CCIE Service Provider
Full-scale lab: Configuration section

v1.0

Main Table of Contents

Material information and copyrights

Please read following information carefully, as they may influence your ability to properly finish the scenario.

It is best practice for passing real CCIE SP lab to read the whole workbook at least twice, and only then start configuring devices. Some tasks may be connected with each other, and you'll save a lot of time (and possibility of making additional errors) by understanding the whole scenario before starting your work.

You are provided with two Cisco VIRL files - startup and final. After you're done with the scenario, check the configuration against the final config and note differences.

Please remember, than properly loading VIRL files to your VIRL server is out of the scope of this scenario workbook. We provide only best effort support for the scenario. To contact us, please use this e-mail address:

netdesign.zone@gmail.com

Please read following information carefully, as they may influence your ability to properly finish the scenario.

IPv4 topology:
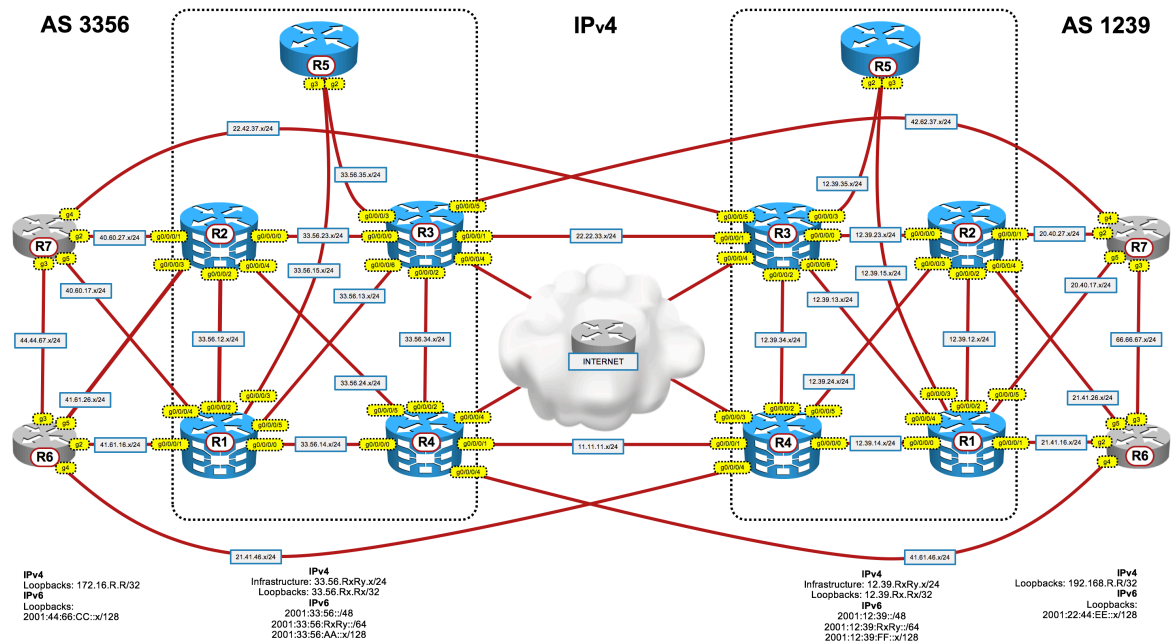
IPv6 topology:
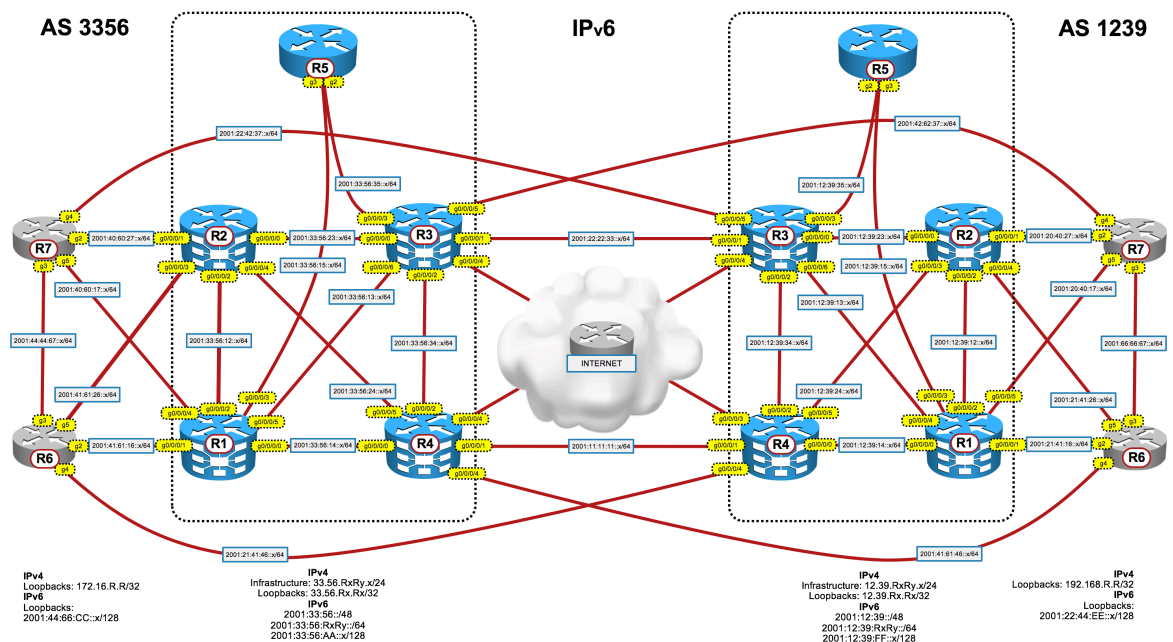
Unless explicitly noted, you are not permitted to create any new interfaces (including tunnel interfaces), or add new routing protocol instances on devices within the pod to solve any of the tasks.

Unless explicitly noted, you should not use redistribution or origination of default route to solve any of the tasks.

Task #1: Border Gateway Protocol (total: 5 points)

Make sure AS3356 and AS1239 have properly configured following sessions:

- eBGP session between AS3356 R3 and AS1239 R3 carrying both IPv4 and IPv6 unicast prefixes
- eBGP session between AS3356 R4 and AS1239 R4 carrying both IPv4 and IPv6 unicast prefixes
- iBGP sessions within AS3356 with RR on R5 for both IPv4 and IPv6 unicast AF
- iBGP sessions within AS1239 with RR on R5 for both IPv4 and IPv6 unicast AF

If there are any missing configuration elements, you are permitted to fix the configuration to be inline with this task requirements.

Task #2: IGP in AS3356 (total: 3 points)

Make sure AS3356 is using OSPFv2 for IPv4 and OSPFv3 for IPv6. Following additional requirements need to be met:

- all links between routers should avoid electing DR and BDR
- in future, network will migrate to 10GE interfaces; please make sure that IGP will treat those interfaces as with cost of 1
- links between R2 and R4 and between R1 and R3 should be preferred for any traffic for IGP carried prefixes; you are not permitted to use any policy based routing mechanisms

If there are any missing configuration elements, you are permitted to fix the configuration to be inline with this task requirements.

Task #3: IGP in AS1239 (total: 3 points)

Make sure AS1239 is using ISIS routing only as IGP for both IPv4 and IPv6. Following requirements needs to be met:

- NET address of 1239 and specific router ID as XX in following format: 1239.0000.0000.00XX.00
- ISIS hello packets should be padded ONLY for initial exchange
- make sure network characteristics for interfaces match this example output from one of the routers (after proper configuration):

```
RP/0/0/CPU0:SP2R1#sh isis adjacency

IS-IS AS1239 Level-2 adjacencies:

System Id      Interface     SNPA           State Hold Changed  NSF IPv4 IPv6
                                                                    BFD  BFD
SP2R2          Gi0/0/0/2     *PtoP*         Up    28   05:46:37 Yes None None
SP2R4          Gi0/0/0/0     *PtoP*         Up    29   05:44:29 Yes None None
SP2R3          Gi0/0/0/4     *PtoP*         Up    22   05:44:48 Yes None None
SP2-R5-RR      Gi0/0/0/3     *PtoP*         Up    27   05:47:22 Yes None None

Total adjacency count: 4
```

Task #4: BGP TE (total: 4 points)

Make sure all traffic inbound to AS3356 from or via AS1239 prefers AS1239 R4 as egress router.

Make sure all traffic inbound to AS1239 from or via AS3356 prefers AS3356 R3 as egress router.

Task #1: MPLS in AS3356 (total: 5 points)

Enable MPLS processing in AS3356 on all interfaces where IGP is running.

Make sure LDP is used to assign labels.

Make sure LDP properly carries information needed to propagate QoS information even on last hop routes within MPLS network.

LDP router id should be based on IP assigned to loopback 0 interface.

Make sure your configuration for LDP characteristics matches this example output:

```
RP/0/0/CPU0:SP1R1#sh mpls ldp interface brief

Interface          VRF Name            Config Enabled IGP-Auto-Cfg TE-Mesh-Grp cfg
---------------    ------------------  ------ ------- ------------ ---------------
Gi0/0/0/0          default             N      Y       1            N/A
Gi0/0/0/1          default             N      N       0            N/A
Gi0/0/0/2          default             N      Y       1            N/A
Gi0/0/0/3          default             N      Y       1            N/A
Gi0/0/0/4          default             N      N       0            N/A
Gi0/0/0/5          default             N      Y       1            N/A
```

Routers within AS3356 should use this label ranges to facilitate troubleshooting:

- R1: 33100-33199
- R2: 33200-33299
- R3: 33300-33399
- R4: 33400-33499
- R5: 33500-33599

Task #2: MPLS in AS1239 (total: 3 points)

Enable MPLS processing in AS1239 on all core facing interfaces.

Make sure LDP is used to assign labels.

Make sure LDP properly carries information needed to propagate QoS information even on last hop routes within MPLS network.

LDP router id should be based on IP assigned to loopback 0 interface.

Task #1: MPLS-TE in AS3356 (total: 2 points)

Build tunnel between R1 and R5, going through R4 and then via R2. Please use only loopback addresses when describing this path.

Tunnel needs to reserve explicitly 15Mbit/s of bandwidth for forwarding traffic. Make sure that if in future any new tunnels appear, this tunnel will be first to be teared down or rerouted.

This tunnel should be best path to R5 loopback address from R1 point of view.

Task #2: MPLS-TE in AS1239 (total: 2 points)

Build tunnel between R2 and R3, going through R1. Please use only loopback addresses when describing this path.

Make sure that this tunnel is treated always with highest importance and needs to stay up using only this specific path.

This tunnel should be best path to R3 loopback address from R2 point of view.

Other tunnel characteristics should be inline with this example output taken from R2:

```
RP/0/0/CPU0:SP2R2#sh 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)
------------------------- -----------  ------------- -------------------- -------------
GigabitEthernet0/0/0/0           1G            1G            0 (   0%)               0
GigabitEthernet0/0/0/2           1G            1G           35M (   3%)              0
GigabitEthernet0/0/0/3           1G            1G            0 (   0%)               0
```

Task #3: MPLS control plane protection (total: 1 point)

Make sure LDP within AS3356 protects label advertisements over links, that may flap from time to time.

Task #1: QoS for traffic from AS3356 (total: 2 points)

Traffic from AS3356 entering AS100 should receive following treatment:

- TCP traffic to ports 80 and 443 should be marked with DSCP AF21
- All other TCP traffic should be marked with DSCP AF23
- UDP traffic to port 53 should be marked with DSCP AF11
- All other UDP traffic should be marked with DSCP 0
- All ICMP traffic should be marked with AF13 and policed down to 32kbps
- All other traffic entering AS100 should be left as-is

Task #1: AS3356 core separation (total: 1 point)

Make sure AS3356 does not propagate TTL information for L3 VPN services. AS3356 devices should not be visible in traceroute output from CE devices.

Task #2: BGP security (total: 2 points)

Make sure eBGP peerings between AS3356 and AS1239 are protected with a lightweight mechanism that makes sure packets can't be injected remotely to direct peerings.

Sessions within ASes need to be protected using password AS3356 for AS3356 and AS1239 for AS1239

Task #3: MPLS security (total: 1 points)

Protect LDP sessions using password LDP in AS3356.