mpls-vpn assessment part 2

Network Implementation and equipment configuration

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Lab 1: Mpls Fundamentals (detailed)

Part 1: Configuring network interfaces and baseline protocols

1.8: Show interfaces

10.10.42.37 - PuTTY

```
        }
    }
}

[edit interfaces]
lab@dani# show
ge-0/0/0 {
    vlan-tagging;
    unit 210 {
        vlan-id 210;
        family inet {
            address 172.22.210.1/24;
        }
    }
}
ge-0/0/1 {
    vlan-tagging;
    unit 211 {
        vlan-id 211;
        family inet {
            address 172.22.211.1/24;
        }
    }
}
fxp0 {
    unit 0 {
        family inet {
            dhcp {
                vendor-id Juniper-vmx-VM5B631D44E9;
            }
        }
    }
}
lo0 {
    unit 0 {
        family inet {
            address 192.168.1.1/32;
        }
    }
}
```

Part 2: Configuring Customer Edge Router and Network Interfaces

2.2: show

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```
[edit routing-instances ce1-l]
lab@dani# show
instance-type virtual-router;
interface ge-0/0/8.0; ## 'ge-0/0/8.0' is not defined
interface lo0.1; ## 'lo0.1' is not defined
```

2.4: ping

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```
lab@dani> ping 10.0.10.1 routing-instance ce1-l
PING 10.0.10.1 (10.0.10.1): 56 data bytes
64 bytes from 10.0.10.1: icmp_seq=0 ttl=64 time=315.884 ms
64 bytes from 10.0.10.1: icmp_seq=1 ttl=64 time=2.893 ms
64 bytes from 10.0.10.1: icmp_seq=2 ttl=64 time=2.043 ms
64 bytes from 10.0.10.1: icmp_seq=3 ttl=64 time=4.232 ms
64 bytes from 10.0.10.1: icmp_seq=4 ttl=64 time=1.499 ms
64 bytes from 10.0.10.1: icmp_seq=5 ttl=64 time=3.246 ms
^C
--- 10.0.10.1 ping statistics ---
6 packets transmitted, 6 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.499/54.966/315.884/116.689 ms

lab@dani>
```

2.6: show bgp summary

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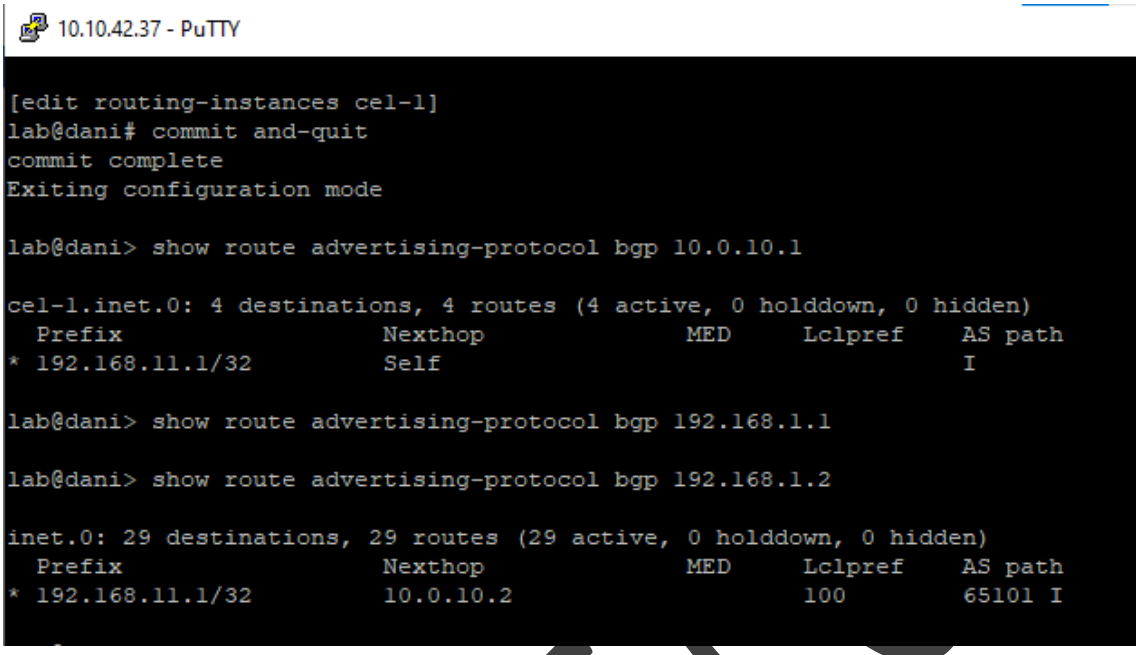
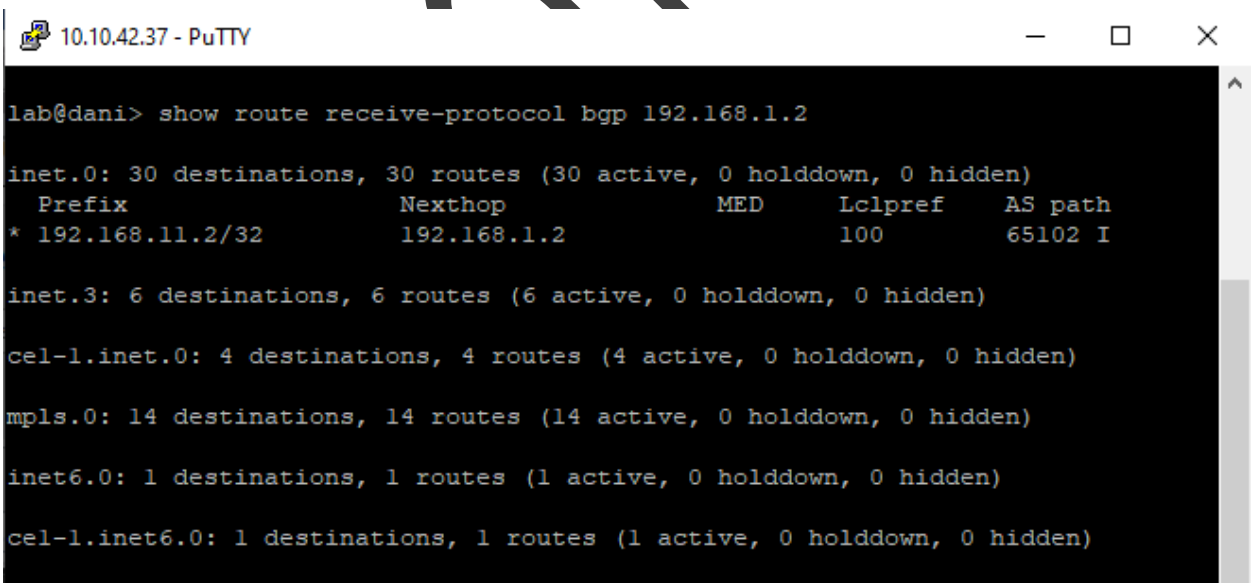
```
lab@dani> show bgp summary
Groups: 3 Peers: 3 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
10.0.10.1             65512          5          4       0       0        1:20 Establ
  ce1-l.inet.0: 0/0/0/0
10.0.10.2             65101          5          4       0       0        1:20 Establ
  inet.0: 0/0/0/0
192.168.1.2           65512          3          2       0       7          42 Establ
  inet.0: 0/0/0/0

lab@dani>
```

2.9: show



2.13: show



2.14 show

10.10.42.37 - PuTTY

```
lab@dani> show route receive-protocol bgp 10.0.10.1

inet.0: 30 destinations, 30 routes (30 active, 0 holddown, 0 hidden)

inet.3: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

cel-1.inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 192.168.11.2/32         10.0.10.1                               65512 65102 I

mpls.0: 14 destinations, 14 routes (14 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

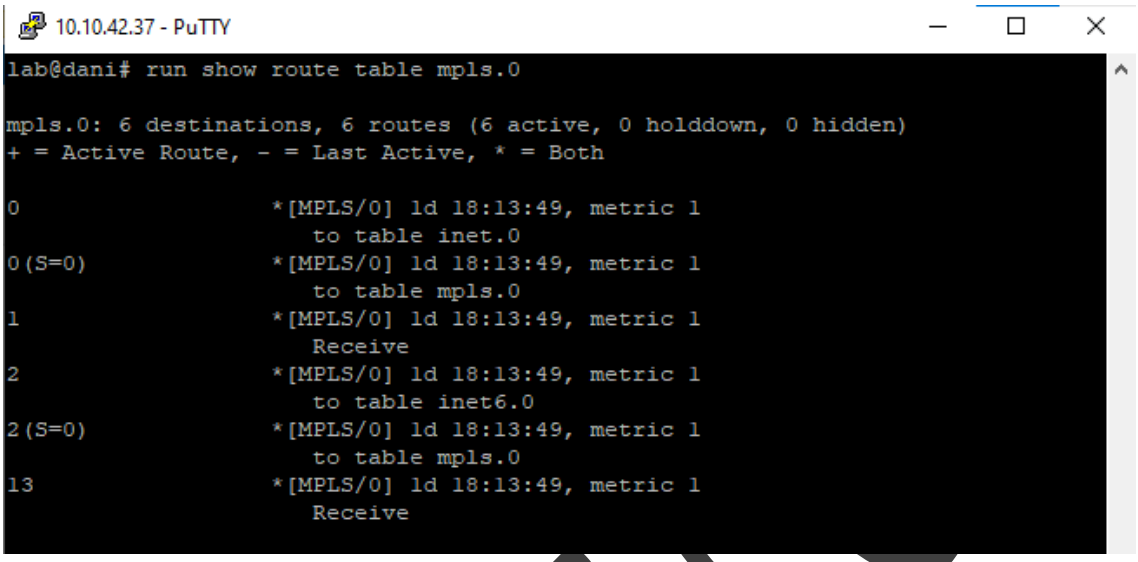
```
lab@dani> show route table cel-1.inet.0

cel-1.inet.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.10.0/24       *[Direct/0] 1d 18:48:55
                    > via ge-0/0/8.0
10.0.10.2/32       *[Local/0] 1d 18:48:55
                      Local via ge-0/0/8.0
192.168.11.1/32    *[Direct/0] 1d 18:48:55
                    > via lo0.1
```

10.10.42.37 - PuTTY

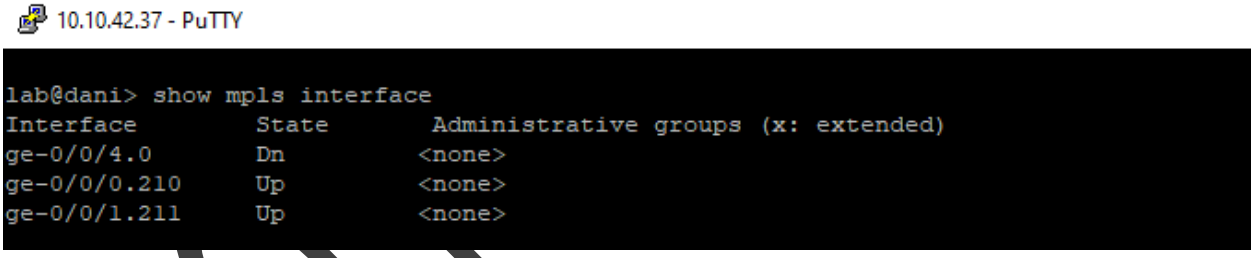
```
lab@dani> show route table cel-1.inet.0

cel-1.inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.10.0/24       *[Direct/0] 00:17:39
                    > via ge-0/0/8.0
10.0.10.2/32       *[Local/0] 00:17:39
                      Local via ge-0/0/8.0
192.168.11.1/32    *[Direct/0] 00:17:39
                    > via lo0.1
192.168.11.2/32    *[BGP/170] 00:00:27, localpref 100
                      AS path: 65512 65102 I, validation-state: unverified
                    > to 10.0.10.1 via ge-0/0/8.0
```

Part 3: Configuring a Static LSP Through the Core

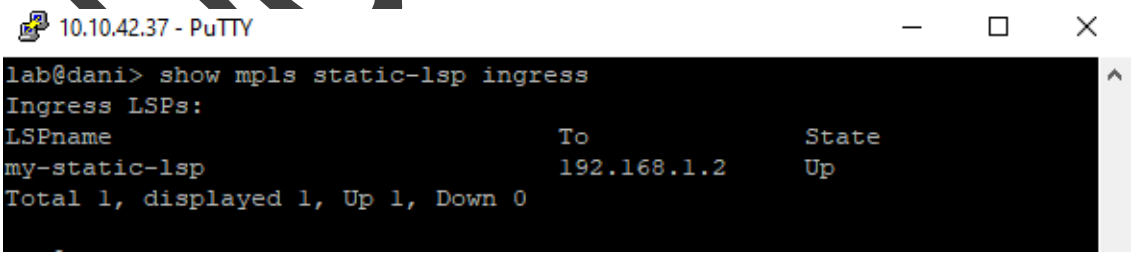
3.3: run show route table mpls.0



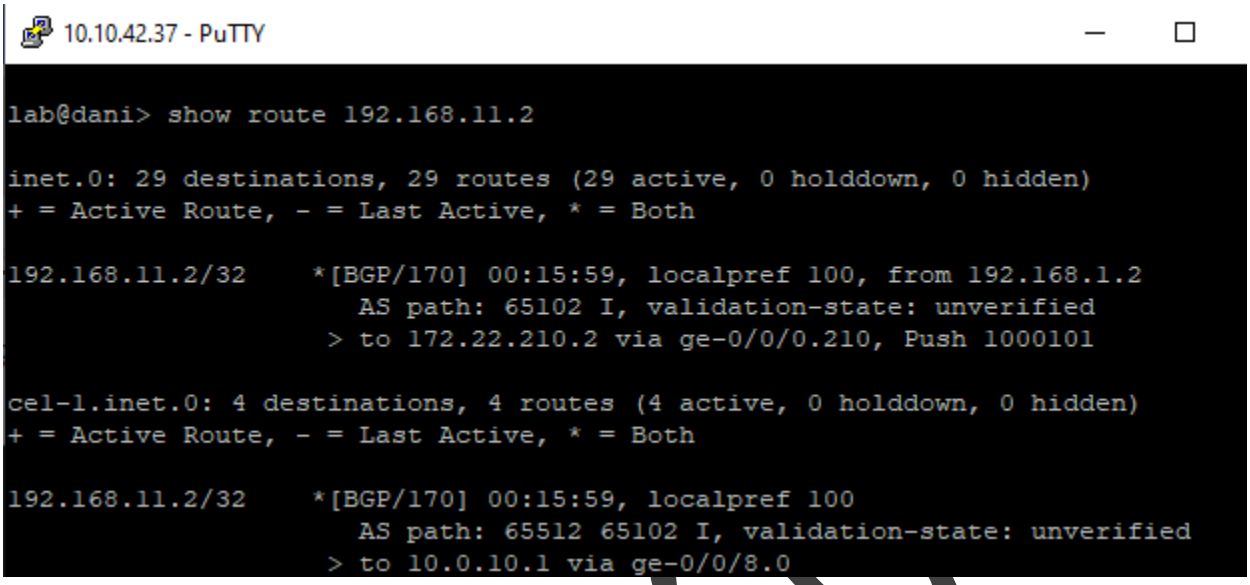
3.4: show mpls interface



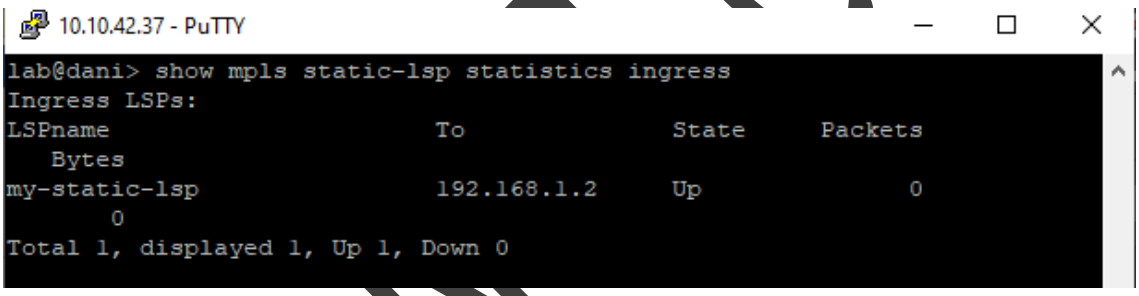
3.7: show mpls static-lsp ingress



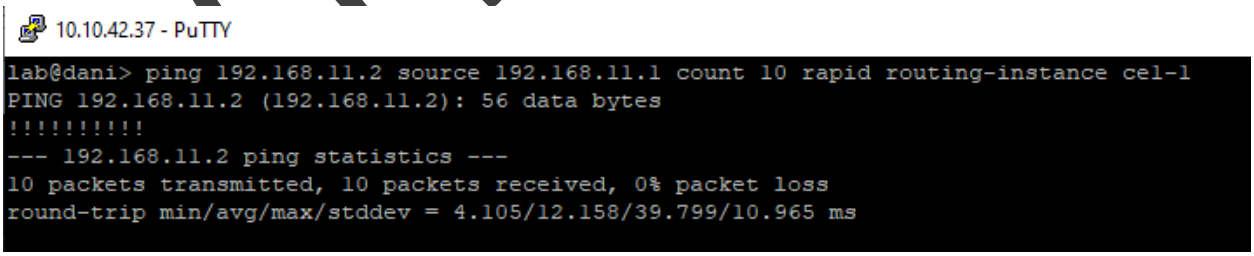
3.8: show route



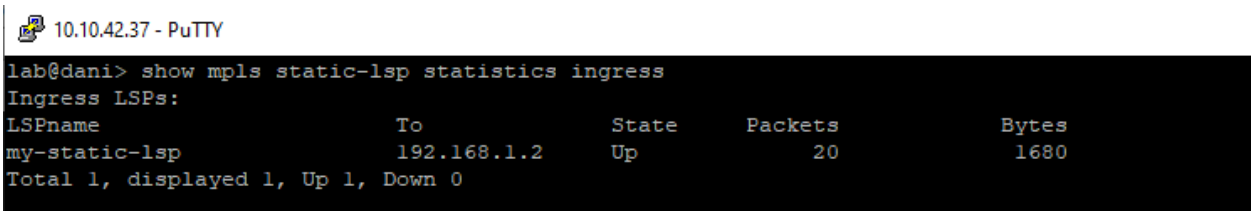
3.9: show mpls



3.10 ping



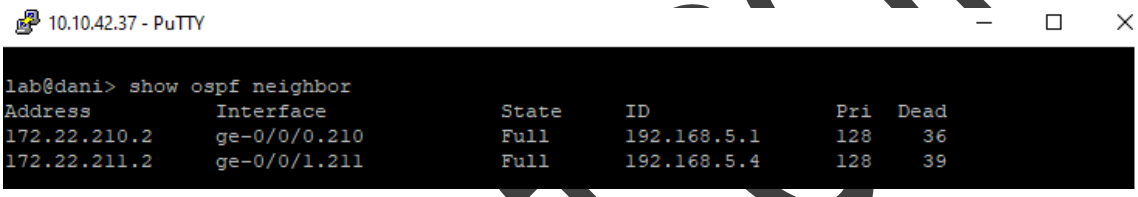
3.11 ping



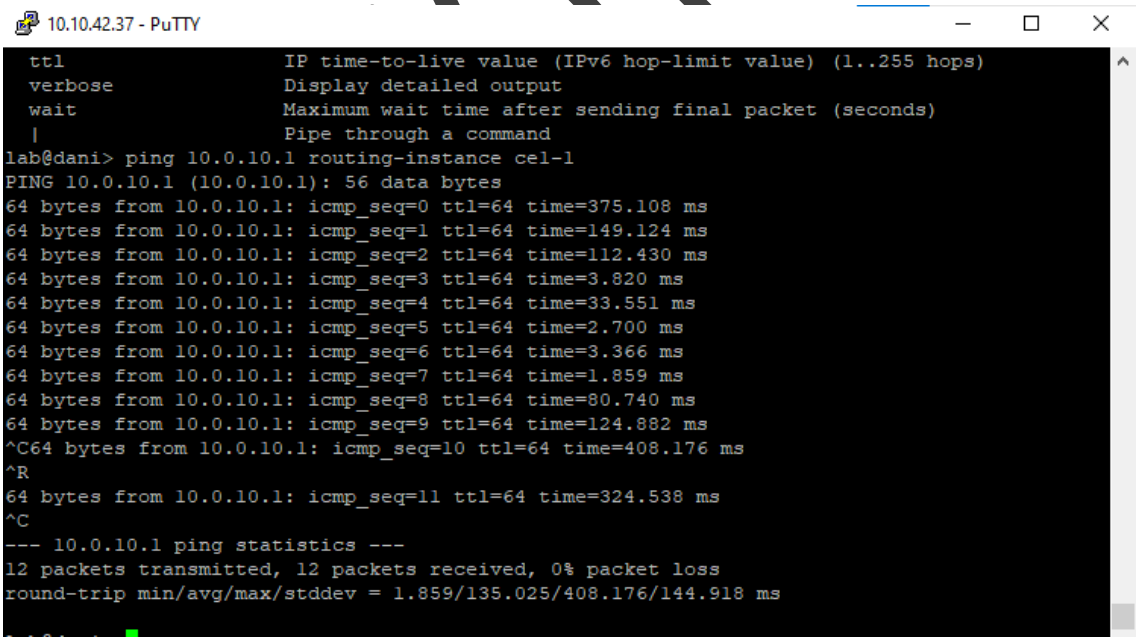
Lab 2: Label Distribution Protocols

Part 1: Configuring customer edge router and network interfaces

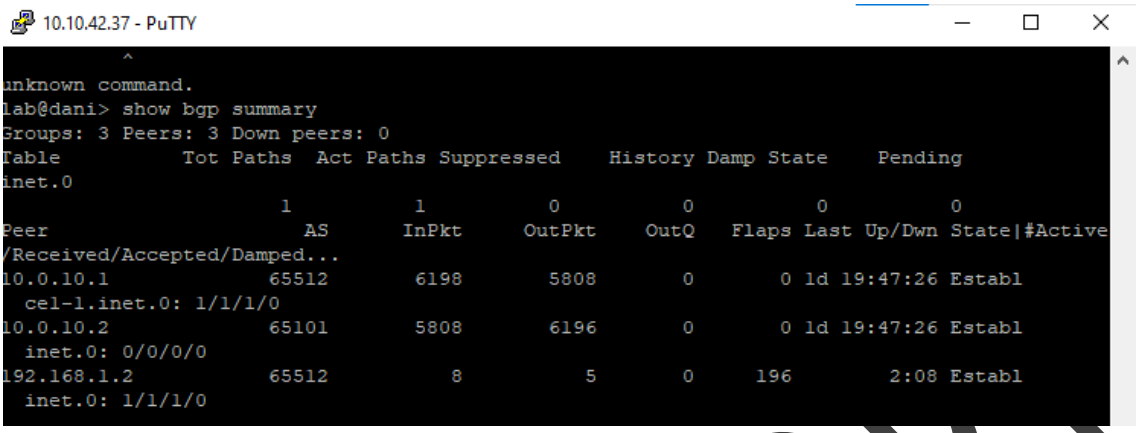
1.1: show ospf neighbor



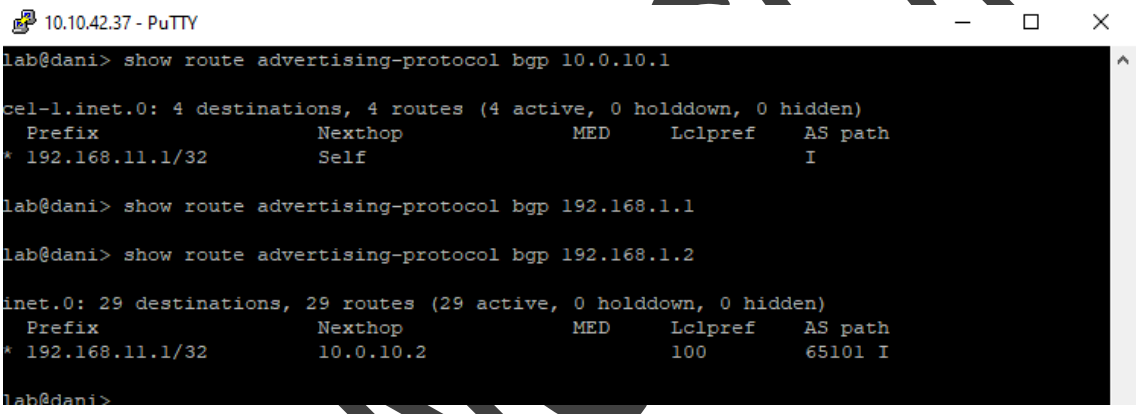
1.2: ping



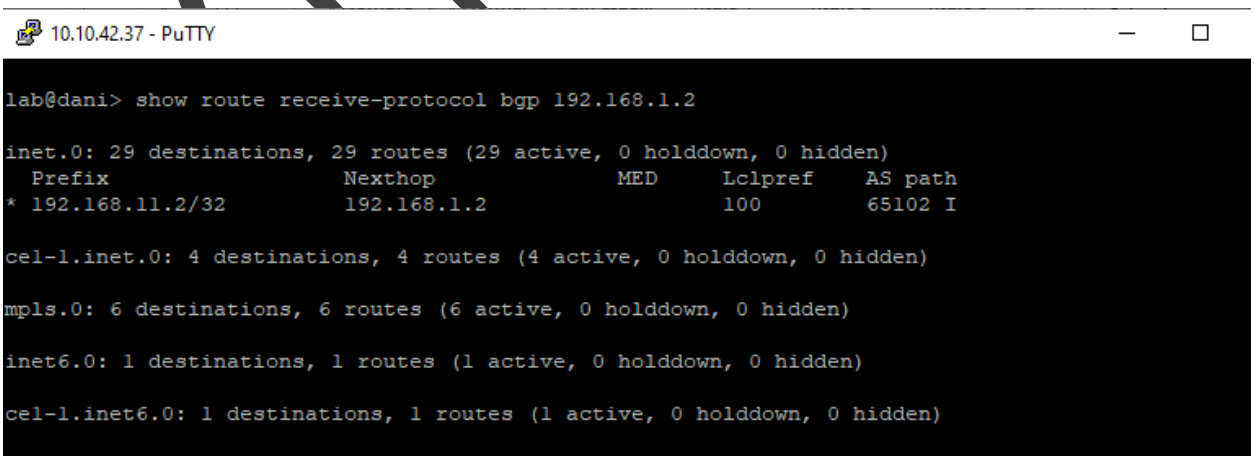
1.3: show bgp summary



1.5: show route advertising-protocol



1.9: show route receive-protocol



1.10: show route receive-protocol

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```
lab@dani> show route receive-protocol bgp 10.0.10.1

inet.0: 29 destinations, 29 routes (29 active, 0 holddown, 0 hidden)

cel-1.inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 192.168.11.2/32         10.0.10.1                               65512 65102 I

mpls.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

lab@dani>
```

10.10.42.37 - PuTTY

```
lab@dani> show route table cel-1.inet.0

cel-1.inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.10.0/24       *[Direct/0] 4d 00:48:22
                    > via ge-0/0/8.0
10.0.10.2/32       *[Local/0] 4d 00:48:22
                      Local via ge-0/0/8.0
192.168.11.1/32    *[Direct/0] 00:48:08
                    > via lo0.1
192.168.11.2/32    *[BGP/170] 00:29:40, localpref 100
                      AS path: 65512 65102 I, validation-state: unverified
                    > to 10.0.10.1 via ge-0/0/8.0
```

Part 2: configuring RSVP

2.3: show mpls interface

10.10.42.37 - PuTTY

```
lab@dani#

[edit protocols mpls]
lab@dani# run show mpls interface
Interface         State       Administrative groups (x: extended)
ge-0/0/0.210      Up          <none>
ge-0/0/1.211      Up          <none>
ge-0/0/4.0        Dn          <none>
```

2.5: show

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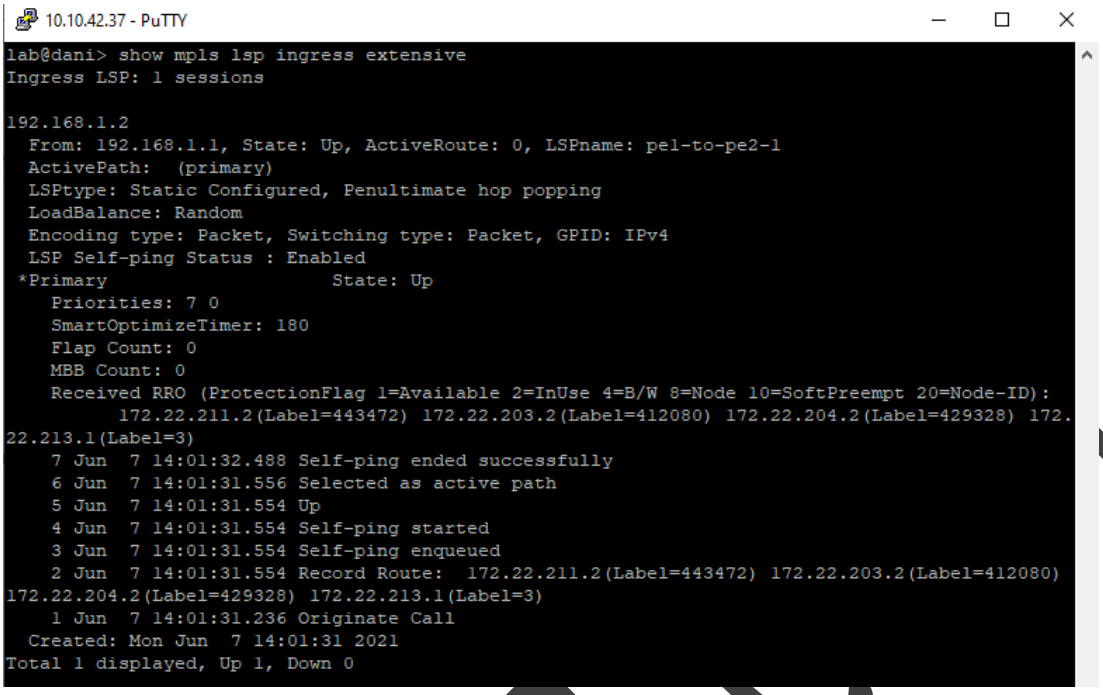
```
lab@dani#

[edit]
lab@dani# edit protocols mpls

[edit protocols mpls]
lab@dani# set no-cspf

[edit protocols mpls]
lab@dani# set label-si
              ^
syntax error.
lab@dani# set label-switched-path ?
Possible completions:
  <path_name>          Name of path
[edit protocols mpls]
lab@dani# set label-switched-path pe1-to-pe2-1 to 192.168.1.2

[edit protocols mpls]
lab@dani# show
no-cspf;
label-switched-path pe1-to-pe2-1 {
    to 192.168.1.2;
}
interface all;
interface fxp0.0 {
    disable;
}

[edit protocols mpls]
lab@dani# commit and-quit
commit complete
Exiting configuration mode
```

2.6: show mpls lsp

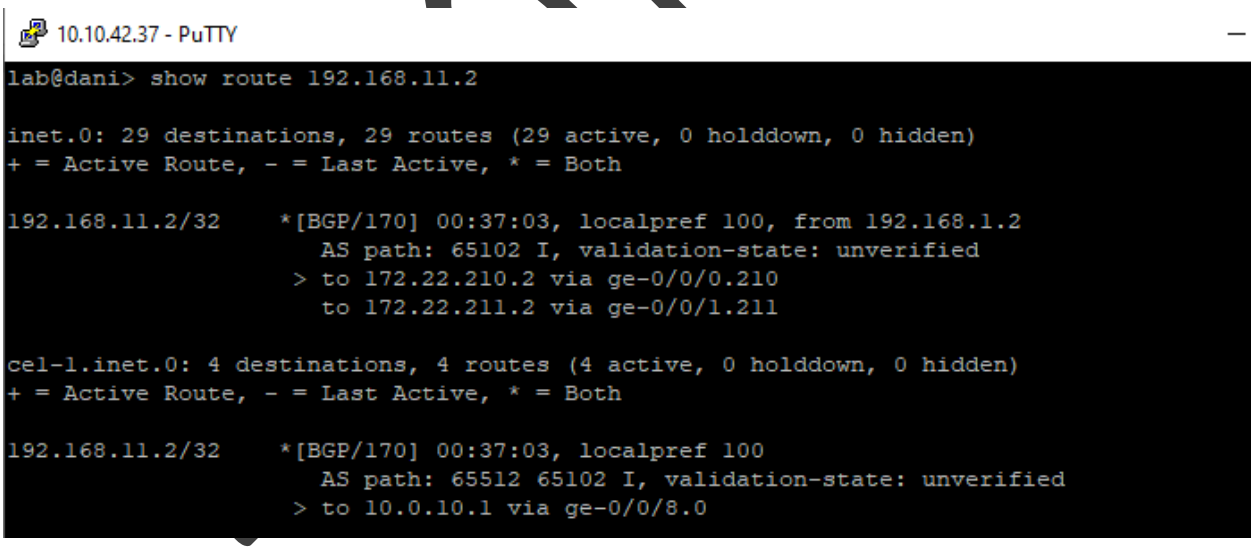
10.10.42.37 - PuTTY

```
lab@dani> show mpls lsp
Ingress LSP: 1 sessions
To              From            State Rt P     ActivePath       LSPname
192.168.1.2     192.168.1.1     Up     0 *                      pe1-to-pe2-1
Total 1 displayed, Up 1, Down 0

Egress LSP: 1 sessions
To              From            State   Rt Style Labelin Labelout LSPname
192.168.1.1     192.168.1.2     Up       0  1 FF       3         - pe2-to-pe1-1
Total 1 displayed, Up 1, Down 0

Transit LSP: 0 sessions
Total 0 displayed, Up 0, Down 0
```

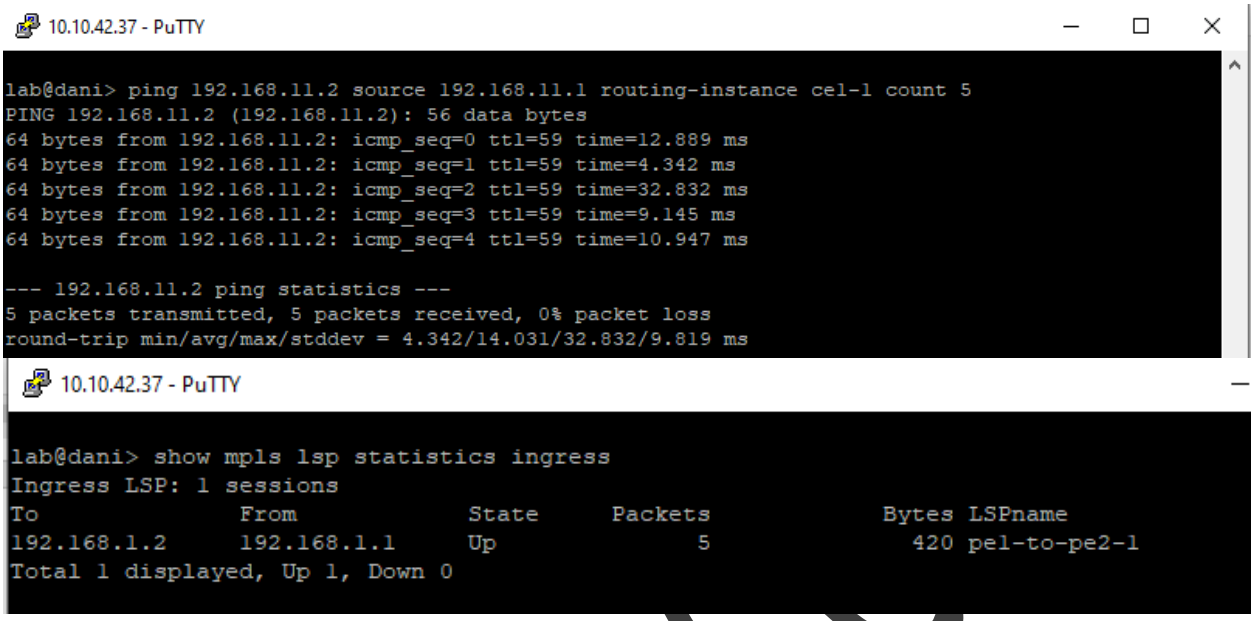
2.7: show mpls lsp ingress extensive



2.8 show route 192.168.11.2

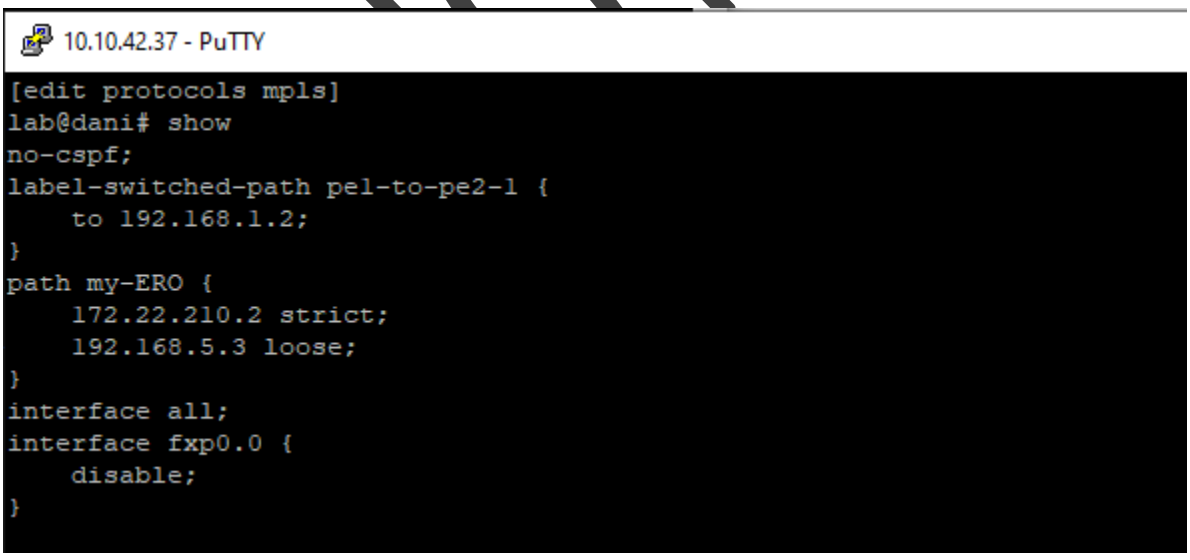


2.9: ping

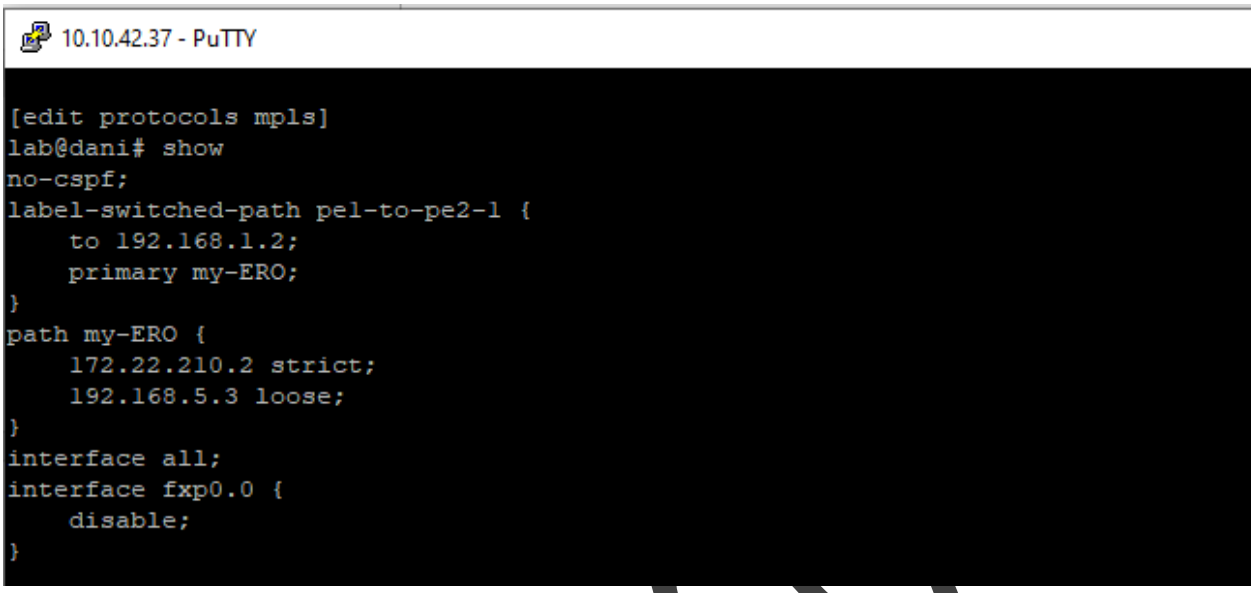


Part 3: Configuring an explicit route object (ero)

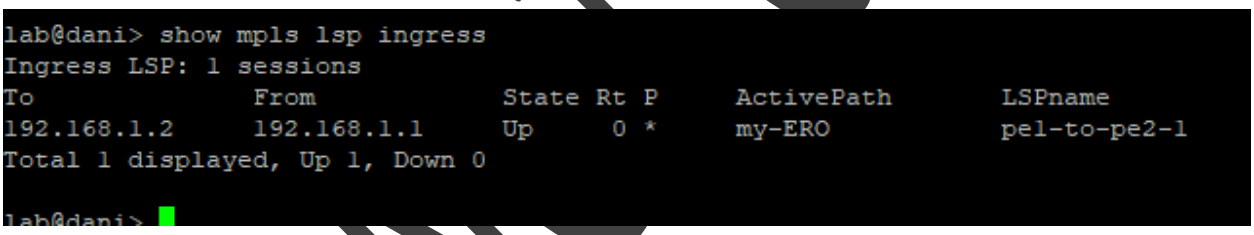
3.1: show



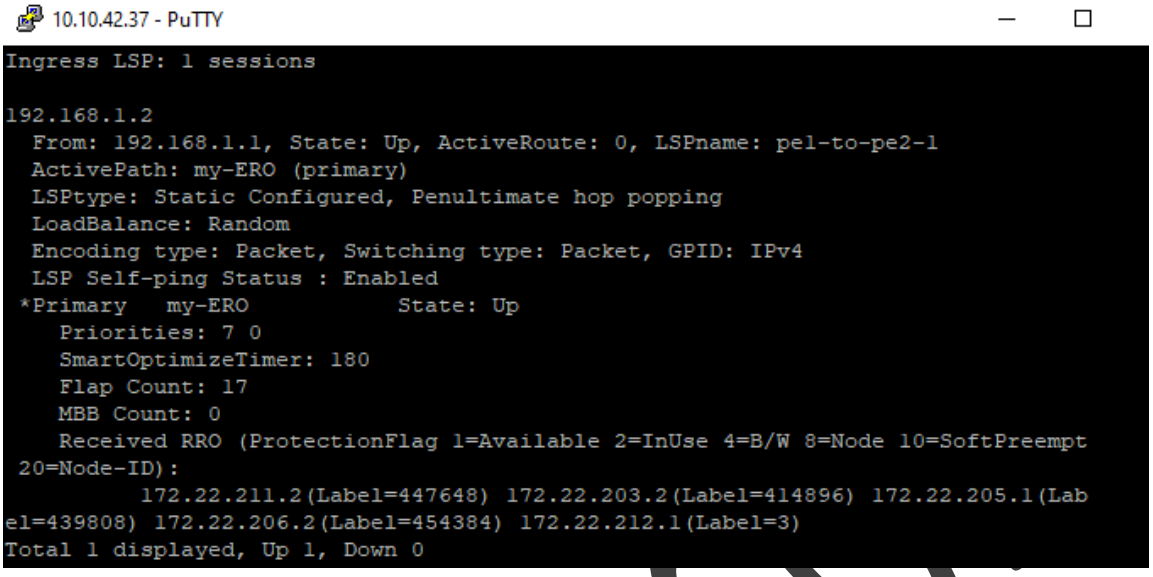
3.2: show



3.3: show mpls lsp ingress

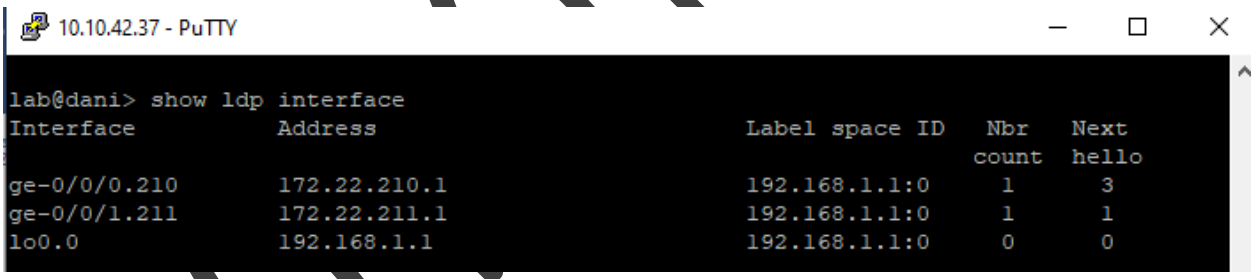


3.4 show mpls lsp ingress detail

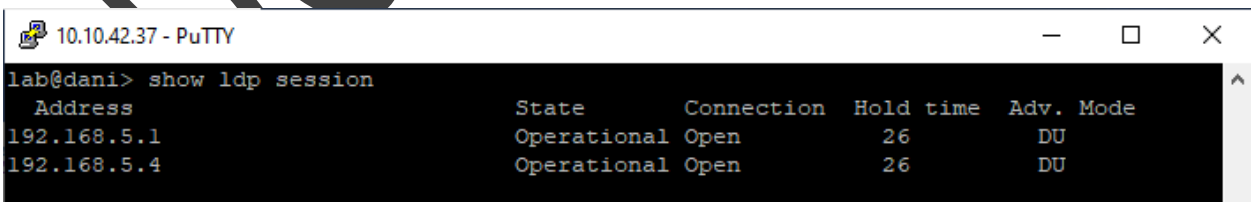


Part 4: configuring LDP

4.3: show ldp interface

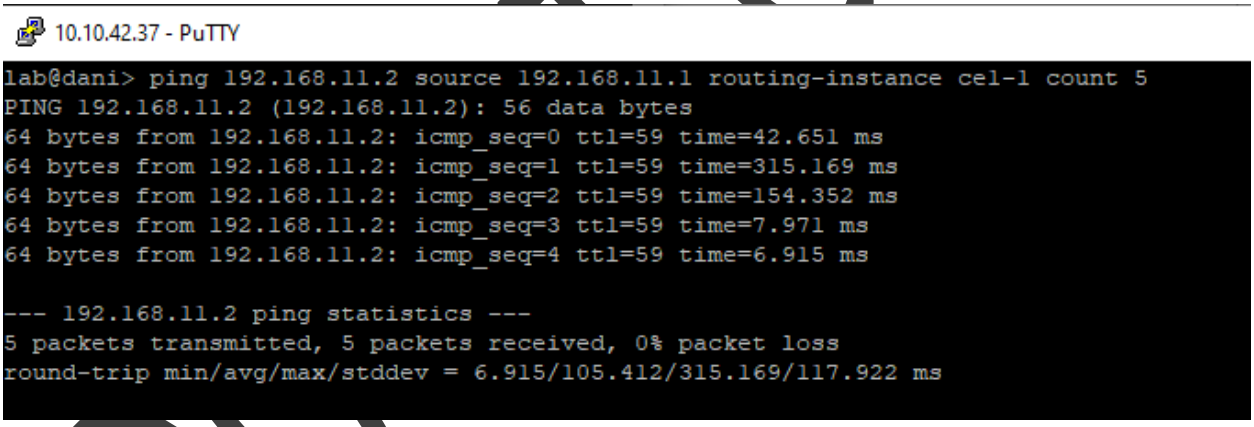


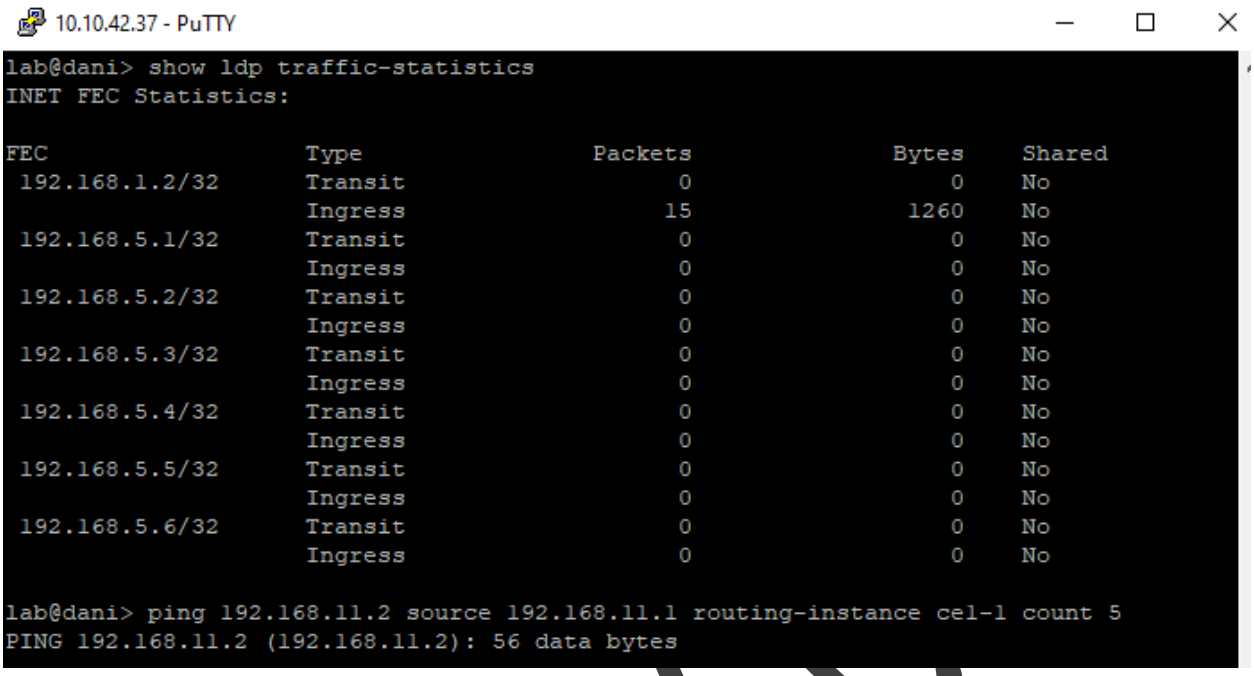
4.4: show ldp session



4.5: show route

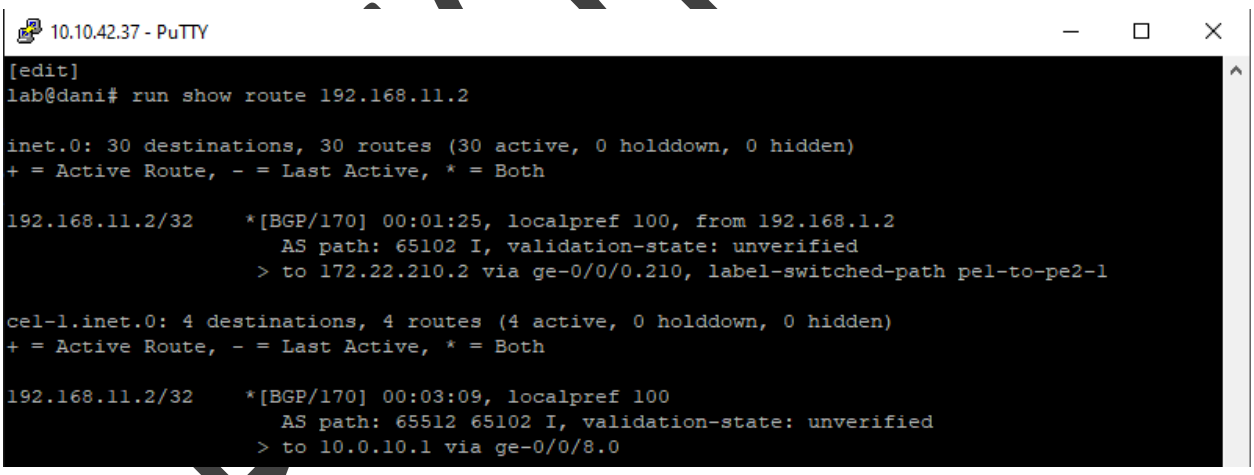
4.6 ping and show



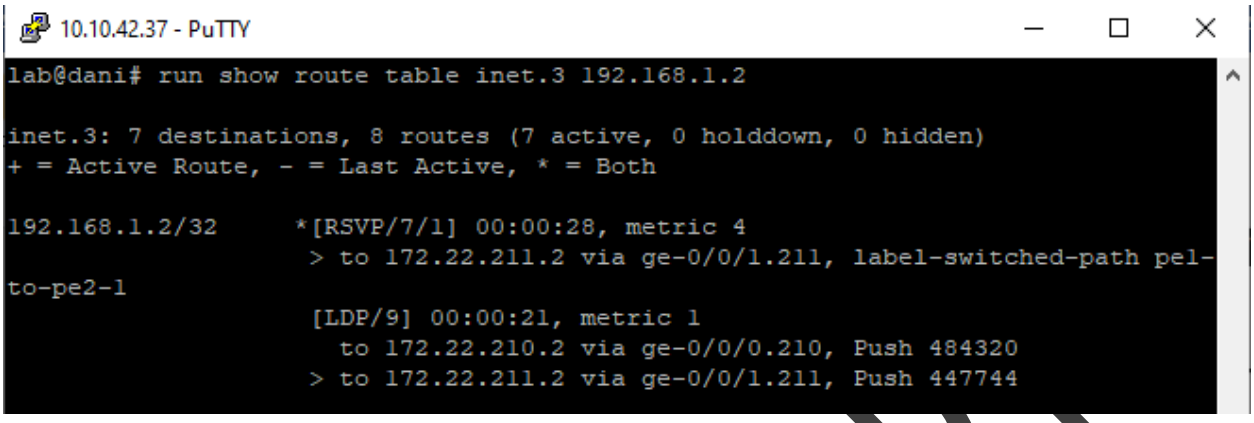


Part 5: Changing the default route preference

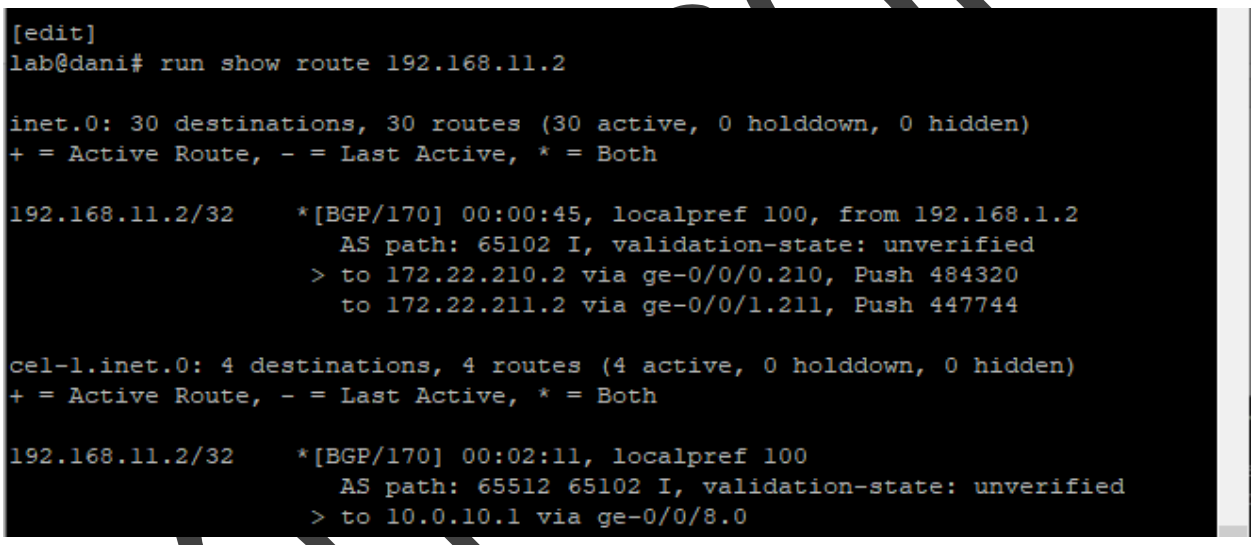
5.2: show

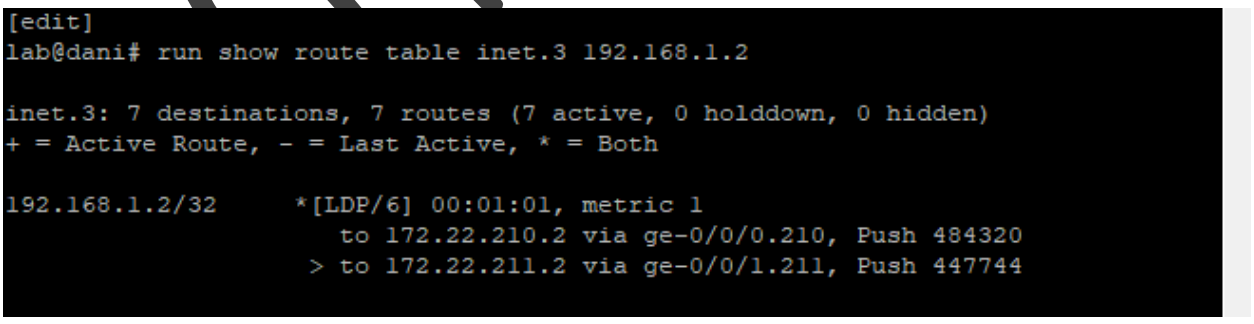


5.3


10.10.42.37 - PuTTY
lab@dani# run show route table inet.3 192.168.1.2
inet.3: 7 destinations, 8 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
192.168.1.2/32 *[RSVP/7/1] 00:00:28, metric 4
> to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-
to-pe2-1
[LDP/9] 00:00:21, metric 1
to 172.22.210.2 via ge-0/0/0.210, Push 484320
> to 172.22.211.2 via ge-0/0/1.211, Push 447744

5.4


[edit]
lab@dani# run show route 192.168.11.2
inet.0: 30 destinations, 30 routes (30 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
192.168.11.2/32 *[BGP/170] 00:00:45, localpref 100, from 192.168.1.2
AS path: 65102 I, validation-state: unverified
> to 172.22.210.2 via ge-0/0/0.210, Push 484320
to 172.22.211.2 via ge-0/0/1.211, Push 447744
ce1-1.inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
192.168.11.2/32 *[BGP/170] 00:02:11, localpref 100
AS path: 65512 65102 I, validation-state: unverified
> to 10.0.10.1 via ge-0/0/8.0


[edit]
lab@dani# run show route table inet.3 192.168.1.2
inet.3: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
192.168.1.2/32 *[LDP/6] 00:01:01, metric 1
to 172.22.210.2 via ge-0/0/0.210, Push 484320
> to 172.22.211.2 via ge-0/0/1.211, Push 447744

Lab 3: CSPF (Detailed)

PART 1: Creating the baseline network

1.2: show ospf neighbor

10.10.42.37 - PuTTY

```
lab@dani> show ospf neighbor
Address          Interface              State     ID               Pri  Dead
172.22.210.2     ge-0/0/0.210           Full      192.168.5.1      128    38
172.22.211.2     ge-0/0/1.211           Full      192.168.5.4      128    36
```

1.3: show bgp neighbor 192.168.1.2

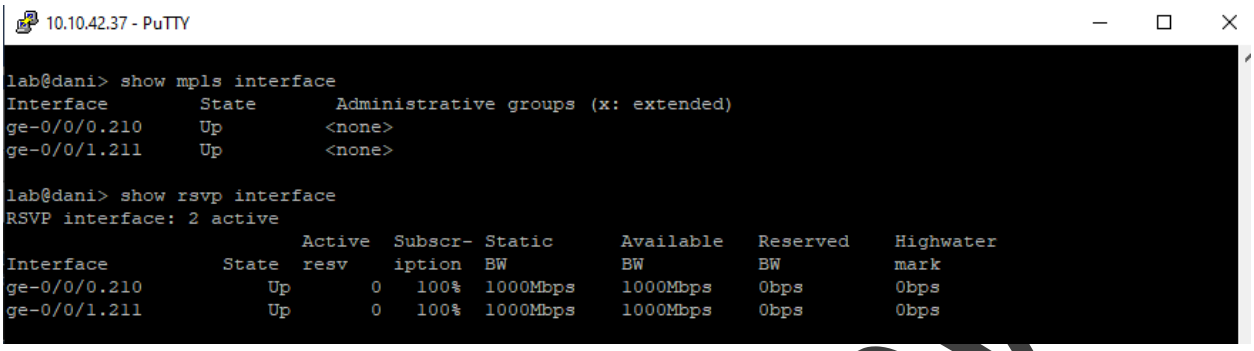
10.10.42.37 - PuTTY

```
  Output Queue[1]: 0              (inet.0, inet-unicast)

lab@dani> show bgp neighbor 192.168.1.2
Peer: 192.168.1.2+57212 AS 65512 Local: 192.168.1.1+179 AS 65512
  Group: my-int-group          Routing-Instance: master
  Forwarding routing-instance: master
  Type: Internal    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: Cease
  Options: <Preference LocalAddress Refresh>
  Local Address: 192.168.1.1 Holdtime: 90 Preference: 170
  Number of flaps: 2
  Last flap event: HoldTime
  Error: 'Hold Timer Expired Error' Sent: 2 Recv: 0
  Error: 'Cease' Sent: 2 Recv: 0
  Peer ID: 192.168.1.2     Local ID: 192.168.1.1       Active Holdtime: 90
  Keepalive Interval: 30         Group index: 0    Peer index: 0    SNMP index: 19
  I/O Session Thread: bgpio-0 State: Enabled
  BFD: disabled, down
  NLRI for restart configured on peer: inet-unicast
  NLRI advertised by peer: inet-unicast
  NLRI for this session: inet-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
```

10.10.42.37 - PuTTY

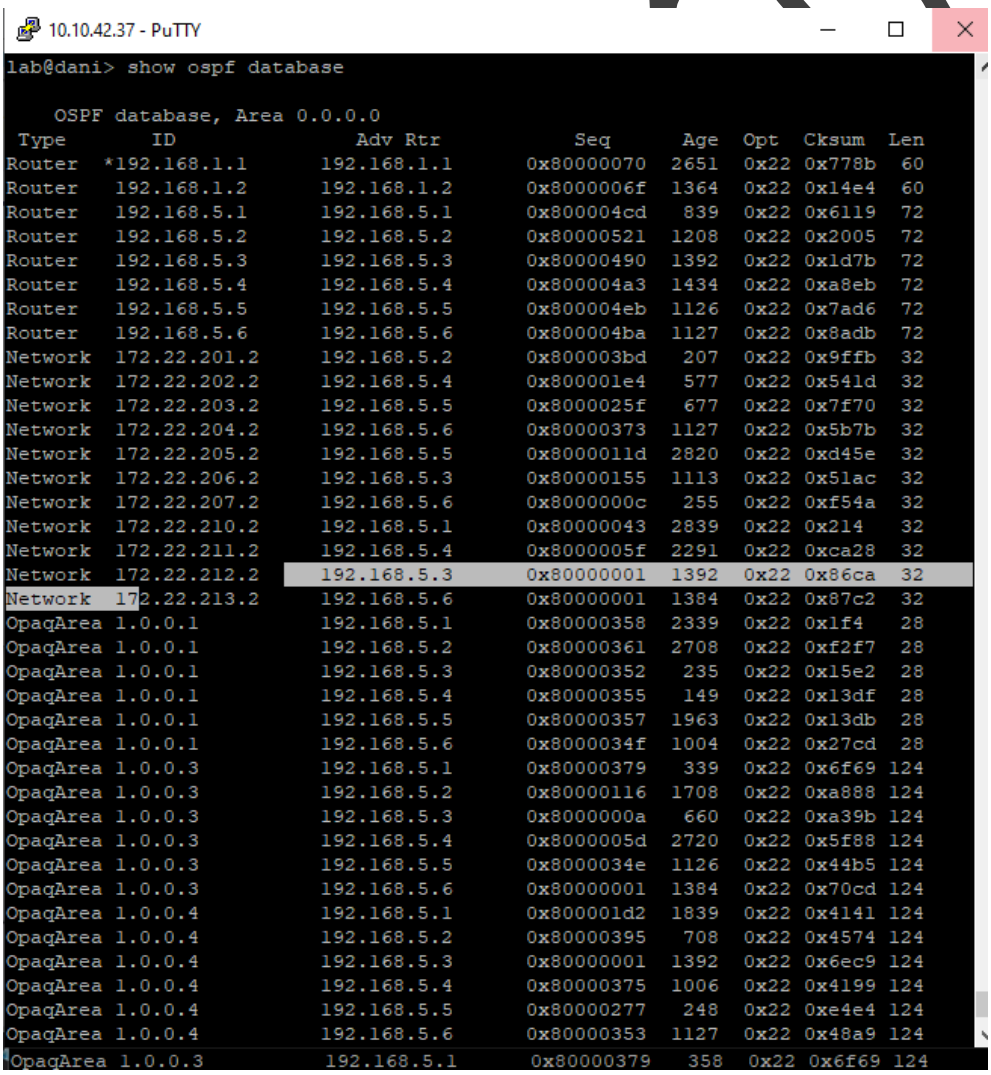
```
lab@dani> show bgp summary
Groups: 3 Peers: 3 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Re
ceived/Accepted/Damped...
10.0.10.1            65512         20         15       0       0        5:59 Establ
  cel-1.inet.0: 0/0/0/0
10.0.10.2            65101         15         18       0       0        5:59 Establ
  inet.0: 0/0/0/0
192.168.1.2          65512          2          2       0       2          54 Establ
  inet.0: 0/0/0/0

lab@dani>
```

1.7: show mpls interface – show rsvp interface

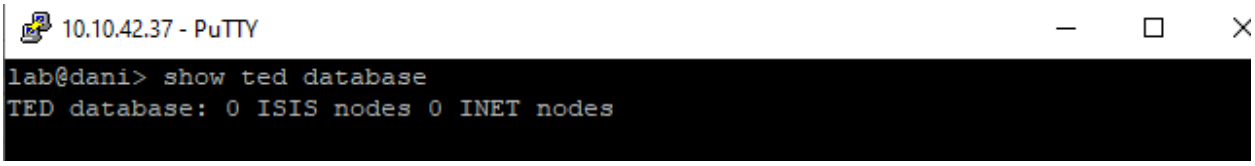


Part 2: Enabling the TED

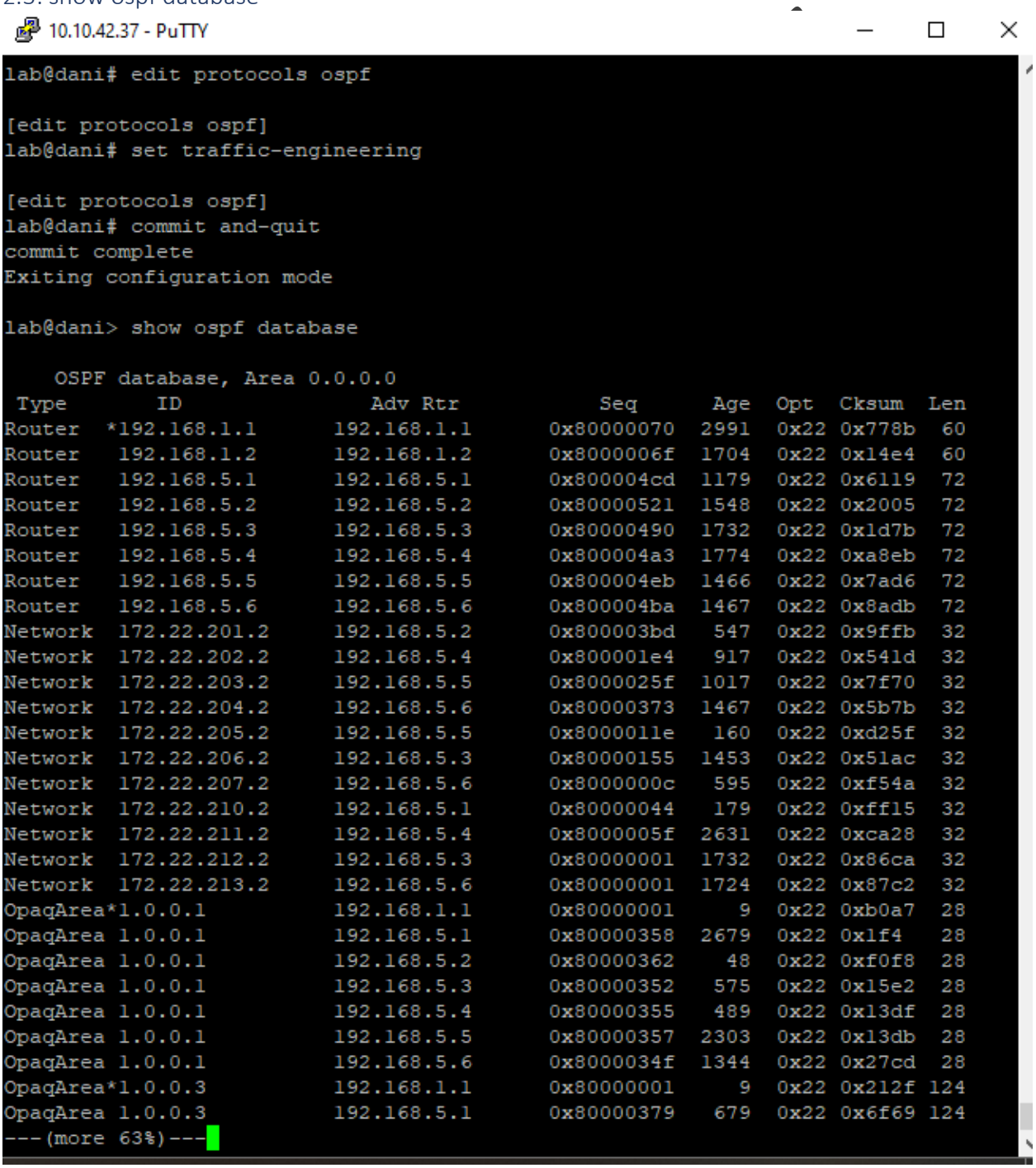
2.1: show ospf database

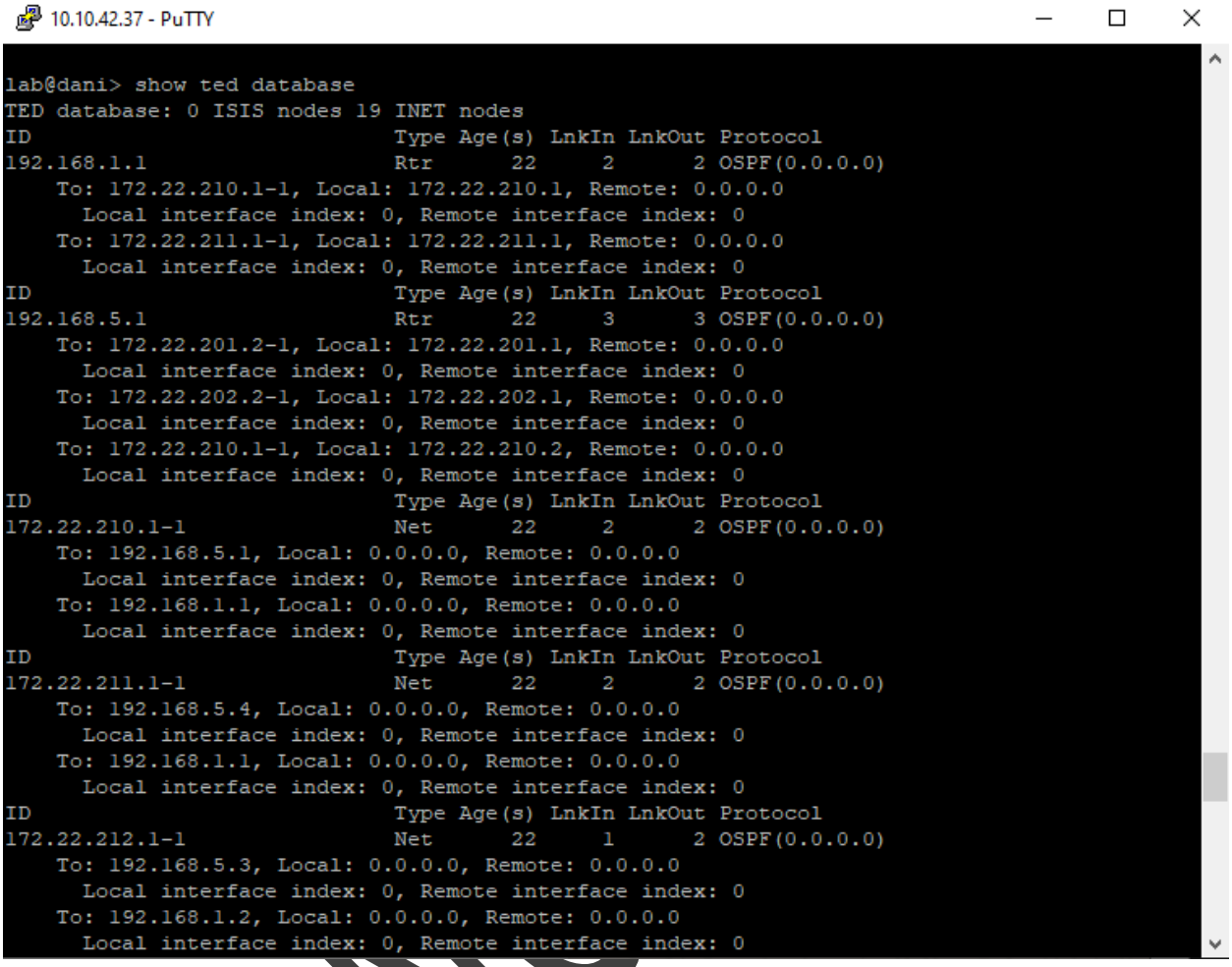


2.2: show ted database

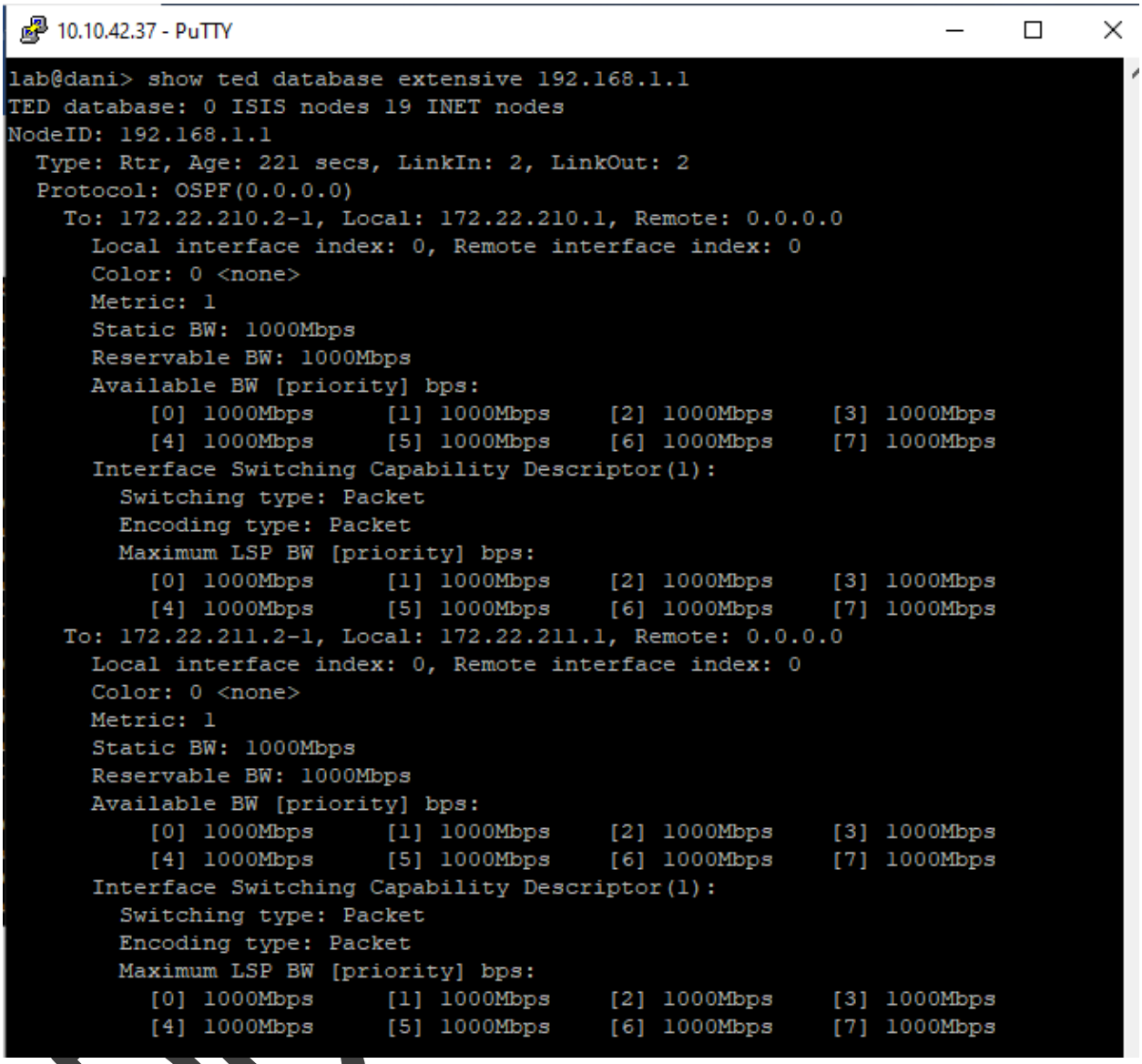


2.3: show ospf database




10.10.42.37 - PuTTY
lab@dani> show ted database
TED database: 0 ISIS nodes 19 INET nodes
ID Type Age(s) LnkIn LnkOut Protocol
192.168.1.1 Rtr 22 2 2 OSPF(0.0.0.0)
To: 172.22.210.1-1, Local: 172.22.210.1, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
To: 172.22.211.1-1, Local: 172.22.211.1, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
ID Type Age(s) LnkIn LnkOut Protocol
192.168.5.1 Rtr 22 3 3 OSPF(0.0.0.0)
To: 172.22.201.2-1, Local: 172.22.201.1, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
To: 172.22.202.2-1, Local: 172.22.202.1, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
To: 172.22.210.1-1, Local: 172.22.210.2, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
ID Type Age(s) LnkIn LnkOut Protocol
172.22.210.1-1 Net 22 2 2 OSPF(0.0.0.0)
To: 192.168.5.1, Local: 0.0.0.0, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
To: 192.168.1.1, Local: 0.0.0.0, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
ID Type Age(s) LnkIn LnkOut Protocol
172.22.211.1-1 Net 22 2 2 OSPF(0.0.0.0)
To: 192.168.5.4, Local: 0.0.0.0, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
To: 192.168.1.1, Local: 0.0.0.0, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
ID Type Age(s) LnkIn LnkOut Protocol
172.22.212.1-1 Net 22 1 2 OSPF(0.0.0.0)
To: 192.168.5.3, Local: 0.0.0.0, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0
To: 192.168.1.2, Local: 0.0.0.0, Remote: 0.0.0.0
Local interface index: 0, Remote interface index: 0

2.4: show ted database esxtensive 192.168.1.1



Part 3: Configuring RSVP-Signalled LSPs

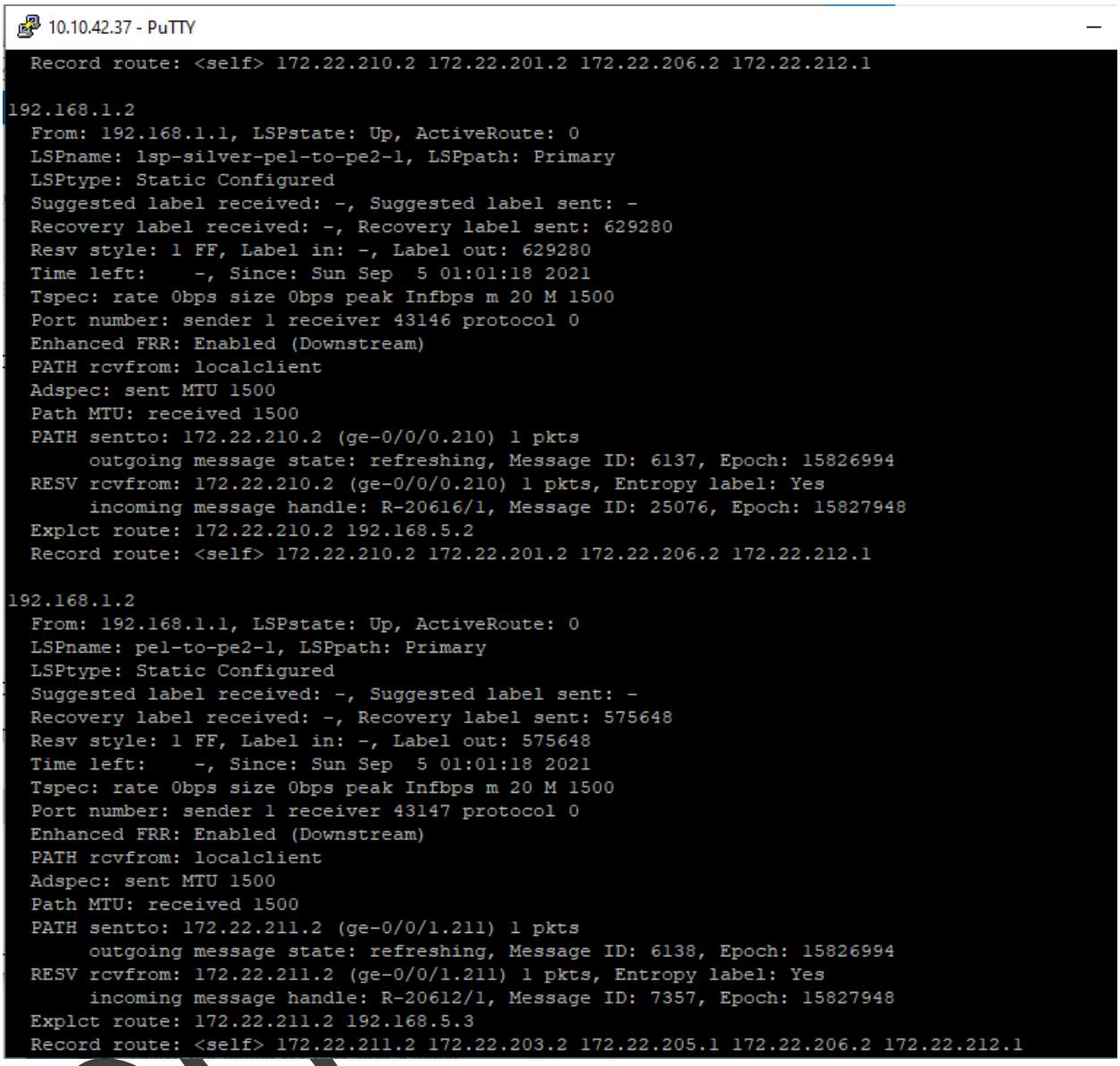
3.4: show rsvp session

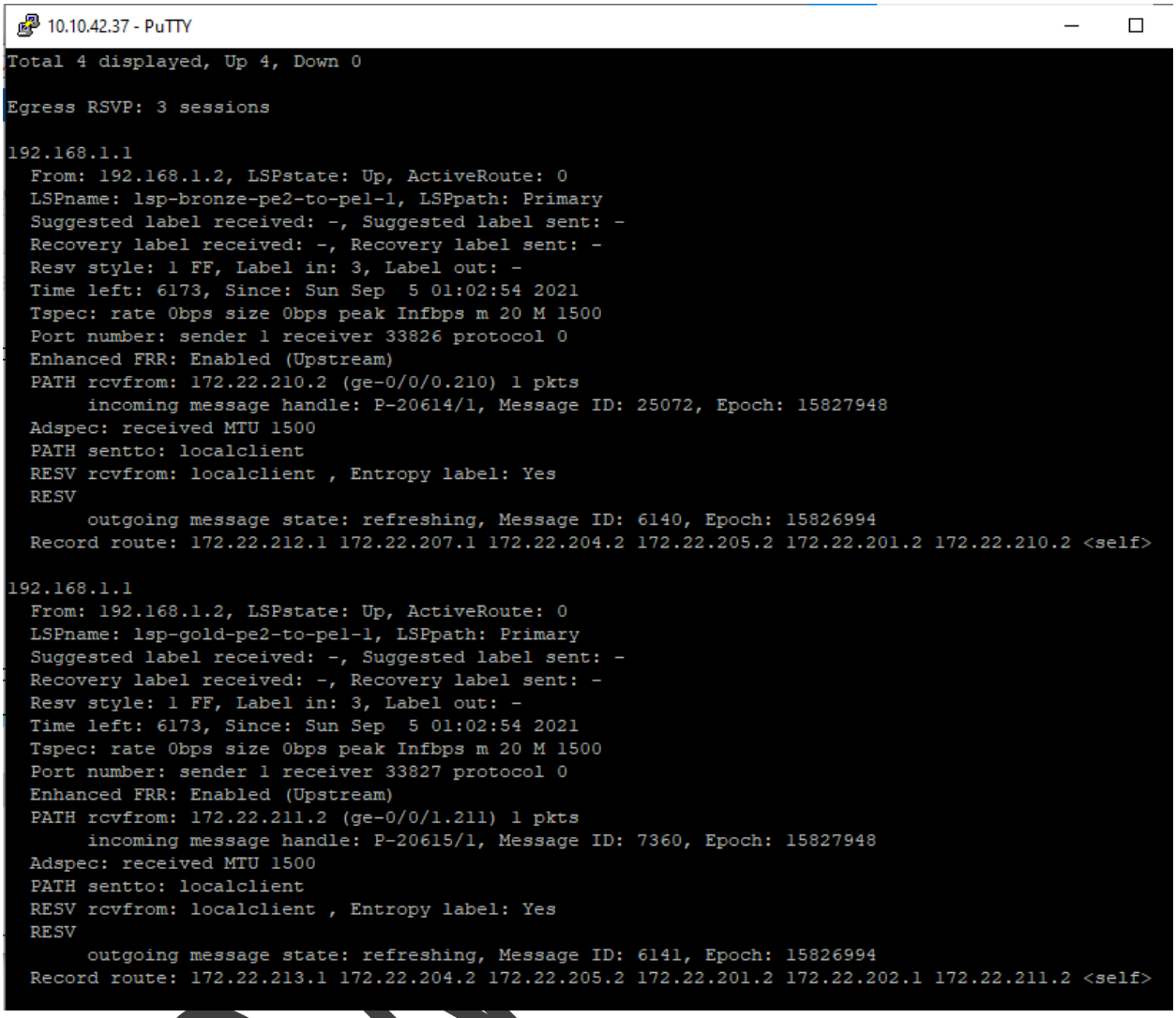
10.10.42.37 - PuTTY

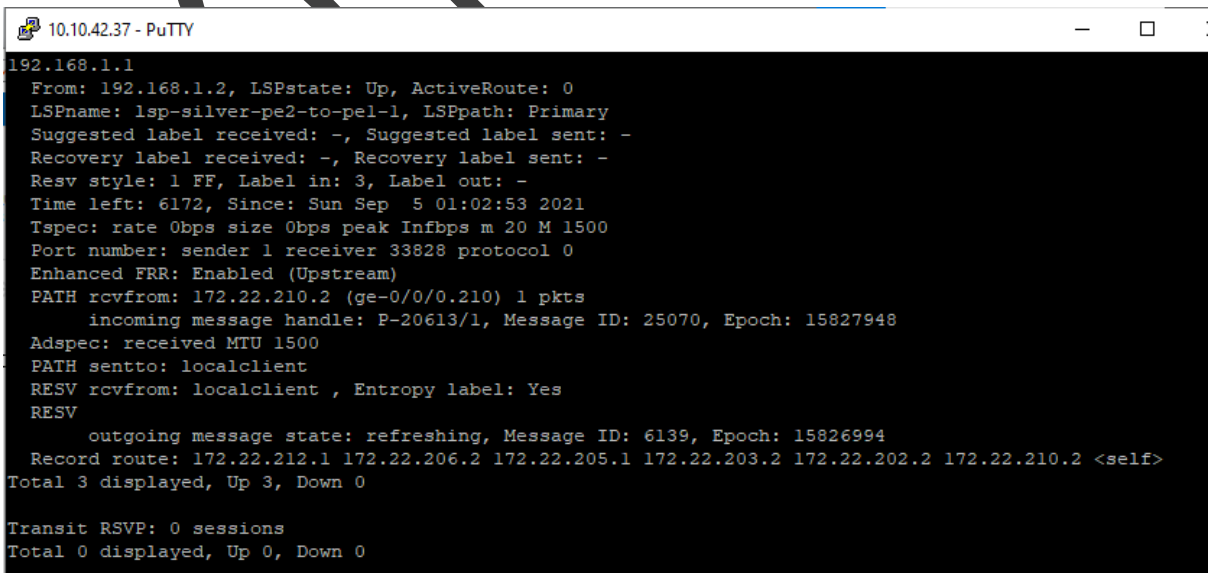
```
  statistics            Show RSVP statistics
lab@dani> show rsvp session
Ingress RSVP: 4 sessions
To              From            State   Rt Style Labelin Labelout LSPname
192.168.1.2     192.168.1.1     Up       0  1 FF       -   309024 pe1-to-pe2-1
192.168.1.2     192.168.1.1     Up       0  1 FF       -   309952 lsp-bronze-pe1-to-pe2-1
192.168.1.2     192.168.1.1     Up       0  1 FF       -   309968 lsp-gold-pe1-to-pe2-1
192.168.1.2     192.168.1.1     Up       0  1 FF       -   309984 lsp-silver-pe1-to-pe2-1
Total 4 displayed, Up 4, Down 0

Egress RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0

Transit RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0
```

10.10.42.37 - PuTTY

```
lab@dani> show rsvp session extensive
Ingress RSVP: 4 sessions

192.168.1.2
  From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-bronze-pe1-to-pe2-1, LSPpath: Primary
  LSPtype: Static Configured
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 629312
  Resv style: 1 FF, Label in: -, Label out: 629312
  Time left:    -, Since: Sun Sep  5 01:01:18 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 43144 protocol 0
  Enhanced FRR: Enabled (Downstream)
  PATH rcvfrom: localclient
  Adspec: sent MTU 1500
  Path MTU: received 1500
  PATH sentto: 172.22.210.2 (ge-0/0/0.210) 1 pkts
       outgoing message state: refreshing, Message ID: 6135, Epoch: 15826994
  RESV rcvfrom: 172.22.210.2 (ge-0/0/0.210) 1 pkts, Entropy label: Yes
       incoming message handle: R-20618/1, Message ID: 25078, Epoch: 15827948
  Explct route: 172.22.210.2 192.168.5.2
  Record route: <self> 172.22.210.2 172.22.201.2 172.22.206.2 172.22.212.1

192.168.1.2
  From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-gold-pe1-to-pe2-1, LSPpath: Primary
  LSPtype: Static Configured
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 629296
  Resv style: 1 FF, Label in: -, Label out: 629296
  Time left:    -, Since: Sun Sep  5 01:01:18 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 1 receiver 43145 protocol 0
  Enhanced FRR: Enabled (Downstream)
  PATH rcvfrom: localclient
  Adspec: sent MTU 1500
  Path MTU: received 1500
  PATH sentto: 172.22.210.2 (ge-0/0/0.210) 1 pkts
       outgoing message state: refreshing, Message ID: 6136, Epoch: 15826994
  RESV rcvfrom: 172.22.210.2 (ge-0/0/0.210) 1 pkts, Entropy label: Yes
       incoming message handle: R-20617/1, Message ID: 25077, Epoch: 15827948
  Explct route: 172.22.210.2 192.168.5.2
```

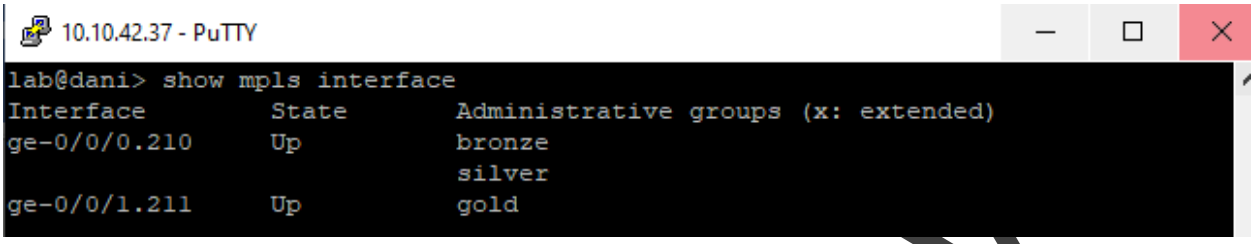

10.10.42.37 - PuTTY
Record route: <self> 172.22.210.2 172.22.201.2 172.22.206.2 172.22.212.1
192.168.1.2
From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
LSPname: lsp-silver-pe1-to-pe2-1, LSPpath: Primary
LSPtype: Static Configured
Suggested label received: -, Suggested label sent: -
Recovery label received: -, Recovery label sent: 629280
Resv style: 1 FF, Label in: -, Label out: 629280
Time left: -, Since: Sun Sep 5 01:01:18 2021
Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
Port number: sender 1 receiver 43146 protocol 0
Enhanced FRR: Enabled (Downstream)
PATH rcvfrom: localclient
Adspec: sent MTU 1500
Path MTU: received 1500
PATH sentto: 172.22.210.2 (ge-0/0/0.210) 1 pkts
outgoing message state: refreshing, Message ID: 6137, Epoch: 15826994
RESV rcvfrom: 172.22.210.2 (ge-0/0/0.210) 1 pkts, Entropy label: Yes
incoming message handle: R-20616/1, Message ID: 25076, Epoch: 15827948
Explct route: 172.22.210.2 192.168.5.2
Record route: <self> 172.22.210.2 172.22.201.2 172.22.206.2 172.22.212.1
192.168.1.2
From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
LSPname: pe1-to-pe2-1, LSPpath: Primary
LSPtype: Static Configured
Suggested label received: -, Suggested label sent: -
Recovery label received: -, Recovery label sent: 575648
Resv style: 1 FF, Label in: -, Label out: 575648
Time left: -, Since: Sun Sep 5 01:01:18 2021
Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
Port number: sender 1 receiver 43147 protocol 0
Enhanced FRR: Enabled (Downstream)
PATH rcvfrom: localclient
Adspec: sent MTU 1500
Path MTU: received 1500
PATH sentto: 172.22.211.2 (ge-0/0/1.211) 1 pkts
outgoing message state: refreshing, Message ID: 6138, Epoch: 15826994
RESV rcvfrom: 172.22.211.2 (ge-0/0/1.211) 1 pkts, Entropy label: Yes
incoming message handle: R-20612/1, Message ID: 7357, Epoch: 15827948
Explct route: 172.22.211.2 192.168.5.3
Record route: <self> 172.22.211.2 172.22.203.2 172.22.205.1 172.22.206.2 172.22.212.1


10.10.42.37 - PuTTY
Total 4 displayed, Up 4, Down 0
Egress RSVP: 3 sessions
192.168.1.1
From: 192.168.1.2, LSPstate: Up, ActiveRoute: 0
LSPname: lsp-bronze-pe2-to-pe1-1, LSPpath: Primary
Suggested label received: -, Suggested label sent: -
Recovery label received: -, Recovery label sent: -
Resv style: 1 FF, Label in: 3, Label out: -
Time left: 6173, Since: Sun Sep 5 01:02:54 2021
Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
Port number: sender 1 receiver 33826 protocol 0
Enhanced FRR: Enabled (Upstream)
PATH rcvfrom: 172.22.210.2 (ge-0/0/0.210) 1 pkts
incoming message handle: P-20614/1, Message ID: 25072, Epoch: 15827948
Adspec: received MTU 1500
PATH sentto: localclient
RESV rcvfrom: localclient , Entropy label: Yes
RESV
outgoing message state: refreshing, Message ID: 6140, Epoch: 15826994
Record route: 172.22.212.1 172.22.207.1 172.22.204.2 172.22.205.2 172.22.201.2 172.22.210.2 <self>
192.168.1.1
From: 192.168.1.2, LSPstate: Up, ActiveRoute: 0
LSPname: lsp-gold-pe2-to-pe1-1, LSPpath: Primary
Suggested label received: -, Suggested label sent: -
Recovery label received: -, Recovery label sent: -
Resv style: 1 FF, Label in: 3, Label out: -
Time left: 6173, Since: Sun Sep 5 01:02:54 2021
Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
Port number: sender 1 receiver 33827 protocol 0
Enhanced FRR: Enabled (Upstream)
PATH rcvfrom: 172.22.211.2 (ge-0/0/1.211) 1 pkts
incoming message handle: P-20615/1, Message ID: 7360, Epoch: 15827948
Adspec: received MTU 1500
PATH sentto: localclient
RESV rcvfrom: localclient , Entropy label: Yes
RESV
outgoing message state: refreshing, Message ID: 6141, Epoch: 15826994
Record route: 172.22.213.1 172.22.204.2 172.22.205.2 172.22.201.2 172.22.202.1 172.22.211.2 <self>

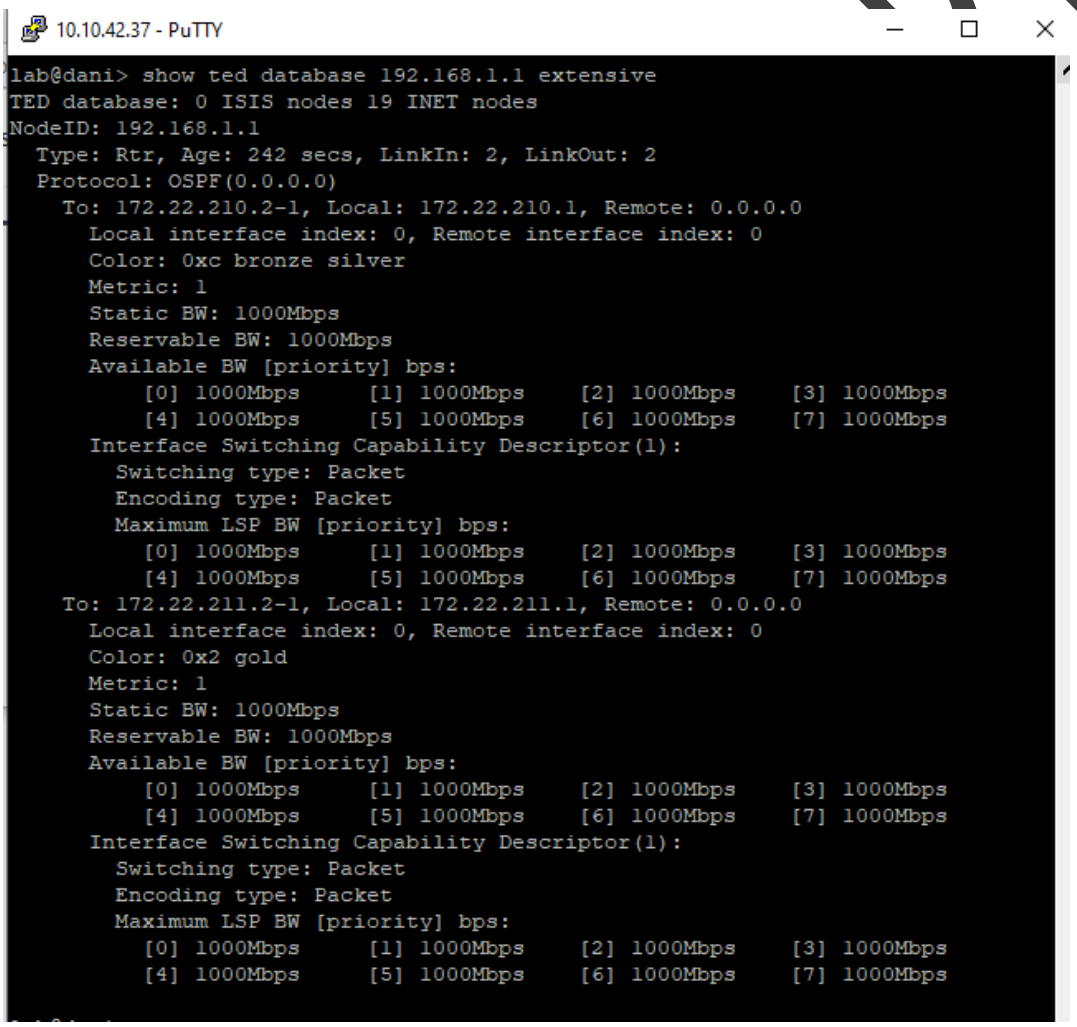

10.10.42.37 - PuTTY
192.168.1.1
From: 192.168.1.2, LSPstate: Up, ActiveRoute: 0
LSPname: lsp-silver-pe2-to-pe1-1, LSPpath: Primary
Suggested label received: -, Suggested label sent: -
Recovery label received: -, Recovery label sent: -
Resv style: 1 FF, Label in: 3, Label out: -
Time left: 6172, Since: Sun Sep 5 01:02:53 2021
Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
Port number: sender 1 receiver 33828 protocol 0
Enhanced FRR: Enabled (Upstream)
PATH rcvfrom: 172.22.210.2 (ge-0/0/0.210) 1 pkts
incoming message handle: P-20613/1, Message ID: 25070, Epoch: 15827948
Adspec: received MTU 1500
PATH sentto: localclient
RESV rcvfrom: localclient , Entropy label: Yes
RESV
outgoing message state: refreshing, Message ID: 6139, Epoch: 15826994
Record route: 172.22.212.1 172.22.206.2 172.22.205.1 172.22.203.2 172.22.202.2 172.22.210.2 <self>
Total 3 displayed, Up 3, Down 0
Transit RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0

Part 4: Adding administrative groups to core-facing interfaces

4.4: show mpls interface



4.5: show ted database 192.168.1.1 extensive



Part 5: Configuring LSPs to take gold, silver, and bronze paths using CSPF

5.3:

10.10.42.37 - PuTTY

```
[edit protocols mpls]
lab@dani# set label-switched-path lsp-bronze-pe1-to-pe2-1 primary lsp-bronze-pe1-to-pe2-1 admin-group include-any bronze
```

10.10.42.37 - PuTTY

```
lab@dani# edit protocols mpls

[edit protocols mpls]
lab@dani# show
admin-groups {
    gold 1;
    silver 2;
    bronze 3;
}
label-switched-path lsp-gold-pe1-to-pe2-1 {
    to 192.168.1.2;
    primary lsp-gold-pe1-to-pe2-1 {
        admin-group include-any gold;
    }
}
label-switched-path lsp-silver-pe1-to-pe2-1 {
    to 192.168.1.2;
    primary lsp-gold-pe1-to-pe2-1 {
        admin-group include-any silver;
    }
}
label-switched-path lsp-bronze-pe1-to-pe2-1 {
    to 192.168.1.2;
    primary lsp-gold-pe1-to-pe2-1 {
        admin-group include-any bronze;
    }
}
path lsp-gold-pe1-to-pe2-1 {
    192.168.5.2 loose;
}
interface ge-0/0/0.210 {
    admin-group [ silver bronze ];
}
interface ge-0/0/1.211 {
    admin-group gold;
}
```

5.4: show

10.10.42.37 - PuTTY

```
lab@dani> show rsvp session
Ingress RSVP: 3 sessions
To              From            State   Rt Style Labelin Labelout LSPname
192.168.1.2     192.168.1.1     Up       0  1 FF       -    629904 lsp-bronze-pe1-to-pe2-1
192.168.1.2     192.168.1.1     Up       0  1 FF       -    576176 lsp-gold-pe1-to-pe2-1
192.168.1.2     192.168.1.1     Up       0  1 FF       -    629936 lsp-silver-pe1-to-pe2-1
Total 3 displayed, Up 3, Down 0

Egress RSVP: 2 sessions
To              From            State   Rt Style Labelin Labelout LSPname
192.168.1.1     192.168.1.2     Up       0  1 FF       3        - lsp-gold-pe2-to-pe1-1
192.168.1.1     192.168.1.2     Up       0  1 FF       3        - lsp-silver-pe2-to-pe1-1
Total 2 displayed, Up 2, Down 0

Transit RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0

lab@dani>
```

10.10.42.37 - PuTTY

```
lab@dani> show rsvp session detail
Ingress RSVP: 3 sessions

192.168.1.2
  From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-bronze-pe1-to-pe2-1, LSPpath: Primary
  LSPtype: Static Configured
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 629904
  Resv style: 1 FF, Label in: -, Label out: 629904
  Time left:    -, Since: Sun Sep  5 11:47:01 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 43148 protocol 0
  PATH rcvfrom: localclient
  Adspec: sent MTU 1500
  Path MTU: received 1500
  PATH sentto: 172.22.210.2 (ge-0/0/0.210) 3 pkts
  RESV rcvfrom: 172.22.210.2 (ge-0/0/0.210) 2 pkts, Entropy label: Yes
  Explct route: 172.22.210.2 172.22.201.2 172.22.205.2 172.22.204.2 172.22.207.1 172.22.212.1
  Record route: <self> 172.22.210.2 172.22.201.2 172.22.205.2 172.22.204.2 172.22.207.1 172.22.212.1

192.168.1.2
  From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-gold-pe1-to-pe2-1, LSPpath: Primary
  LSPtype: Static Configured
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 576176
  Resv style: 1 FF, Label in: -, Label out: 576176
  Time left:    -, Since: Sun Sep  5 11:47:01 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 43149 protocol 0
  PATH rcvfrom: localclient
  Adspec: sent MTU 1500
  Path MTU: received 1500
  PATH sentto: 172.22.211.2 (ge-0/0/1.211) 4 pkts
  RESV rcvfrom: 172.22.211.2 (ge-0/0/1.211) 2 pkts, Entropy label: Yes
  Explct route: 172.22.211.2 172.22.202.1 172.22.201.2 172.22.205.2 172.22.204.2 172.22.213.1
  Record route: <self> 172.22.211.2 172.22.202.1 172.22.201.2 172.22.205.2 172.22.204.2 172.22.213.1
```

10.10.42.37 - PuTTY

```
192.168.1.2
  From: 192.168.1.1, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-silver-pe1-to-pe2-1, LSPpath: Primary
  LSPtype: Static Configured
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: 629936
  Resv style: 1 FF, Label in: -, Label out: 629936
  Time left:    -, Since: Sun Sep  5 11:47:01 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 2 receiver 43150 protocol 0
  PATH rcvfrom: localclient
  Adspec: sent MTU 1500
  Path MTU: received 1500
  PATH sentto: 172.22.210.2 (ge-0/0/0.210) 3 pkts
  RESV rcvfrom: 172.22.210.2 (ge-0/0/0.210) 2 pkts, Entropy label: Yes
  Explct route: 172.22.210.2 172.22.202.2 172.22.203.2 172.22.205.1 172.22.206.2 172.22.212.1
  Record route: <self> 172.22.210.2 172.22.202.2 172.22.203.2 172.22.205.1 172.22.206.2 172.22.212.1
Total 3 displayed, Up 3, Down 0

Egress RSVP: 2 sessions

192.168.1.1
  From: 192.168.1.2, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-gold-pe2-to-pe1-1, LSPpath: Primary
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 1 FF, Label in: 3, Label out: -
  Time left: 5708, Since: Sun Sep  5 11:40:51 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 5 receiver 33827 protocol 0
  PATH rcvfrom: 172.22.211.2 (ge-0/0/1.211) 1 pkts
  Adspec: received MTU 1500
  PATH sentto: localclient
  RESV rcvfrom: localclient , Entropy label: Yes
  Record route: 172.22.213.1 172.22.204.2 172.22.205.2 172.22.201.2 172.22.202.1 172.22.211.2 <self>
```

10.10.42.37 - PuTTY

```
192.168.1.1
  From: 192.168.1.2, LSPstate: Up, ActiveRoute: 0
  LSPname: lsp-silver-pe2-to-pe1-1, LSPpath: Primary
  Suggested label received: -, Suggested label sent: -
  Recovery label received: -, Recovery label sent: -
  Resv style: 1 FF, Label in: 3, Label out: -
  Time left: 5804, Since: Sun Sep  5 11:42:27 2021
  Tspec: rate 0bps size 0bps peak Infbps m 20 M 1500
  Port number: sender 7 receiver 33828 protocol 0
  PATH rcvfrom: 172.22.210.2 (ge-0/0/0.210) 1 pkts
  Adspec: received MTU 1500
  PATH sentto: localclient
  RESV rcvfrom: localclient , Entropy label: Yes
  Record route: 172.22.212.1 172.22.206.2 172.22.205.1 172.22.203.2 172.22.202.2 172.22.210.2 <self>
Total 2 displayed, Up 2, Down 0

Transit RSVP: 0 sessions
Total 0 displayed, Up 0, Down 0
```

Lab 6: VPN Baseline Configuration (Detailed)

Part 1: Creating the baseline SP network and enabling PE for Layer 3 VPN Signaling

1.8: show

10.10.42.37 - PuTTY

```
lab@dani> show mpls interface
Interface         State       Administrative groups (x: extended)
ge-0/0/0.210      Up          <none>
ge-0/0/1.211      Up          <none>

lab@dani> show rsvp interface
RSVP interface: 2 active
                        Active  Subscr- Static      Available   Reserved    Highwater
Interface          State  resv    iption  BW          BW          BW          mark
ge-0/0/0.210           Up       0   100%  1000Mbps    1000Mbps    0bps        0bps
ge-0/0/1.211           Up       0   100%  1000Mbps    1000Mbps    0bps        0bps
```

1.9: show ospf neighbor

10.10.42.37 - PuTTY

```
lab@dani> show ospf neighbor
Address          Interface              State     ID               Pri  Dead
172.22.210.2     ge-0/0/0.210           Full      192.168.5.1      128    38
172.22.211.2     ge-0/0/1.211           Full      192.168.5.4      128    36
```

1.10: show bgp neighbor 192.168.1.2

10.10.42.37 - PuTTY

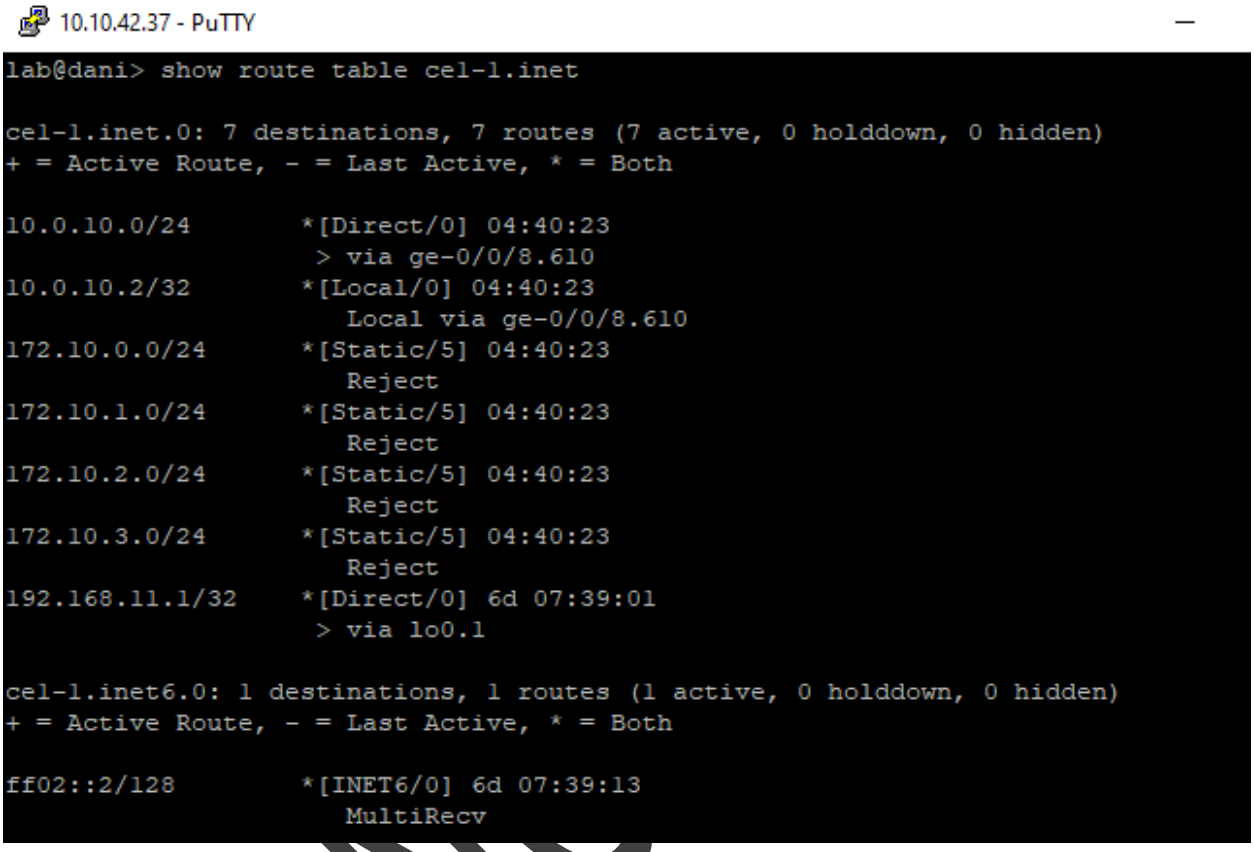
```
lab@dani> show bgp neighbor 192.168.1.2
Peer: 192.168.1.2+179 AS 65512 Local: 192.168.1.1+58705 AS 65512
  Group: my-int-group          Routing-Instance: master
  Forwarding routing-instance: master
  Type: Internal    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference LocalAddress AddressFamily Rib-group Refresh>
  Address families configured: inet-unicast inet-vpn-unicast
  Local Address: 192.168.1.1 Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 192.168.1.2     Local ID: 192.168.1.1       Active Holdtime: 90
  Keepalive Interval: 30         Group index: 0    Peer index: 0    SNMP index: 0
  I/O Session Thread: bgpio-0 State: Enabled
  BFD: disabled, down
  NLRI for restart configured on peer: inet-unicast inet-vpn-unicast
  NLRI advertised by peer: inet-unicast
  NLRI for this session: inet-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
  Peer does not support Restarter functionality
  Restart flag received from the peer: Notification
  NLRI that restart is negotiated for: inet-unicast
  NLRI of received end-of-rib markers: inet-unicast
  NLRI of all end-of-rib markers sent: inet-unicast
  Peer does not support LLGR Restarter functionality
  Peer supports 4 byte AS extension (peer-as 65512)
  Peer does not support Addpath
  Table inet.0 Bit: 20001
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              2
    Received prefixes:            2
    Accepted prefixes:            2
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 526992 Sent 147 Checked 526992
  Input messages:  Total 8      Updates 2       Refreshes 0     Octets 189
  Output messages: Total 6      Updates 0       Refreshes 0     Octets 118
  Output Queue[1]: 0            (inet.0, inet-unicast)
```

10.10.42.37 - PuTTY

```
lab@dani> show bgp summary
Groups: 3 Peers: 3 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       2          2          0          0          0          0
bgp.l3vpn.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
10.0.10.1             65512       2053       1939       0       1    14:37:29 Establ
  cel-1.inet.0: 2/2/2/0
10.0.10.2             65101       1939       2052       0       3    14:37:29 Establ
  inet.0: 0/0/0/0
192.168.1.2           65512         12         10       0       0        4:18 Establ
  inet.0: 2/2/2/0
```

Part 2: Configuring the CE Router Properties

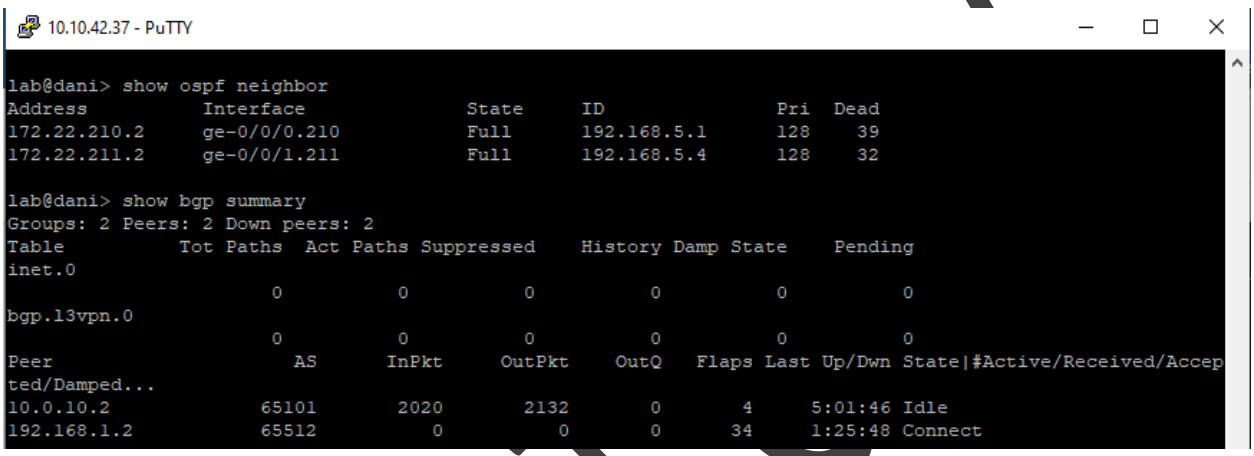
2.9: show route table ce1-1.inet



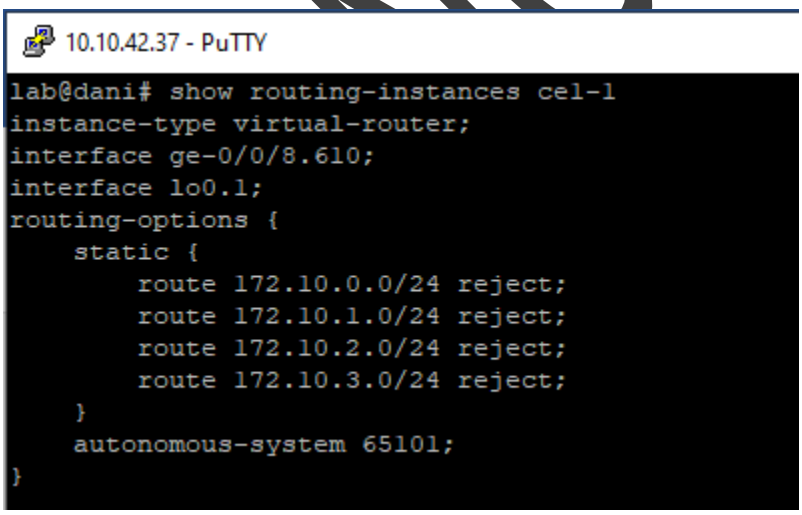
Lab 7: Layer 3 VPN with Static and BGP Routing (detailed)

Part 1: Loading and Verifying the VPN Baseline Configuration

1.2: show



1.3: show routing-instances ce1-1



Part 2: Establishing an RSVP Signaled LSP between PE routers

2.1: show

10.10.42.37 - PuTTY

```
syntax error.
lab@dani# set label-switched-path pe1-to-pe2-1 to 192.168.1.2

[edit protocols mpls]
lab@dani# show
label-switched-path pe1-to-pe2-1 {
    to 192.168.1.2;
}
interface ge-0/0/0.210;
interface ge-0/0/1.211;

[edit protocols mpls]
lab@dani# commit and-quit
commit complete
Exiting configuration mode
```

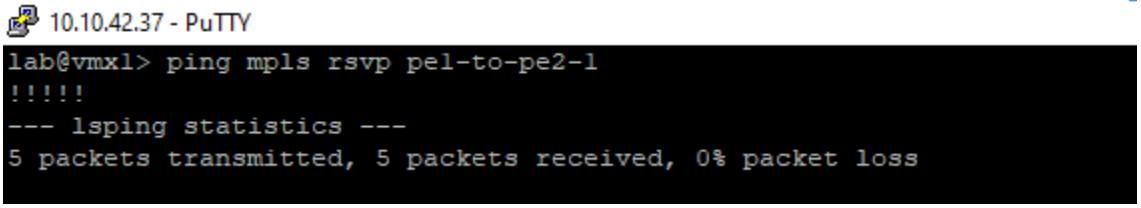
2.2: show mpls lsp – show route table inet.3

```
lab@vmx1> show mpls lsp
Ingress LSP: 1 sessions
To              From            State Rt P     ActivePath       LSPname
192.168.1.2     192.168.1.1     Up     0 *                      pe1-to-pe2-1
Total 1 displayed, Up 1, Down 0

Egress LSP: 1 sessions
To              From            State   Rt Style Labelin Labelout LSPname
192.168.1.1     192.168.1.2     Up       0  1 FF       3        - pe2-to-pe1-1
Total 1 displayed, Up 1, Down 0

Transit LSP: 0 sessions
Total 0 displayed, Up 0, Down 0
```

10.10.42.37 - PuTTY

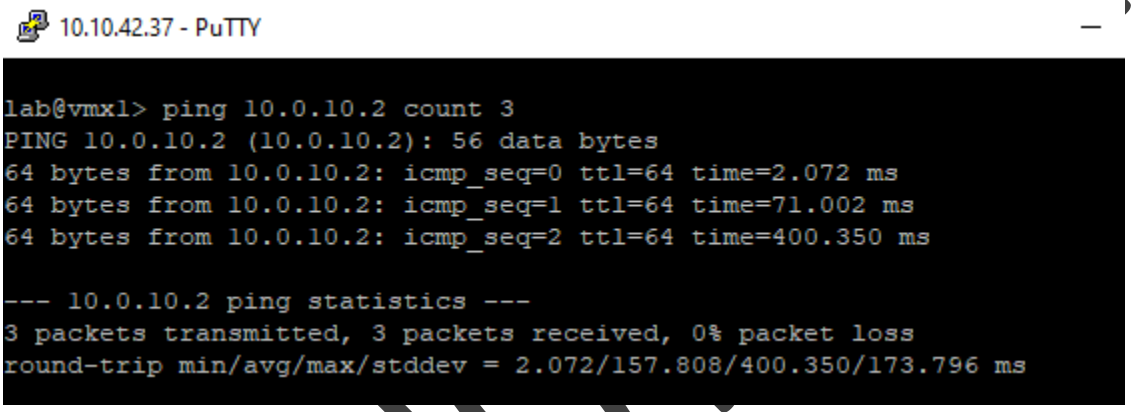
```
lab@vmx1> show route table inet.3

inet.3: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.1.2/32     *[RSVP/7/1] 00:00:14, metric 4
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
```

2.3: ping



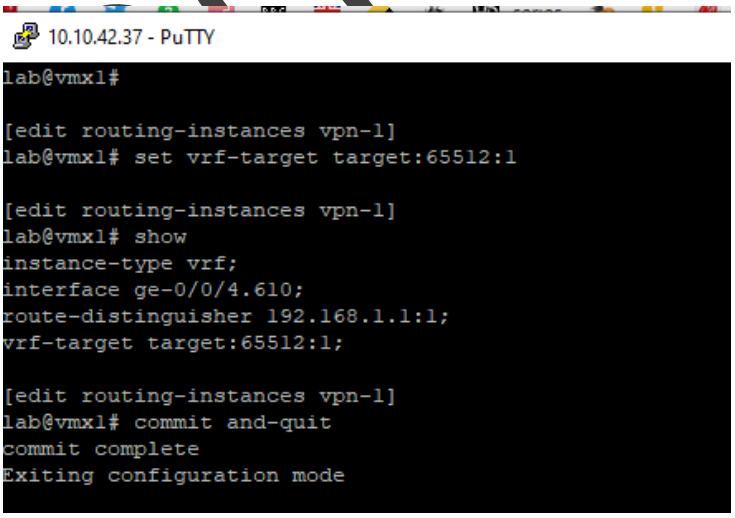
Part 3: Configuring the PE to CE Interface

3.2: Ping 10.0.10.2 count 3



Part 4: Configuring a Layer 3 VPN Instance

4.5: show



4.6: show route table vpn-1. inet.0

```
lab@vmx1> show route table vpn-1.inet.0

vpn-1.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.10.0/24       *[Direct/0] 00:01:02
                    > via ge-0/0/4.610
10.0.10.1/32       *[Local/0] 00:01:02
                      Local via ge-0/0/4.610
```

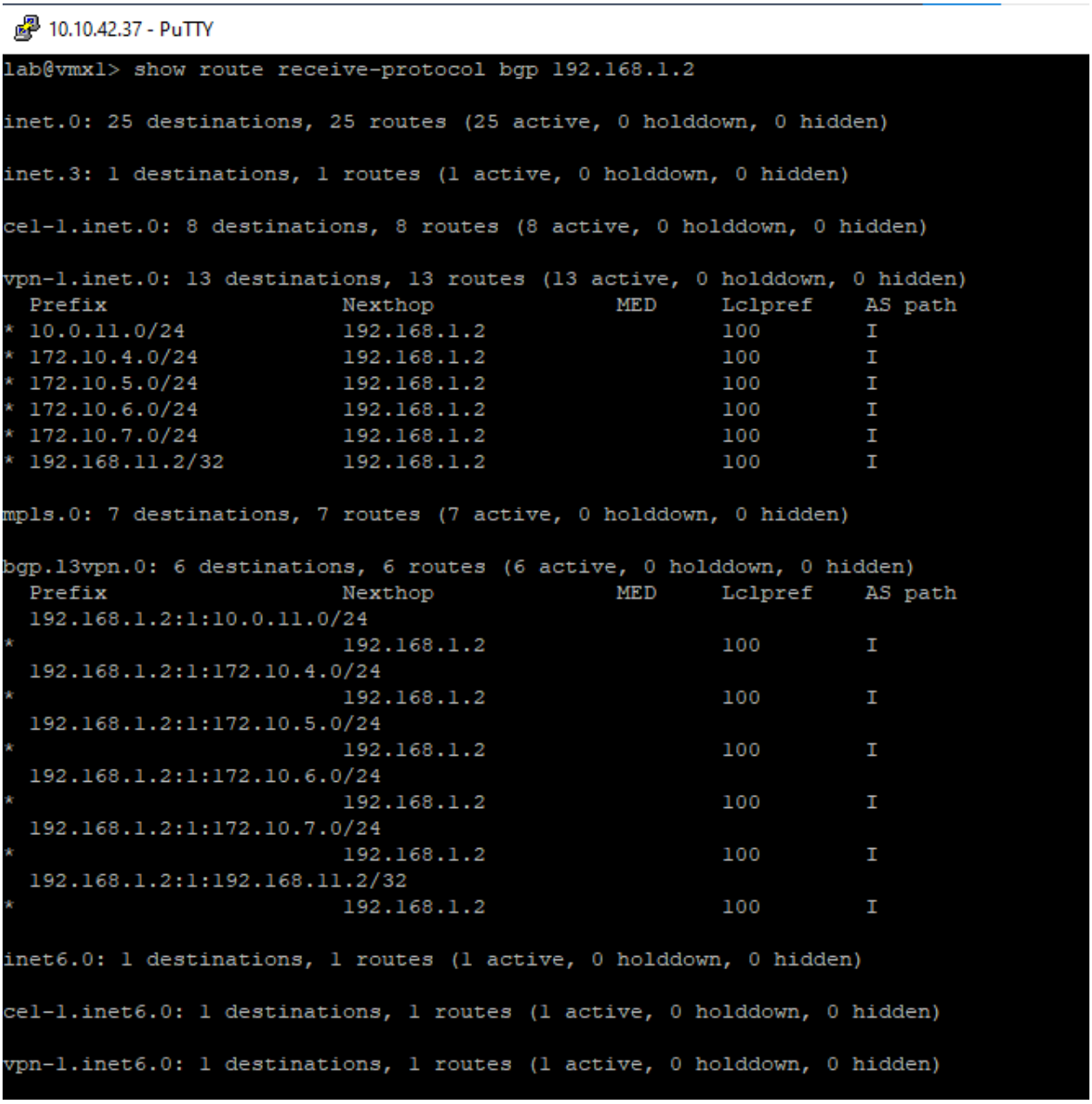
Part 5: Configuring Static Routing between the PE and CE Routers

5.3: show route advertising-protocol bgp 192.168.1.2

10.10.42.37 - PuTTY

```
lab@vmx1> show route advertising-protocol bgp 192.168.1.2

vpn-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.10.0/24            Self                         100        I
* 172.10.0.0/24           Self                         100        I
* 172.10.1.0/24           Self                         100        I
* 172.10.2.0/24           Self                         100        I
* 172.10.3.0/24           Self                         100        I
* 192.168.11.1/32         Self                         100        I
```

5.4: show route receive-protocol bgp 192.168.1.2



5.5: show route table vpn-1. inet.0

10.10.42.37 - PuTTY

```
lab@vmx1> show route table vpn-1.inet.0

vpn-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.10.0/24       *[Direct/0] 00:03:44
                    > via ge-0/0/4.610
10.0.10.1/32       *[Local/0] 00:03:44
                      Local via ge-0/0/4.610
10.0.11.0/24       *[BGP/170] 00:01:50, localpref 100, from 192.168.1.2
                      AS path: I, validation-state: unverified
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
172.10.0.0/24      *[Static/5] 00:03:44
                    > to 10.0.10.2 via ge-0/0/4.610
172.10.1.0/24      *[Static/5] 00:03:44
                    > to 10.0.10.2 via ge-0/0/4.610
172.10.2.0/24      *[Static/5] 00:03:44
                    > to 10.0.10.2 via ge-0/0/4.610
172.10.3.0/24      *[Static/5] 00:03:44
                    > to 10.0.10.2 via ge-0/0/4.610
172.10.4.0/24      *[BGP/170] 00:01:49, localpref 100, from 192.168.1.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
172.10.5.0/24      *[BGP/170] 00:01:49, localpref 100, from 192.168.1.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
172.10.6.0/24      *[BGP/170] 00:01:49, localpref 100, from 192.168.1.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
172.10.7.0/24      *[BGP/170] 00:01:49, localpref 100, from 192.168.1.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
192.168.11.1/32    *[Static/5] 00:03:44
                    > to 10.0.10.2 via ge-0/0/4.610
192.168.11.2/32    *[BGP/170] 00:01:49, localpref 100, from 192.168.1.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.211.2 via ge-0/0/1.211, label-switched-path pe1-to-pe2-1
```

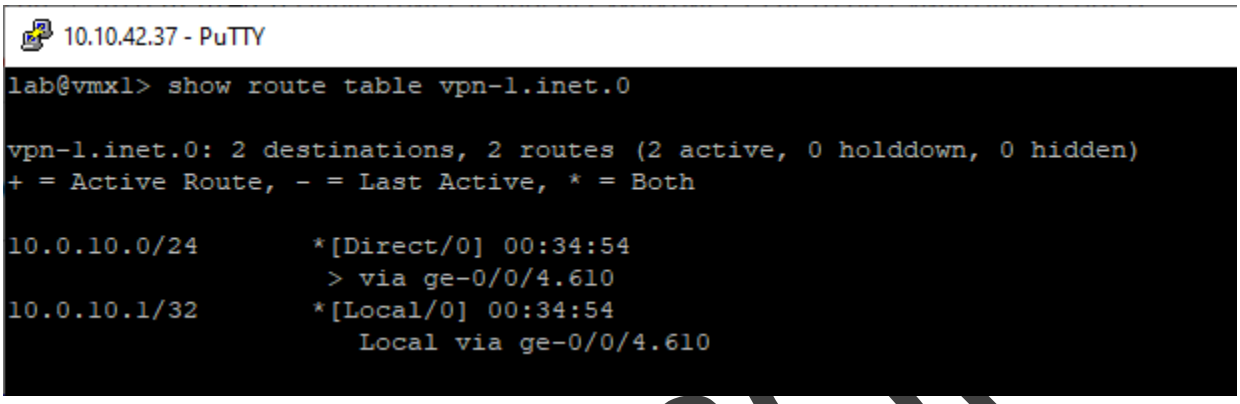
5.6: ping

10.10.42.37 - PuTTY

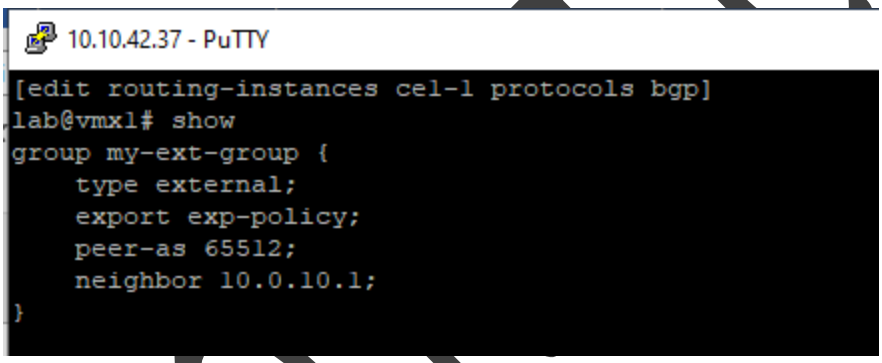
```
lab@vmx1> ping 192.168.11.2 source 192.168.11.1 routing-instance ce1-1 count 5
PING 192.168.11.2 (192.168.11.2): 56 data bytes
64 bytes from 192.168.11.2: icmp_seq=0 ttl=59 time=301.515 ms
64 bytes from 192.168.11.2: icmp_seq=1 ttl=59 time=268.641 ms
64 bytes from 192.168.11.2: icmp_seq=2 ttl=59 time=357.681 ms
64 bytes from 192.168.11.2: icmp_seq=3 ttl=59 time=29.267 ms
64 bytes from 192.168.11.2: icmp_seq=4 ttl=59 time=11.785 ms

--- 192.168.11.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 11.785/193.778/357.681/144.403 ms
```

Part 6: Configuring BGP Routing between the PE and CE Routers

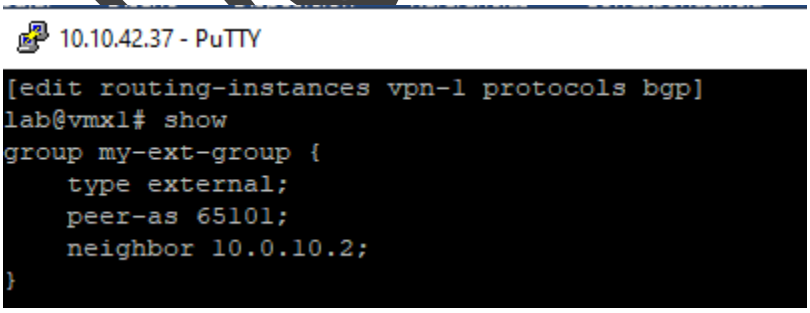
6.3: show route table vpn-1. inet.0



6.4: show



6.5: show



6.6: show route receive-protocol bgp 10.0.10.2

10.10.42.37 - PuTTY

```
lab@vmx1> show route receive-protocol bgp 10.0.10.2

inet.0: 25 destinations, 25 routes (25 active, 0 holddown, 0 hidden)

inet.3: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

vpn-1.inet.0: 7 destinations, 8 routes (7 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
  10.0.10.0/24            10.0.10.2                               65101 I
* 172.10.0.0/24           10.0.10.2                               65101 I
* 172.10.1.0/24           10.0.10.2                               65101 I
* 172.10.2.0/24           10.0.10.2                               65101 I
* 172.10.3.0/24           10.0.10.2                               65101 I
* 192.168.11.1/32         10.0.10.2                               65101 I

mpls.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

6.7: show route

10.10.42.37 - PuTTY

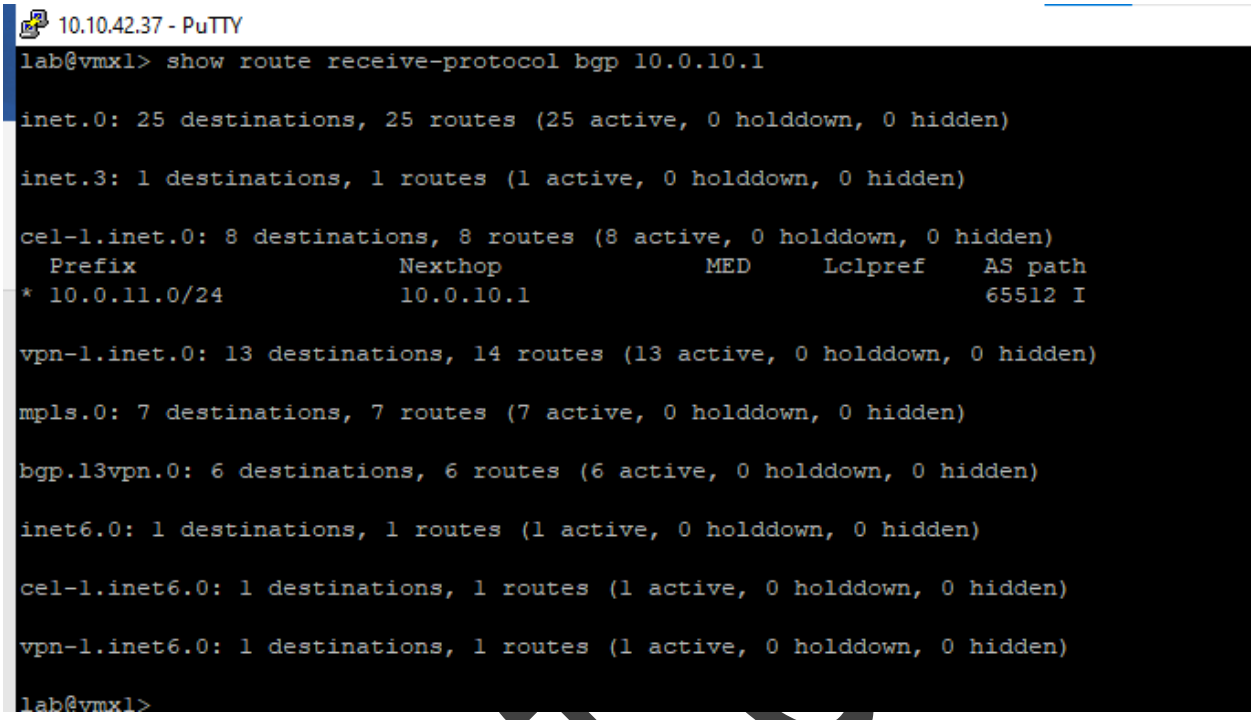
```
lab@vmx1> show route advertising-protocol bgp 192.168.1.2

vpn-1.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.10.0/24            Self                         100        I
* 172.10.0.0/24           Self                         100        65101 I
* 172.10.1.0/24           Self                         100        65101 I
* 172.10.2.0/24           Self                         100        65101 I
* 172.10.3.0/24           Self                         100        65101 I
* 192.168.11.1/32         Self                         100        65101 I
```

6.8: show route

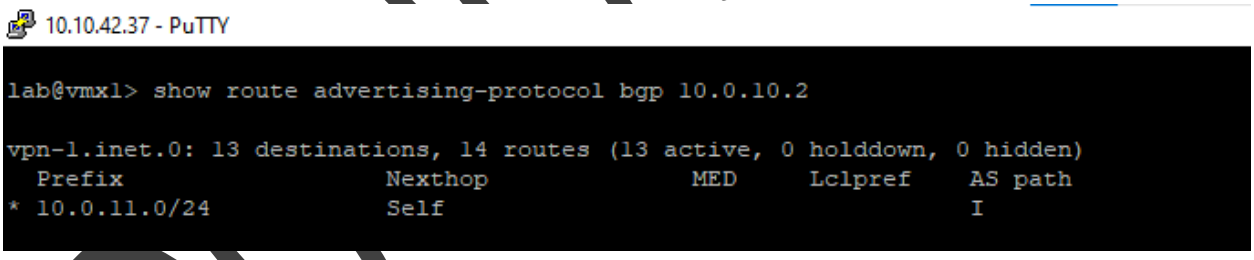
10.10.42.37 - PuTTY

```
lab@vmx1> show route receive-protocol bgp 192.168.1.2

inet.0: 25 destinations, 25 routes (25 active, 0 holddown, 0 hidden)

inet.3: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)

vpn-1.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.11.0/24            192.168.1.2                  100        I
* 172.10.4.0/24           192.168.1.2                  100        65101 I
* 172.10.5.0/24           192.168.1.2                  100        65101 I
* 172.10.6.0/24           192.168.1.2                  100        65101 I
* 172.10.7.0/24           192.168.1.2                  100        65101 I
* 192.168.11.2/32         192.168.1.2                  100        65101 I

mpls.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
  192.168.1.2:1:10.0.11.0/24
*                         192.168.1.2                  100        I
  192.168.1.2:1:172.10.4.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:1:172.10.5.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:1:172.10.6.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:1:172.10.7.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:1:192.168.11.2/32
*                         192.168.1.2                  100        65101 I

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

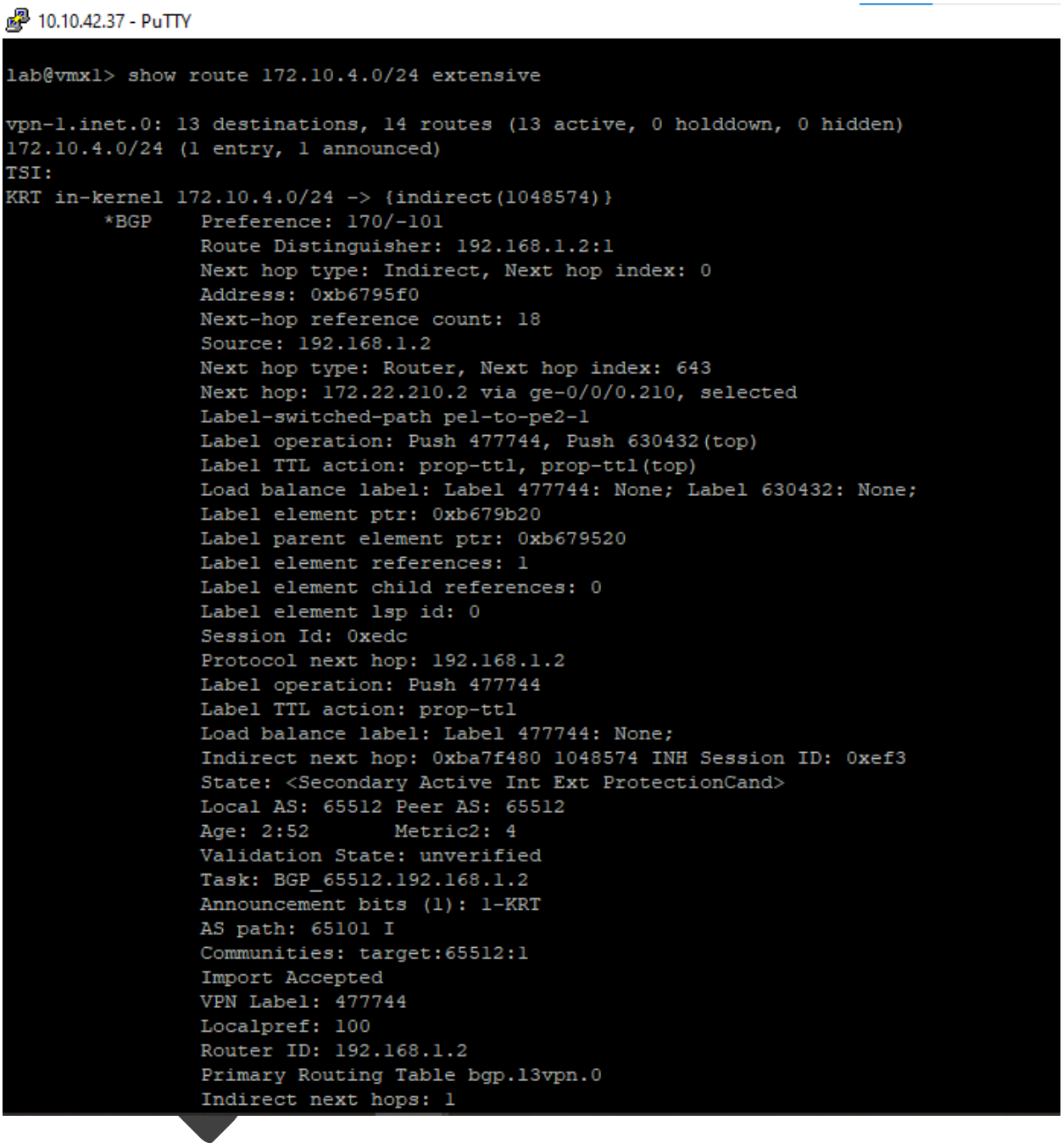
6.9: show route

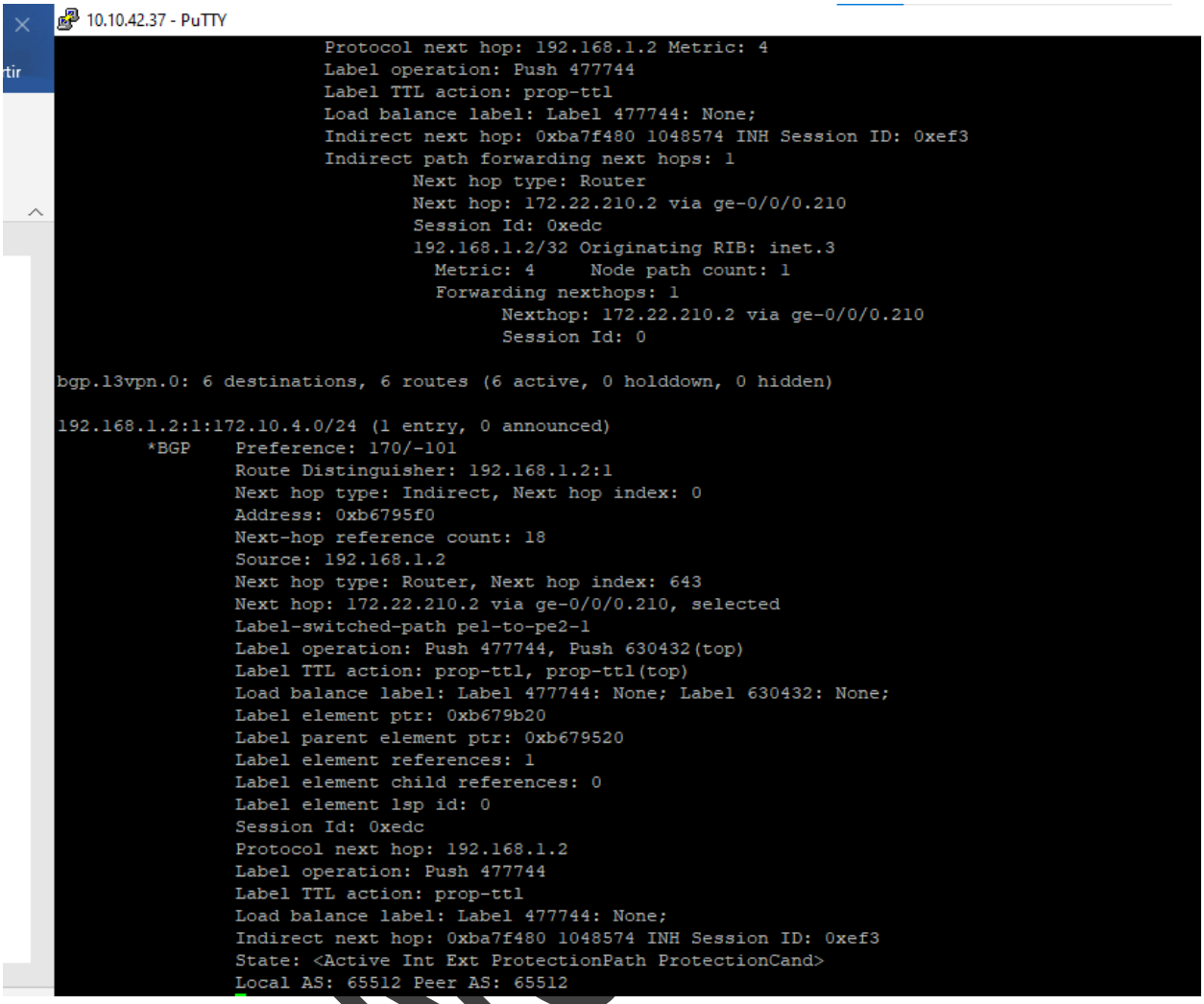


6.10: show route



6.11: show route 172.10.4.0/24 extensive




10.10.42.37 - PuTTY
Protocol next hop: 192.168.1.2 Metric: 4
Label operation: Push 477744
Label TTL action: prop-ttl
Load balance label: Label 477744: None;
Indirect next hop: 0xba7f480 1048574 INH Session ID: 0xef3
Indirect path forwarding next hops: 1
Next hop type: Router
Next hop: 172.22.210.2 via ge-0/0/0.210
Session Id: 0xedc
192.168.1.2/32 Originating RIB: inet.3
Metric: 4 Node path count: 1
Forwarding nexthops: 1
Nexthop: 172.22.210.2 via ge-0/0/0.210
Session Id: 0
bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
192.168.1.2:1:172.10.4.0/24 (1 entry, 0 announced)
*BGP Preference: 170/-101
Route Distinguisher: 192.168.1.2:1
Next hop type: Indirect, Next hop index: 0
Address: 0xb6795f0
Next-hop reference count: 18
Source: 192.168.1.2
Next hop type: Router, Next hop index: 643
Next hop: 172.22.210.2 via ge-0/0/0.210, selected
Label-switched-path pe1-to-pe2-1
Label operation: Push 477744, Push 630432(top)
Label TTL action: prop-ttl, prop-ttl(top)
Load balance label: Label 477744: None; Label 630432: None;
Label element ptr: 0xb679b20
Label parent element ptr: 0xb679520
Label element references: 1
Label element child references: 0
Label element lsp id: 0
Session Id: 0xedc
Protocol next hop: 192.168.1.2
Label operation: Push 477744
Label TTL action: prop-ttl
Load balance label: Label 477744: None;
Indirect next hop: 0xba7f480 1048574 INH Session ID: 0xef3
State: <Active Int Ext ProtectionPath ProtectionCand>
Local AS: 65512 Peer AS: 65512

10.10.42.37 - PuTTY

```
                Age: 2:52       Metric2: 4
                Validation State: unverified
                Task: BGP_65512.192.168.1.2
                AS path: 65101 I
                Communities: target:65512:1
                Import Accepted
                VPN Label: 477744
                Localpref: 100
                Router ID: 192.168.1.2
                Secondary Tables: vpn-1.inet.0
                Indirect next hops: 1
                        Protocol next hop: 192.168.1.2 Metric: 4
                        Label operation: Push 477744
                        Label TTL action: prop-ttl
                        Load balance label: Label 477744: None;
                        Indirect next hop: 0xba7f480 1048574 INH Session ID: 0xef3
                        Indirect path forwarding next hops: 1
                                Next hop type: Router
                                Next hop: 172.22.210.2 via ge-0/0/0.210
                                Session Id: 0xedc
                                192.168.1.2/32 Originating RIB: inet.3
                                  Metric: 4     Node path count: 1
                                  Forwarding nexthops: 1
                                        Nexthop: 172.22.210.2 via ge-0/0/0.210
                                        Session Id: 0
```

6.13: show route

10.10.42.37 - PuTTY

```
lab@vmx1> show route receive-protocol bgp 10.0.10.1

inet.0: 25 destinations, 25 routes (25 active, 0 holddown, 0 hidden)

inet.3: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

ce1-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.11.0/24            10.0.10.1                               65512 I
* 172.10.4.0/24           10.0.10.1                               65512 65512 I
* 172.10.5.0/24           10.0.10.1                               65512 65512 I
* 172.10.6.0/24           10.0.10.1                               65512 65512 I
* 172.10.7.0/24           10.0.10.1                               65512 65512 I
* 192.168.11.2/32         10.0.10.1                               65512 65512 I

vpn-1.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)

mpls.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

ce1-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

6.14: ping 192.168.11.2

10.10.42.37 - PuTTY

```
lab@vmx1> ping 192.168.11.2 source 192.168.11.1 routing-instance ce1-1 count 5
PING 192.168.11.2 (192.168.11.2): 56 data bytes
64 bytes from 192.168.11.2: icmp_seq=0 ttl=59 time=15.742 ms
64 bytes from 192.168.11.2: icmp_seq=1 ttl=59 time=25.488 ms
64 bytes from 192.168.11.2: icmp_seq=2 ttl=59 time=37.124 ms
64 bytes from 192.168.11.2: icmp_seq=3 ttl=59 time=391.404 ms
64 bytes from 192.168.11.2: icmp_seq=4 ttl=59 time=48.432 ms

--- 192.168.11.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 15.742/103.638/391.404/144.301 ms
```

Lab 8: Route Reflection and Internet Access (Detailed)

Part 1: Loading and Verifying the VPN baseline configuration

1.2: show

10.10.42.37 - PuTTY

```
lab@vmx1> show ospf neighbor
Address          Interface              State     ID               Pri  Dead
172.22.210.2     ge-0/0/0.210           Full      192.168.5.1      128    36
172.22.211.2     ge-0/0/1.211           Full      192.168.5.4      128    39
```

10.10.42.37 - PuTTY

```
lab@dani> show bgp summary
Groups: 2 Peers: 2 Down peers: 1
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       0          0          0          0          0          0
bgp.l3vpn.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
10.0.10.2             65101          0          0       0       0        2:08 Idle
192.168.1.2           65512          4          3       0       1          23 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 0/0/0/0
```

1.3: show

```
10.10.42.37 - PuTTY
[edit]
lab@dani# show routing-instances ce1-1
instance-type virtual-router;
interface ge-0/0/8.610;
interface lo0.1;
routing-options {
    static {
        route 172.10.0.0/24 reject;
        route 172.10.1.0/24 reject;
        route 172.10.2.0/24 reject;
        route 172.10.3.0/24 reject;
    }
    autonomous-system 65101;
}
```

Part 2: Configuring your PE router to peer with the Route Reflector

2.1: show

```
10.10.42.37 - PuTTY
[edit protocols bgp group my-int-group]
lab@dani# show
type internal;
local-address 192.168.1.1;
family inet {
    unicast;
}
family inet-vpn {
    unicast;
}
neighbor 192.168.5.2;
```

2.2: show bgp summary

```
10.10.42.37 - PuTTY
lab@dani> show bgp summary
Groups: 2 Peers: 2 Down peers: 1
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       0          0          0          0          0          0
bgp.l3vpn.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
10.0.10.2             65101          0          0       0       0        6:09 Idle
192.168.5.2           65512          3          3       0       0           2 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 0/0/0/0
```

10.10.42.37 - PuTTY

```
lab@dani> show bgp neighbor 192.168.5.2
Peer: 192.168.5.2+179 AS 65512 Local: 192.168.1.1+59484 AS 65512
  Group: my-int-group          Routing-Instance: master
  Forwarding routing-instance: master
  Type: Internal    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference LocalAddress HoldTime AddressFamily Rib-group Refresh>
  Address families configured: inet-unicast inet-vpn-unicast
  Local Address: 192.168.1.1 Holdtime: 0 Preference: 170
  Number of flaps: 0
  Peer ID: 192.168.5.2     Local ID: 192.168.1.1       Active Holdtime: 90
  Keepalive Interval: 30         Group index: 0    Peer index: 0    SNMP index: 11
  I/O Session Thread: bgpio-0 State: Enabled
  BFD: disabled, down
  NLRI for restart configured on peer: inet-unicast inet-vpn-unicast
  NLRI advertised by peer: inet-unicast inet-vpn-unicast route-target
  NLRI for this session: inet-unicast inet-vpn-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
  Peer does not support Restarter functionality
  Restart flag received from the peer: Notification
  NLRI that restart is negotiated for: inet-unicast inet-vpn-unicast
  NLRI of received end-of-rib markers: inet-unicast inet-vpn-unicast
  NLRI of all end-of-rib markers sent: inet-unicast inet-vpn-unicast
  Peer does not support LLGR Restarter functionality
  Peer supports 4 byte AS extension (peer-as 65512)
  Peer does not support Addpath
  Table inet.0 Bit: 20000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
```

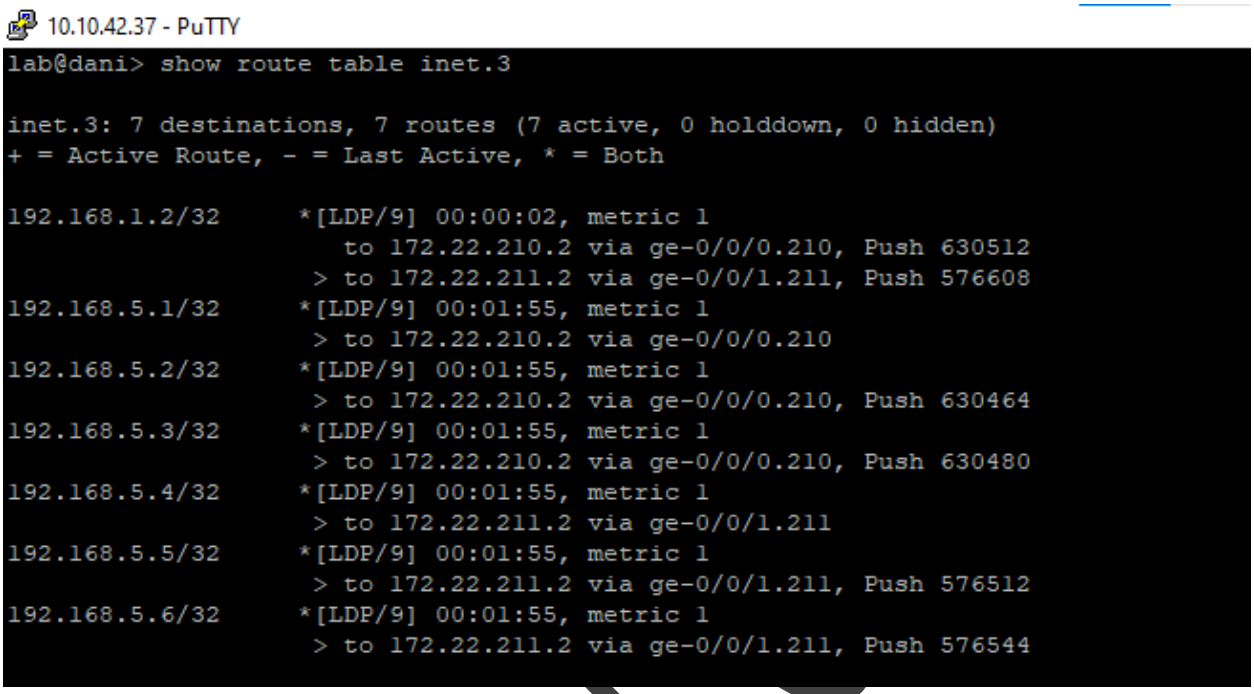
Part 3: Establishing LDP signaled LSPs between PE routers and router reflector

3.2: show

10.10.42.37 - PuTTY

```
lab@dani> show ldp neighbor
Address                         Interface       Label space ID     Hold time
172.22.210.2                    ge-0/0/0.210    192.168.5.1:0        12
172.22.211.2                    ge-0/0/1.211    192.168.5.4:0        11

lab@dani> show ldp session
  Address                       State       Connection  Hold time  Adv. Mode
192.168.5.1                     Operational Open          28         DU
192.168.5.4                     Operational Open          28         DU
```

3.3: show route table inet.3



Part 4: Configuring another CE router using a virtual router

4.7: show route table ce1-3

10.10.42.37 - PuTTY

```
lab@dani> show route table ce1-3.inet

ce1-3.inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.1.10.0/24       *[Direct/0] 00:00:13
                    > via ge-0/0/9.611
10.1.10.2/32       *[Local/0] 00:00:13
                      Local via ge-0/0/9.611
172.11.0.0/24      *[Static/5] 00:00:13
                      Reject
172.11.1.0/24      *[Static/5] 00:00:13
                      Reject
172.11.2.0/24      *[Static/5] 00:00:13
                      Reject
172.11.3.0/24      *[Static/5] 00:00:13
                      Reject
192.168.21.1/32    *[Direct/0] 00:00:13
                    > via lo0.2

ce1-3.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

ff02::2/128        *[INET6/0] 00:00:13
                      MultiRecv
```

Part 5: Configuring the PE to CE interfaces

5.2: ping

10.10.42.37 - PuTTY

```
lab@dani> ping 10.0.10.2 count 5
PING 10.0.10.2 (10.0.10.2): 56 data bytes
64 bytes from 10.0.10.2: icmp_seq=0 ttl=64 time=1.924 ms
64 bytes from 10.0.10.2: icmp_seq=1 ttl=64 time=47.170 ms
64 bytes from 10.0.10.2: icmp_seq=2 ttl=64 time=1.842 ms
64 bytes from 10.0.10.2: icmp_seq=3 ttl=64 time=20.750 ms
64 bytes from 10.0.10.2: icmp_seq=4 ttl=64 time=1.522 ms

--- 10.0.10.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.522/14.642/47.170/17.850 ms

lab@dani> ping 10.1.10.2 count 5
PING 10.1.10.2 (10.1.10.2): 56 data bytes
64 bytes from 10.1.10.2: icmp_seq=0 ttl=64 time=10.904 ms
64 bytes from 10.1.10.2: icmp_seq=1 ttl=64 time=7.541 ms
64 bytes from 10.1.10.2: icmp_seq=2 ttl=64 time=67.065 ms
64 bytes from 10.1.10.2: icmp_seq=3 ttl=64 time=7.159 ms
64 bytes from 10.1.10.2: icmp_seq=4 ttl=64 time=257.578 ms

--- 10.1.10.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 7.159/70.049/257.578/96.474 ms
```

Part 6: Configuring two layer 3 VPN instances

6.1: show

10.10.42.37 - PuTTY

```
[edit routing-instances vpn1-a]
lab@dani# show
instance-type vrf;
interface ge-0/0/4.610;
vrf-target target:65512:101;
```

6.2: show

10.10.42.37 - PuTTY

```
[edit routing-instances vpn1-b]
lab@dani# show
instance-type vrf;
interface ge-0/0/5.611;
vrf-target target:65512:102;
```

6.3: show routes

10.10.42.37 - PuTTY

```
lab@dani> show route table vpn1-a

vpn1-a.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.10.0/24       *[Direct/0] 00:03:17
                    > via ge-0/0/4.610
10.0.10.1/32       *[Local/0] 00:03:17
                       Local via ge-0/0/4.610

vpn1-a.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

ff02::2/128        *[INET6/0] 00:03:17
                       MultiRecv

lab@dani> show route table vpn1-b

vpn1-b.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.1.10.0/24       *[Direct/0] 00:00:54
                    > via ge-0/0/5.611
10.1.10.1/32       *[Local/0] 00:00:54
                       Local via ge-0/0/5.611

vpn1-b.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

ff02::2/128        *[INET6/0] 00:00:54
                       MultiRecv
```

Part 7: Configuring bgp routing between the PE and CE Routers

7.1: show

10.10.42.37 - PuTTY

```
[edit routing-instances vpn1-a protocols bgp]
lab@dani# show
group my-ext-group-a {
    type external;
    peer-as 65101;
    as-override;
    neighbor 10.0.10.2;
}
```

7.2: show

10.10.42.37 - PuTTY

```
[edit routing-instances ce1-1 protocols bgp]
lab@dani# show
group my-ext-group {
    type external;
    export exp-policy;
    peer-as 65512;
    neighbor 10.0.10.1;
}
```

7.3: show routes

10.10.42.37 - PuTTY

```
lab@dani> show route receive-protocol bgp 10.0.10.2

inet.0: 26 destinations, 26 routes (26 active, 0 holddown, 0 hidden)

inet.3: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

cel-3.inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

vpn1-a.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
  10.0.10.0/24            10.0.10.2                               65101 I
* 172.10.0.0/24           10.0.10.2                               65101 I
* 172.10.1.0/24           10.0.10.2                               65101 I
* 172.10.2.0/24           10.0.10.2                               65101 I
* 172.10.3.0/24           10.0.10.2                               65101 I
* 192.168.11.1/32         10.0.10.2                               65101 I

vpn1-b.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

cel-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)

mpls.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-3.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-a.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-b.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

10.10.42.37 - PuTTY

```
lab@dani> show route advertising-protocol bgp 192.168.5.2

vpn1-a.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.10.0/24            Self                            100        I
* 172.10.0.0/24           Self                            100        65101 I
* 172.10.1.0/24           Self                            100        65101 I
* 172.10.2.0/24           Self                            100        65101 I
* 172.10.3.0/24           Self                            100        65101 I
* 192.168.11.1/32         Self                            100        65101 I

vpn1-b.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.1.10.0/24            Not advertised                  100        I
```

10.10.42.37 - PuTTY

```
lab@dani> show route receive-protocol bgp 192.168.5.2

inet.0: 26 destinations, 26 routes (26 active, 0 holddown, 0 hidden)

inet.3: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

ce1-3.inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

vpn1-a.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.11.0/24            192.168.1.2                  100        I
* 172.10.4.0/24           192.168.1.2                  100        65101 I
* 172.10.5.0/24           192.168.1.2                  100        65101 I
* 172.10.6.0/24           192.168.1.2                  100        65101 I
* 172.10.7.0/24           192.168.1.2                  100        65101 I
* 192.168.11.2/32         192.168.1.2                  100        65101 I

vpn1-b.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

ce1-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)

mpls.0: 16 destinations, 16 routes (16 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
  192.168.1.2:24:10.0.11.0/24
*                         192.168.1.2                  100        I
  192.168.1.2:24:172.10.4.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:172.10.5.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:172.10.6.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:172.10.7.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:192.168.11.2/32
*                         192.168.1.2                  100        65101 I

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

ce1-3.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-a.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-b.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

ce1-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

10.10.42.37 - PuTTY

```
lab@dani> show route receive-protocol bgp 192.168.5.2

inet.0: 26 destinations, 26 routes (26 active, 0 holddown, 0 hidden)

inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)

cel-3.inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

vpn1-a.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.11.0/24            192.168.1.2                  100        I
* 172.10.4.0/24           192.168.1.2                  100        65101 I
* 172.10.5.0/24           192.168.1.2                  100        65101 I
* 172.10.6.0/24           192.168.1.2                  100        65101 I
* 172.10.7.0/24           192.168.1.2                  100        65101 I
* 192.168.11.2/32         192.168.1.2                  100        65101 I

vpn1-b.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

cel-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)

mpls.0: 14 destinations, 14 routes (14 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
  192.168.1.2:24:10.0.11.0/24
*                         192.168.1.2                  100        I
  192.168.1.2:24:172.10.4.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:172.10.5.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:172.10.6.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:172.10.7.0/24
*                         192.168.1.2                  100        65101 I
  192.168.1.2:24:192.168.11.2/32
*                         192.168.1.2                  100        65101 I

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-3.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-a.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-b.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

10.10.42.37 - PuTTY

```
lab@dani> show route receive-protocol bgp 10.0.10.1

inet.0: 26 destinations, 26 routes (26 active, 0 holddown, 0 hidden)

inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)

ce1-3.inet.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)

vpn1-a.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)

vpn1-b.inet.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)

ce1-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.0.11.0/24            10.0.10.1                               65512 I
* 172.10.4.0/24           10.0.10.1                               65512 65512 I
* 172.10.5.0/24           10.0.10.1                               65512 65512 I
* 172.10.6.0/24           10.0.10.1                               65512 65512 I
* 172.10.7.0/24           10.0.10.1                               65512 65512 I
* 192.168.11.2/32         10.0.10.1                               65512 65512 I

mpls.0: 14 destinations, 14 routes (14 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

ce1-3.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-a.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-b.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

ce1-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

10.10.42.37 - PuTTY

```
  ce1-3
lab@dani> ping 192.168.11.2 source 192.168.11.1 routing-instance ce1-1 count 5
PING 192.168.11.2 (192.168.11.2): 56 data bytes
64 bytes from 192.168.11.2: icmp_seq=0 ttl=59 time=18.437 ms
64 bytes from 192.168.11.2: icmp_seq=1 ttl=59 time=239.250 ms
64 bytes from 192.168.11.2: icmp_seq=2 ttl=59 time=23.552 ms
64 bytes from 192.168.11.2: icmp_seq=3 ttl=59 time=289.876 ms
64 bytes from 192.168.11.2: icmp_seq=4 ttl=59 time=94.737 ms

--- 192.168.11.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 18.437/133.170/289.876/111.774 ms

lab@dani>
```

7.4: show

10.10.42.37 - PuTTY

```
[edit routing-instances vpn1-b protocols bgp]
lab@dani# show
group my-ext-group-b {
    type external;
    peer-as 65102;
    as-override;
    neighbor 10.1.10.2;
}
```

7.5: show

10.10.42.37 - PuTTY

```
[edit routing-instances ce1-3 protocols bgp]
lab@dani# show
group my-ext-group {
    type external;
    export exp-policy;
    peer-as 65512;
    neighbor 10.1.10.1;
}
```

7.6: shows

10.10.42.37 - PuTTY

```
lab@dani> show route advertising-protocol bgp 10.1.10.1

cel-3.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.1.10.0/24            Self                                    I
* 172.11.0.0/24           Self                                    I
* 172.11.1.0/24           Self                                    I
* 172.11.2.0/24           Self                                    I
* 172.11.3.0/24           Self                                    I
* 192.168.21.1/32         Self                                    I

lab@dani> show route receive-protocol bgp 10.1.10.1

inet.0: 26 destinations, 26 routes (26 active, 0 holddown, 0 hidden)

inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)

cel-3.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
  Prefix                  Nexthop              MED     Lclpref    AS path
* 10.1.11.0/24            10.1.10.1                               65512 I
* 172.11.4.0/24           10.1.10.1                               65512 65512 I
* 172.11.5.0/24           10.1.10.1                               65512 65512 I
* 172.11.6.0/24           10.1.10.1                               65512 65512 I
* 172.11.7.0/24           10.1.10.1                               65512 65512 I
* 192.168.21.2/32         10.1.10.1                               65512 65512 I

vpn1-a.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)

vpn1-b.inet.0: 13 destinations, 14 routes (13 active, 0 holddown, 0 hidden)

cel-1.inet.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)

mpls.0: 15 destinations, 15 routes (15 active, 0 holddown, 0 hidden)

bgp.l3vpn.0: 12 destinations, 12 routes (12 active, 0 holddown, 0 hidden)

inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-3.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-a.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

vpn1-b.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

cel-1.inet6.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
```

10.10.42.37 - PuTTY

```
lab@dani> ping 192.168.21.2 source 192.168.21.1 routing-instance ce1-3 count 5
PING 192.168.21.2 (192.168.21.2): 56 data bytes
64 bytes from 192.168.21.2: icmp_seq=0 ttl=59 time=21.059 ms
64 bytes from 192.168.21.2: icmp_seq=1 ttl=59 time=47.851 ms
64 bytes from 192.168.21.2: icmp_seq=2 ttl=59 time=183.332 ms
64 bytes from 192.168.21.2: icmp_seq=3 ttl=59 time=292.302 ms
64 bytes from 192.168.21.2: icmp_seq=4 ttl=59 time=147.609 ms

--- 192.168.21.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 21.059/138.431/292.302/97.732 ms
```

Part 8: Implementing route target filtering

8.2: show route table bgp.13vpn.0

10.10.42.37 - PuTTY

```
lab@dani> show route table bgp.l3vpn.0

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.1.2:24:10.0.11.0/24
                   *[BGP/170] 00:13:46, localpref 100, from 192.168.5.2
                      AS path: I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.4.0/24
                   *[BGP/170] 00:13:45, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.5.0/24
                   *[BGP/170] 00:13:45, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.6.0/24
                   *[BGP/170] 00:13:45, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.7.0/24
                   *[BGP/170] 00:13:45, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:192.168.11.2/32
                   *[BGP/170] 00:13:45, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
```

8.4: show route table bgp.13vpn.0

10.10.42.37 - PuTTY

```
lab@dani> show route table bgp.l3vpn.0

bgp.l3vpn.0: 12 destinations, 12 routes (12 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.1.2:24:10.0.11.0/24
                   *[BGP/170] 00:15:37, localpref 100, from 192.168.5.2
                      AS path: I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.4.0/24
                   *[BGP/170] 00:15:36, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.5.0/24
                   *[BGP/170] 00:15:36, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.6.0/24
                   *[BGP/170] 00:15:36, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:172.10.7.0/24
                   *[BGP/170] 00:15:36, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:24:192.168.11.2/32
                   *[BGP/170] 00:15:36, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322240, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322240, Push 448032(top)
192.168.1.2:25:10.1.11.0/24
                   *[BGP/170] 00:00:10, localpref 100, from 192.168.5.2
                      AS path: I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322256, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322256, Push 448032(top)
192.168.1.2:25:172.11.4.0/24
                   *[BGP/170] 00:00:10, localpref 100, from 192.168.5.2
                      AS path: 65102 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322256, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322256, Push 448032(top)
192.168.1.2:25:172.11.5.0/24
                   *[BGP/170] 00:00:10, localpref 100, from 192.168.5.2
                      AS path: 65102 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322256, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322256, Push 448032(top)
```

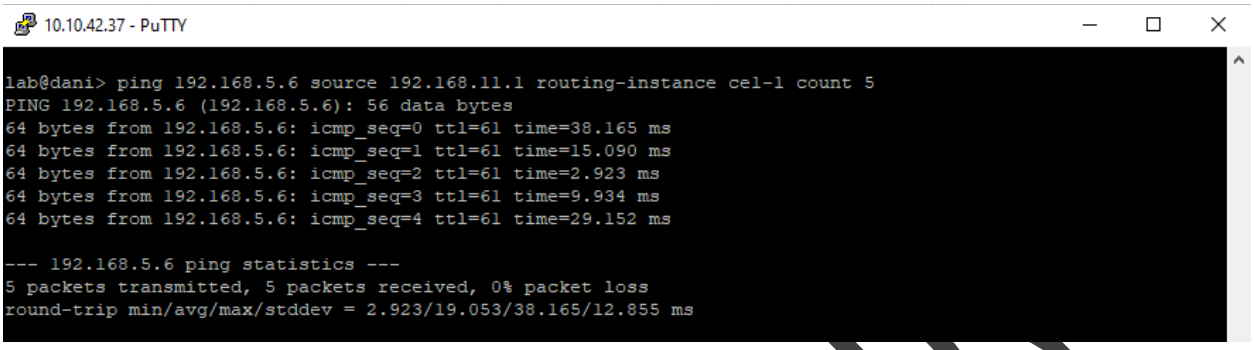
```
192.168.1.2:25:172.11.6.0/24
                   *[BGP/170] 00:00:10, localpref 100, from 192.168.5.2
                      AS path: 65102 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322256, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322256, Push 448032(top)
192.168.1.2:25:172.11.7.0/24
                   *[BGP/170] 00:00:10, localpref 100, from 192.168.5.2
                      AS path: 65102 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322256, Push 477392(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322256, Push 448032(top)
192.168.1.2:25:192.168.21.2/32
                   *[BGP/170] 00:00:10, localpref 100, from 192.168.5.2
                      AS path: 65102 I, validation-state: unverified
                      to 172.22.210.2 via ge-0/0/0.210, Push 322256, Push 477392(top)
                    > to 172.22.211.2 via ge-0/0/1.211, Push 322256, Push 448032(top)
```

8.6: show route table bgp.13vpn.o

10.10.42.37 - PuTTY

```
lab@dani> show route table bgp.13vpn.0

bgp.13vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.1.2:24:10.0.11.0/24
                   *[BGP/170] 00:00:13, localpref 100, from 192.168.5.2
                      AS path: I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322320, Push 477488(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322320, Push 448112(top)
192.168.1.2:24:172.10.4.0/24
                   *[BGP/170] 00:00:13, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322320, Push 477488(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322320, Push 448112(top)
192.168.1.2:24:172.10.5.0/24
                   *[BGP/170] 00:00:13, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322320, Push 477488(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322320, Push 448112(top)
192.168.1.2:24:172.10.6.0/24
                   *[BGP/170] 00:00:13, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322320, Push 477488(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322320, Push 448112(top)
192.168.1.2:24:172.10.7.0/24
                   *[BGP/170] 00:00:13, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322320, Push 477488(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322320, Push 448112(top)
192.168.1.2:24:192.168.11.2/32
                   *[BGP/170] 00:00:13, localpref 100, from 192.168.5.2
                      AS path: 65101 I, validation-state: unverified
                    > to 172.22.210.2 via ge-0/0/0.210, Push 322320, Push 477488(top)
                      to 172.22.211.2 via ge-0/0/1.211, Push 322320, Push 448112(top)
```

Part 9: Configuring internet access using a non-vrf interface



Lab 12: Virtual Private LAN Service

Part 1: Loading and verifying the VPN baseline configuration

1.2: Shows

```
lab@dani> show ospf neighbor
Address          Interface              State     ID               Pri  Dead
172.22.210.2     ge-0/0/0.210           Full      192.168.5.1      128    38
172.22.211.2     ge-0/0/1.211           Full      192.168.5.4      128    35

lab@dani> show bgp summary
Groups: 2 Peers: 2 Down peers: 1
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       0          0          0          0          0          0
bgp.l3vpn.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
10.0.10.2             65101          0          0       0       0        5:29 Idle
192.168.1.2           65512          6          6       0       0        1:48 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 0/0/0/0
```

1.3: show routing-instances ce1-1

```
lab@dani> configure
Entering configuration mode

[edit]
lab@dani# show routing-instances ce1-1
instance-type virtual-router;
interface ge-0/0/8.610;
interface lo0.1;
routing-options {
    static {
        route 172.10.0.0/24 reject;
        route 172.10.1.0/24 reject;
        route 172.10.2.0/24 reject;
        route 172.10.3.0/24 reject;
    }
    autonomous-system 65101;
}
```


Part 2: Adjusting the properties of the virtual router

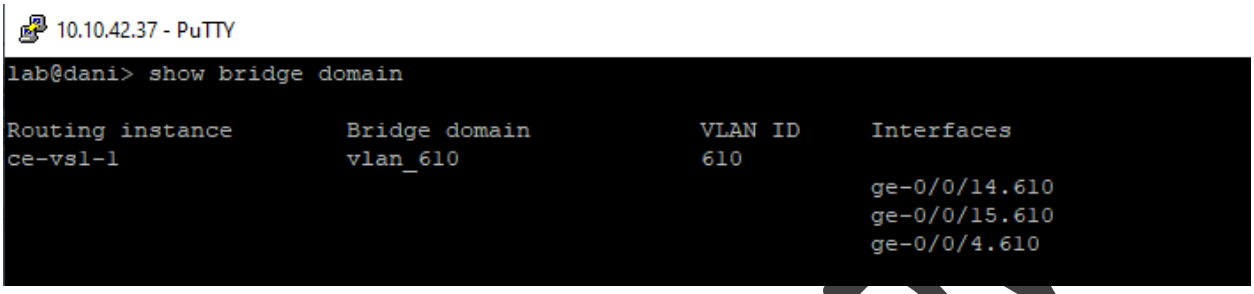
2.2: show

10.10.42.37 - PuTTY

```
lab@dani# show
c-router-1-1 {
    instance-type virtual-router;
    interface ge-0/0/8.610;
    interface lo0.1;
    routing-options {
        static {
            route 172.10.0.0/24 reject;
            route 172.10.1.0/24 reject;
            route 172.10.2.0/24 reject;
            route 172.10.3.0/24 reject;
        }
        autonomous-system 65101;
    }
}
```

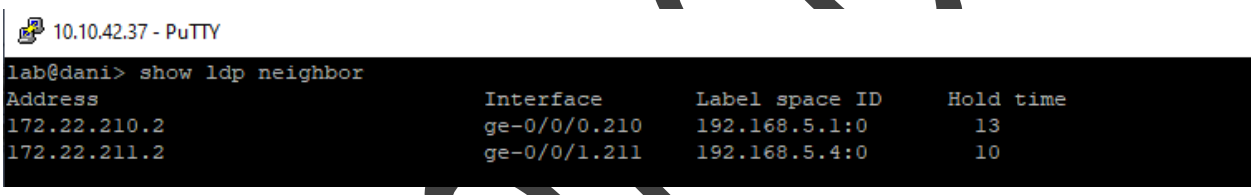
Part 3: Configuring a virtual switch instance

3.4: show bridge domain

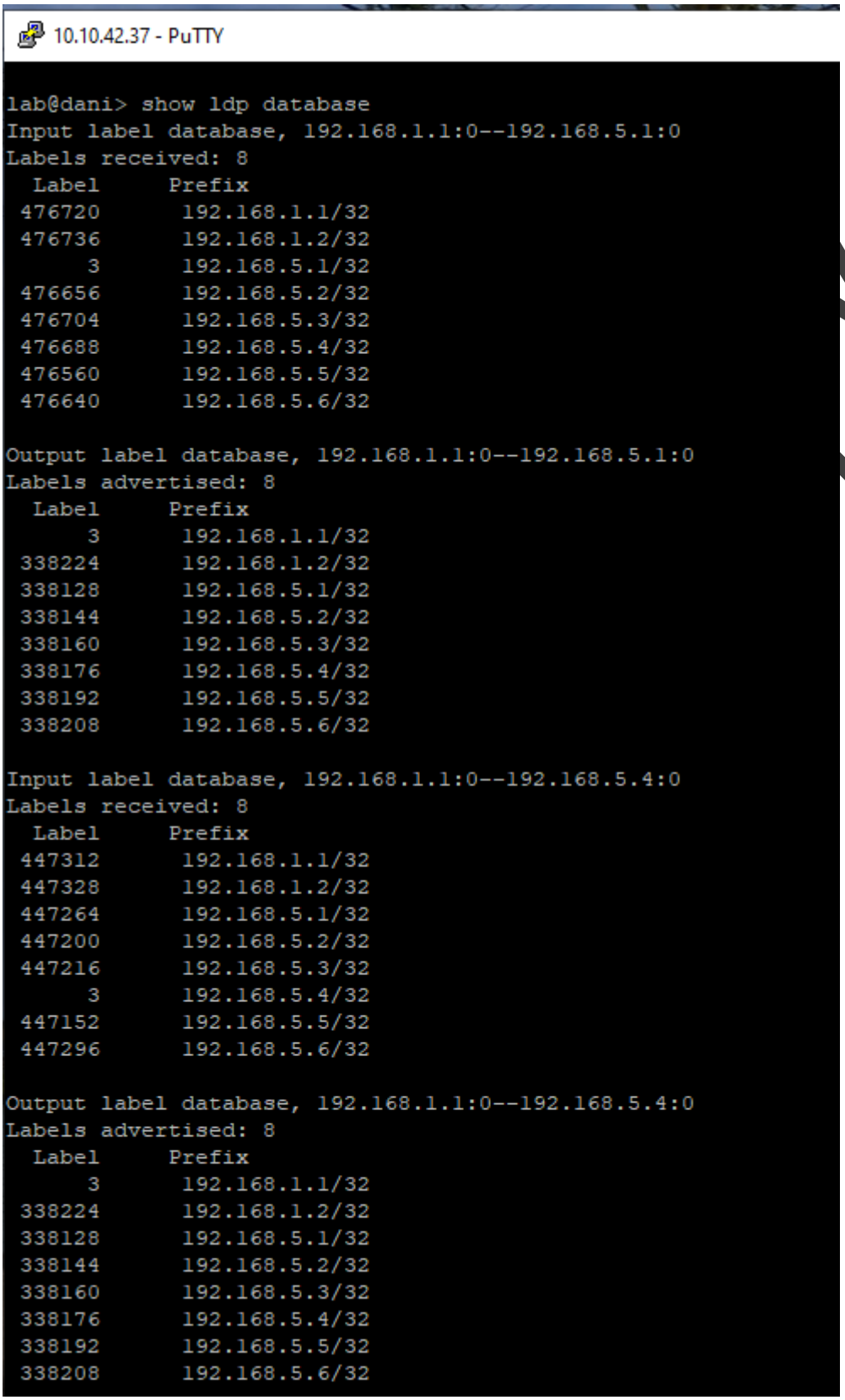


Part 4: Enabling LDP signaling in the core

4.2: show ldp neighbor



4.3: show ldp database



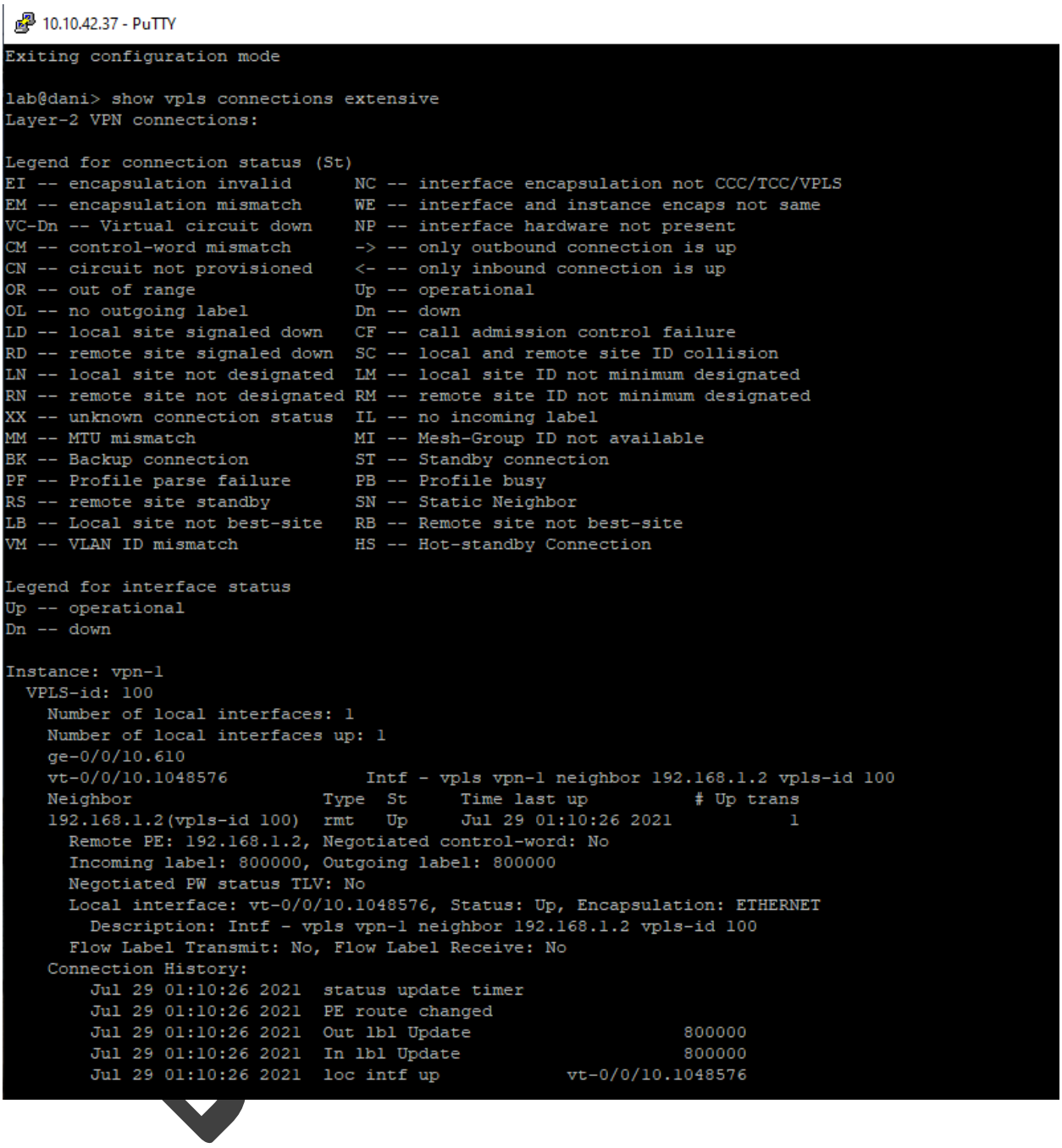
Part 5: Configuring an LDP VPLS instance

5.5: show vpls connections

10.10.42.37 - PuTTY

```
lab@dani> show vpls connections
Layer-2 VPN connections:

Legend for connection status (St)
EI -- encapsulation invalid      NC -- interface encapsulation not CCC/TCC/VPLS
EM -- encapsulation mismatch     WE -- interface and instance encaps not same
VC-Dn -- Virtual circuit down    NP -- interface hardware not present
CM -- control-word mismatch      -> -- only outbound connection is up
CN -- circuit not provisioned    <- -- only inbound connection is up
OR -- out of range               Up -- operational
OL -- no outgoing label          Dn -- down
LD -- local site signaled down   CF -- call admission control failure
RD -- remote site signaled down  SC -- local and remote site ID collision
LN -- local site not designated  LM -- local site ID not minimum designated
RN -- remote site not designated RM -- remote site ID not minimum designated
XX -- unknown connection status  IL -- no incoming label
MM -- MTU mismatch               MI -- Mesh-Group ID not available
BK -- Backup connection          ST -- Standby connection
PF -- Profile parse failure      PB -- Profile busy
RS -- remote site standby        SN -- Static Neighbor
LB -- Local site not best-site   RB -- Remote site not best-site
VM -- VLAN ID mismatch           HS -- Hot-standby Connection

Legend for interface status
Up -- operational
Dn -- down

Instance: vpn-1
  VPLS-id: 100
    Neighbor                Type  St     Time last up          # Up trans
    192.168.1.2(vpls-id 100)  rmt   NP
```

5.7: show vpls connections extensive



5.8: Ping

10.10.42.37 - PuTTY

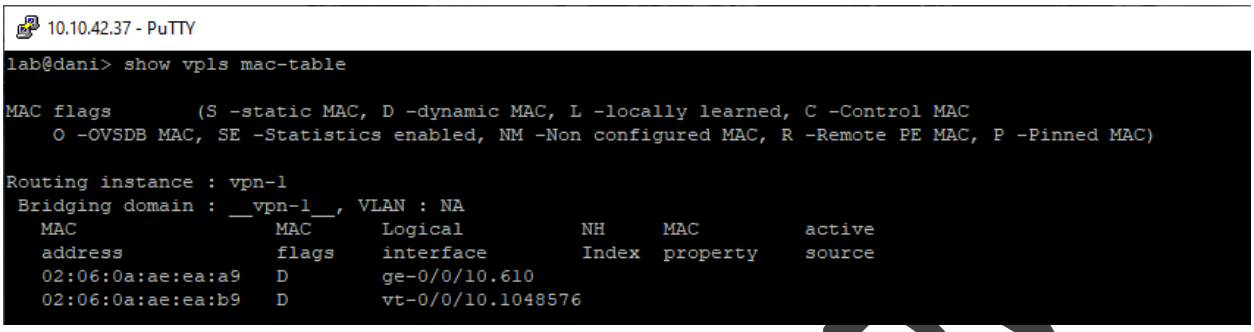
```
lab@dani> ping 10.0.10.2 routing-instance c-router-1-1 count 5
PING 10.0.10.2 (10.0.10.2): 56 data bytes
64 bytes from 10.0.10.2: icmp_seq=0 ttl=64 time=677.670 ms
64 bytes from 10.0.10.2: icmp_seq=1 ttl=64 time=61.366 ms
64 bytes from 10.0.10.2: icmp_seq=2 ttl=64 time=255.542 ms
64 bytes from 10.0.10.2: icmp_seq=3 ttl=64 time=11.112 ms
64 bytes from 10.0.10.2: icmp_seq=4 ttl=64 time=8.026 ms

--- 10.0.10.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 8.026/202.743/677.670/254.153 ms
```

5.9: show vpls statistics

10.10.42.37 - PuTTY

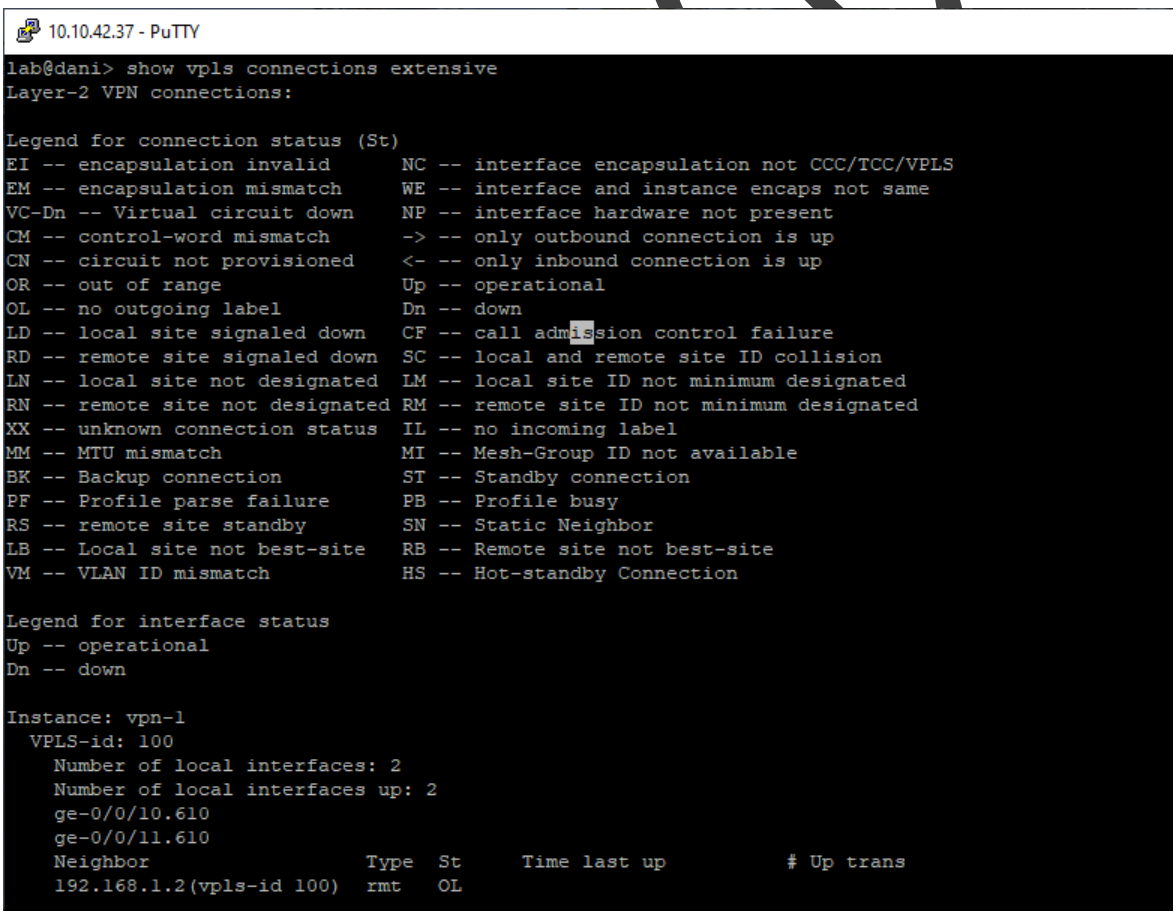
```
lab@dani> show vpls statistics
VPLS statistics:

Instance: vpn-1
   Local interface: ge-0/0/10.610, Index: 350
     Broadcast packets:                    1
     Broadcast bytes  :                   60
     Multicast packets:                    0
     Multicast bytes  :                    0
     Flooded packets  :                    0
     Flooded bytes    :                    0
     Unicast packets  :                   10
     Unicast bytes    :                 1020
     Current MAC count:                    1 (Limit 1024)
   Local interface: vt-0/0/10.1048576, Index: 352
   Remote PE: 192.168.1.2
     Broadcast packets:                    0
     Broadcast bytes  :                    0
     Multicast packets:                    0
     Multicast bytes  :                    0
     Flooded packets  :                    0
     Flooded bytes    :                    0
     Unicast packets  :                   11
     Unicast bytes    :                 1080
     Current MAC count:                    1
```

5.10: show vpls mac-table

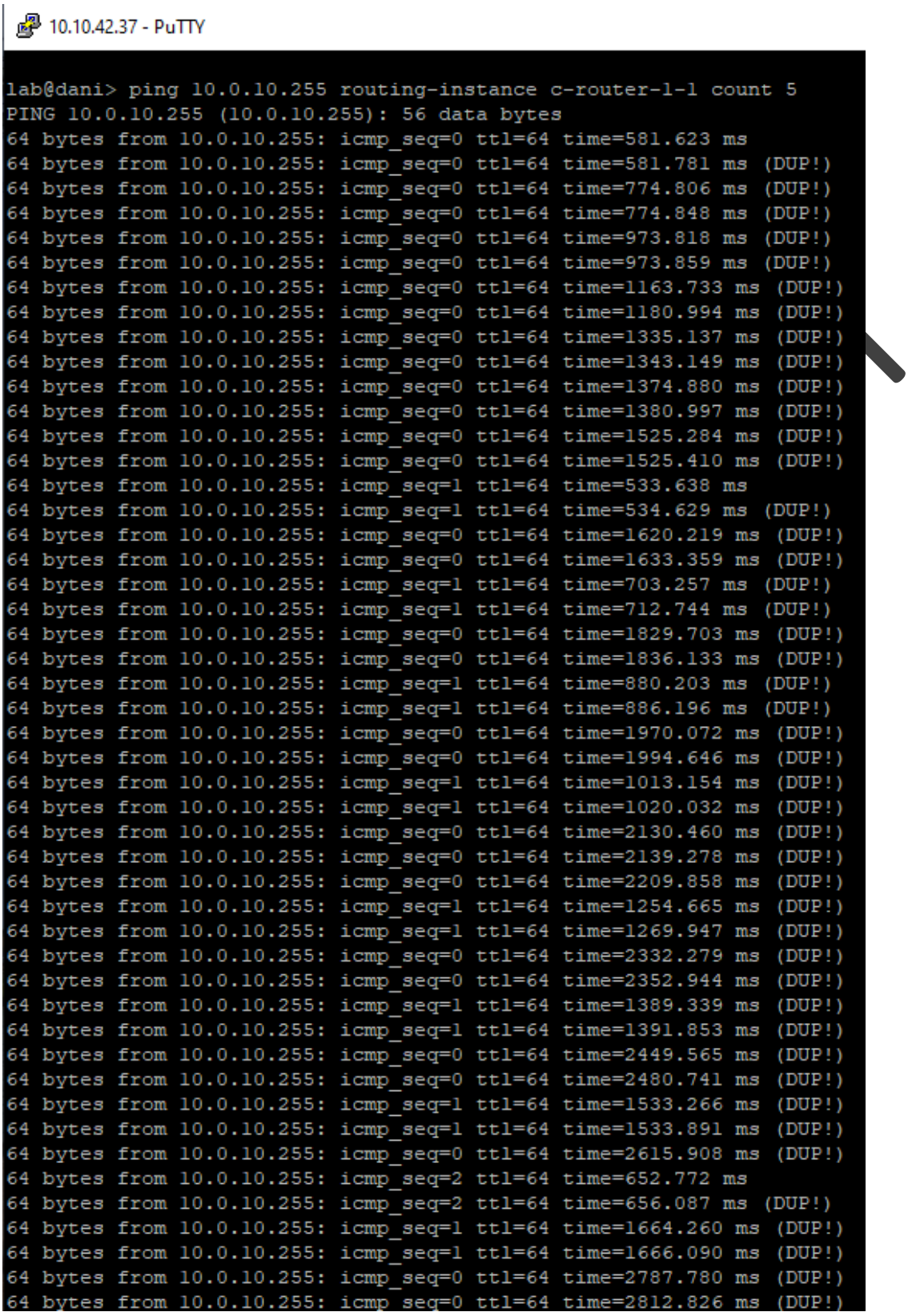


Part 6: Using MSTP to prevent a layer 2 loop in a vpls

6.3: show vpls connections extensive



6.4: ping


10.10.42.37 - PuTTY
lab@dani> ping 10.0.10.255 routing-instance c-router-1-1 count 5
PING 10.0.10.255 (10.0.10.255): 56 data bytes
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=581.623 ms
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=581.781 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=774.806 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=774.848 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=973.818 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=973.859 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1163.733 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1180.994 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1335.137 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1343.149 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1374.880 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1380.997 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1525.284 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1525.410 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=533.638 ms
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=534.629 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1620.219 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1633.359 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=703.257 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=712.744 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1829.703 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1836.133 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=880.203 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=886.196 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1970.072 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=1994.646 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1013.154 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1020.032 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2130.460 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2139.278 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2209.858 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1254.665 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1269.947 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2332.279 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2352.944 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1389.339 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1391.853 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2449.565 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2480.741 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1533.266 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1533.891 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2615.908 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=652.772 ms
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=656.087 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1664.260 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=1666.090 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2787.780 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=2812.826 ms (DUP!)

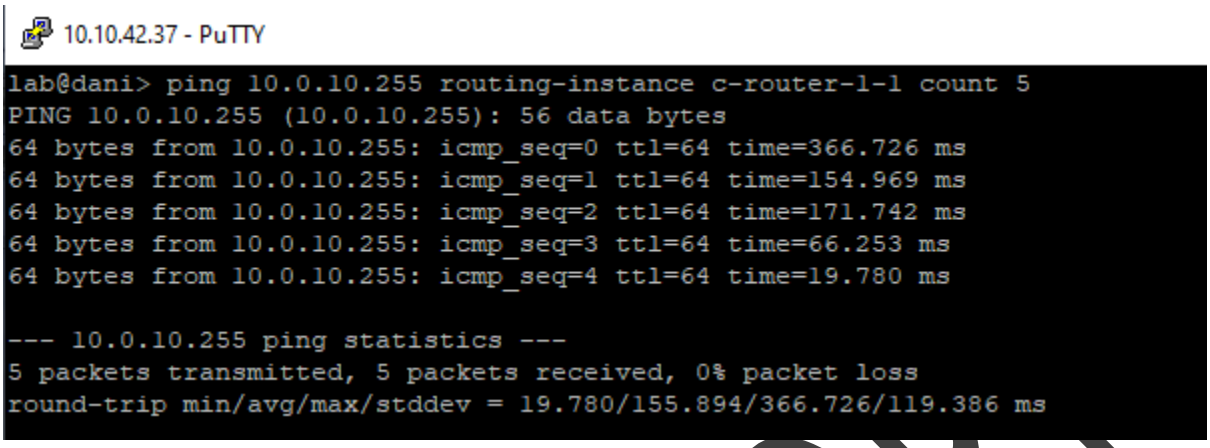
```
64 bytes from 10.0.10.255: icmp_seq=3 ttl=64 time=1033.389 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=3 ttl=64 time=1150.511 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=4768.454 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=5090.276 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=3352.685 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=3468.494 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=4607.834 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=4643.335 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=3 ttl=64 time=2971.499 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=3 ttl=64 time=2971.552 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=6444.317 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=6665.579 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=4674.546 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=4682.908 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=5720.089 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=1 ttl=64 time=5722.479 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=3 ttl=64 time=3761.085 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=3 ttl=64 time=3761.162 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=6806.690 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=0 ttl=64 time=6838.271 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=2 ttl=64 time=4854.208 ms (DUP!)
64 bytes from 10.0.10.255: icmp_seq=4 ttl=64 time=2896.009 ms

--- 10.0.10.255 ping statistics ---
5 packets transmitted, 5 packets received, +96 duplicates, 0% packet loss
round-trip min/avg/max/stddev = 533.638/2327.340/6838.271/1528.614 ms
```

6.8: show spanning-tree interface routing-instance

10.10.42.37 - PuTTY

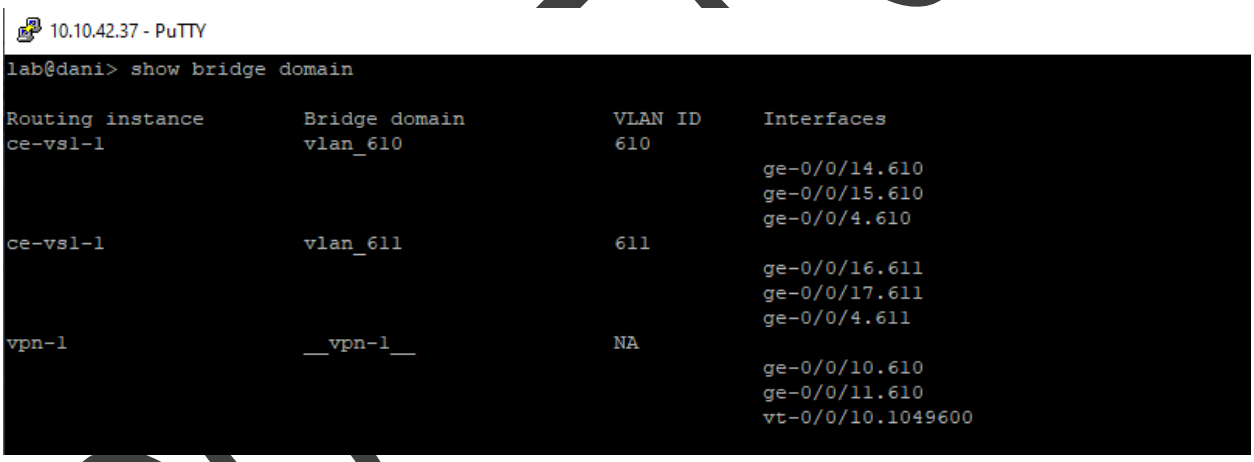
```
lab@dani> show spanning-tree interface routing-instance vpn-l-l2control

Spanning tree interface parameters for instance 0

Interface                   Port ID    Designated         Designated         Port    State  Role
                                       port ID            bridge ID          Cost
ge-0/0/10                   128:492      128:490  32768.2c6bf50404d1        20000    FWD    ROOT
ge-0/0/11                   128:493      128:491  32768.2c6bf50404d1        20000    BLK    ALT

lab@dani> show spanning-tree interface routing-instance ce-vsl-l

Spanning tree interface parameters for instance 0

Interface                   Port ID    Designated         Designated         Port    State  Role
                                       port ID            bridge ID          Cost
ge-0/0/14                   128:490      128:490  32768.2c6bf50404d1        20000    FWD    DESG
ge-0/0/15                   128:491      128:491  32768.2c6bf50404d1        20000    FWD    DESG

lab@dani>
```

6.9: ping



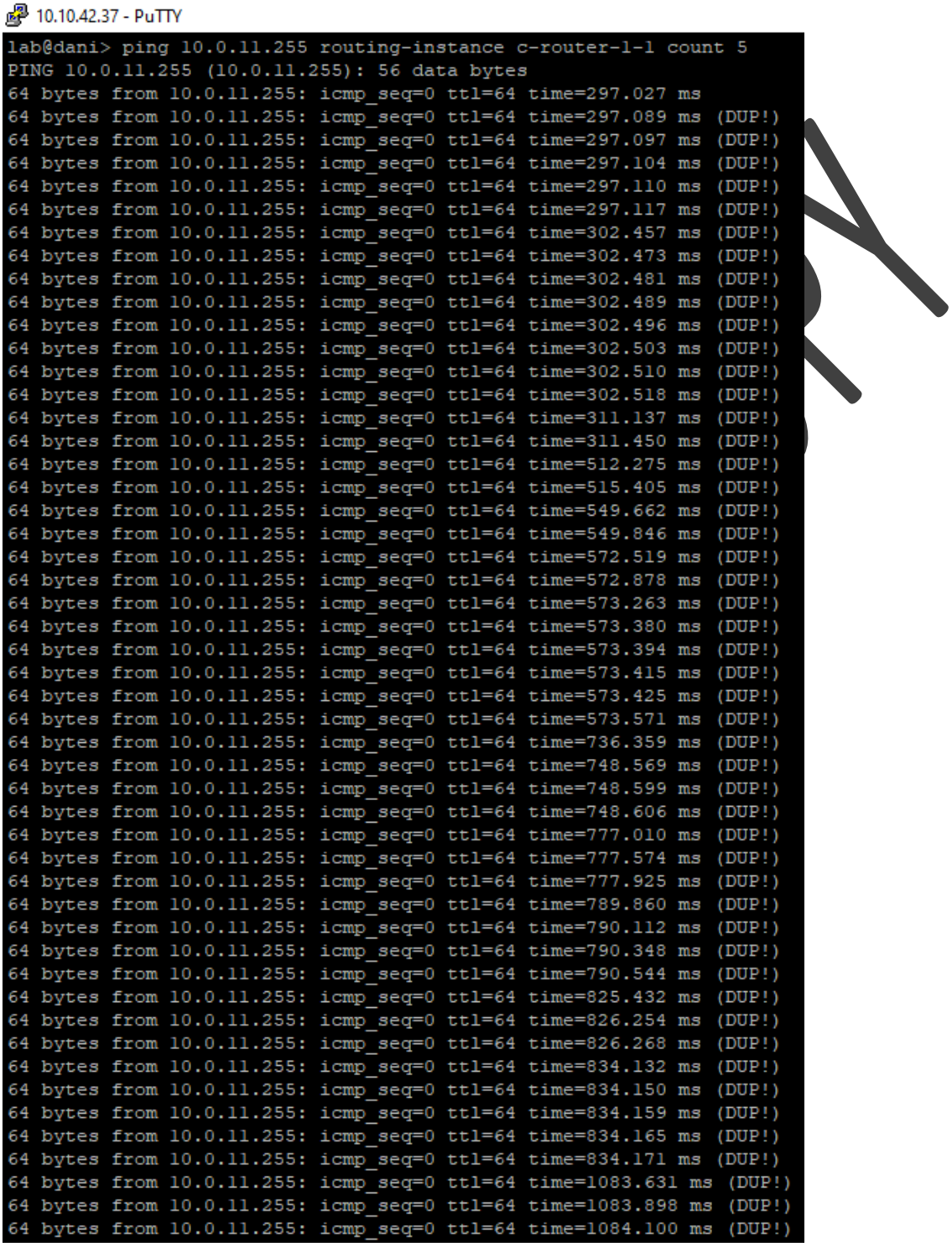
Part 8: Configuring the virtual switch instance

8.3: show bridge domain



Part 9: Configuring a BGP VPLS with redundant links between CE and PE Routers

9.7: ping



10.10.42.37 - PuTTY

```
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2742.471 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5746.045 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3742.925 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2742.489 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4744.123 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5746.069 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3742.949 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2742.513 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4761.429 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4761.454 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3760.823 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5763.965 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2760.406 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4762.042 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3760.864 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5763.998 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2760.438 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5764.013 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3760.893 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2760.458 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4762.093 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4771.086 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3769.922 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5773.058 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2769.498 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5773.072 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3769.953 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2769.518 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4771.154 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4771.162 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3769.983 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5773.117 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2769.857 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5773.436 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3770.318 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2769.884 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4771.520 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4775.786 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3774.711 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5777.847 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2774.286 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=0 ttl=64 time=5778.894 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=2 ttl=64 time=3775.785 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=3 ttl=64 time=2775.351 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=1 ttl=64 time=4777.904 ms (DUP!)
64 bytes from 10.0.11.255: icmp_seq=4 ttl=64 time=1774.349 ms

--- 10.0.11.255 ping statistics ---
5 packets transmitted, 5 packets received, +1961 duplicates, 0% packet loss
round-trip min/avg/max/stddev = 297.027/3735.026/5778.894/1096.590 ms

lab@dani>
```

9.9: show vpls connections extensive

10.10.42.37 - PuTTY

```
lab@dani> show vpls connections extensive
Layer-2 VPN connections:

Legend for connection status (St)
EI -- encapsulation invalid      NC -- interface encapsulation not CCC/TCC/VPLS
EM -- encapsulation mismatch     WE -- interface and instance encaps not same
VC-Dn -- Virtual circuit down    NP -- interface hardware not present
CM -- control-word mismatch      -> -- only outbound connection is up
CN -- circuit not provisioned    <- -- only inbound connection is up
OR -- out of range               Up -- operational
OL -- no outgoing label          Dn -- down
LD -- local site signaled down   CF -- call admission control failure
RD -- remote site signaled down  SC -- local and remote site ID collision
LN -- local site not designated  LM -- local site ID not minimum designated
RN -- remote site not designated RM -- remote site ID not minimum designated
XX -- unknown connection status  IL -- no incoming label
MM -- MTU mismatch               MI -- Mesh-Group ID not available
BK -- Backup connection          ST -- Standby connection
PF -- Profile parse failure      PB -- Profile busy
RS -- remote site standby        SN -- Static Neighbor
LB -- Local site not best-site   RB -- Remote site not best-site
VM -- VLAN ID mismatch           HS -- Hot-standby Connection

Legend for interface status
Up -- operational
Dn -- down

Instance: vpn-l1
Edge protection: Not-Primary
  Local site: ce-vsl-1 (1)
    Number of local interfaces: 2
    Number of local interfaces up: 2
    IRB interface present: no
    ge-0/0/12.611
    ge-0/0/13.611
        Interface flags: VC-Down
    vt-0/0/10.1049857   2         Intf - vpls vpn-l1 local site 1 remote site 2
    Label-base        Offset     Size  Range     Preference
    800256            1          8     8         100
    connection-site           Type  St     Time last up          # Up trans
    2                         rmt   Up     Jul 29 03:02:41 2021           1
      Remote PE: 192.168.1.2, Negotiated control-word: No
      Incoming label: 800257, Outgoing label: 800256
      Local interface: vt-0/0/10.1049857, Status: Up, Encapsulation: VPLS
        Description: Intf - vpls vpn-l1 local site 1 remote site 2
      Flow Label Transmit: No, Flow Label Receive: No
    Connection History:
        Jul 29 03:02:41 2021  status update timer
        Jul 29 03:02:41 2021  loc intf up            vt-0/0/10.1049857
        Jul 29 03:02:41 2021  PE route changed
        Jul 29 03:02:41 2021  Out lbl Update                   800256
        Jul 29 03:02:41 2021  In lbl Update                    800257
```

9.10: show route table vpn-11 extensive

9.11: ping

10.10.42.37 - PuTTY

```
lab@dani> ping 10.0.11.2 routing-instance c-router-1-1 count 5
PING 10.0.11.2 (10.0.11.2): 56 data bytes
64 bytes from 10.0.11.2: icmp_seq=0 ttl=64 time=294.177 ms
64 bytes from 10.0.11.2: icmp_seq=1 ttl=64 time=271.195 ms
64 bytes from 10.0.11.2: icmp_seq=2 ttl=64 time=233.966 ms
64 bytes from 10.0.11.2: icmp_seq=3 ttl=64 time=27.771 ms
64 bytes from 10.0.11.2: icmp_seq=4 ttl=64 time=33.395 ms

--- 10.0.11.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 27.771/172.101/294.177/117.149 ms
```

9.12: show vpls mac-table

10.10.42.37 - PuTTY

```
lab@dani> show vpls mac-table

MAC flags       (S -static MAC, D -dynamic MAC, L -locally learned, C -Control MAC
    O -OVSDB MAC, SE -Statistics enabled, NM -Non configured MAC, R -Remote PE MAC, P -Pinned MAC)

Routing instance : vpn-1
 Bridging domain : __vpn-1__, VLAN : NA
   MAC                 MAC      Logical          NH     MAC         active
   address             flags    interface        Index  property    source
   02:06:0a:ae:ea:a9   D        ge-0/0/10.610
   02:06:0a:ae:ea:b9   D        vt-0/0/10.1049856

MAC flags       (S -static MAC, D -dynamic MAC, L -locally learned, C -Control MAC
    O -OVSDB MAC, SE -Statistics enabled, NM -Non configured MAC, R -Remote PE MAC, P -Pinned MAC)

Routing instance : vpn-11
 Bridging domain : __vpn-11__, VLAN : NA
   MAC                 MAC      Logical          NH     MAC         active
   address             flags    interface        Index  property    source
   02:06:0a:ae:ea:a9   D        ge-0/0/12.611
   02:06:0a:ae:ea:b9   D        vt-0/0/10.1049857
```

9.14: show vpls connections extensive

10.10.42.37 - PuTTY

```
lab@dani> show vpls connections extensive
Layer-2 VPN connections:

Legend for connection status (St)
EI -- encapsulation invalid      NC -- interface encapsulation not CCC/TCC/VPLS
EM -- encapsulation mismatch     WE -- interface and instance encaps not same
VC-Dn -- Virtual circuit down    NP -- interface hardware not present
CM -- control-word mismatch      -> -- only outbound connection is up
CN -- circuit not provisioned    <- -- only inbound connection is up
OR -- out of range               Up -- operational
OL -- no outgoing label          Dn -- down
LD -- local site signaled down   CF -- call admission control failure
RD -- remote site signaled down  SC -- local and remote site ID collision
LN -- local site not designated  LM -- local site ID not minimum designated
RN -- remote site not designated RM -- remote site ID not minimum designated
XX -- unknown connection status  IL -- no incoming label
MM -- MTU mismatch               MI -- Mesh-Group ID not available
BK -- Backup connection          ST -- Standby connection
PF -- Profile parse failure      PB -- Profile busy
RS -- remote site standby        SN -- Static Neighbor
LB -- Local site not best-site   RB -- Remote site not best-site
VM -- VLAN ID mismatch           HS -- Hot-standby Connection

Legend for interface status
Up -- operational
Dn -- down

Instance: vpn-l1
Edge protection: Not-Primary
  Local site: ce-vsl-1 (1)
    Number of local interfaces: 2
    Number of local interfaces up: 1
    IRB interface present: no
    ge-0/0/12.611
        Interface flags: VC-Down
    ge-0/0/13.611
    vt-0/0/10.1049857   2          Intf - vpls vpn-l1 local site 1 remote site 2
    Label-base        Offset     Size  Range     Preference
    800256            1          8     8         100
    connection-site           Type  St     Time last up          # Up trans
    2                         rmt   Up     Jul 29 03:02:41 2021           1
      Remote PE: 192.168.1.2, Negotiated control-word: No
      Incoming label: 800257, Outgoing label: 800256
      Local interface: vt-0/0/10.1049857, Status: Up, Encapsulation: VPLS
        Description: Intf - vpls vpn-l1 local site 1 remote site 2
      Flow Label Transmit: No, Flow Label Receive: No
    Connection History:
        Jul 29 03:02:41 2021  status update timer
        Jul 29 03:02:41 2021  loc intf up            vt-0/0/10.1049857
        Jul 29 03:02:41 2021  PE route changed
        Jul 29 03:02:41 2021  Out lbl Update                   800256
        Jul 29 03:02:41 2021  In lbl Update                    800257
```

9.15: ping

10.10.42.37 - PuTTY

```
lab@dani> ping 10.0.11.2 routing-instance c-router-1-1 count 5
PING 10.0.11.2 (10.0.11.2): 56 data bytes
64 bytes from 10.0.11.2: icmp_seq=0 ttl=64 time=14.998 ms
64 bytes from 10.0.11.2: icmp_seq=1 ttl=64 time=10.429 ms
64 bytes from 10.0.11.2: icmp_seq=2 ttl=64 time=245.463 ms
64 bytes from 10.0.11.2: icmp_seq=3 ttl=64 time=210.035 ms
64 bytes from 10.0.11.2: icmp_seq=4 ttl=64 time=7.090 ms

--- 10.0.11.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 7.090/97.603/245.463/106.882 ms
```

9.16: show vpls mac-table

10.10.42.37 - PuTTY

```
lab@dani> show vpls mac-table

MAC flags       (S -static MAC, D -dynamic MAC, L -locally learned, C -Control MAC
    O -OVSDB MAC, SE -Statistics enabled, NM -Non configured MAC, R -Remote PE MAC, P -Pinned MAC)

Routing instance : vpn-l1
 Bridging domain : __vpn-l1__, VLAN : NA
   MAC               MAC      Logical          NH     MAC         active
   address           flags    interface        Index  property    source
   02:06:0a:ae:ea:a9   D        ge-0/0/13.611
   02:06:0a:ae:ea:b9   D        vt-0/0/10.1049857
```