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CCIE Service Provider v5.0
Real Labs
Deploy Module – Lab 1

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8. We do require CISCO ID and Official email id for security purposes. We do not sell without these details. We do background verification of the details provided, so request to give us the correct CISCO ID and official email id.

9. The workbooks are in secured pdc format and delivered via email within 24 hours after payment is received.

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12. We do not provide Refund in any circumstances once the product is sold.

13. This policy is in effect from 23 November 2016 and in immediate effect for new clients and new renewals. Old clients will continue with the old Policies until the accounts get expired.

14. If there is any update, one will receive the update automatically on their registered email id.

15. Design Module will be given only 3 days before the CCIE exam

16. For any future update you can check our 'updates' page.

17. Labs are always published in phases. For e.g., if there is a new lab we publish it as First, Second, Third ... till Final release.

18. Client who have purchased our workbooks and services and wishes to attempt the lab, need to consult our experts before their CCIE Lab.

CCIE Deploy Guidelines

CCIE Service Provided DCO Module Deploy, Operate and Optimize. Before you starting, please read the below guidelines

1. The network that you will deploy, operate and optimize in this module will be similar, but not necessarily identical to the network designed in the previous module. All relevant information that is needed to successfully complete this module can be found in this module itself and overrides any information that was provided in the previous module.

2. Before you start confirm that all devices in your rack are accessible. During the exam, if any device becomes locked or inaccessible, you must recover it.

3. Do not change these parameters, unless you are specifically told to:
   - Hostname and interface descriptions
   - Username admin password admin
   - NSO Credentials = Username nso5, password CCIEsplab

   Line console static and default routes are not permitted unless explicitly stated. This includes floating static routes and routes that are generated by routing protocols.

4. The following routing protocols are partially preconfigured. Additional configuration requirements can be found within the exam itself.
   - Basic IGP
   - External BGP
   - BGP
   - Basic MPLS

5. Points are awarded only for working configurations. No partial scoring is provided. It is recommended that toward the end of the exam you go back and test the functionally as per all question requirements.

6. If you need clarification on any of the questions, or if you suspect that there might be a hardware issue with your equipment, Contact the lab proctor as soon as possible.

7. Item level feedback can be provided at the question level. Feedback will be processed, but Cisco will not reach out to you to discuss any feedback provided. You will not be compensated for time you spend providing feedback.

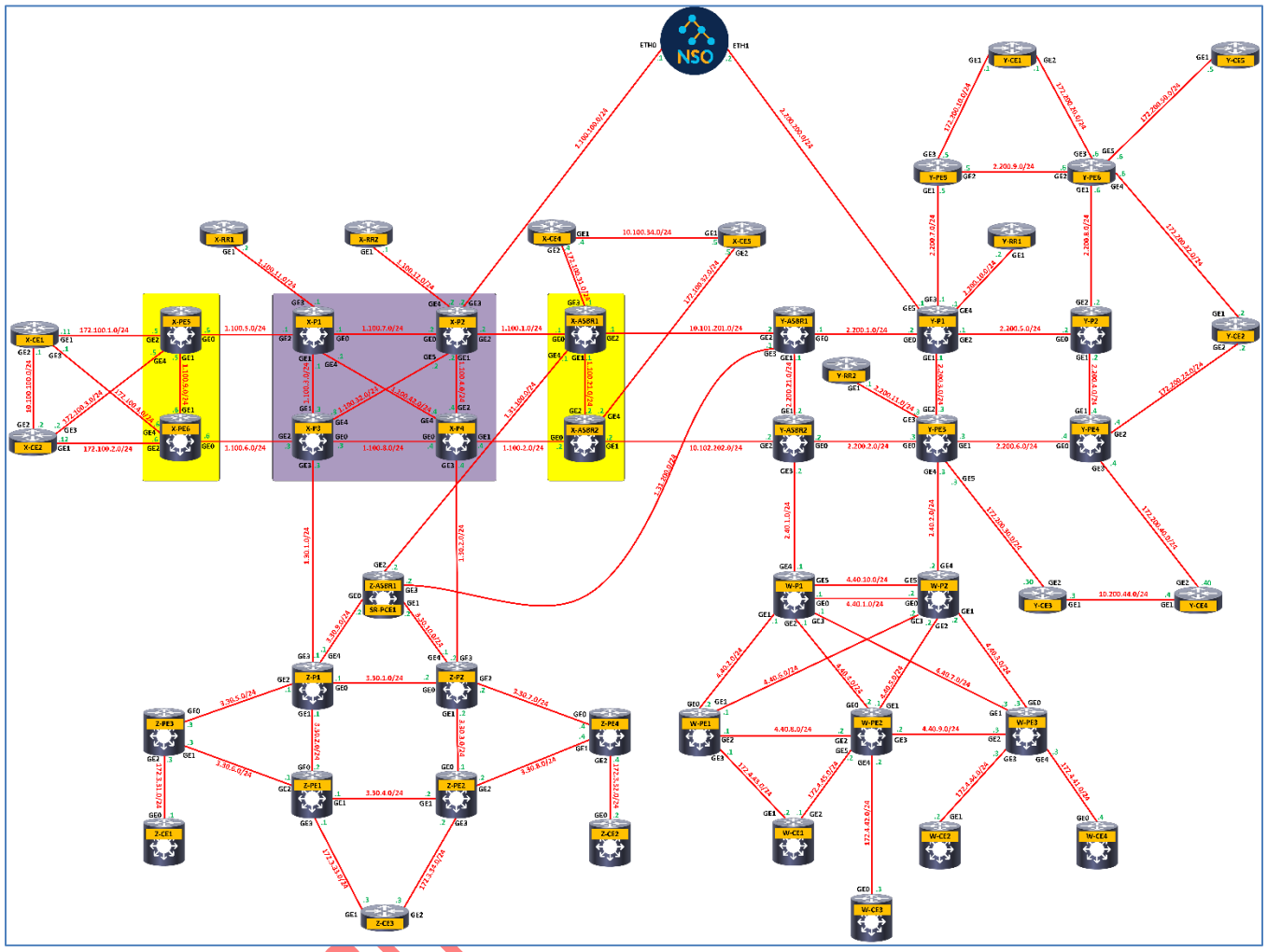
8. Access to select Cisco online documentation is available from your desktop.

When you finish the lab exam make sure that all devices are accessible for the grading proctor, by having them in EXEC mode and close the console windows. A device that is not accessible for grading cannot be marked, and this may cause you to loose substantial points. For Cisco IOS XR devices, make sure that you commit all of your changes and have the prompt in the EXEC mode. Failure to do this, can delay your lab grading.

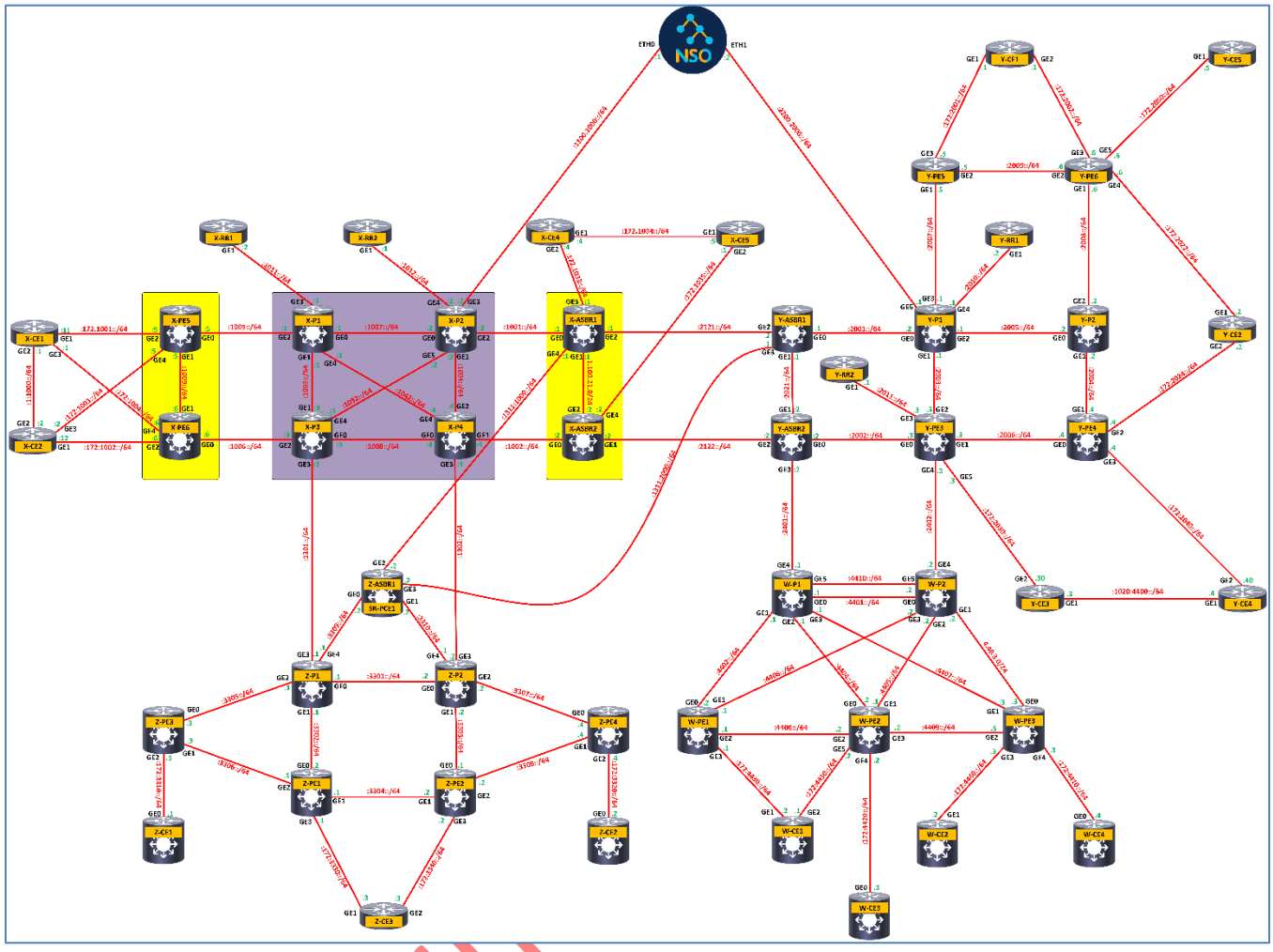
11. You have 5 hours to complete this module. Upon finishing the exam, ensure that all devices are accessible. Any device is not accessible for grading purpose may cause you to lose substantial points.

Diagrams

1. Physical and IPv4 Topology



2. IPv6 Topology



3. IGP and BGP Topology

Next Update

4. L2 / L3 Services Topology

Next Update

Section 1: Core Routing

SECTION 1.1: IGP IS-IS

The Emerald Tier 1 Service Provider operates in different geographical locations. Enable IS-IS in this network across three instances (AGG1, CORE, AGG2) as per given requirements

- All three instances must be in Layer 2.
- Derive the NET-ID where the last three octets of the device loopback0 address should match the system ID of the node. For example, loopback0 address of 10.255.0.1 should have net ID of 49.0001.0010.0255.0000.0001.00
- Only use flexible CLI configuration groups called CCIE-ISIS to simplify the configuration. Use AGG1, CORE and AGG2 IS-IS instances for both IPv4 and IPv6 respectively.
- Use the same IS-IS database for IPv4 and IPv6
- Make sure to allow IS-IS to be able to use metric values higher than 63. Use a Layer 2 metric of 200 for IPv4 and 400 for IPv6.
- Make sure IS-IS adjacency formation/maintenance is optimized from the bandwidth utilization point of view using flexible CLI configuration groups.
- Make sure not to leak IGP routes between the three IS-IS instances.
- Interfaces connected between nodes need to be P2P.
- Make sure both Route Reflectors (RR) are reachable from the IS-IS CORE instance.
- Make sure LDP is enabled in each IS-IS instance.

Refer to Diagrams and Tables 1,2,3 and 4 for more details.

SECTION 1.1: IS-IS-Solution

AGG1 Instance config X-PE5, X-PE6

X-PE5

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
   hello-padding disable
   address-family ipv4 unicast
    metric 200 level 2
   !
   address-family ipv6 unicast
    metric 400 level 2
   !
  !
 !
end-group
!
!
router isis AGG1
 is-type level-2-only
 net 49.0001.0001.0000.0100.0007.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/0
  apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/1
  apply-group CCIE-ISIS
 !
end
```

X-PE6

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
   hello-padding disable
   address-family ipv4 unicast
    metric 200 level 2
   !
   address-family ipv6 unicast
    metric 400 level 2
   !
  !
 !
end-group
!
!
router isis AGG1
 is-type level-2-only
 net 49.0001.0001.0000.0100.0008.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
!
 interface GigabitEthernet0/0/0/0
  apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/1
  apply-group CCIE-ISIS
```

```
 !
End
```

CORE Instance config X-P1, X-P2, X-P3, X-P4, X-RR1, X-RR2

X-P1

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
   hello-padding disable
   address-family ipv4 unicast
    metric 200 level 2
   !
   address-family ipv6 unicast
    metric 400 level 2
   !
  !
 !
end-group
!
!
router isis CORE
 is-type level-2-only
 net 49.0001.0001.0000.0100.0003.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/0
```

```
 apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/1
  apply-group CCIE-ISIS
 !
interface GigabitEthernet0/0/0/3
 apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/4
  apply-group CCIE-ISIS
 !
!
router isis AGG1
 is-type level-2-only
 net 49.0001.0001.0000.0100.0003.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/2
  apply-group CCIE-ISIS
 !
end
```

X-P2

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
```

```
  hello-padding disable
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
!
end-group
!
!
router isis CORE
 is-type level-2-only
 net 49.0001.0001.0000.0100.0004.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/0
  apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/1
  apply-group CCIE-ISIS
 !
!
interface GigabitEthernet0/0/0/4
 apply-group CCIE-ISIS
!
 interface GigabitEthernet0/0/0/5
  apply-group CCIE-ISIS
```

```
 !
!
router isis AGG2
 is-type level-2-only
 net 49.0001.0001.0000.0100.0004.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/2
  apply-group CCIE-ISIS
 !
end
```

X-P3

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
   hello-padding disable
   address-family ipv4 unicast
    metric 200 level 2
   !

!
   address-family ipv6 unicast
    metric 400 level 2
   !
  !
 !
```

```
end-group
!
!
router isis CORE
 is-type level-2-only
 net 49.0001.0001.0000.0100.0005.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/0
  apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/1
  apply-group CCIE-ISIS
 !
interface GigabitEthernet0/0/0/4
  apply-group CCIE-ISIS
 !
!
router isis AGG1
 is-type level-2-only
 net 49.0001.0001.0000.0100.0005.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
```

```
 passive
 address-family ipv4 unicast
  metric 200 level 2
 !
 address-family ipv6 unicast
  metric 400 level 2
 !
!
interface GigabitEthernet0/0/0/2
 apply-group CCIE-ISIS
!
end
```

X-P4

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
   hello-padding disable
   address-family ipv4 unicast
    metric 200 level 2
   !
   address-family ipv6 unicast
    metric 400 level 2
   !
  !
 !
end-group
!
!
router isis CORE
 is-type level-2-only
 net 49.0001.0001.0000.0100.0006.00
 address-family ipv4 unicast
  metric-style wide

 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
```

```
 passive
 address-family ipv4 unicast
  metric 200 level 2
 !
 address-family ipv6 unicast
  metric 400 level 2
 !
!
interface GigabitEthernet0/0/0/0
 apply-group CCIE-ISIS
!
interface GigabitEthernet0/0/0/2
 apply-group CCIE-ISIS
!
interface GigabitEthernet0/0/0/4
 apply-group CCIE-ISIS
!
!
router isis AGG2
 is-type level-2-only
 net 49.0001.0001.0000.0100.0006.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !

 !
 interface GigabitEthernet0/0/0/2
  apply-group CCIE-ISIS
 !
end
```

X-RR1

```
router isis CORE
 net 49.0001.0001.0000.0100.0009.00
 is-type level-2-only
 metric-style wide
 passive-interface Loopback0
!
interface GigabitEthernet1
ip router isis CORE
ipv6 router isis CORE
isis network point-to-point
no isis hello padding
!
Exit
```

X-RR2

```
router isis CORE
 net 49.0001.0001.0000.0100.0010.00
 is-type level-2-only
 metric-style wide
 passive-interface Loopback0
!
interface GigabitEthernet1
ip router isis CORE
ipv6 router isis CORE
isis network point-to-point
no isis hello padding
!
exit
```


AGG2 Instance config X-ASBR1, A-ASBR2

X-ASBR1

```
group CCIE-ISIS
 router isis '.*'
```

```
 interface 'GigabitEthernet.*'
  point-to-point
  hello-padding disable
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
!
end-group
!
!
router isis AGG2
 is-type level-2-only
 net 49.0001.0001.0000.0100.0001.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/0
  apply-group CCIE-ISIS


 !
 interface GigabitEthernet0/0/0/1
  apply-group CCIE-ISIS
 !
end
```

X-ASBR2

```
group CCIE-ISIS
 router isis '.*'
  interface 'GigabitEthernet.*'
   point-to-point
   hello-padding disable
   address-family ipv4 unicast
    metric 200 level 2
   !
   address-family ipv6 unicast
    metric 400 level 2
   !
  !
 !
end-group
!
!
router isis AGG2
 is-type level-2-only
 net 49.0001.0001.0000.0100.0002.00
 address-family ipv4 unicast
  metric-style wide
 !
 address-family ipv6 unicast
  metric-style wide
  single-topology
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 200 level 2
  !
  address-family ipv6 unicast
   metric 400 level 2
  !
 !
 interface GigabitEthernet0/0/0/0
  apply-group CCIE-ISIS
 !
 interface GigabitEthernet0/0/0/2
  apply-group CCIE-ISIS
 !
```

Verification output

Verification command on all **X-PE5, X-PE6, X-PE1, X-PE2, X-PE3, X-PE4, X-ASBR1, X-ASBR2**

```
RP/0/0/CPU0:passsplabs-X-P1#show isis neighbors
Thu Nov 11 12:54:53.947 UTC

IS-IS AGG1 neighbors:
System Id      Interface        SNPA           State Holdtime Type IETF-NSF
passsplabs-X-PE5 Gi0/0/0/2        *PtoP*         Up    28       L2   Capable

Total neighbor count: 1

IS-IS CORE neighbors:
System Id      Interface        SNPA           State Holdtime Type IETF-NSF
passsplabs-X-P4 Gi0/0/0/4         *PtoP*         Up    29       L2   Capable
passsplabs-X-P2 Gi0/0/0/0         *PtoP*         Up    22       L2   Capable
passsplabs-X-P3 Gi0/0/0/1         *PtoP*         Up    28       L2   Capable
passsplabs-X-RR1 Gi0/0/0/3        *PtoP*         Up    23       L2   Capable

Total neighbor count: 4
```

Verification command on all **X-PE5, X-PE6, X-PE1, X-PE2, X-PE3, X-PE4, X-ASBR1, X-ASBR2**

```
RP/0/0/CPU0:passsplabs-X-P1#show isis topology
Thu Nov 11 13:06:04.111 UTC

IS-IS AGG1 paths to IPv4 Unicast (Level-2) routers
System Id       Metric  Next-Hop        Interface       SNPA
passsplabs-X-P1  --
passsplabs-X-P3  600     passsplabs-X-PE5  Gi0/0/0/2       *PtoP*
passsplabs-X-PE5  200     passsplabs-X-PE5  Gi0/0/0/2       *PtoP*
passsplabs-X-PE6  400     passsplabs-X-PE5  Gi0/0/0/2       *PtoP*

IS-IS CORE paths to IPv4 Unicast (Level-2) routers
System Id       Metric  Next-Hop        Interface       SNPA
passsplabs-X-P1  --
passsplabs-X-P2  200     passsplabs-X-P2  Gi0/0/0/0       *PtoP*
passsplabs-X-P3  200     passsplabs-X-P3  Gi0/0/0/1       *PtoP*
passsplabs-X-P4  200     passsplabs-X-P4  Gi0/0/0/4       *PtoP*
passsplabs-X-RR1  200     passsplabs-X-RR1  Gi0/0/0/3       *PtoP*
passsplabs-X-RR2  400     passsplabs-X-P2  Gi0/0/0/0       *PtoP*
```

Verification command on all **X-PE5, X-PE6, X-PE1, X-PE2, X-PE3, X-PE4, X-ASBR1, X-ASBR2**

```
RP/0/0/CPU0:passsplabs-X-PE5#show route ipv4 | inc L2
Thu Nov 11 14:26:10.840 UTC
       i - ISIS, L1 - IS-IS level-1, L2 - IS-IS level-2
i L2 1.0.100.3/32 [115/400] via 1.100.5.1, 14:50:44, GigabitEthernet0/0/0/0
i L2 1.0.100.5/32 [115/600] via 1.100.9.6, 20:01:02, GigabitEthernet0/0/0/1
i L2 1.0.100.8/32 [115/400] via 1.100.9.6, 20:08:56, GigabitEthernet0/0/0/1
i L2 1.100.6.0/24 [115/400] via 1.100.9.6, 20:08:56, GigabitEthernet0/0/0/1
```


1.2: BGP – Unified MPLS

Implement Unified MPLS across the core and aggregation metro fabric at the Emerald Tier 1 service provider, given their requirements

- All the X-PE and X-ASBR devices loopback0 should be learned in different IS-IS domain and not via IGP.
- All the X-PE's and X-ASBR devices loopback0 should be reachable via MPLS path
- Create iBGP-LU in core IS-IS process using X-RR1 and provide redundancy on X-RR2
- Use suitable inline route reflectors for AGG1 and AGG2 processes.

Refer to Diagrams and Tables 1,2,3 and 4 for more details.

SECTION 1.2: Unified MPLS

AGG1 Instance (iBGP-LU) config X-PE5, X-PE6

X-PE5

```
router bgp 100
 address-family ipv4 unicast
  network 1.0.100.7/32
  allocate-label all
 !
 neighbor 1.0.100.3
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
 neighbor 1.0.100.5
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
```

X-PE6

```
router bgp 100
 address-family ipv4 unicast
  network 1.0.100.8/32
  allocate-label all
 !
 neighbor 1.0.100.3
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !


!
 neighbor 1.0.100.5
  remote-as 100
  update-source Loopback0
```

```
 address-family ipv4 labeled-unicast
  next-hop-self
 !
!
end
```

CORE Instance (iBGP-LU) config X-P1, X-P3, X-P2, X-P4

X-P1

```
router bgp 100
bgp router-id 1.0.100.3
ibgp policy out enforce-modifications
 mpls activate
  interface GigabitEthernet0/0/0/1
  interface GigabitEthernet0/0/0/2
 !
!
 address-family ipv4 unicast
  network 1.0.100.3/32
  allocate-label all
 !
 neighbor 1.0.100.7
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   route-reflector-client
   next-hop-self
  !
 !
 neighbor 1.0.100.8
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   route-reflector-client
   next-hop-self
  !


 !
 neighbor 1.0.100.9
  remote-as 100
  update-source Loopback0
```

```
 address-family ipv4 labeled-unicast
  next-hop-self
 !
!
 neighbor 1.0.100.10
 remote-as 100
 update-source Loopback0
 address-family ipv4 labeled-unicast
  next-hop-self
 !
!
!
end
```

X-P3

```
router bgp 100
bgp router-id 1.0.100.5
ibgp policy out enforce-modifications
 mpls activate
  interface GigabitEthernet0/0/0/1
  interface GigabitEthernet0/0/0/2
!
 address-family ipv4 unicast
  network 1.0.100.5/32
  allocate-label all
 !
 neighbor 1.0.100.7
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   route-reflector-client
   next-hop-self
  !



 !
 neighbor 1.0.100.8
  remote-as 100
  update-source Loopback0
```

```
 address-family ipv4 labeled-unicast
  route-reflector-client
  next-hop-self
 !
!
 neighbor 1.0.100.9
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
 neighbor 1.0.100.10
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
!
end
```

X-P2

```
router bgp 100
bgp router-id 1.0.100.4
ibgp policy out enforce-modifications
 mpls activate
  interface GigabitEthernet0/0/0/1
  interface GigabitEthernet0/0/0/2
!
 address-family ipv4 unicast
  network 1.0.100.4/32
  allocate-label all
 !


!
 neighbor 1.0.100.1
  remote-as 100
  update-source Loopback0
```

```
 address-family ipv4 labeled-unicast
  route-reflector-client
  next-hop-self
 !
!
 neighbor 1.0.100.2
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   route-reflector-client
   next-hop-self
  !
 !
 !
neighbor 1.0.100.9
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
 neighbor 1.0.100.10
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
end
```

X-P4

```
router bgp 100
bgp router-id 1.0.100.6
ibgp policy out enforce-modifications
 mpls activate
  interface GigabitEthernet0/0/0/1
  interface GigabitEthernet0/0/0/2
!
!
 address-family ipv4 unicast
  network 1.0.100.6/32
  allocate-label all
```

```
 !
 neighbor 1.0.100.1
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   route-reflector-client
   next-hop-self
  !
 !
 neighbor 1.0.100.2
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   route-reflector-client
   next-hop-self
  !
 !
 neighbor 1.0.100.9
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
 neighbor 1.0.100.10
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
end
```


AGG2 Instance (iBGP-LU) config X-ASBR1, X-ASBR2

X-ASBR1

```
router bgp 100
 address-family ipv4 unicast
  network 1.0.100.1/32
  allocate-label all
 !
 neighbor 1.0.100.4
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
 neighbor 1.0.100.6
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
end
```

X-ASBR2

```
router bgp 100
 address-family ipv4 unicast
  network 1.0.100.2/32
  allocate-label all
 !
 neighbor 1.0.100.4
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
 !
 neighbor 1.0.100.6
  remote-as 100
  update-source Loopback0
  address-family ipv4 labeled-unicast
   next-hop-self
  !
```

X-RR1

```
router bgp 100
 bgp router-id 1.0.100.9
```

```
bgp log-neighbor-changes
neighbor 1.0.100.3 remote-as 100
neighbor 1.0.100.3 update-source Loopback0
neighbor 1.0.100.4 remote-as 100
neighbor 1.0.100.4 update-source Loopback0
neighbor 1.0.100.5 remote-as 100
neighbor 1.0.100.5 update-source Loopback0
neighbor 1.0.100.6 remote-as 100
neighbor 1.0.100.6 update-source Loopback0
!
address-family ipv4
 network 1.0.100.9 mask 255.255.255.255
 neighbor 1.0.100.3 activate
 neighbor 1.0.100.3 route-reflector-client
 neighbor 1.0.100.3 send-label
 neighbor 1.0.100.4 activate
 neighbor 1.0.100.4 route-reflector-client
 neighbor 1.0.100.4 send-label
 neighbor 1.0.100.5 activate
 neighbor 1.0.100.5 route-reflector-client
 neighbor 1.0.100.5 send-label
 neighbor 1.0.100.6 activate
 neighbor 1.0.100.6 route-reflector-client
 neighbor 1.0.100.6 send-label
exit-address-family
```


X-RR2

```
router bgp 100
 bgp router-id 1.0.100.10
 bgp log-neighbor-changes
```

```
neighbor 1.0.100.3 remote-as 100
neighbor 1.0.100.3 update-source Loopback0
neighbor 1.0.100.4 remote-as 100
neighbor 1.0.100.4 update-source Loopback0
neighbor 1.0.100.5 remote-as 100
neighbor 1.0.100.5 update-source Loopback0
neighbor 1.0.100.6 remote-as 100
neighbor 1.0.100.6 update-source Loopback0
!
address-family ipv4
 network 1.0.100.10 mask 255.255.255.255
 neighbor 1.0.100.3 activate
 neighbor 1.0.100.3 route-reflector-client
 neighbor 1.0.100.3 next-hop-self
 neighbor 1.0.100.3 send-label
 neighbor 1.0.100.4 activate
 neighbor 1.0.100.4 route-reflector-client
 neighbor 1.0.100.4 next-hop-self
 neighbor 1.0.100.4 send-label
 neighbor 1.0.100.5 activate
 neighbor 1.0.100.5 route-reflector-client
 neighbor 1.0.100.5 next-hop-self
 neighbor 1.0.100.5 send-label
 neighbor 1.0.100.6 activate
 neighbor 1.0.100.6 route-reflector-client
 neighbor 1.0.100.6 next-hop-self
 neighbor 1.0.100.6 send-label
exit-address-family
```


Verification output

X-PE5 & X-PE6 and X-ASBR1 & X-ASBR2 devices loopback0 should be learned not via IGP.

Verification command on both **X-PE5** and **X-PE6**

```
RP/0/0/CPU0:passsplabs-X-PE6#show route ipv4 | inc B
Thu Nov 11 13:40:16.919 UTC
Codes: C - connected, S - static, R - RIP, B - BGP, (>) - Diversion path
       M - mobile route, r - RPL, t - Traffic Engineering, (!) - FRR Backup path
B    1.0.100.1/32 [200/0] via 1.0.100.5, 13:59:42
B    1.0.100.2/32 [200/0] via 1.0.100.5, 13:59:42
B    1.0.100.4/32 [200/0] via 1.0.100.5, 13:59:42
B    1.0.100.6/32 [200/0] via 1.0.100.5, 13:59:42
B    1.0.100.9/32 [200/0] via 1.0.100.5, 13:59:42
B    1.0.100.10/32 [200/0] via 1.0.100.5, 13:59:42
```

X-PE5 & X-PE6 and X-ASBR1 & X-ASBR2 devices loopback0 should be learned not via IGP.

Verification command on both **X-ASBR1** and **X-ASBR2**

```
RP/0/0/CPU0:passsplabs-X-ASBR1#show route ipv4 | inc B
Thu Nov 11 13:45:34.310 UTC
Codes: C - connected, S - static, R - RIP, B - BGP, (>) - Diversion path
       M - mobile route, r - RPL, t - Traffic Engineering, (!) - FRR Backup path
B    1.0.100.3/32 [200/0] via 1.0.100.4, 14:10:05
B    1.0.100.5/32 [200/0] via 1.0.100.4, 14:11:00
B    1.0.100.7/32 [200/0] via 1.0.100.4, 14:05:37
B    1.0.100.8/32 [200/0] via 1.0.100.4, 14:11:00
B    1.0.100.9/32 [200/0] via 1.0.100.4, 14:11:05
B    1.0.100.10/32 [200/0] via 1.0.100.4, 17:07:35
```

Verification From **X-PE5 & X-PE6 to X-ASBR1 & X-ASBR2** reachable via MPLS path

Verification command on both **X-PE5** and **X-PE6**

```
RP/0/0/CPU0:passsplabs-X-PE6#ping mpls ipv4 1.0.100.1/32 source 1.0.100.8
Thu Nov 11 12:21:53.911 UTC

Sending 5, 100-byte MPLS Echos to 1.0.100.1/32,
     timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 10/16/30 ms
```

Verification command on both **X-ASBR1** and **X-ASBR2**

```
RP/0/0/CPU0:passsplabs-X-ASBR1#ping mpls ipv4 1.0.100.7/32 source 1.0.100.1
Thu Nov 11 12:35:39.238 UTC

Sending 5, 100-byte MPLS Echos to 1.0.100.7/32,
     timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/8/20 ms
```

Verification for suitable inline route reflectors for AGG1 and AGG2 processes

Verification command on both **X-PE5** and **X-PE6 AGG1**

```
RP/0/0/CPU0:passsplabs-X-PE6#show bgp ipv4 labeled-unicast summary
Thu Nov 11 13:58:35.624 UTC
BGP router identifier 1.0.100.8, local AS number 100
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0000000   RD version: 1349
BGP main routing table version 1349
BGP NSR Initial initsync version 7 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs

BGP is operating in STANDALONE mode.


Process       RcvTblVer   bRIB/RIB   LabelVer  ImportVer  SendTblVer  StandbyVer
Speaker            1349       1349       1349       1349        1349           0

Neighbor        Spk    AS MsgRcvd MsgSent   TblVer  InQ OutQ  Up/Down  St/PfxRcd
1.0.100.3         0   100    1268    1156     1349    0    0 14:18:06           9
1.0.100.5         0   100    2204    1150     1349    0    0 18:22:11           9
```

Verification command on both **X-ASBR1** and **X-ASBR2 AGG2**

```
RP/0/0/CPU0:passsplabs-X-ASBR1#show bgp ipv4 labeled-unicast summary
Thu Nov 11 13:59:42.732 UTC
BGP router identifier 1.0.100.1, local AS number 100
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0000000   RD version: 375
BGP main routing table version 375
BGP NSR Initial initsync version 3 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs

BGP is operating in STANDALONE mode.


Process       RcvTblVer   bRIB/RIB   LabelVer  ImportVer  SendTblVer  StandbyVer
Speaker             375        375        375        375         375           0

Neighbor        Spk    AS MsgRcvd MsgSent   TblVer  InQ OutQ  Up/Down  St/PfxRcd
1.0.100.4         0   100    1949    1798      375    0    0 17:21:50           9
1.0.100.6         0   100    1975    1797      375    0    0 17:21:48           9
```

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