

Multi-Level IS-IS

« [IS-IS Authentication \(/workbook/view/service-provider-v4/task/is-is-authentication-Mjg0MQ%3D%3D\)](/workbook/view/service-provider-v4/task/is-is-authentication-Mjg0MQ%3D%3D) | [IS-IS Route Leaking \(/workbook/view/service-provider-v4/task/is-is-route-leaking-Mjg0Mw%3D%3D\)](/workbook/view/service-provider-v4/task/is-is-route-leaking-Mjg0Mw%3D%3D) »

Last updated: April 23, 2016

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Note:

Initial Configuration & Diagrams: [Load the initial configuration files for the section named Base IPv4, which can be found in CCIE SPv4 Topology Diagrams & Initial Configurations \(<http://labs.ine.com/workbook/view/service-provider-v4/task/ccie-spv4-topology-diagrams-initial-configs>\).](#) [Refer to the Base IPv4 Diagram in order to complete this task.](#)

Task

- Using the Base IPv4 Diagram, configure IS-IS on all interfaces of the devices as follows:
 - R1, R2, R3, and R4 should use NET addresses 49.1234.0000.0000.000Y.00 where Y is their router number.
 - R5 and R6 should use NET addresses 49.0056.0000.0000.0000Y.00 where Y is their router number.
 - XR1 and XR2 should use NET addresses 49.1920.0000.0000.000Y.00 where Y is their router number.
- Configure IS-IS Level assignments as follows:
 - R1 and R2 should be L1 only routers.
 - R3 and R4 should be L1/L2 routers, with their links to R2 running Level-1 and all other links running Level-2.
 - R5 and R6 should be L2 only routers.
 - XR1 should be an L1/L2 router, with its link to XR2 running Level-1 and all other links running Level-2.
 - XR2 should be an L1 only router.
- Advertise the Loopback interfaces of the routers using the **passive-interface** or **passive** command.
- Once complete, all devices should have IPv4 reachability to each other.

Configuration [Click to collapse](#)

```
R1:
interface GigabitEthernet1.12
 ip router isis
!
router isis
```

```
 net 49.1234.0000.0000.0001.00
 is-type level-1
 passive-interface Loopback0
```

```
R2:
interface GigabitEthernet1.23
 ip router isis
!
```

```
interface GigabitEthernet1.24
 ip router isis
!
```

```
interface GigabitEthernet1.12
 ip router isis
!
router isis
```

```
 net 49.1234.0000.0000.0002.00
 is-type level-1
 passive-interface Loopback0
```

```
R3:
interface GigabitEthernet1.23
 ip router isis
 isis circuit-type level-1
!
```

```
interface GigabitEthernet1.34
 ip router isis
 isis circuit-type level-2
!
```

```
interface GigabitEthernet1.36
 ip router isis
 isis circuit-type level-2
!
```

```
interface Loopback0
 isis circuit-type level-2
!
```

```
router isis
 net 49.1234.0000.0000.0003.00
 is-type level-1-2
 passive-interface Loopback0
```

```
R4:
interface GigabitEthernet1.24
 ip router isis
 isis circuit-type level-1
!
```

```
interface GigabitEthernet1.34
 ip router isis
 isis circuit-type level-2
```

```
!  
interface GigabitEthernet1.45  
  ip router isis  
  isis circuit-type level-2  
!  
interface GigabitEthernet1.46  
  ip router isis  
  isis circuit-type level-2  
!  
interface Loopback0  
  isis circuit-type level-2  
!  
router isis  
  net 49.1234.0000.0000.0004.00  
  is-type level-1-2  
  passive-interface Loopback0  
  
R5:  
interface GigabitEthernet1.45  
  ip router isis  
!  
interface GigabitEthernet1.56  
  ip router isis  
!  
interface GigabitEthernet1.519  
  ip router isis  
!  
router isis  
  net 49.0056.0000.0000.0005.00  
  is-type level-2-only  
  passive-interface Loopback0  
  
R6:  
interface GigabitEthernet1.36  
  ip router isis  
!  
interface GigabitEthernet1.46  
  ip router isis  
!  
interface GigabitEthernet1.56  
  ip router isis  
!  
interface GigabitEthernet1.619  
  ip router isis  
!  
router isis  
  net 49.0056.0000.0000.0006.00  
  is-type level-2-only  
  passive-interface Loopback0  
  
XR1:  
router isis 1  
  is-type level-1-2  
  net 49.1920.0000.0000.0019.00
```

```
interface Loopback0
  passive
  circuit-type level-2
  address-family ipv4 unicast
  !
!
```

```
interface GigabitEthernet0/0/0/0.519
  circuit-type level-2
  address-family ipv4 unicast
  !
!
```

```
interface GigabitEthernet0/0/0/0.619
  circuit-type level-2
  address-family ipv4 unicast
  !
!
```

```
interface GigabitEthernet0/0/0/0.1920
  circuit-type level-1
  address-family ipv4 unicast
  !
!
```

XR2:

```
router isis 1
  is-type level-1
  net 49.1920.0000.0000.0020.00
  interface Loopback0
    passive
    address-family ipv4 unicast
    !
  !
  interface GigabitEthernet0/0/0/0.1920
    address-family ipv4 unicast
    !
  !
!
```

Verification

All routers should be adjacent with all their directly connected neighbors. R1, R2, & XR2 should be forming only L1 adjacencies, R3, R4, & XR1 should be forming both L1 and L2 adjacencies, and R5 & R6 should be forming only L2 adjacencies.

R1#show isis neighbors

Tag null:

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R2	L1	Gi1.12	10.1.2.2	UP	29	R1.01

R2#show isis neighbors

Tag null:

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R1	L1	Gi1.12	10.1.2.1	UP	7	R1.01
R3	L1	Gi1.23	20.2.3.3	UP	6	R3.01
R4	L1	Gi1.24	20.2.4.4	UP	28	R2.02

R3#show isis neighbors

Tag null:

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R2	L1	Gi1.23	20.2.3.2	UP	28	R3.01
R4	L2	Gi1.34	20.3.4.4	UP	22	R3.02
R6	L2	Gi1.36	20.3.6.6	UP	26	R3.03

R4#show isis neighbors

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R2	L1	Gi1.24	20.2.4.2	UP	9	R2.02
R3	L2	Gi1.34	20.3.4.3	UP	9	R3.02
R5	L2	Gi1.45	20.4.5.5	UP	23	R4.03
R6	L2	Gi1.46	20.4.6.6	UP	7	R6.02

R5#show isis neighbors

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R4	L2	Gi1.45	20.4.5.4	UP	8	R4.03
R6	L2	Gi1.56	20.5.6.6	UP	7	R6.03
XR1	L2	Gi1.519	20.5.19.19	UP	9	XR1.05

R6#show isis neighbors

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R3	L2	Gi1.36	20.3.6.3	UP	9	R3.03
R4	L2	Gi1.46	20.4.6.4	UP	29	R6.02
R5	L2	Gi1.56	20.5.6.5	UP	27	R6.03
XR1	L2	Gi1.619	20.6.19.19	UP	24	R6.04

RP/0/0/CPU0:XR1#show isis adjacency

Mon Apr 27 22:52:44.605 UTC

IS-IS 1 Level-1 adjacencies:

System Id	Interface	SNPA	State	Hold	Changed	NSF	IPv4	IPv6
-----------	-----------	------	-------	------	---------	-----	------	------

```

                                BFD BFD
XR2      Gi0/0/0/0.1920  0050.569e.27ac Up  21  00:07:15 Yes None None

```

Total adjacency count: 1

IS-IS 1 Level-2 adjacencies:

```

System Id      Interface      SNPA          State Hold Changed  NSF IPv4 IPv6
                                BFD BFD
R6      Gi0/0/0/0.619  0050.569e.5cec Up   7   00:07:39 Yes None None
R5      Gi0/0/0/0.519  0050.569e.0962 Up  28   00:07:39 Yes None None

```

Total adjacency count: 2

RP/0/3/CPU0:XR2#show isis adjacency

Mon Apr 27 22:53:25.703 UTC

IS-IS 1 Level-1 adjacencies:

```

System Id      Interface      SNPA          State Hold Changed  NSF IPv4 IPv6
                                BFD BFD
XR1      Gi0/0/0/0.1920  0050.569e.59fe Up   8   00:07:57 Yes None None

```

Total adjacency count: 1

R1 and R2, as Level-1 only routers, should see Level-1 routes within their own Area, and a default route out to the L1/L2 routers.

```
R1#show ip route isis
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override
```

Gateway of last resort is 10.1.2.2 to network 0.0.0.0

```
i*L1 0.0.0.0/0 [115/20] via 10.1.2.2, 00:09:17, GigabitEthernet1.12
      2.0.0.0/32 is subnetted, 1 subnets
i L1  2.2.2.2 [115/10] via 10.1.2.2, 00:10:39, GigabitEthernet1.12
      20.0.0.0/24 is subnetted, 2 subnets
i L1  20.2.3.0 [115/20] via 10.1.2.2, 00:10:39, GigabitEthernet1.12
i L1  20.2.4.0 [115/20] via 10.1.2.2, 00:10:39, GigabitEthernet1.12
```

```
R2#show ip route isis
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override
```

Gateway of last resort is 20.2.4.4 to network 0.0.0.0

```
i*L1 0.0.0.0/0 [115/10] via 20.2.4.4, 00:09:57, GigabitEthernet1.24
      [115/10] via 20.2.3.3, 00:09:57, GigabitEthernet1.23
      1.0.0.0/32 is subnetted, 1 subnets
i L1  1.1.1.1 [115/10] via 10.1.2.1, 00:11:20, GigabitEthernet1.12
```

R3 and R4, as L1/L2 routers, should see L1 routes from R1 and R2, and L2 routes about all other destinations in the topology.

```

R3#show ip route isis
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, I - LISP
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is not set

    1.0.0.0/32 is subnetted, 1 subnets
i L1   1.1.1.1 [115/20] via 20.2.3.2, 00:11:23, GigabitEthernet1.23
    2.0.0.0/32 is subnetted, 1 subnets
i L1   2.2.2.2 [115/10] via 20.2.3.2, 00:11:33, GigabitEthernet1.23
    4.0.0.0/32 is subnetted, 1 subnets
i L2   4.4.4.4 [115/10] via 20.3.4.4, 00:10:57, GigabitEthernet1.34
    5.0.0.0/32 is subnetted, 1 subnets
i L2   5.5.5.5 [115/20] via 20.3.6.6, 00:05:02, GigabitEthernet1.36
       [115/20] via 20.3.4.4, 00:05:02, GigabitEthernet1.34
    6.0.0.0/32 is subnetted, 1 subnets
i L2   6.6.6.6 [115/10] via 20.3.6.6, 00:10:43, GigabitEthernet1.36
   10.0.0.0/24 is subnetted, 2 subnets
i L1   10.1.2.0 [115/20] via 20.2.3.2, 00:11:33, GigabitEthernet1.23
i L2   10.19.20.0 [115/30] via 20.3.6.6, 00:10:06, GigabitEthernet1.36
   19.0.0.0/32 is subnetted, 1 subnets
i L2   19.19.19.19 [115/20] via 20.3.6.6, 00:10:14, GigabitEthernet1.36
   20.0.0.0/8 is variably subnetted, 13 subnets, 2 masks
i L1   20.2.4.0/24 [115/20] via 20.2.3.2, 00:11:33, GigabitEthernet1.23
i L2   20.4.5.0/24 [115/20] via 20.3.4.4, 00:05:02, GigabitEthernet1.34
i L2   20.4.6.0/24 [115/20] via 20.3.6.6, 00:10:43, GigabitEthernet1.36
       [115/20] via 20.3.4.4, 00:10:43, GigabitEthernet1.34
i L2   20.5.6.0/24 [115/20] via 20.3.6.6, 00:10:43, GigabitEthernet1.36
i L2   20.5.19.0/24 [115/30] via 20.3.6.6, 00:05:02, GigabitEthernet1.36
       [115/30] via 20.3.4.4, 00:05:02, GigabitEthernet1.34
i L2   20.6.19.0/24 [115/20] via 20.3.6.6, 00:10:43, GigabitEthernet1.36
i L2   20.20.20.0/32 [115/30] via 20.3.6.6, 00:09:53, GigabitEthernet1.36

```

R4#show ip route isis Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, * - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route, H - NHRP, I - LISP a - application route + - replicated route, % - next hop override

Gateway of last resort is not set

```

1.0.0.0/32 is subnetted, 1 subnets
i L1 1.1.1.1 [115/20] via 20.2.4.2, 00:11:46, GigabitEthernet1.24
2.0.0.0/32 is subnetted, 1 subnets
i L1 2.2.2.2 [115/10] via 20.2.4.2, 00:11:57, GigabitEthernet1.24
3.0.0.0/32 is subnetted, 1 subnets
i L2 3.3.3.3 [115/10] via 20.3.4.3, 00:11:57, GigabitEthernet1.34
5.0.0.0/32 is subnetted, 1 subnets
i L2 5.5.5.5 [115/10] via 20.4.5.5, 00:06:01, GigabitEthernet1.45
6.0.0.0/32 is subnetted, 1 subnets
i L2 6.6.6.6 [115/10] via 20.4.6.6, 00:11:42, GigabitEthernet1.46
10.0.0.0/24 is subnetted, 2 subnets
i L1 10.1.2.0 [115/20] via 20.2.4.2, 00:11:57, GigabitEthernet1.24
i L2 10.19.20.0 [115/30] via 20.4.6.6, 00:06:01, GigabitEthernet1.46
      [115/30] via 20.4.5.5, 00:06:01, GigabitEthernet1.45
19.0.0.0/32 is subnetted, 1 subnets
i L2 19.19.19.19 [115/20] via 20.4.6.6, 00:06:01, GigabitEthernet1.46
      [115/20] via 20.4.5.5, 00:06:01, GigabitEthernet1.45
20.0.0.0/8 is variably subnetted, 14 subnets, 2 masks
i L1 20.2.3.0/24 [115/20] via 20.2.4.2, 00:11:57, GigabitEthernet1.24
i L2 20.3.6.0/24 [115/20] via 20.4.6.6, 00:11:42, GigabitEthernet1.46
      [115/20] via 20.3.4.3, 00:11:42, GigabitEthernet1.34
i L2 20.5.6.0/24 [115/20] via 20.4.6.6, 00:06:01, GigabitEthernet1.46
      [115/20] via 20.4.5.5, 00:06:01, GigabitEthernet1.45
i L2 20.5.19.0/24 [115/20] via 20.4.5.5, 00:06:01, GigabitEthernet1.45
i L2 20.6.19.0/24 [115/20] via 20.4.6.6, 00:11:42, GigabitEthernet1.46
i L2 20.20.20.20/32 [115/30] via 20.4.6.6, 00:06:01, GigabitEthernet1.46
      [115/30] via 20.4.5.5, 00:06:01, GigabitEthernet1.45

```

R5 and R6, as L2 only routers, should see L2 routes about all prefixes in the topology.

R5#show ip route isis

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, * - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override

Gateway of last resort is not set

1.0.0.0/32 is subnetted, 1 subnets

i L2 1.1.1.1 [115/30] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

2.0.0.0/32 is subnetted, 1 subnets

i L2 2.2.2.2 [115/20] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

3.0.0.0/32 is subnetted, 1 subnets

i L2 3.3.3.3 [115/20] via 20.5.6.6, 00:06:56, GigabitEthernet1.56

[115/20] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

4.0.0.0/32 is subnetted, 1 subnets

i L2 4.4.4.4 [115/10] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

6.0.0.0/32 is subnetted, 1 subnets

i L2 6.6.6.6 [115/10] via 20.5.6.6, 00:12:35, GigabitEthernet1.56

10.0.0.0/24 is subnetted, 2 subnets

i L2 10.1.2.0 [115/30] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

i L2 10.19.20.0 [115/20] via 20.5.19.19, 00:11:58, GigabitEthernet1.519

19.0.0.0/32 is subnetted, 1 subnets

i L2 19.19.19.19 [115/10] via 20.5.19.19, 00:12:08, GigabitEthernet1.519

20.0.0.0/8 is variably subnetted, 13 subnets, 2 masks

i L2 20.2.3.0/24 [115/30] via 20.5.6.6, 00:06:56, GigabitEthernet1.56

[115/30] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

i L2 20.2.4.0/24 [115/20] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

i L2 20.3.4.0/24 [115/20] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

i L2 20.3.6.0/24 [115/20] via 20.5.6.6, 00:12:35, GigabitEthernet1.56

i L2 20.4.6.0/24 [115/20] via 20.5.6.6, 00:06:56, GigabitEthernet1.56

[115/20] via 20.4.5.4, 00:06:56, GigabitEthernet1.45

i L2 20.6.19.0/24 [115/20] via 20.5.19.19, 00:12:08, GigabitEthernet1.519

[115/20] via 20.5.6.6, 00:12:08, GigabitEthernet1.56

i L2 20.20.20.0/32

[115/20] via 20.5.19.19, 00:11:46, GigabitEthernet1.519

R6#show ip route isis

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, * - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

a - application route

+ - replicated route, % - next hop override

Gateway of last resort is not set

```

1.0.0.0/32 is subnetted, 1 subnets
i L2 1.1.1.1 [115/20] via 20.4.6.4, 00:13:33, GigabitEthernet1.46
      [115/30] via 20.3.6.3, 00:13:23, GigabitEthernet1.36
2.0.0.0/32 is subnetted, 1 subnets
i L2 2.2.2.2 [115/20] via 20.4.6.4, 00:13:33, GigabitEthernet1.46
      [115/20] via 20.3.6.3, 00:13:33, GigabitEthernet1.36
3.0.0.0/32 is subnetted, 1 subnets
i L2 3.3.3.3 [115/10] via 20.3.6.3, 00:13:33, GigabitEthernet1.36
4.0.0.0/32 is subnetted, 1 subnets
i L2 4.4.4.4 [115/10] via 20.4.6.4, 00:13:33, GigabitEthernet1.46
5.0.0.0/32 is subnetted, 1 subnets
i L2 5.5.5.5 [115/10] via 20.5.6.5, 00:13:33, GigabitEthernet1.56
10.0.0.0/24 is subnetted, 2 subnets
i L2 10.1.2.0 [115/30] via 20.4.6.4, 00:13:33, GigabitEthernet1.46
      [115/30] via 20.3.6.3, 00:13:33, GigabitEthernet1.36
i L2 10.19.20.0 [115/20] via 20.6.19.19, 00:12:53, GigabitEthernet1.619
19.0.0.0/32 is subnetted, 1 subnets
i L2 19.19.19.19 [115/10] via 20.6.19.19, 00:13:03, GigabitEthernet1.619
20.0.0.0/8 is variably subnetted, 14 subnets, 2 masks
i L2 20.2.3.0/24 [115/20] via 20.3.6.3, 00:13:33, GigabitEthernet1.36
i L2 20.2.4.0/24 [115/20] via 20.4.6.4, 00:13:33, GigabitEthernet1.46
i L2 20.3.4.0/24 [115/20] via 20.4.6.4, 00:13:33, GigabitEthernet1.46
      [115/20] via 20.3.6.3, 00:13:33, GigabitEthernet1.36
i L2 20.4.5.0/24 [115/20] via 20.5.6.5, 00:07:51, GigabitEthernet1.56
      [115/20] via 20.4.6.4, 00:07:51, GigabitEthernet1.46
i L2 20.5.19.0/24 [115/20] via 20.6.19.19, 00:13:03, GigabitEthernet1.619
      [115/20] via 20.5.6.5, 00:13:03, GigabitEthernet1.56
i L2 20.20.20.20/32
      [115/20] via 20.6.19.19, 00:12:41, GigabitEthernet1.619

```

XR1, as an L1/L2 router, should see L1 routes from XR2, and L2 routes about all other prefixes in the topology from R5 and R6.

```

RP/0/0/CPU0:XR1#show route ipv4 isis
Mon Apr 27 22:58:56.690 UTC

i L2 1.1.1.1/32 [115/40] via 20.6.19.6, 00:08:37, GigabitEthernet0/0/0.619
    [115/40] via 20.5.19.5, 00:08:37, GigabitEthernet0/0/0.519
i L2 2.2.2.2/32 [115/30] via 20.6.19.6, 00:08:37, GigabitEthernet0/0/0.619
    [115/30] via 20.5.19.5, 00:08:37, GigabitEthernet0/0/0.519
i L2 3.3.3.3/32 [115/20] via 20.6.19.6, 00:13:42, GigabitEthernet0/0/0.619
i L2 4.4.4.4/32 [115/20] via 20.6.19.6, 00:08:37, GigabitEthernet0/0/0.619
    [115/20] via 20.5.19.5, 00:08:37, GigabitEthernet0/0/0.519
i L2 5.5.5.5/32 [115/10] via 20.5.19.5, 00:13:45, GigabitEthernet0/0/0.519
i L2 6.6.6.6/32 [115/10] via 20.6.19.6, 00:13:45, GigabitEthernet0/0/0.619
i L2 10.1.2.0/24 [115/40] via 20.6.19.6, 00:08:37, GigabitEthernet0/0/0.619
    [115/40] via 20.5.19.5, 00:08:37, GigabitEthernet0/0/0.519
i L2 20.2.3.0/24 [115/30] via 20.6.19.6, 00:13:42, GigabitEthernet0/0/0.619
i L2 20.2.4.0/24 [115/30] via 20.6.19.6, 00:08:37, GigabitEthernet0/0/0.619
    [115/30] via 20.5.19.5, 00:08:37, GigabitEthernet0/0/0.519
i L2 20.3.4.0/24 [115/30] via 20.6.19.6, 00:08:37, GigabitEthernet0/0/0.619
    [115/30] via 20.5.19.5, 00:08:37, GigabitEthernet0/0/0.519
i L2 20.3.6.0/24 [115/20] via 20.6.19.6, 00:13:45, GigabitEthernet0/0/0.619
i L2 20.4.5.0/24 [115/20] via 20.5.19.5, 00:13:45, GigabitEthernet0/0/0.519
i L2 20.4.6.0/24 [115/20] via 20.6.19.6, 00:13:45, GigabitEthernet0/0/0.619
i L2 20.5.6.0/24 [115/20] via 20.6.19.6, 00:13:45, GigabitEthernet0/0/0.619
    [115/20] via 20.5.19.5, 00:13:45, GigabitEthernet0/0/0.519
i L1 20.20.20.20/32 [115/10] via 10.19.20.20, 00:13:25, GigabitEthernet0/0/0.1920

```

XR2, as an L1 only router, should see only an L1 default from XR1, its L1/L2 router, as there are no other prefixes advertised into the L1 domain other than its connected routes.

```

RP/0/0/CPU0:XR2#show ip route isis
Mon Apr 27 22:59:43.727 UTC

i*L1 0.0.0.0/0 [115/10] via 10.19.20.19, 00:14:09, GigabitEthernet0/0/0.1920

```

The L1/L2 routers R4, R5, and XR1 should all be setting the Attached (ATT) bit in the Link State Database to indicate to the L1 routers that they are a default exit point out to the L2 domain.

R2#show isis database

Tag null:

IS-IS Level-1 Link State Database:

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT /P/OL
R1.00-00	0x00000004	0xF7AE	1010	0/0/0
R1.01-00	0x00000002	0x8DC5	916	0/0/0
R2.00-00	* 0x00000006	0xE322	899	0/0/0
R2.02-00	* 0x00000002	0xBE8F	882	0/0/0
R3.00-00	0x00000004	0xD132	991	1/0/0
R3.01-00	0x00000002	0x9BB1	933	0/0/0
R4.00-00	0x00000004	0x47B7	1051	1/0/0

RP/0/0/CPU0:XR2#show isis database

Mon Apr 27 23:02:02.167 UTC

IS-IS 1 (Level-1) Link State Database

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT /P/OL
XR1.00-00	0x00000004	0xcbf7	1020	1/0/0
XR1.01-00	0x00000002	0xa0ea	894	0/0/0
XR2.00-00	* 0x00000004	0x5c87	973	0/0/0

Total Level-1 LSP count: 3 Local Level-1 LSP count: 1

Note that the Attached bit is stripped as advertisements are sent out to the L2 domain, as only the L1 routers should be using this to default to their L1/L2 exit points.

R5#show isis database

IS-IS Level-2 Link State Database:

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
R3.00-00	0x00000007	0x58F3	951	0/0/0
R3.02-00	0x00000002	0x567C	979	0/0/0
R3.03-00	0x00000002	0x814E	865	0/0/0
R4.00-00	0x00000008	0x3934	1146	0/0/0
R4.03-00	0x00000001	0x705F	451	0/0/0
R5.00-00	* 0x00000005	0x0F7B	452	0/0/0
R6.00-00	0x00000005	0x0CB5	1023	0/0/0
R6.02-00	0x00000002	0x6864	799	0/0/0
R6.03-00	0x00000002	0x7A50	913	0/0/0
R6.04-00	0x00000002	0x694C	961	0/0/0
XR1.00-00	0x00000006	0x1BBF	848	0/0/0
XR1.05-00	0x00000002	0xDEC3	1004	0/0/0

All routes should have full reachability to all prefixes in the topology.

```
R1#traceroute 20.20.20.20

Type escape sequence to abort.
Tracing the route to 20.20.20.20
VRF info: (vrf in name/id, vrf out name/id)
```

```
 1 10.1.2.2 5 msec 1 msec 1 msec
 2 20.2.3.3 1 msec 2 msec 1 msec
 3 20.3.6.6 6 msec 1 msec 1 msec
 4 20.6.19.19 8 msec 12 msec 13 msec
 5 10.19.20.20 13 msec * 3 msec
```

```
RP/0/0/CPU0:XR2#traceroute 1.1.1.1
Mon Apr 27 23:05:00.425 UTC
```

```
Type escape sequence to abort.
Tracing the route to 1.1.1.1
```

```
 1 10.19.20.19 0 msec 0 msec 0 msec
 2 20.5.19.5 0 msec 0 msec 0 msec
 3 20.4.5.4 0 msec 0 msec 0 msec
 4 20.2.4.2 0 msec 0 msec 0 msec
 5 10.1.2.1 0 msec * 0 msec
```

Any router that has both an L1 and an L2 route to the same destination should prefer the L1 route over L2. For example, R3 prefers to route to R2 to reach the link between R2 and R4, as opposed to routing directly to R4. This route preference is similar to OSPF always preferring Intra Area routers over Inter Area routes.

```
R3#show ip route 20.2.4.4
Routing entry for 20.2.4.0/24
  Known via "isis", distance 115, metric 20, type level-1
  Redistributing via isis
  Last update from 20.2.3.2 on GigabitEthernet1.23, 00:22:12 ago
  Routing Descriptor Blocks:
  * 20.2.3.2, from 2.2.2.2, 00:22:12 ago, via GigabitEthernet1.23
    Route metric is 20, traffic share count is 1
```

```
R3#traceroute 20.2.4.4
Type escape sequence to abort.
Tracing the route to 20.2.4.4
VRF info: (vrf in name/id, vrf out name/id)
 1 20.2.3.2 4 msec 2 msec 1 msec
 2 20.2.4.4 2 msec * 2 msec
```

In order for the L1L2 ISIS router to set the ATT bit on its LSP, it not only has to be L1L2 router, but also be connected to two distinct areas. If the areas of all the routers were changed to be the same, yet maintained the same level configuration, XR1, R3, and R4 would not generate the ATT bit.

Note that the L1L2 router itself does not have to be directly attached to the two distinct areas - as long as there is another distinct area connected into L2, the L1L2 router would generate the ATT bit into L1. Take the following example.: R5, R6, XR1, and XR2 are in area 49.9999 but maintain the current level configurations, and R1, R2, R3, and R4 are in area 49.1111 and maintain the current level configurations. XR1, the L1L2 router for XR2, is not directly connected to two distinct areas, but the L2 domain to which XR1 connects to does connect to another area (R5 and R6 in area 49.9999 connect to R3 and R4 in area 49.1111).

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