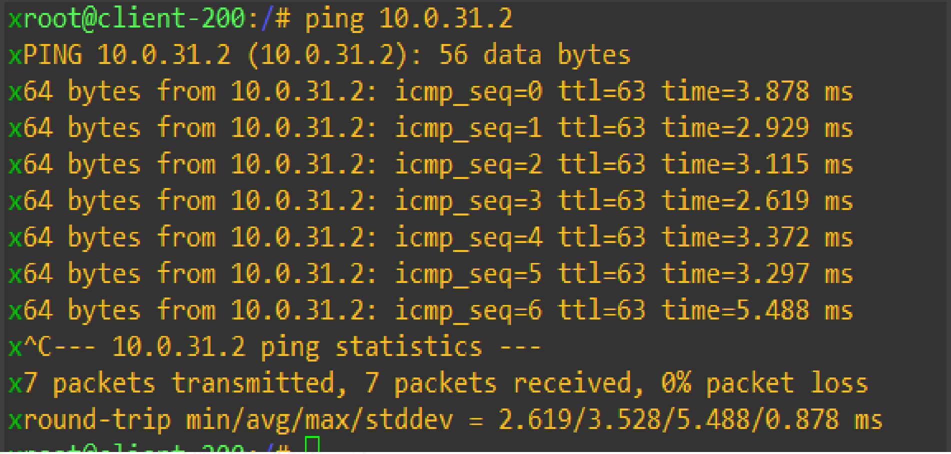


Capturing from - [R-302 eth1 to GW-300 eth0]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

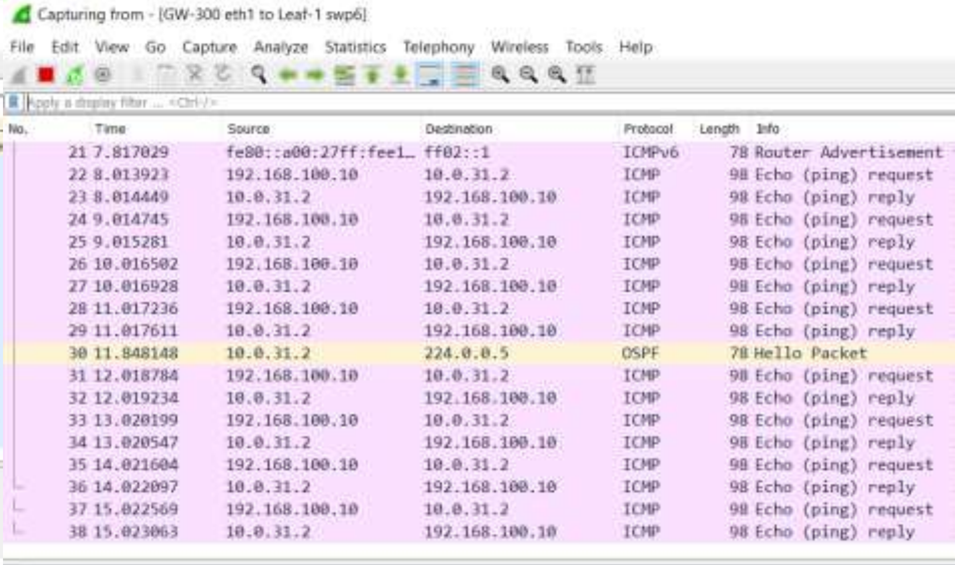
No.	Time	Source	Destination	Protocol	Length	Info
71	16.056471	a2:2b:e9:7b:2f:21	7a:b2:8d:e1:3c:0f	ARP	42	Who has 3.4.0.9? Tell 3.
72	16.056660	7a:b2:8d:e1:3c:0f	a2:2b:e9:7b:2f:21	ARP	42	3.4.0.9 is at 7a:b2:8d:
73	17.028218	5.4.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
74	17.028576	3.4.0.9	4.2.0.9	OpenVPN	150	MessageType: P_DATA_V2
75	17.029389	4.2.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
76	17.029640	3.4.0.9	5.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
77	18.030797	5.4.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
78	18.031203	3.4.0.9	4.2.0.9	OpenVPN	150	MessageType: P_DATA_V2
79	18.032038	4.2.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
80	18.032462	3.4.0.9	5.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
81	19.032353	5.4.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
82	19.032778	3.4.0.9	4.2.0.9	OpenVPN	150	MessageType: P_DATA_V2
83	19.033311	4.2.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
84	19.033522	3.4.0.9	5.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
85	20.034296	5.4.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
86	20.034579	3.4.0.9	4.2.0.9	OpenVPN	150	MessageType: P_DATA_V2
87	20.035199	4.2.0.9	3.4.0.9	OpenVPN	150	MessageType: P_DATA_V2
88	20.035409	3.4.0.9	5.4.0.9	OpenVPN	150	MessageType: P_DATA_V2

```
Frame 1: 150 bytes on wire (1200 bits), 150 bytes captured (1200 bits) on interface -, id 0
Ethernet II, Src: a2:2b:e9:7b:2f:21 (a2:2b:e9:7b:2f:21), Dst: 7a:b2:8d:e1:3c:0f (7a:b2:8d:e1:3c:0f)
Internet Protocol Version 4, Src: 5.4.0.9, Dst: 3.4.0.9
User Datagram Protocol, Src Port: 1194, Dst Port: 1194
OpenVPN Protocol
```

Client-200 to Leaf-1



```
xroot@client-200:/# ping 10.0.31.2
xPING 10.0.31.2 (10.0.31.2): 56 data bytes
x64 bytes from 10.0.31.2: icmp_seq=0 ttl=63 time=3.878 ms
x64 bytes from 10.0.31.2: icmp_seq=1 ttl=63 time=2.929 ms
x64 bytes from 10.0.31.2: icmp_seq=2 ttl=63 time=3.115 ms
x64 bytes from 10.0.31.2: icmp_seq=3 ttl=63 time=2.619 ms
x64 bytes from 10.0.31.2: icmp_seq=4 ttl=63 time=3.372 ms
x64 bytes from 10.0.31.2: icmp_seq=5 ttl=63 time=3.297 ms
x64 bytes from 10.0.31.2: icmp_seq=6 ttl=63 time=5.488 ms
x^C--- 10.0.31.2 ping statistics ---
x7 packets transmitted, 7 packets received, 0% packet loss
xround-trip min/avg/max/stddev = 2.619/3.528/5.488/0.878 ms
xroot@client-200:/#
```



Capturing from - [GW-300 eth1 to Leaf-1 swp6]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
21	7.817029	fe80::a00:27ff:fee1…	ff02::1	ICMPv6	78	Router Advertisement
22	8.013923	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
23	8.014449	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
24	9.014745	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
25	9.015281	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
26	10.016502	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
27	10.016928	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
28	11.017236	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
29	11.017611	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
30	11.848148	10.0.31.2	224.0.0.5	OSPF	78	Hello Packet
31	12.018784	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
32	12.019234	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
33	13.020199	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
34	13.020547	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
35	14.021604	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
36	14.022097	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply
37	15.022569	192.168.100.10	10.0.31.2	ICMP	98	Echo (ping) request
38	15.023063	10.0.31.2	192.168.100.10	ICMP	98	Echo (ping) reply

Network and System Defense Project 1

Aizaz Ali Qureshi

THANK YOU