360SP04-WKB-DIAG02

Cisco Expert-Level Training for CCIE Service Provider Exercise Workbook Diagnostic Lab 02

This diagnostic module is a technology-specific task that focuses on issue spotting and analysis of networking issues.

Cisco Expert-Level Training for CCIE Service Provider Exercise Workbook Diagnostic Lab 02

Table of Contents

Diagnostic Module

Duration

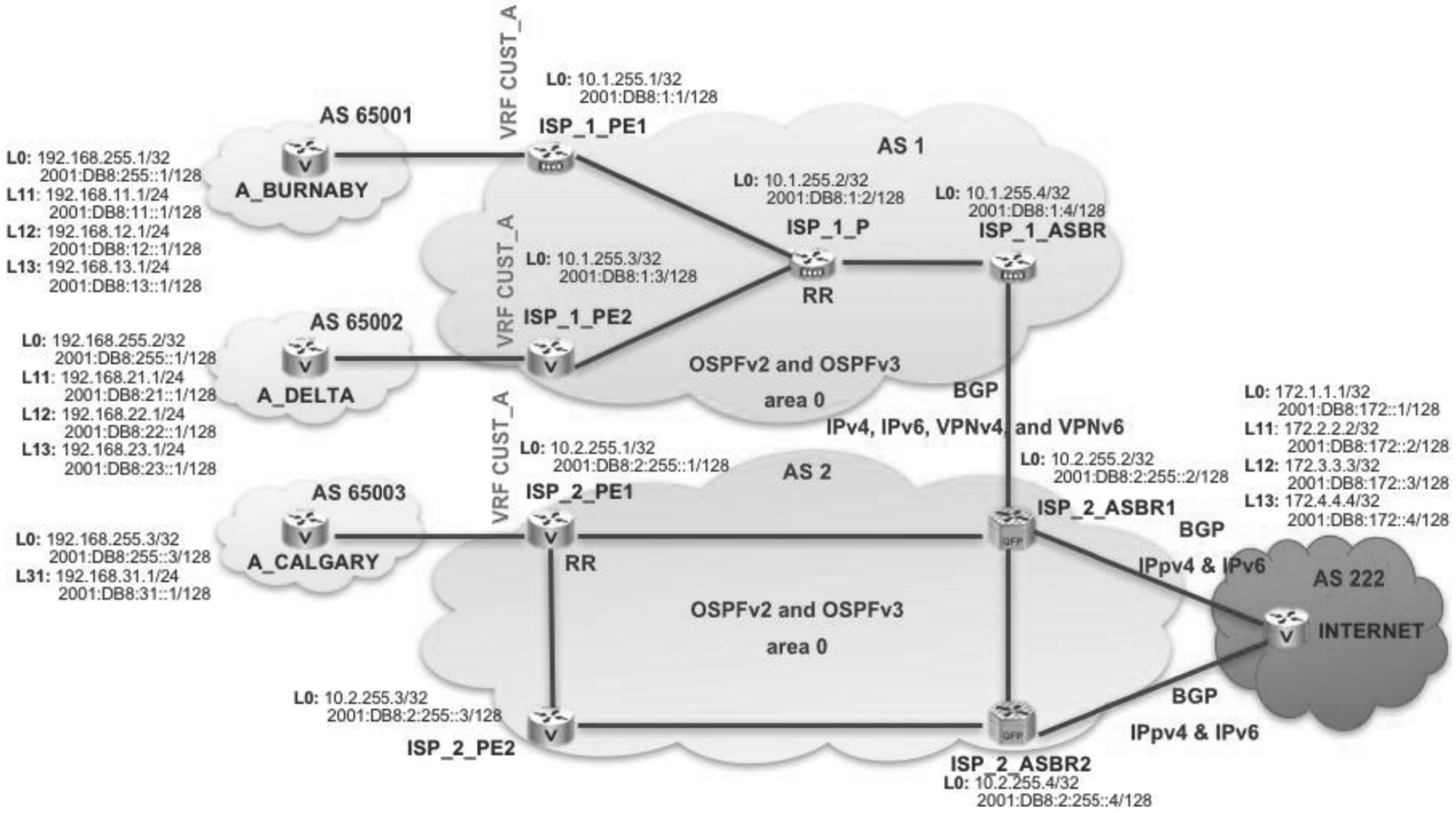
- Diagnostic section duration: 30 minutes total (6 minutes per task in average)

Diagnostic Guidelines

Caution	Read the Following Guidelines Before Starting the Section.

- The diagnostic section is comprised of a set of support tasks for which you are playing the role of Senior Network engineer.
- You have a fixed time of 30 minutes to complete the section, 6 minutes per task in average.
- The real CCIE SP DIAG lab contain 10 tasks and the duration is the 60 minutes.
- The final score of this section is combined with the Troubleshooting and the Configuration sections to comprise your final Pass or Fail status on the CCIE lab exam.
- A student is required to achieve a minimum score in every individual section of the lab exam as well as achieve a minimum overall total score (sum of score in all three sections) in order to pass the Cisco Service Provider certification.
- Each task explicitly mentions what is expected of you.
- Ensure that you carefully read all information provided before selecting your answer(s).
- Select your answer(s) according to the requirement(s) of each task.
- Click the submit button after answering to all tasks in the diagnostic section.
- All tasks are independent from each other, i.e. the resolution of a task does not depend on the resolution of any other task.
- The five tasks of this DIAG module shares the same topology and device configuration. Only the e-mails and output resources are specific per task.

Network Topology



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Task 1: Interior Gateway Protocol

Difficulty Level

- Difficulty: Intermediate

Task Description

ISP_2 recently deployed OSPFv3 in their backbone. Last weekend, an operations engineer noticed that there is no OSPFv3 adjacency between the ISP_2_PE1 and ISP_2_PE2 routers.

Based on the resources provided, you need to diagnose this issue and answer the question.

Indicate what is the root cause of this issue, by selecting one of the options:

- ISP_2_PE1 and ISP_2_PE2 use the same IPv6 link local address on this link.
- There is an area-ID mismatch on the link between ISP_2_PE1 and ISP_2_PE2.
- IPv6 is not enabled on the GigabitEthernet0/1 interface of the ISP_2_PE2.
- There is a duplicated router ID; both routers, ISP_2_PE1 and ISP_2_PE2, use the same router ID.
- There is a network type mismatch on the link between ISP_2_PE1 and ISP_2_PE2.

Resources

- Email thread
- Network Topology
- Device Output
- Device Configuration

Email Thread

From: Skye <skye@isp2.com>
Date: Wed, Jun 28, 2017 at 1:11 PM
To: Support <support@isp2.com>
Subject: CASE #45678 OSPFv3 is not working properly

Hi Support,

We noticed today that there isn't any OSPFv3 adjacency between ISP_2_PE1 and ISP_2_PE2. We deployed exactly the same architecture used for OSPFv2 and we do not understand why in some places the adjacency is not up.

Is this something you can help us fix?

Kind Regards,
Skye

From: Support <support@isp2.com>
Date: Wed, Jun 28, 2017 at 1:34 PM
To: Skye <skye@isp2.com>
Subject: Re: CASE #45678 OSPFv3 is not working properly

Hi Skye,

Certainty we can help. Could you please send us the output of the following show commands? It will help us identify if there are some mistakes in the configuration.

show ospfv3 neighbor
show ospfv3 interface brief
show ospfv3

Regards,
Marshall

From: Skye <skye@isp2.com>
Date: Wed, Jun 28, 2017 at 1:51 PM
To: Marshall <Marshall@isp2.com>
Subject: Re: CASE #45678 OSPFv3 is not working properly
Attachment: log.txt (175KB)

Hi Marshall,

Please, find attached the information requested. We need to have this problem sorted out asap.

Kind Regards,
Skye

<Click here to return to Task 1 description>

Device Output

- **ISP_2_PE1**
  - show ospfv3 neighbor
  - show ospfv3 interface brief
  - show ospfv3

- **ISP_2_PE2**
  - show ospfv3 neighbor
  - show ospfv3 interface brief
  - show ospfv3

<Click here to return to Task 1 description>

- **ISP_2_PE1**
  - show ospfv3 neighbor
  - show ospfv3 interface brief
  - show ospfv3

```
ISP_2_PE1# show ospfv3 neighbor

OSPFv3 1 address-family ipv6 (router-id 10.2.255.1)

Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
ISP_2_ASBR1       1   FULL/BDR        00:00:33    7               GigabitEthernet0/3
```

```
ISP_2_PE1# show ospfv3 interface brief

Interface    PID   Area            AF         Cost  State Nbrs F/C
Lo0          1     0               ipv6       1     LOOP  0/0
Gi0/3        1     0               ipv6       1     DR    1/1
Gi0/2        1     0               ipv6       1     DR    0/0
```

```
ISP_2_PE1# show ospfv3

OSPFv3 1 address-family ipv6
Router ID 10.2.255.1
Supports NSSA (compatible with RFC 3101)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
Retransmission limit dc 24 non-dc 24
Number of external LSA 0. Checksum Sum 0x000000
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Graceful restart helper support enabled
Reference bandwidth unit is 100 mbps
RFC1583 compatibility enabled
Area BACKBONE(0)
Number of interfaces in this area is 3
SPF algorithm executed 8245 times
Number of LSA 15. Checksum Sum 0x08192D
Number of DCbitless LSA 0
```



```
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 4
```

<Click here to return to Device Output>

- **ISP_2_PE2**
  - show ospfv3 neighbor
  - show ospfv3 interface brief
  - show ospfv3

```
ISP_2_PE2# show ospfv3 neighbor

OSPFv3 1 address-family ipv6 (router-id 10.2.255.1)

Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
ISP_2_ASBR2       1   FULL/DR         00:00:34    8               GigabitEthernet0/2
```

```
ISP_2_PE2# show ospfv3 interface brief

Interface    PID   Area            AF         Cost  State Nbrs F/C
Lo0          1     0               ipv6       1     LOOP  0/0
Gi0/2        1     0               ipv6       1     BDR   1/1
Gi0/1        1     0               ipv6       1     DR    0/0
```

```
ISP_2_PE2# show ospfv3

OSPFv3 1 address-family ipv6
Router ID 10.2.255.1
Supports NSSA (compatible with RFC 3101)
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
Retransmission limit dc 24 non-dc 24
Number of external LSA 0. Checksum Sum 0x000000
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Graceful restart helper support enabled
Reference bandwidth unit is 100 mbps
RFC1583 compatibility enabled
Area BACKBONE(0)
Number of interfaces in this area is 3
SPF algorithm executed 8295 times
Number of LSA 13. Checksum Sum 0x064F77
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 4
```

<Click here to return to Device Output>

<Click here to return to Task 1 description>

Task 2: MPLS Traffic Engineering

Difficulty Level

- Difficulty: Advanced

Task Description

ISP_1 uses an MPLS Traffic Engineering solution in their core network. ISP_1_PE1 has a 45 Mbps MPLS TE tunnel configured, where ISP_1_PE2 is the tail-end of this tunnel. The status of this MPLS TE tunnel is down.

Based on the resources provided, you need to diagnose the issue and answer the question.

Indicate what the root cause of this issue is, by selecting one of the options:

- ISP_1_PE1 is missing a static route for the MPLS TE tunnel to be activated.
- ISP_1_P does not have RSVP enabled on the interface facing ISP_1_PE2.
- ISP_1_PE2 does not have **mpls traffic-eng** enabled globally.
- There are not enough bandwidth resources available for the MPLS TE tunnel in the path between ISP_1_P and ISP_1_PE2**.**

Resources

- Email thread
- Network Topology
- Device Output
- Device Configuration

Email Thread

From: Rubble Brown <rubble.brown@isp1.com>
Date: Tuesday, June 27, 2017 at 11:37 AM
To: Diego Garcia <diego.garcia@isp1.com>
Subject: MPLS issue

Hi Diego,

How are you? Sorry for disturbing you, I know that you are very busy, but I am stuck with the MPLS TE tunnel and I need some help.

We enabled MPLS Traffic Engineering a while back in all core devices. Yesterday, we tried to create an MPLS TE tunnel on ISP_1_PE1 destined toward ISP_1_PE2, but the status is always down.

Thank you in advanced for your help,
Rubble

From: Diego Garcia <diego.garcia@isp1.com>
Date: Tuesday, June 27, 2017 at 14:04 PM
To: Rubble Brown <rubble.brown@isp1.com>
Subject: Re: MPLS issue

Hi Rubble,

No worries, I can help you. Did you have any changes on the network besides creating this tunnel on ISP_1_PE1?

B.R.,
Diego

From: Rubble Brown <rubble.brown@isp1.com>
Date: Tuesday, June 27, 2017 at 16:32 PM
To: Diego Garcia <diego.garcia@isp1.com>
Subject: Re: MPLS issue

Hi Diego,

Now that you asked, I remembered that last week we had to RMA one line card on the ISP_1_P router. But, what has this got to do with the MPLS TE tunnel that we are trying to troubleshoot?

Thank you,
R

From: Diego Garcia <diego.garcia@isp1.com>
Date: Tuesday, June 27, 2017 at 17:07 PM
To: Rubble Brown <rubble.brown@isp1.com>
Subject: Re: MPLS issue

Rubble,

We never know if when replacing the line card, you recovered the exact same configuration you had before. Please, compare the information of the following show commands in all three routers involved in this MPLS TE tunnel. I believe you will find the answer to your question.

sh ip rsvp interface
sh mpls interface
sh mpls traffic-eng tunnels

B.R.,
D

<Click here to return to Task 2 description>

Device Output

- **ISP_1_PE1**
  - show mpls traffic-eng tunnels brief
  - show mpls traffic-eng tunnels

- **ISP_1_PE2**
  - show mpls interface
  - show ip rsvp interface

- **ISP_1_P**
  - show mpls interface
  - show ip rsvp interface

<Click here to return to Task 2 description>

- **ISP_1_PE1**
  - show mpls traffic-eng tunnels brief
  - show mpls traffic-eng tunnels

```
ISP_1_PE1# show mpls traffic-eng tunnels brief

TUNNEL NAME          DESTINATION      STATUS  STATE
tunnel-te1           10.1.255.3        down  down
Displayed 1 (of 1) heads, 0 (of 0) midpoints, 0 (of 0) tails
Displayed 0 up, 1 down, 0 recovering, 0 recovered heads
```

```
ISP_1_PE1# show mpls traffic-eng tunnels

Name: tunnel-te1  Destination: 10.1.255.3  Ifhandle:0x480
Signalled-Name: ISP_1_PE1_t1
Status:
Admin:    up Oper: down   Path: not valid   Signalling: Down

path option 1,  type dynamic
Last PCALC Error: Tue Jun 27 05:26:12 2017
Info: No path to destination, 10.1.255.3 (bw)
G-PID: 0x0800 (derived from egress interface properties)
Bandwidth Requested: 45000 kbps  CT0
Creation Time: Tue Jun 27 05:12:51 2017 (1d00h ago)
Config Parameters:
Bandwidth:    45000 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
Metric Type: TE (default)
Hop-limit: disabled
Cost-limit: disabled
AutoRoute:  enabled  LockDown: disabled   Policy class: not set
Forward class: 0 (default)
Forwarding-Adjacency: disabled
Loadshare:          0 equal loadshares
Auto-bw: disabled
Fast Reroute: Disabled, Protection Desired: None
Path Protection: Not Enabled
BFD Fast Detection: Disabled
Reoptimization after affinity failure: Enabled
Soft Preemption: Disabled
Displayed 1 (of 1) heads, 0 (of 0) midpoints, 0 (of 0) tails
Displayed 0 up, 1 down, 0 recovering, 0 recovered heads
```

<Click here to return to Device Output>

- **ISP_1_PE2**
  - show mpls interface
  - show ip rsvp interface

```
ISP_1_PE2# show mpls interface

Interface              IP            Tunnel   BGP Static Operational
GigabitEthernet0/1     Yes (ldp)     Yes      No  No     Yes
```

```
ISP_1_PE2# show ip rsvp interface

interface    rsvp  allocated  i/f max  flow max sub max  VRF
Gi0/1        ena   0          750M     750M     0
```

<Click here to return to Device Output>

- **ISP_1_P**
  - show mpls interface
  - show ip rsvp interface

```
ISP_1_P# show mpls interface

Interface                  LDP      Tunnel   Static   Enabled
-------------------------- -------- -------- -------- --------
GigabitEthernet0/0/0/0     Yes      Yes      No       Yes
GigabitEthernet0/0/0/1     Yes      Yes      No       Yes
GigabitEthernet0/0/0/2     Yes      No       No       Yes
```

```
ISP_1_P# show ip rsvp interface

*: RDM: Default I/F B/W % : 75% [default] (max resv/bc0), 0% [default] (bc1)

Interface   MaxBW (bps)  MaxFlow (bps) Allocated (bps)      MaxSub (bps)
----------- ------------ ------------- -------------------- -------------
Gi0/0/0/0          10M            10M             0 (  0%)             0
Gi0/0/0/1         100M           100M             0 (  0%)             0
```

<Click here to return to Device Output>

<Click here to return to Task 2 description>

Task 3: L3VPN

Difficulty Level

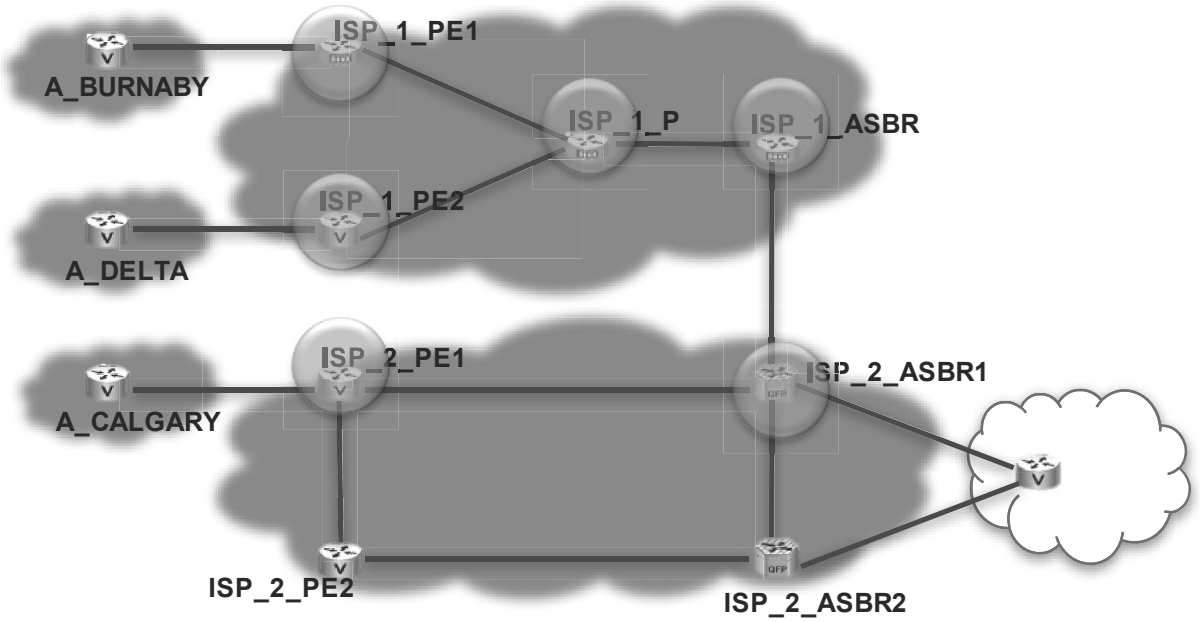
- Difficulty: Basic

Task Description

ISP_1 and ISP_2 use an MPLS Inter-AS solution to provide connectivity between sites of their common customers. Customer_A opened a case with ISP_1 reporting that the Burnaby and Delta sites lost connectivity with the Calgary site.

Based on the resources provided, you need to diagnose the issue and answer the question.

Indicate which device is causing this issue, by click in the device of the diagram:



Resources

- Email thread
- Network Topology
- Device Output
- Device Configuration

Email Thread

From: Dora <dora@isp1.com>
Date: Wednesday, June 28, 2017 at 2:46 PM
To: Everest <everest@isp2.com>
Subject: L3VPN and CSC troubleshooting

Hi Everest,

We are having a lot of complaints from our customers. All of them that have sites connected to our backbone cannot communicate with the remote sites that are directly connected to your backbone.

Are you getting similar complaints? We didn't hear anything from you guys. I just wonder if the issue is only for traffic coming from out backbone going through your backbone. Or if this is a two-way issue.

Please, help us identify what is wrong.

Thank you,
Dora

From: Everest <everest@isp2.com>
Date: Wednesday, June 28, 2017 at 2:46 PM
To: Dora <dora@isp1.com>
Subject: Re: L3VPN and CSC troubleshooting

Hi Dora,

We didn't hear anything, but our communications are down. So, we are troubleshooting our IGP network at the moment. Is this something you can try to check from your side first? I am sending you the information the ASBR from our side receives from your side. There is something there that does not look right.

If after analyzing the outputs you cannot find anything. I can send you the confirmations of our PE routers, so you can compare with yours to see if we have compatible information to import and export the prefixes into the VRF table.

BR,
Everest

<Click here to return to Task 3 description>

Device Output

- **ISP_1_ASBR**
  - show bgp vpnv4 unicast summary
  - show bgp vpnv4 unicast label
  - show mpls forwarding

- **ISP_2_ASBR1**
  - show bgp vpnv4 unicast summary
  - show bgp vpnv4 unicast label
  - show mpls forwarding

<Click here to return to Task 3 description>

- **ISP_1_ASBR**
  - show bgp vpnv4 unicast summary
  - show bgp vpnv4 unicast label
  - show mpls forwarding

```
RP/0/0/CPU0:ISP_1_ASBR# show bgp vpnv4 unicast summary
BGP router identifier 10.1.255.4, local AS number 1
BGP generic scan interval 60 secs
BGP table state: Active
Table ID: 0x0   RD version: 0
BGP main routing table version 34
BGP scan interval 60 secs

BGP is operating in STANDALONE mode.

Process       RcvTblVer   bRIB/RIB   LabelVer  ImportVer  SendTblVer  StandbyVer
Speaker              34         34         34         34          34          34

Neighbor        Spk    AS MsgRcvd MsgSent   TblVer  InQ OutQ  Up/Down  St/PfxRcd
10.1.255.2        0     1    1526    1517       34    0    0    1d01h         11
192.168.101.2     0     2    1689    1520       34    0    0    1d01h          3
```

```
RP/0/0/CPU0:ISP_1_ASBR# show bgp vpnv4 unicast label
BGP router identifier 10.1.255.4, local AS number 1
BGP generic scan interval 60 secs
BGP table state: Active
Table ID: 0x0   RD version: 0
BGP main routing table version 34
BGP scan interval 60 secs

Status codes: s suppressed, d damped, h history, * valid, > best
i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
Network            Next Hop        Rcvd Label      Local Label
Route Distinguisher: 1:1011
*>i192.168.11.0/24    10.1.255.1      24004           24005
*>i192.168.12.0/24    10.1.255.1      24005           24006
*>i192.168.13.0/24    10.1.255.1      24006           24007
*>i192.168.91.0/24    10.1.255.1      24007           24008
*>i192.168.255.1/32   10.1.255.1      24008           24009
Route Distinguisher: 2:1011
*>i10.18.0.0/16       10.1.255.3      31              24014
*>i192.168.21.0/24    10.1.255.3      32              24015
*>i192.168.22.0/24    10.1.255.3      33              24016
*>i192.168.23.0/24    10.1.255.3      34              24017
```

```
*> 192.168.31.0/24    192.168.101.2   22              24010
*>i192.168.92.0/24    10.1.255.3      35              24018
*> 192.168.93.0/24    192.168.101.2   38              24022
*>i192.168.255.2/32   10.1.255.3      36              24019
*> 192.168.255.3/32   192.168.101.2   23              24011

Processed 14 prefixes, 14 paths
```

```
RP/0/0/CPU0:ISP_1_ASBR# show mpls forwarding
Local  Outgoing    Prefix             Outgoing     Next Hop        Bytes
Label  Label       or ID              Interface                    Switched
------ ----------- ------------------ ------------ --------------- ------------
24000  24000       10.1.255.1/32      Gi0/0/0/0    10.1.24.2       1620
24001  Pop         10.1.255.2/32      Gi0/0/0/0    10.1.24.2       286613
24002  Pop         10.1.12.0/24       Gi0/0/0/0    10.1.24.2       0
24003  Pop         10.1.23.0/24       Gi0/0/0/0    10.1.24.2       0
24005  24004       1:1011:192.168.11.0/24   \
       10.1.255.1      0
24006  24005       1:1011:192.168.12.0/24   \
       10.1.255.1      0
24007  24006       1:1011:192.168.13.0/24   \
       10.1.255.1      0
24008  24007       1:1011:192.168.91.0/24   \
       10.1.255.1      520
24009  24008       1:1011:192.168.255.1/32   \
       10.1.255.1      1040
24010  22          2:1011:192.168.31.0/24   \
       192.168.101.2   0
24011  23          2:1011:192.168.255.3/32   \
       192.168.101.2   1560
24012  24          2:1011:2001:db8:255::3/128   \
       192.168.101.2   0
24013  24002       10.1.255.3/32      Gi0/0/0/0    10.1.24.2       540
24014  31          2:1011:10.18.0.0/16   \
       10.1.255.3      0
24015  32          2:1011:192.168.21.0/24   \
       10.1.255.3      0
24016  33          2:1011:192.168.22.0/24   \
       10.1.255.3      0
24017  34          2:1011:192.168.23.0/24   \
       10.1.255.3      0
24018  35          2:1011:192.168.92.0/24   \
       10.1.255.3      0
24019  36          2:1011:192.168.255.2/32   \
       10.1.255.3      520
24020  29          2:1011:2001:db8:192:92::/64   \
       10.1.255.3      0
24021  30          2:1011:2001:db8:255::2/128   \
       10.1.255.3      0
24022  38          2:1011:192.168.93.0/24   \
       192.168.101.2   0
24023  39          2:1011:2001:db8:31::1/128   \
       192.168.101.2   0
24024  40          2:1011:2001:db8:192:93::/64   \
       192.168.101.2   0
24025  Aggregate   192.168.101.0/24   default
```

<Click here to return to Device Output>

- **ISP_2_ASBR1**
  - show bgp vpnv4 unicast summary
  - show bgp vpnv4 unicast label
  - show mpls forwarding

```
ISP_2_ASBR1# show bgp vpnv4 unicast summary
Load for five secs: 2%/0%; one minute: 1%; five minutes: 1%
No time source, *06:25:54.562 UTC Wed Jun 28 2017
BGP router identifier 10.2.255.2, local AS number 2
BGP table version is 27, main routing table version 27
14 network entries using 3584 bytes of memory
14 path entries using 1680 bytes of memory
6/6 BGP path/bestpath attribute entries using 1584 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
5 BGP AS-PATH entries using 152 bytes of memory
1 BGP extended community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 7104 total bytes of memory
BGP activity 735/677 prefixes, 2026/1963 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.2.255.1      4            2    1687    1702       27    0    0 1d01h           3
192.168.101.1   4            1    1527    1696       27    0    0 1d01h          11
```

```
ISP_2_ASBR1# show bgp vpnv4 unicast label
Network          Next Hop      In label/Out label
Route Distinguisher: 1:1011
192.168.11.0     192.168.101.1   25/24005
192.168.12.0     192.168.101.1   26/24006
192.168.13.0     192.168.101.1   27/24007
192.168.91.0     192.168.101.1   29/24008
192.168.255.1/32 192.168.101.1   28/24009
Route Distinguisher: 2:1011
10.18.0.0/16     192.168.101.1   30/24014
192.168.21.0     192.168.101.1   31/24015
192.168.22.0     192.168.101.1   32/24016
192.168.23.0     192.168.101.1   33/24017
192.168.31.0     10.2.255.1      22/19
192.168.92.0     192.168.101.1   34/24018
192.168.93.0     10.2.255.1      38/24
192.168.255.2/32 192.168.101.1   35/24019
192.168.255.3/32 10.2.255.1      23/20
```

```
ISP_2_ASBR1# show mpls forwarding
Load for five secs: 1%/0%; one minute: 1%; five minutes: 1%

Local      Outgoing   Prefix           Bytes Label   Outgoing   Next Hop
Label      Label      or Tunnel Id     Switched      interface
16         Pop Label  10.2.13.0/24     0             Gi2        10.2.12.1
17         Pop Label  10.2.14.0/24     0             Gi5        10.2.34.4
18         Pop Label  10.2.255.1/32    0             Gi2        10.2.12.1
19         16         10.2.255.3/32    0             Gi2        10.2.12.1
          20         10.2.255.3/32    0             Gi5        10.2.34.4
20         Pop Label  10.2.255.4/32    214137        Gi5        10.2.34.4
21         Pop Label  192.168.101.1/32 0             Gi3        192.168.101.1
22         19         2:1011:192.168.31.0/24   \
                                       0             Gi2        10.2.12.1
23         20         2:1011:192.168.255.3/32   \
                                       1770          Gi2        10.2.12.1
24         18         [2:1011]2001:DB8:255::3/128   \
                                       0             Gi2        10.2.12.1
25         24005      1:1011:192.168.11.0/24   \
                                       0             Gi3        192.168.101.1
26         24006      1:1011:192.168.12.0/24   \
```

```
                                    0              Gi3         192.168.101.1
27          24007      1:1011:192.168.13.0/24   \
                                    0              Gi3         192.168.101.1
28          24009      1:1011:192.168.255.1/32   \
                                    1180           Gi3         192.168.101.1
29          24008      1:1011:192.168.91.0/24   \
                                    590            Gi3         192.168.101.1
30          24014      2:1011:10.18.0.0/16   \
                                    0              Gi3         192.168.101.1
31          24015      2:1011:192.168.21.0/24   \
                                    0              Gi3         192.168.101.1
32          24016      2:1011:192.168.22.0/24   \
                                    0              Gi3         192.168.101.1
33          24017      2:1011:192.168.23.0/24   \
                                    0              Gi3         192.168.101.1
34          24018      2:1011:192.168.92.0/24   \
                                    0              Gi3         192.168.101.1
35          24019      2:1011:192.168.255.2/32   \
                                    590            Gi3         192.168.101.1
36          24020      [2:1011]2001:DB8:192:92::/64   \
                                    0              Gi3         192.168.101.1
37          24021      [2:1011]2001:DB8:255::2/128   \
                                    0              Gi3         192.168.101.1
38          24         2:1011:192.168.93.0/24   \
                                    0              Gi2         10.2.12.1
39          25         [2:1011]2001:DB8:31::1/128   \
                                    0              Gi2         10.2.12.1
40          26         [2:1011]2001:DB8:192:93::/64   \
                                    0              Gi2         10.2.12.1
```

<Click here to return to Device Output>

<Click here to return to Task 3 description>

Task 4: PE-CE Connectivity

Difficulty Level

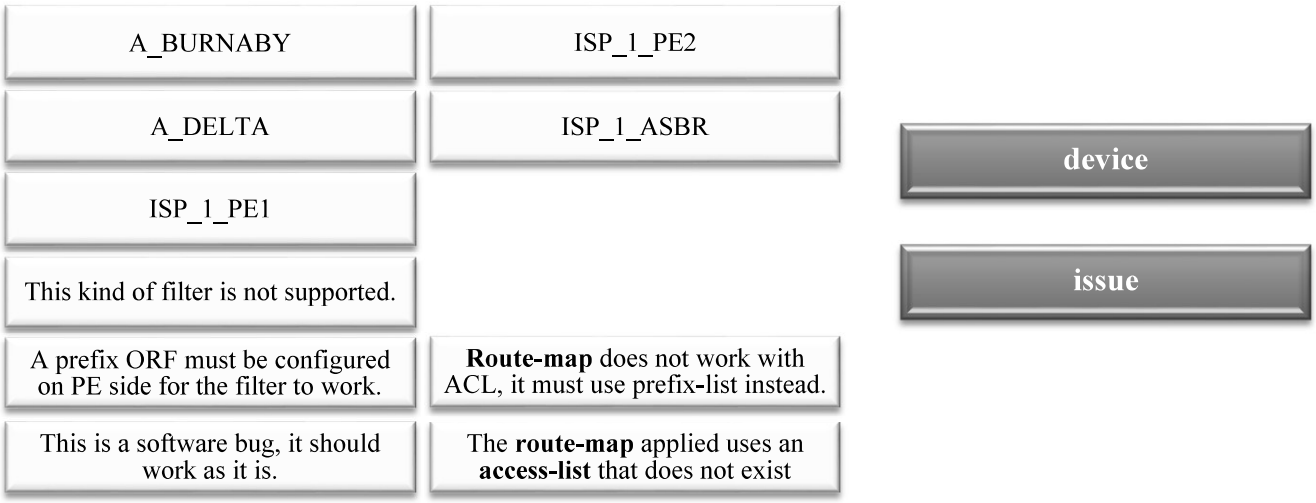
- Difficulty: Intermediate

Task Description

Customer_A is asking for help with investigating an issue related to a BGP filtering applied between a CE and PE link.

Based on the resources provided, you need to diagnose the issue and answer the question.

Drag and drop the *reason* why the PE-CE filtering is not working on the left onto the ***issue*** rectangle on the right. Also drag and drop the *device* responsible for this issue on the left onto the ***device*** rectangle on the right.



Resources

- Email thread
- Network Topology
- Device Output
- Device Configuration

Email Thread

From: Garcia <garcia@customer_a.com>
Date: Thursday, June 28, 2017 at 10:21 PM
To: Pablo <pablo@isp1.comt>
Subject: Routing filter

Hi Pablo,

Could you please help us with an issue related to the BGP filtering?

We need to allow 192.168.22.0/24 to be advertised from Delta to other branches. We applied a route-map and I still see other subnets in the routing table of the other branches.

Cheers,
Garcia

From: Pablo <pablo@isp1.comt>
Date: Thursday, June 28, 2017 at 10:21 PM
To: Garcia <garcia@customer_a.com>
Subject: Re: Routing filter

Hi Garcia,

Did you check if the **show access-list** output and the **show route-map** outputs that you are using to filter the BGP prefixes on your PE-CE connection are matching?

I can assure you from our side everything seems fine.

Cheers,
Pablo

<Click here to return to Task 4 description>

Device Output

- **A_DELTA**
  - show bgp ipv4 unicast neighbor 192.168.92.3 advertised-routes
  - show route-map
  - show access-list

<Click here to return to Task 4 description>

- **A_DELTA**
  - show bgp ipv4 unicast neighbor 192.168.92.3 advertised-routes
  - show route-map
  - show access-list

```
A_DELTA# show bgp ipv4 unicast neighbor 192.168.92.3 advertised-routes

BGP table version is 15, local router ID is 192.168.255.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,

r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

Network          Next Hop            Metric LocPrf Weight Path
*>  10.18.0.0/16     0.0.0.0                  0         32768 ?
*>  192.168.21.0     0.0.0.0                  0         32768 ?
*>  192.168.22.0     0.0.0.0                  0         32768 ?
*>  192.168.23.0     0.0.0.0                  0         32768 ?
*>  192.168.92.0     0.0.0.0                  0         32768 ?
*>  192.168.255.2/32 0.0.0.0                  0         32768 i

Total number of prefixes 6
```

```
A_DELTA# show route-map

route-map ALLOW_SUBNETS, permit, sequence 10
Match clauses:
ip address (access-lists): access-list ALLOW_SUBNETS
Set clauses:
Policy routing matches: 0 packets, 0 bytes
route-map ALLOW_SUBNETS, deny, sequence 100
Match clauses:
Set clauses:
Policy routing matches: 0 packets, 0 bytes
```

```
A_DELTA# show access-list

Standard IP access list ALLOW_SUBNETS
10 permit 192.168.22.0, wildcard bits 0.0.0.255
```

<Click here to return to Device Output>

<Click here to return to Task 4 description>

Task 5: Routing/Fast Convergence

Difficulty Level

- Difficulty: Intermediate

Task Description

ISP_2 uses two ASBRs for Internet connectivity. A design engineer has a requirement to increase fast convergence on the network. For that, the BGP route reflector must have a second path in the BGP database. Right now, it only learns the path from one of the ASBR devices.

Based on the resources provided, you need to diagnose the issue and answer the question.

Select in the drop down list, which solution meets this requirement:

drop down list
Apply the bandwidth community attribute to enable ICMP requirement.
Enable BGP multipath on BGP router reflector device.
Apply advertise external path feature on the 2nd ASBR device.
Enable BGP PIC on the core
Configure IP FRR
Enable MPLS TE/FRR
Enable LDP session protection

Resources

- Email thread
- Network Topology
- Device Output
- Device Configuration

Email Thread

From: Emma <emma@isp2.com>
Date: Thursday, June 29, 2017 at 5:53 PM
To: Diego <diego@support.net>
Subject: BGP advanced features

Hi Diego,

We are trying to improve the network fast convergence and we do not know which BGP feature can meet this requirement. At the moment, the BGP route reflector only learns the Internet prefixes from one of the ASBRs. We would like for the BGP route reflector to have in the information from our second ASBR in the BGP database as well.

Please, guide us how to achieve this requirement by using some of the BGP advanced features.

Thank you very much in advanced for your help,
Emma

<Click here to return to Task 5 description>

Device Output

- **ISP_2_PE1**
  - show bgp ipv6 unicast summary
  - show bgp ipv6 unicast

- **ISP_2_ASBR1**
  - show bgp ipv6 unicast summary
  - show bgp ipv6 unicast

- **ISP_2_ASBR2**
  - show bgp ipv6 unicast summary
  - show bgp ipv6 unicast

<Click here to return to Task 5 description>

- **ISP_2_PE1**
  - show bgp ipv6 unicast summary
  - show bgp ipv6 unicast

```
ISP_2_PE1# show bgp ipv6 unicast summary

BGP router identifier 10.2.255.1, local AS number 2
BGP table version is 6543, main routing table version 6543
16 network entries using 2624 bytes of memory
19 path entries using 1976 bytes of memory
4/4 BGP path/bestpath attribute entries using 576 bytes of memory
5 BGP AS-PATH entries using 120 bytes of memory
1 BGP extended community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 5320 total bytes of memory
BGP activity 2236/2173 prefixes, 4967/4896 paths, scan interval 60 secs

Neighbor           V  AS MsgRcvd MsgSent  TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:2:255::2  4   2    10       7    6543   0    0 00:01:43       12
2001:DB8:2:255::3  4   2     0       0       1   0    0 1d01h        Idle
2001:DB8:2:255::4  4   2    11      11    6543   0    0 00:01:43        4
```

```
ISP_2_PE1# show bgp ipv6 unicast

BGP table version is 6543, local router ID is 10.2.255.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

Network              Next Hop            Metric LocPrf Weight Path
* i 2001:2:12::/64   2001:DB8:2:255::2        0    200      0 ?
*>                   ::                      0         32768 ?
*>  2001:2:13::/64   ::                      0         32768 ?
r>i 2001:2:14::/64   2001:DB8:2:255::4        0    100      0 ?
r i 2001:2:34::/64   2001:DB8:2:255::4        0    100      0 ?
r>i                  2001:DB8:2:255::2        0    200      0 ?
*>i 2001:DB8:1::/64  2001:DB8:2:255::2        0    200      0 ?
* i 2001:DB8:2::/64  2001:DB8:2:255::4        0    100      0 ?
*>i                  2001:DB8:2:255::2        0    200      0 222 ?
```



```
*>  2001:DB8:2:255::1/128
                      ::                         0         32768 ?
r>i 2001:DB8:2:255::2/128
                       2001:DB8:2:255::2         0    200      0 ?
r>i 2001:DB8:2:255::4/128
                       2001:DB8:2:255::4         0    100      0 ?
*>i 2001:DB8:168:101::/64
                      2001:DB8:2:255::2          0    200      0 ?
*>i 2001:DB8:172::1/128
                      2001:DB8:2:255::2          0    200      0 222 ?
*>i 2001:DB8:172::2/128
                      2001:DB8:2:255::2          0    200      0 222 ?
*>i 2001:DB8:172::3/128
                      2001:DB8:2:255::2          0    200      0 222 ?
*>i 2001:DB8:172::4/128
                      2001:DB8:2:255::2          0    200      0 222 ?
*>i 2001:DB8:172::5/128
                      2001:DB8:2:255::2          0    200      0 222 ?
*>i 2001:DB8:172::6/128
                      2001:DB8:2:255::2          0    200      0 222 ?
```

<Click here to return to Device Output>

- **ISP_2_ASBR1**
  - show bgp ipv6 unicast summary
  - show bgp ipv6 unicast

```
ISP_2_ASBR1# show bgp ipv6 unicast summary

BGP router identifier 10.2.255.2, local AS number 2
BGP table version is 9002, main routing table version 9002
16 network entries using 4352 bytes of memory
18 path entries using 2592 bytes of memory
3/3 BGP path/bestpath attribute entries using 744 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
5 BGP AS-PATH entries using 152 bytes of memory
1 BGP extended community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 7944 total bytes of memory
BGP activity 751/693 prefixes, 2071/2008 paths, scan interval 60 secs

Neighbor            V   AS MsgRcvd MsgSent  TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:1::2       4  222    1945    2749    9002    0    0 1d01h           8
2001:DB8:2:255::1   4    2      12      15       1    0    0 00:06:03        5
2001:DB8:168:101::1 4    1       0       0       1    0    0 never        Idle
```

```
ISP_2_ASBR1# show bgp ipv6 unicast
BGP table version is 9002, local router ID is 10.2.255.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

Network          Next Hop            Metric LocPrf Weight Path
* i 2001:2:12::/64   2001:DB8:2:255::1
                                       0    100      0 ?
*>                   ::                0         32768 ?
* i 2001:2:13::/64   2001:DB8:2:255::1
                                       0    100      0 ?
r>i 2001:2:14::/64   2001:DB8:2:255::4
                                       0    100      0 ?
*>  2001:2:34::/64   ::                0         32768 ?
*   2001:DB8:1::/64  2001:DB8:1::2            0             0 222 ?
```

```
*>                    ::                         0         32768 ?
*>  2001:DB8:2::/64   2001:DB8:1::2              0             0 222 ?
* i 2001:DB8:2:255::1/128
    2001:DB8:2:255::1
                                                 0    100      0 ?
*>  2001:DB8:2:255::2/128
                      ::                         0         32768 ?
r>i 2001:DB8:2:255::4/128
                      2001:DB8:2:255::4          0    100      0 ?
*>  2001:DB8:168:101::/64
                      ::                         0         32768 ?
*>  2001:DB8:172::1/128
                      2001:DB8:1::2              0             0 222 ?
*>  2001:DB8:172::2/128
                      2001:DB8:1::2              0             0 222 ?
*>  2001:DB8:172::3/128
                      2001:DB8:1::2              0             0 222 ?
*>  2001:DB8:172::4/128
                      2001:DB8:1::2              0             0 222 ?
*>  2001:DB8:172::5/128
                      2001:DB8:1::2              0             0 222 ?
*>  2001:DB8:172::6/128
                      2001:DB8:1::2              0             0 222 ?
```

<Click here to return to Device Output>

- **ISP_2_ASBR2**
  - show bgp ipv6 unicast summary
  - show bgp ipv6 unicast

```
ISP_2_ASBR2# show bgp ipv6 unicast summary

BGP router identifier 10.2.255.4, local AS number 2
BGP table version is 9077, main routing table version 9077
16 network entries using 4352 bytes of memory
26 path entries using 3744 bytes of memory
5/4 BGP path/bestpath attribute entries using 1240 bytes of memory
2 BGP rrinfo entries using 80 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 9464 total bytes of memory
BGP activity 897/858 prefixes, 3151/3091 paths, scan interval 60 secs

Neighbor            V   AS MsgRcvd MsgSent  TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:DB8:2::1       4  222    1942    3241     9077    0    0 1d02h           8
2001:DB8:2:255::1   4    2      11      11     9077    0    0 00:01:23       14
```

```
ISP_2_ASBR2# show bgp ipv6 unicast

BGP table version is 9077, local router ID is 10.2.255.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
x best-external, a additional-path, c RIB-compressed,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

Network              Next Hop          Metric LocPrf Weight Path
r>i 2001:2:12::/64   2001:DB8:2:255::1
                                            0    100      0 ?
r>i 2001:2:13::/64   2001:DB8:2:255::1      0    100      0 ?
*>  2001:2:14::/64   ::                     0         32768 ?
```



```
* i 2001:2:34::/64   2001:DB8:2:255::2      0    200      0 ?
*>                   ::                     0         32768 ?
*>i 2001:DB8:1::/64  2001:DB8:2:255::2      0    200      0 ?
*                    2001:DB8:2::1          0             0 222 ?
* i 2001:DB8:2::/64  2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
*>                   ::                     0         32768 ?
r>i 2001:DB8:2:255::1/128
                     2001:DB8:2:255::1      0    100      0 ?
r>i 2001:DB8:2:255::2/128
                     2001:DB8:2:255::2      0    200      0 ?
*>  2001:DB8:2:255::4/128
                     ::                     0         32768 ?
*>i 2001:DB8:168:101::/64
                     2001:DB8:2:255::2      0    200      0 ?
*>i 2001:DB8:172::1/128
                     2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
*>i 2001:DB8:172::2/128
                     2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
*>i 2001:DB8:172::3/128
                     2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
*>i 2001:DB8:172::4/128
                     2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
*>i 2001:DB8:172::5/128
                     2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
*>i 2001:DB8:172::6/128
                     2001:DB8:2:255::2      0    200      0 222 ?
*                    2001:DB8:2::1          0             0 222 ?
```

<Click here to return to Device Output>

<Click here to return to Task 5 description>

Device Configuration

- A_BURNABY router
- A_DELTA router
- A_CALGARY router
- INTERNET router
- ISP_1_PE1 router
- ISP_1_PE2 router
- ISP_1_P router
- ISP_1_ASBR router
- ISP_2_PE1 router
- ISP_2_PE2 router
- ISP_2_ASBR1 router
- ISP_2_ASBR2 router

<Click here to return to Task 1 description>

<Click here to return to Task 2 description>

<Click here to return to Task 3 description>

<Click here to return to Task 4 description>

<Click here to return to Task 5 description>

```
hostname A_BURNABY
!
boot-start-marker
boot-end-marker
!
!
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
!
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
!
!
!
!
redundancy
!
!
!
```



```
interface Loopback0
 ip address 192.168.255.1 255.255.255.255
 ipv6 address 2001:DB8:255::1/128
!
interface Loopback11
 ip address 192.168.11.1 255.255.255.0
 ipv6 address 2001:DB8:11::1/128
!
interface Loopback12
 ip address 192.168.12.1 255.255.255.0
 ipv6 address 2001:DB8:12::1/128
!
interface Loopback13
 ip address 192.168.13.1 255.255.255.0
 ipv6 address 2001:DB8:13::1/128
!
interface GigabitEthernet0/0
 ip address 10.18.0.3 255.255.0.0
 shutdown
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/1
 ip address 192.168.91.1 255.255.255.0
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:DB8:192:91::1/64
!
router bgp 65001
 bgp router-id 192.168.255.1
 bgp log-neighbor-changes
 neighbor 2001:DB8:192:91::2 remote-as 1
 neighbor 192.168.91.2 remote-as 1
 !
 address-family ipv4
  network 192.168.11.0
  network 192.168.12.0
  network 192.168.13.0
  network 192.168.255.1 mask 255.255.255.255
  redistribute connected
  no neighbor 2001:DB8:192:91::2 activate
  neighbor 192.168.91.2 activate
  neighbor 192.168.91.2 route-map ALLOW_SUBNETS out
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:192:91::2 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
ip access-list standard ALLOW_SUBNETS
 permit 192.168.12.0 0.0.0.255
!
!
route-map ALLOW_SUBNETS_1 permit 10
 match ip address ALLOW_SUBNETS
!
route-map ALLOW_SUBNETS_1 deny 100
!
route-map ALLOW_SUBNETS permit 10
```

```
 match ip address access-list ALLOW_SUBNETS
!
route-map ALLOW_SUBNETS deny 100
!
!
!
control-plane
!
banner exec ^CCCCCCC ^C
banner incoming ^CCCCCCC ^C
banner login ^CCCCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname A_DELTA
!
boot-start-marker
boot-end-marker
!
!
enable password cisco
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
!
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
!
!
!
!
redundancy
!
!
!
!
interface Loopback0
```



```
 description Loopback
 ip address 192.168.255.2 255.255.255.255
 ipv6 address 2001:DB8:255::2/128
!
interface Loopback11
 ip address 192.168.21.1 255.255.255.0
!
interface Loopback12
 ip address 192.168.22.1 255.255.255.0
!
interface Loopback13
 ip address 192.168.23.1 255.255.255.0
!
interface GigabitEthernet0/0
 description OOB Management
 ip address 10.18.0.6 255.255.0.0
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/1
 description to ISP_1_PE2
 ip address 192.168.92.1 255.255.255.0
 ip ospf cost 1
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:DB8:192:92::1/64
!
router bgp 65002
 bgp router-id 192.168.255.2
 bgp log-neighbor-changes
 neighbor 2001:DB8:192:92::3 remote-as 1
 neighbor 192.168.92.3 remote-as 1
 !
 address-family ipv4
  network 192.168.255.2 mask 255.255.255.255
  redistribute connected
  no neighbor 2001:DB8:192:92::3 activate
  neighbor 192.168.92.3 activate
  neighbor 192.168.92.3 route-map ALLOW_SUBNETS out
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:192:92::3 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
ip access-list standard ALLOW_SUBNETS
 permit 192.168.22.0 0.0.0.255
!
!
route-map ALLOW_SUBNETS permit 10
 match ip address access-list ALLOW_SUBNETS
!
route-map ALLOW_SUBNETS deny 100
!
!
!
control-plane
!
banner exec ^CCCCCCC ^C
```

```
banner incoming ^CCCCCCC ^C
banner login ^CCCCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 password cisco
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 password cisco
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname A_CALGARY
!
boot-start-marker
boot-end-marker
!
!
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
!
!
redundancy
!
!
!
interface Loopback0
 ip address 192.168.255.3 255.255.255.255
 ipv6 address 2001:DB8:255::3/128
!
interface Loopback31
 ip address 192.168.31.1 255.255.255.0
 ipv6 address 2001:DB8:31::1/128
!
interface GigabitEthernet0/0
 ip address 10.18.0.9 255.255.0.0
 shutdown
 duplex auto
 speed auto
 media-type rj45
```



```
!
interface GigabitEthernet0/1
 ip address 192.168.93.1 255.255.255.0
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:DB8:192:93::1/64
!
router bgp 65003
 bgp router-id 192.168.255.3
 bgp log-neighbor-changes
 neighbor 2001:DB8:192:93::2 remote-as 2
 neighbor 192.168.93.2 remote-as 2
 !
 address-family ipv4
  network 192.168.31.0
  network 192.168.255.3 mask 255.255.255.255
  redistribute connected
  no neighbor 2001:DB8:192:93::2 activate
  neighbor 192.168.93.2 activate
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  network 2001:DB8:255::3/128
  neighbor 2001:DB8:192:93::2 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
!
control-plane
!
banner exec ^CCCCCC ^C
banner incoming ^CCCCCC ^C
banner login ^CCCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname INTERNET
!
```

```
boot-start-marker
boot-end-marker
!
!
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
no ip domain lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
!
!
!
!
redundancy
!
!
!
interface Loopback0
 ip address 172.1.1.1 255.255.255.255
 ipv6 address 2001:DB8:172::1/128
!
interface Loopback1
 ip address 172.2.2.2 255.255.255.255
 ipv6 address 2001:DB8:172::2/128
!
interface Loopback2
 ip address 172.3.3.3 255.255.255.255
 ipv6 address 2001:DB8:172::3/128
!
interface Loopback3
 ip address 172.4.4.4 255.255.255.255
 ipv6 address 2001:DB8:172::4/128
!
interface Loopback4
 ip address 172.5.5.5 255.255.255.255
 ipv6 address 2001:DB8:172::5/128
!
interface Loopback5
 ip address 172.6.6.6 255.255.255.255
 ipv6 address 2001:DB8:172::6/128
!
interface GigabitEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/1
 ip address 1.1.1.2 255.255.255.0
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:DB8:1::2/64
!
interface GigabitEthernet0/2
 ip address 2.2.2.1 255.255.255.0
 duplex auto
 speed auto
```



```
 ipv6 address 2001:DB8:2::1/64
!
router bgp 222
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 1.1.1.1 remote-as 2
 neighbor 2.2.2.2 remote-as 2
 neighbor 2001:DB8:1::1 remote-as 2
 neighbor 2001:DB8:2::2 remote-as 2
 !
 address-family ipv4
  redistribute connected
  neighbor 1.1.1.1 activate
  neighbor 2.2.2.2 activate
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:1::1 activate
  neighbor 2001:DB8:2::2 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
!
control-plane
!
banner exec ^CCCCC ^C
banner incoming ^CCCCC ^C
banner login ^CCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_1_PE1
logging console debugging
domain ipv4 host isp_1_p 10.1.255.2
domain ipv4 host isp_1_pe1 10.1.255.1
domain ipv4 host isp_1_pe2 10.1.255.3
domain ipv4 host isp_1_asbr 10.1.255.4
vrf CUST_A
 description Customer A
```

```
 address-family ipv4 unicast
  import route-target
   1:1011
  !
  export route-target
   1:1011
  !
 !
!
interface Loopback0
 ipv4 address 10.1.255.1 255.255.255.255
 ipv6 address 2001:db8:1::1/128
!
interface tunnel-te1
 ipv4 unnumbered Loopback0
 signalled-bandwidth 45000
 autoroute announce
 !
 destination 10.1.255.3
 path-option 1 dynamic
 logging events link-status
!
interface MgmtEth0/0/CPU0/0
 shutdown
!
interface GigabitEthernet0/0/0/0
 vrf CUST_A
 ipv4 address 192.168.91.2 255.255.255.0
 ipv6 address 2001:db8:192:91::2/64
!
interface GigabitEthernet0/0/0/1
 ipv4 address 10.1.12.1 255.255.255.0
 ipv6 address 2001:db8:1:12::1/64
!
route-policy ALLOW_ALL
  pass
end-policy
!
ospf name-lookup
router ospf ISP_A
 log adjacency changes
 router-id 10.1.255.1
 address-family ipv4 unicast
 area 0
  mpls traffic-eng
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/1
   network point-to-point
  !
 !
 mpls traffic-eng router-id 10.1.255.1
!
ospfv3 name-lookup
router ospfv3 ISP_A
 router-id 10.1.255.1
 area 0
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/1
   network point-to-point
  !
 !
 address-family ipv6 unicast
!
router bgp 1
 bgp router-id 10.1.255.1
 address-family ipv4 unicast
```



```
 !
 address-family vpnv4 unicast
 !
 address-family ipv6 unicast
  redistribute connected
 !
 address-family vpnv6 unicast
 !
 neighbor 10.1.255.2
  remote-as 1
  update-source Loopback0
  address-family ipv4 unicast
  !
  address-family vpnv4 unicast
  !
  address-family vpnv6 unicast
  !
 !
 neighbor 2001:db8:1::2
  remote-as 1
  update-source Loopback0
  address-family ipv6 unicast
   next-hop-self
  !
 !
 vrf CUST_A
  rd 1:1011
  address-family ipv4 unicast
   redistribute connected
  !
  address-family ipv6 unicast
   redistribute connected
  !
  neighbor 192.168.91.1
   remote-as 65001
   address-family ipv4 unicast
    route-policy ALLOW_ALL in
    route-policy ALLOW_ALL out
   !
  !
  neighbor 2001:db8:192:91::1
   remote-as 65001
   address-family ipv6 unicast
    route-policy ALLOW_ALL in
    route-policy ALLOW_ALL out
   !
  !
 !
!
rsvp
 interface GigabitEthernet0/0/0/1
  bandwidth 100000
 !
!
mpls traffic-eng
 interface GigabitEthernet0/0/0/1
 !
!
mpls ldp
 log
  neighbor
 !
 router-id 10.1.255.1
 interface GigabitEthernet0/0/0/1
 !
!
end
```

```
hostname ISP_1_PE2
!
boot-start-marker
boot-end-marker
!
!
vrf definition CUST_A
 rd 2:1011
 route-target export 1:1011
 route-target import 1:1011
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
!
no ip domain lookup
ip host ISP_1_P 10.1.255.2
ip host ISP_1_ASBR1 10.1.255.4
ip host ISP_1_PE2 10.1.255.3
ip host ISP_1_PE1 10.1.255.1
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
mpls traffic-eng tunnels
!
!
redundancy
!
!
interface Loopback0
 ip address 10.1.255.3 255.255.255.255
 ipv6 address 2001:DB8:1::3/128
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet0/0
 ip address 10.18.0.14 255.255.0.0
 shutdown
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/1
 ip address 10.1.23.3 255.255.255.0
 ip ospf network point-to-point
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:DB8:1:23::3/64
 mpls traffic-eng tunnels
 mpls ip
 ospfv3 network point-to-point
```



```
 ospfv3 1 ipv6 area 0
 ip rsvp bandwidth
!
interface GigabitEthernet0/2
 vrf forwarding CUST_A
 ip address 192.168.92.3 255.255.255.0
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:DB8:192:92::3/64
!
router ospfv3 1
 !
 address-family ipv6 unicast
 exit-address-family
!
router ospf 1
 mpls traffic-eng router-id Loopback0
 mpls traffic-eng area 0
 router-id 10.1.255.3
 network 10.1.0.0 0.0.255.255 area 0
!
router bgp 1
 bgp router-id 10.1.255.3
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 10.1.255.2 remote-as 1
 neighbor 10.1.255.2 update-source Loopback0
 neighbor 2001:DB8:1::2 remote-as 1
 neighbor 2001:DB8:1::2 update-source Loopback0
 !
 address-family ipv4
  redistribute connected
  neighbor 10.1.255.2 activate
  neighbor 10.1.255.2 next-hop-self
 exit-address-family
 !
 address-family vpnv4
  neighbor 10.1.255.2 activate
  neighbor 10.1.255.2 send-community extended
  neighbor 10.1.255.2 next-hop-self
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:1::2 activate
 exit-address-family
 !
 address-family vpnv6
  neighbor 10.1.255.2 activate
  neighbor 10.1.255.2 send-community extended
  neighbor 10.1.255.2 next-hop-self
 exit-address-family
 !
 address-family ipv4 vrf CUST_A
  neighbor 192.168.92.1 remote-as 65002
  neighbor 192.168.92.1 activate
 exit-address-family
 !
 address-family ipv6 vrf CUST_A
  neighbor 2001:DB8:192:92::1 remote-as 65002
  neighbor 2001:DB8:192:92::1 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
```

```
no ip http secure-server
ip ospf name-lookup
!
ipv6 ospf name-lookup
!
!
mpls ldp router-id Loopback0 force
!
control-plane
!
banner exec ^CCCCC ^C
banner incoming ^CCCCC ^C
banner login ^CCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_1_P
logging console debugging
service timestamps log datetime msec
service timestamps debug datetime msec
telnet vrf default ipv4 server max-servers 10
domain ipv4 host isp_1_p 10.1.255.2
domain ipv4 host isp_1_pe1 10.1.255.1
domain ipv4 host isp_1_pe2 10.1.255.3
domain ipv4 host isp_1_asbr 10.1.255.4
domain lookup disable
cdp
line template vty
 timestamp
 exec-timeout 720 0
!
line console
 exec-timeout 0 0
!
line default
 exec-timeout 720 0
!
vty-pool default 0 50
control-plane
 management-plane
  inband
   interface all
    allow all
   !
  !
 !
!
```



```
interface Loopback0
 description Loopback
 ipv4 address 10.1.255.2 255.255.255.255
 ipv6 address 2001:db8:1::2/128
!
interface MgmtEth0/0/CPU0/0
 description OOB Management
 ! Configured on launch
 ipv4 address 10.18.0.5 255.255.0.0
!
interface GigabitEthernet0/0/0/0
 description to ISP_1_PE2
 cdp
 ipv4 address 10.1.23.2 255.255.255.0
 ipv6 address 2001:db8:1:23::2/64
!
interface GigabitEthernet0/0/0/1
 description to ISP_1_PE1
 cdp
 ipv4 address 10.1.12.2 255.255.255.0
 ipv6 address 2001:db8:1:12::2/64
!
interface GigabitEthernet0/0/0/2
 description to ISP_1_PE1
 cdp
 ipv4 address 10.1.24.2 255.255.255.0
 ipv6 address 2001:db8:1:24::2/64
!
ospf name-lookup
router ospf ISP_A
 log adjacency changes
 router-id 10.1.255.2
 area 0
  mpls traffic-eng
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
   network point-to-point
  !
  interface GigabitEthernet0/0/0/1
   network point-to-point
  !
  interface GigabitEthernet0/0/0/2
   network point-to-point
  !
 !
 mpls traffic-eng router-id 10.1.255.2
!
ospfv3 name-lookup
router ospfv3 ISP_A
 router-id 10.1.255.2
 area 0
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
   network point-to-point
  !
  interface GigabitEthernet0/0/0/1
   network point-to-point
  !
  interface GigabitEthernet0/0/0/2
   network point-to-point
  !
 !
!
router bgp 1
 bgp router-id 10.1.255.2
 address-family ipv4 unicast
```

```
 !
 address-family vpnv4 unicast
 !
 address-family ipv6 unicast
  redistribute connected
 !
 address-family vpnv6 unicast
 !
 session-group AS_1
  remote-as 1
  update-source Loopback0
 !
 neighbor-group AS_1_VPNV4
  use session-group AS_1
  address-family ipv4 unicast
   route-reflector-client
  !
  address-family vpnv4 unicast
   route-reflector-client
  !
  address-family vpnv6 unicast
   route-reflector-client
  !
 !
 neighbor 10.1.255.1
  use neighbor-group AS_1_VPNV4
 !
 neighbor 10.1.255.3
  use neighbor-group AS_1_VPNV4
 !
 neighbor 10.1.255.4
  use neighbor-group AS_1_VPNV4
 !
 neighbor 2001:db8:1::1
  remote-as 1
  update-source Loopback0
  address-family ipv6 unicast
   route-reflector-client
  !
 !
 neighbor 2001:db8:1::3
  remote-as 1
  update-source Loopback0
  address-family ipv6 unicast
   route-reflector-client
  !
 !
 neighbor 2001:db8:1::4
  remote-as 1
  update-source Loopback0
  address-family ipv6 unicast
   route-reflector-client
  !
 !
!
rsvp
 interface GigabitEthernet0/0/0/0
  bandwidth 10000
 !
 interface GigabitEthernet0/0/0/1
  bandwidth 100000
 !
!
mpls traffic-eng
 interface GigabitEthernet0/0/0/0
 !
 interface GigabitEthernet0/0/0/1
 !
```



```
!
mpls ldp
 log
  neighbor
 !
 router-id 10.1.255.2
 interface GigabitEthernet0/0/0/0
 !
 interface GigabitEthernet0/0/0/1
 !
 interface GigabitEthernet0/0/0/2
 !
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_1_ASBR
domain ipv4 host isp_1_p 10.1.255.2
domain ipv4 host isp_1_pe1 10.1.255.1
domain ipv4 host isp_1_pe2 10.1.255.3
domain ipv4 host isp_1_asbr 10.1.255.4
cdp
vrf CUST_A
 description Customer A
 address-family ipv4 unicast
  import route-target
   1:1011
  !
  export route-target
   1:1011
  !
 !
!
interface Loopback0
 ipv4 address 10.1.255.4 255.255.255.255
 ipv6 address 2001:db8:1::4/128
!
interface MgmtEth0/0/CPU0/0
 shutdown
!
interface GigabitEthernet0/0/0/0
 cdp
 ipv4 address 10.1.24.4 255.255.255.0
 ipv6 address 2001:db8:1:24::4/64
!
interface GigabitEthernet0/0/0/1
 cdp
 ipv4 address 192.168.101.1 255.255.255.0
 ipv6 address 2001:db8:168:101::1/64
!
route-policy ALLOW_ALL
  pass
end-policy
!
ospf name-lookup
router ospf ISP_A
 log adjacency changes
 router-id 10.1.255.4
 area 0
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
   network point-to-point
  !
 !
```

```
!
ospfv3 name-lookup
router ospfv3 ISP_A
 router-id 10.1.255.4
 area 0
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
   network point-to-point
  !
 !
!
router bgp 1
 bgp router-id 10.1.255.4
 address-family ipv4 unicast
  redistribute connected
 !
 address-family vpnv4 unicast
  retain route-target all
 !
 address-family ipv6 unicast
  redistribute connected
 !
 address-family vpnv6 unicast
  retain route-target all
 !
 neighbor 10.1.255.2
  remote-as 1
  update-source Loopback0
  address-family ipv4 unicast
   next-hop-self
  !
  address-family vpnv4 unicast
   next-hop-self
  !
  address-family vpnv6 unicast
   next-hop-self
  !
 !
 neighbor 192.168.101.2
  remote-as 2
  address-family ipv4 unicast
   route-policy ALLOW_ALL in
   route-policy ALLOW_ALL out
  !
  address-family vpnv4 unicast
   route-policy ALLOW_ALL in
   route-policy ALLOW_ALL out
  !
  address-family vpnv6 unicast
   route-policy ALLOW_ALL in
   route-policy ALLOW_ALL out
  !
 !
 neighbor 2001:db8:1::2
  remote-as 1
  update-source Loopback0
  address-family ipv6 unicast
   next-hop-self
  !
 !
!
mpls ldp
 log
  neighbor
 !
 router-id 10.1.255.4
 interface GigabitEthernet0/0/0/0
```



```
 !
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_2_PE1
!
boot-start-marker
boot-end-marker
!
!
vrf definition CUST_A
 rd 2:1011
 route-target export 1:1011
 route-target import 1:1011
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
!
no ip domain lookup
ip host ISP_2_ASBR2 10.2.255.4
ip host ISP_2_ASBR1 10.2.255.2
ip host ISP_2_PE2 10.2.255.3
ip host ISP_2_PE1 10.2.255.1
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
!
!
redundancy
!
!
!
interface Loopback0
 ip address 10.2.255.1 255.255.255.255
 ipv6 address 2001:DB8:2:255::1/128
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet0/0
 ip address 10.18.0.8 255.255.0.0
 shutdown
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/1
 vrf forwarding CUST_A
 ip address 192.168.93.2 255.255.255.0
 duplex auto
 speed auto
 media-type rj45
```

```
 ipv6 address 2001:DB8:192:93::2/64
!
interface GigabitEthernet0/2
 ip address 10.2.13.1 255.255.255.0
 ip ospf network point-to-point
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:2:13::1/64
 mpls ip
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet0/3
 ip address 10.2.12.1 255.255.255.0
 ip ospf network point-to-point
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:2:12::1/64
 mpls ip
 ospfv3 1 ipv6 area 0
!
router ospfv3 1
 !
 address-family ipv6 unicast
 exit-address-family
!
router ospf 1
 router-id 10.2.255.1
 network 10.2.0.0 0.0.255.255 area 0
!
router bgp 2
 bgp router-id 10.2.255.1
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 10.2.255.2 remote-as 2
 neighbor 10.2.255.2 update-source Loopback0
 neighbor 10.2.255.3 remote-as 2
 neighbor 10.2.255.3 update-source Loopback0
 neighbor 10.2.255.4 remote-as 2
 neighbor 10.2.255.4 update-source Loopback0
 neighbor 2001:DB8:2:255::2 remote-as 2
 neighbor 2001:DB8:2:255::2 update-source Loopback0
 neighbor 2001:DB8:2:255::3 remote-as 2
 neighbor 2001:DB8:2:255::3 update-source Loopback0
 neighbor 2001:DB8:2:255::4 remote-as 2
 neighbor 2001:DB8:2:255::4 update-source Loopback0
 !
 address-family ipv4
  redistribute connected
  neighbor 10.2.255.2 activate
  neighbor 10.2.255.2 route-reflector-client
  neighbor 10.2.255.3 activate
  neighbor 10.2.255.3 route-reflector-client
  neighbor 10.2.255.4 activate
  neighbor 10.2.255.4 route-reflector-client
 exit-address-family
 !
 address-family vpnv4
  neighbor 10.2.255.2 activate
  neighbor 10.2.255.2 send-community extended
  neighbor 10.2.255.2 route-reflector-client
  neighbor 10.2.255.3 activate
  neighbor 10.2.255.3 send-community extended
  neighbor 10.2.255.3 route-reflector-client
  neighbor 10.2.255.4 activate
  neighbor 10.2.255.4 send-community extended
  neighbor 10.2.255.4 route-reflector-client
```

```
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:2:255::2 activate
  neighbor 2001:DB8:2:255::2 route-reflector-client
  neighbor 2001:DB8:2:255::3 activate
  neighbor 2001:DB8:2:255::3 route-reflector-client
  neighbor 2001:DB8:2:255::4 activate
  neighbor 2001:DB8:2:255::4 route-reflector-client
 exit-address-family
 !
 address-family vpnv6
  neighbor 10.2.255.2 activate
  neighbor 10.2.255.2 send-community extended
  neighbor 10.2.255.2 route-reflector-client
  neighbor 10.2.255.3 activate
  neighbor 10.2.255.3 send-community extended
  neighbor 10.2.255.3 route-reflector-client
  neighbor 10.2.255.4 activate
  neighbor 10.2.255.4 send-community extended
  neighbor 10.2.255.4 route-reflector-client
 exit-address-family
 !
 address-family ipv4 vrf CUST_A
  neighbor 192.168.93.1 remote-as 65003
  neighbor 192.168.93.1 activate
 exit-address-family
 !
 address-family ipv6 vrf CUST_A
  neighbor 2001:DB8:192:93::1 remote-as 65003
  neighbor 2001:DB8:192:93::1 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
ip ospf name-lookup
!
ipv6 ospf name-lookup
!
!
mpls ldp router-id Loopback0 force
!
control-plane
!
banner exec ^CCCCC ^C
banner incoming ^CCCCC ^C
banner login ^CCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
```

```
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_2_PE2
!
boot-start-marker
boot-end-marker
!
!
vrf definition CUST_A
 rd 2:1011
 route-target export 2:1011
 route-target import 2:1011
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
!
no aaa new-model
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
!
!
!
no ip domain lookup
ip host ISP_2_ASBR2 10.2.255.4
ip host ISP_2_ASBR1 10.2.255.2
ip host ISP_2_PE2 10.2.255.3
ip host ISP_2_PE1 10.2.255.1
ip cef
ipv6 unicast-routing
ipv6 cef
!
multilink bundle-name authenticated
!
!
!
!
redundancy
!
!
interface Loopback0
 ip address 10.2.255.3 255.255.255.255
 ipv6 address 2001:DB8:2:255::3/128
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet0/0
 ip address 10.18.0.13 255.255.0.0
 shutdown
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/1
 ip address 10.2.13.3 255.255.255.0
 ip ospf network point-to-point
 duplex auto
 speed auto
```



```
 media-type rj45
 ipv6 address 2001:2:13::3/64
 mpls ip
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet0/2
 ip address 10.2.14.3 255.255.255.0
 ip ospf network point-to-point
 duplex auto
 speed auto
 media-type rj45
 ipv6 address 2001:2:14::3/64
 mpls ip
 ospfv3 1 ipv6 area 0
!
router ospfv3 1
 router-id 10.2.255.1
 !
 address-family ipv6 unicast
 exit-address-family
!
router ospf 1
 router-id 10.2.255.3
 network 10.2.0.0 0.0.255.255 area 0
!
router bgp 2
 bgp router-id 10.2.255.3
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 10.2.255.1 remote-as 2
 neighbor 10.2.255.1 update-source Loopback0
 neighbor 2001:DB8:2:255::1 remote-as 2
 neighbor 2001:DB8:2:255::1 update-source Loopback0
 !
 address-family ipv4
  redistribute connected
  neighbor 10.2.255.1 activate
 exit-address-family
 !
 address-family vpnv4
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 send-community extended
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:2:255::1 activate
  neighbor 2001:DB8:2:255::1 next-hop-self
 exit-address-family
 !
 address-family vpnv6
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 send-community extended
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
ip ospf name-lookup
!
ipv6 ospf name-lookup
!
!
mpls ldp router-id Loopback0 force
!
control-plane
```

```
!
banner exec ^CCCCCC ^C
banner incoming ^CCCCCC ^C
banner login ^CCCCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line aux 0
line vty 0 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
no scheduler allocate
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_2_ASBR1
!
boot-start-marker
boot-end-marker
!
!
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
enable secret 5 $1$ccLx$MiKbPng.bhz0ihWZLleYM1
!
no aaa new-model
!
!
!
!
no ip domain lookup
ip host ISP_2_ASBR2 10.2.255.4
ip host ISP_2_ASBR1 10.2.255.2
ip host ISP_2_PE2 10.2.255.3
ip host ISP_2_PE1 10.2.255.1
!
!
!
ipv6 unicast-routing
!
!
subscriber templating
!
multilink bundle-name authenticated
!
!
crypto pki trustpoint TP-self-signed-3365969175
 enrollment selfsigned
```



```
 subject-name cn=IOS-Self-Signed-Certificate-3365969175
 revocation-check none
 rsakeypair TP-self-signed-3365969175
!
crypto pki trustpoint TP-self-signed-1739757965
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-1739757965
 revocation-check none
 rsakeypair TP-self-signed-1739757965
!
!
crypto pki certificate chain TP-self-signed-3365969175
 certificate self-signed 01
  3082022B 30820194 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
  31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
  69666963 6174652D 33333635 39363931 3735301E 170D3137 30363237 30353132
  31345A17 0D323030 31303130 30303030 305A3031 312F302D 06035504 03132649
  4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D33 33363539
  36393137 3530819F 300D0609 2A864886 F70D0101 01050003 818D0030 81890281
  8100B270 D89EA700 56D3BE4E 470512C1 DBC279D9 2BE88AF9 605EBA0F 5683409A
  27D83488 54EAD2FD C5CF520A 0A18FA73 2E39687C E2FE49E0 C84B9140 3A14548C
  EF42ACDE 12BA3AC8 DE8C5455 9796F16C DC77C41B DBD91A77 0EF5ABFA C2998008
  4513EE8B F5688511 4499E5E7 24543303 6A6F1F7B A8A22888 91FD6613 C0A0BA51
  6B4D0203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF 301F0603
  551D2304 18301680 14F66E24 23BF3F35 492BE864 A541D96B 570CA558 6E301D06
  03551D0E 04160414 F66E2423 BF3F3549 2BE864A5 41D96B57 0CA5586E 300D0609
  2A864886 F70D0101 05050003 8181001D 6D0B8B29 D12ED890 67296BC4 06A169A5
  80937ED1 85554141 D6506563 E8DFB280 31140A55 5D8E3354 FE60466D DB31B821
  F3CBFBD9 28932C20 C3DEEBA6 6A543486 88DA5710 4280962C 1F143C70 C654E7EF
  931614F8 5001CD8F D3CA3321 10BB4050 9638F8F5 C7CC8905 E83B0BA8 4382B4DC
  42A7C7C4 636F44E7 C847557E C08BC5
        quit
crypto pki certificate chain TP-self-signed-1739757965
license udi pid CSR1000V sn 9U74GJ289LH
spanning-tree extend system-id
!
username admin privilege 15 secret 5 $1$Rv8o$JVoN8rxJtSwLm7jwlEz8Y1
!
redundancy
!
!
cdp run
!
!
interface Loopback0
 ip address 10.2.255.2 255.255.255.255
 ipv6 address 2001:DB8:2:255::2/128
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet1
 ip address 10.18.0.10 255.255.0.0
 negotiation auto
!
interface GigabitEthernet2
 ip address 10.2.12.2 255.255.255.0
 ip ospf network point-to-point
 negotiation auto
 ipv6 address 2001:2:12::2/64
 mpls ip
 ospfv3 1 ipv6 area 0
 cdp enable
!
interface GigabitEthernet3
 ip address 192.168.101.2 255.255.255.0
 negotiation auto
 ipv6 address 2001:DB8:168:101::2/64
 mpls bgp forwarding
 cdp enable
```

```
!
interface GigabitEthernet4
 ip address 1.1.1.1 255.255.255.0
 negotiation auto
 ipv6 address FE80::F816:3EFF:FE4D:CA0E link-local
 ipv6 address 2001:DB8:1::1/64
 cdp enable
!
interface GigabitEthernet5
 ip address 10.2.34.3 255.255.255.0
 ip ospf network point-to-point
 negotiation auto
 ipv6 address 2001:2:34::3/64
 mpls ip
 ospfv3 1 ipv6 area 0
 cdp enable
!
router ospfv3 1
 router-id 10.2.255.2
 !
 address-family ipv6 unicast
 exit-address-family
!
router ospf 1
 router-id 10.2.255.2
 network 10.2.0.0 0.0.255.255 area 0
!
router bgp 2
 bgp router-id 10.2.255.2
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 bgp default local-preference 200
 no bgp default route-target filter
 neighbor 1.1.1.2 remote-as 222
 neighbor 10.2.255.1 remote-as 2
 neighbor 10.2.255.1 update-source Loopback0
 neighbor 2001:DB8:1::2 remote-as 222
 neighbor 2001:DB8:2:255::1 remote-as 2
 neighbor 2001:DB8:2:255::1 update-source Loopback0
 neighbor 2001:DB8:168:101::1 remote-as 1
 neighbor 192.168.101.1 remote-as 1
 !
 address-family ipv4
  redistribute connected
  neighbor 1.1.1.2 activate
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 next-hop-self
  neighbor 192.168.101.1 activate
 exit-address-family
 !
 address-family vpnv4
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 send-community extended
  neighbor 10.2.255.1 next-hop-self
  neighbor 192.168.101.1 activate
  neighbor 192.168.101.1 send-community extended
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:1::2 activate
  neighbor 2001:DB8:2:255::1 activate
  neighbor 2001:DB8:2:255::1 next-hop-self
  neighbor 2001:DB8:168:101::1 activate
 exit-address-family
 !
 address-family vpnv6
  neighbor 10.2.255.1 activate
```

```
  neighbor 10.2.255.1 send-community extended
  neighbor 10.2.255.1 next-hop-self
  neighbor 192.168.101.1 activate
  neighbor 192.168.101.1 send-community extended
 exit-address-family
!
!
virtual-service csr_mgmt
!
ip forward-protocol nd
!
ip ospf name-lookup
no ip http server
no ip http secure-server
!
ipv6 ospf name-lookup
!
mpls ldp router-id Loopback0 force
!
!
control-plane
!
banner exec ^CCCC ^C
banner incoming ^CCCC ^C
banner login ^CCCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line vty 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
line vty 1
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 length 0
 transport input all
line vty 2 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
!
end
```

<Click here to return to Device Configuration – Device List>

```
hostname ISP_2_ASBR2
!
boot-start-marker
boot-end-marker
!
```

```
!
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
enable secret 5 $1$5QkN$FUkxWqBOMSlBDrSp66RI.1
!
no aaa new-model
!
!
!
no ip domain lookup
ip host ISP_2_ASBR2 10.2.255.4
ip host ISP_2_ASBR1 10.2.255.2
ip host ISP_2_PE2 10.2.255.3
ip host ISP_2_PE1 10.2.255.1
!
!
ipv6 unicast-routing
!
!
subscriber templating
!
multilink bundle-name authenticated
!
!
crypto pki trustpoint TP-self-signed-2199042052
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-2199042052
 revocation-check none
 rsakeypair TP-self-signed-2199042052
!
!
crypto pki certificate chain TP-self-signed-2199042052
 certificate self-signed 01
  3082022B 30820194 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
  31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
  69666963 6174652D 32313939 30343230 3532301E 170D3137 30363237 30313533
  30305A17 0D323030 31303130 30303030 305A3031 312F302D 06035504 03132649
  4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 31393930
  34323035 3230819F 300D0609 2A864886 F70D0101 01050003 818D0030 81890281
  8100BAD4 4E57459C EA5C0F43 CA4785FB 2A1630A8 13101D80 6D8A2A0A C4011984
  8A44E063 399D33E8 89DF1389 D1AA1BA5 19825EA3 A64AFEF7 A8EB3213 BFFA973E
  4A210D05 C7E2FA28 FC3AA7B1 F922E51B 1FEA1708 444CC418 EFCB8C4C 41F5DF31
  2A5139B9 9EC69438 356DFFEB 6A2CE7DE 489EFEE4 9C79DFF3 A1759BA5 20C4DB0E
  4A5B0203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF 301F0603
  551D2304 18301680 14C7A9A7 28E631B5 37835A84 9D1ACAA9 D1961229 A9301D06
  03551D0E 04160414 C7A9A728 E631B537 835A849D 1ACAA9D1 961229A9 300D0609
  2A864886 F70D0101 05050003 81810003 3ED7C958 6BC97693 B4A698E5 6A8D0EB2
  BAEDD371 F9B98F4B 514DCD70 8081F643 F3A0EF53 C8355C47 330D42CC 802305B7
  41F72EC9 EC543FB6 BFB78E87 51E2741D 426413A4 73042898 924F766B F29CE56D
  DB88F976 B28D74AA A7BE139B D4BFB676 A6D55974 F47AB76E B2DBE52E 9907DF1E
  79F74F64 949ADACE 74DFB0F9 D8EDED
        quit
license udi pid CSR1000V sn 9Y9IQUJ8JI6
spanning-tree extend system-id
!
username admin privilege 15 secret 5 $1$iVZd$SoLH9kWIXHVAivy2SZR2u.
!
redundancy
!
!
cdp run
!
```

```
!
interface Loopback0
 ip address 10.2.255.4 255.255.255.255
 ipv6 address 2001:DB8:2:255::4/128
 ospfv3 1 ipv6 area 0
!
interface GigabitEthernet1
 no ip address
 shutdown
 negotiation auto
!
interface GigabitEthernet2
 ip address 2.2.2.2 255.255.255.0
 negotiation auto
 ipv6 address FE80::F816:3EFF:FE63:3615 link-local
 ipv6 address 2001:DB8:2::2/64
 cdp enable
!
interface GigabitEthernet3
 ip address 10.2.14.4 255.255.255.0
 ip ospf network point-to-point
 negotiation auto
 ipv6 address 2001:2:14::3/64
 mpls ip
 ospfv3 1 ipv6 area 0
 cdp enable
!
interface GigabitEthernet4
 ip address 10.2.34.4 255.255.255.0
 ip ospf network point-to-point
 negotiation auto
 ipv6 address 2001:2:34::4/64
 mpls ip
 ospfv3 1 ipv6 area 0
 cdp enable
!
router ospfv3 1
 router-id 10.2.255.4
 !
 address-family ipv6 unicast
 exit-address-family
!
router ospf 1
 router-id 10.2.255.4
 network 10.2.0.0 0.0.255.255 area 0
!
router bgp 2
 bgp router-id 10.2.255.4
 bgp log-neighbor-changes
 no bgp default ipv4-unicast
 neighbor 2.2.2.1 remote-as 222
 neighbor 10.2.255.1 remote-as 2
 neighbor 10.2.255.1 update-source Loopback0
 neighbor 2001:DB8:2::1 remote-as 222
 neighbor 2001:DB8:2:255::1 remote-as 2
 neighbor 2001:DB8:2:255::1 update-source Loopback0
 !
 address-family ipv4
  redistribute connected
  neighbor 2.2.2.1 activate
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 next-hop-self
 exit-address-family
 !
 address-family vpnv4
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 send-community both
  neighbor 10.2.255.1 next-hop-self
```

```
 exit-address-family
 !
 address-family ipv6
  redistribute connected
  neighbor 2001:DB8:2::1 activate
  neighbor 2001:DB8:2:255::1 activate
  neighbor 2001:DB8:2:255::1 next-hop-self
 exit-address-family
 !
 address-family vpnv6
  neighbor 10.2.255.1 activate
  neighbor 10.2.255.1 send-community both
  neighbor 10.2.255.1 next-hop-self
 exit-address-family
!
!
virtual-service csr_mgmt
!
ip forward-protocol nd
!
ip ospf name-lookup
no ip http server
no ip http secure-server
!
ipv6 ospf name-lookup
!
mpls ldp router-id Loopback0 force
!
!
control-plane
!
banner exec ^CCC ^C
banner incoming ^CCC ^C
banner login ^CCC ^C
!
line con 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 exec prompt timestamp
 stopbits 1
line vty 0
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
line vty 1
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 length 0
 transport input all
line vty 2 4
 exec-timeout 60 0
 privilege level 15
 logging synchronous
 no login
 exec prompt timestamp
 transport input all
!
!
end
```

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