LAB11: OSPF – IPv6

Disclaimer

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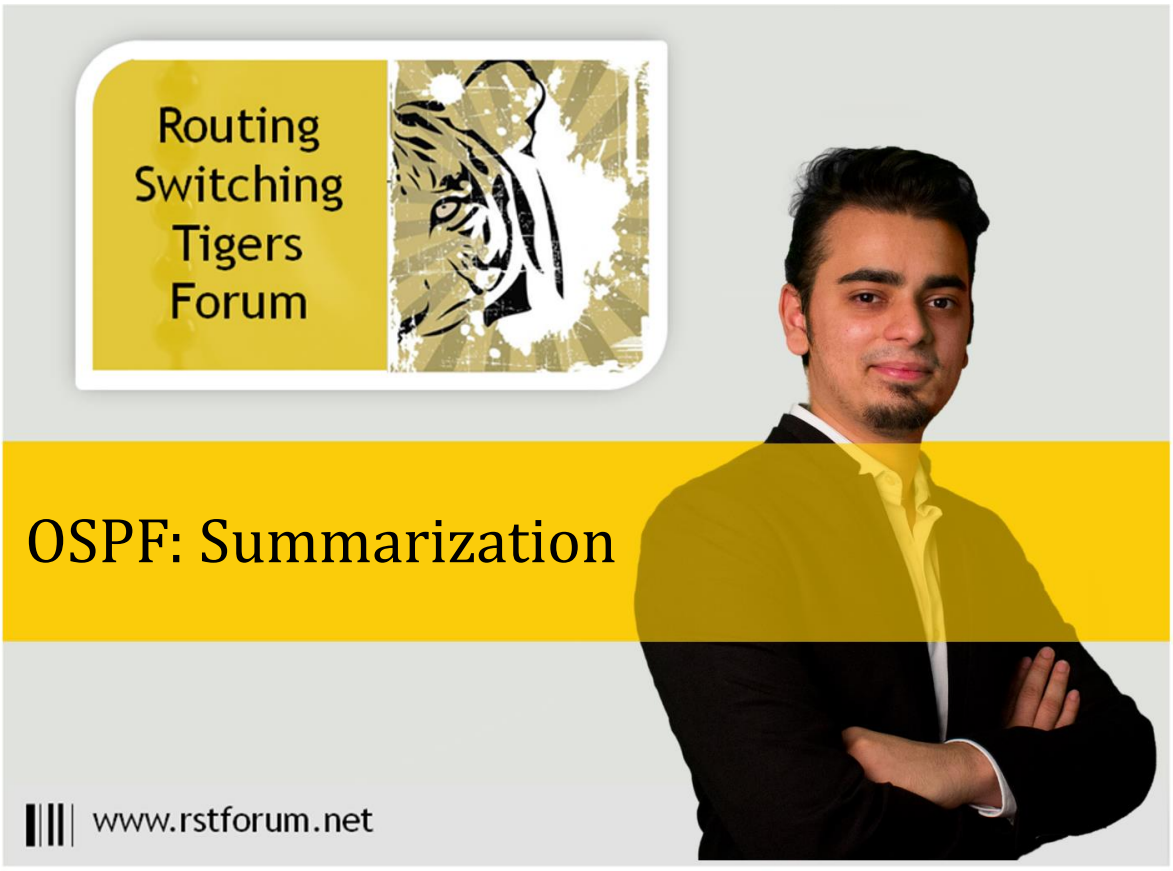
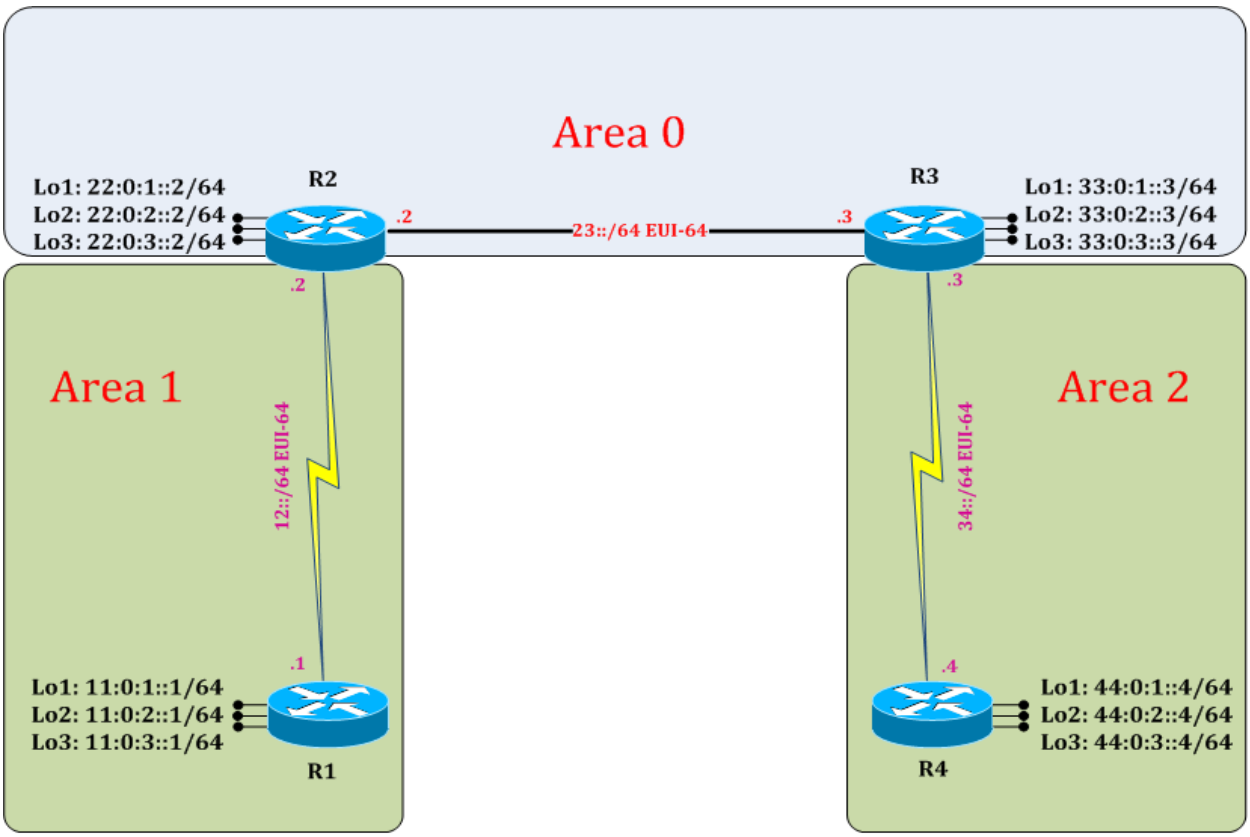


LAB 11: Diagram

Note: This Lab was developed on Cisco IOS Version15.2(4) M1 ADVENTERPRISEK9-M.



LAB 11: IPv6 OSPF Summarization:

Task 1: Configure IPv6 OSPF Summarization

Step 1 In the configuration mode of router configure 4 loopbacks with network address in sequence

R1:

```
interface loopback 0
ipv6 address 11:0:0::1/64
exit
interface loopback 1
ipv6 address 11:0:1::1/64
exit
interface loopback 2
ipv6 address 11:0:2::1/64
exit
interface loopback 3
ipv6 address 11:0:3::1/64
exit
```

Step 2 Verify routes on neighbor router routing table

```
R2#show ipv6 route
! (Shows router's routing table and IPv4 routes entries)

 IPv6 Routing Table - default - 21 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
       H - NHRP, I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
       IS - ISIS summary, D - EIGRP, EX - EIGRP external, NM - NEMO
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, l - LISP
O   11:0:1::1/128 [110/64]
     via FE80::A8BB:CCFF:FE00:100, Serial2/0
O   11:0:2::1/128 [110/64]
     via FE80::A8BB:CCFF:FE00:100, Serial2/0
O   11:0:3::1/128 [110/64]
     via FE80::A8BB:CCFF:FE00:100, Serial2/0
C   12::/64 [0/0]
     via Serial2/0, directly connected
L   12::A8BB:CCFF:FE00:200/128 [0/0]
     via Serial2/0, receive
C   22:0:1::/64 [0/0]
     via Loopback1, directly connected
L   22:0:1::2/128 [0/0]
     via Loopback1, receive
```

```
C   22:0:2::/64 [0/0]
     via Loopback1, receive
C   22:0:2::/64 [0/0]
     via Loopback2, directly connected
L   22:0:2::2/128 [0/0]
     via Loopback2, receive
C   22:0:3::/64 [0/0]
     via Loopback3, directly connected
L   22:0:3::2/128 [0/0]
     via Loopback3, receive
C   23::/64 [0/0]
     via Ethernet0/0, directly connected
L   23::A8BB:CCFF:FE00:200/128 [0/0]
     via Ethernet0/0, receive
O   33:0:1::3/128 [110/10]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
O   33:0:2::3/128 [110/10]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
O   33:0:3::3/128 [110/10]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  34::/64 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  44:0:1::4/128 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  44:0:2::4/128 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  44:0:3::4/128 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

Step 3 Summarize IPv6 OSPF routes on ABR router

! (In OSPF Summary is always done on Area Border Router (ABR))

```
R1:
telnet 12.0.0.2
password: cisco
R2>enable
password: cisco

R2#show ipv6 ospf database
```

! (Shows details of OSPF database based on Area Perspective and LSA Perspective)

```
OSPFv3 Router with ID (22.0.3.2) (Process ID 2)
                Router Link States (Area 0)

ADV Router      Age         Seq#       Fragment ID  Link count  Bits
 22.0.3.2       1421        0x80000002  0           1           B
```

33.0.3.3 1422 0x80000002 0 1 B

Net Link States (Area 0)

ADV Router	Age	Seq#	Link ID	Rtr count
33.0.3.3	1422	0x80000001	3	2

Inter Area Prefix Link States (Area 0)

ADV Router	Age	Seq#	Prefix
22.0.3.2	1476	0x80000001	11:0:1::1/128
22.0.3.2	1476	0x80000001	11:0:2::1/128
22.0.3.2	1476	0x80000001	11:0:3::1/128
22.0.3.2	1476	0x80000001	12::/64
33.0.3.3	1451	0x80000001	34::/64
33.0.3.3	1440	0x80000001	44:0:1::4/128
33.0.3.3	1440	0x80000001	44:0:2::4/128
33.0.3.3	1440	0x80000001	44:0:3::4/128

Link (Type-8) Link States (Area 0)

ADV Router	Age	Seq#	Link ID	Interface
22.0.3.2	1486	0x80000001	3	Et0/0
33.0.3.3	1462	0x80000001	3	Et0/0

Intra Area Prefix Link States (Area 0)

ADV Router	Age	Seq#	Link ID	Ref-lstype	Ref-LSID
22.0.3.2	1421	0x80000002	0	0x2001	0
33.0.3.3	1422	0x80000002	0	0x2001	0
33.0.3.3	1422	0x80000001	3072	0x2002	3

Router Link States (Area 1)

ADV Router	Age	Seq#	Fragment ID	Link count	Bits
11.0.3.1	1487	0x80000002	0	1	None
22.0.3.2	1486	0x80000001	0	1	B

Inter Area Prefix Link States (Area 1)

ADV Router	Age	Seq#	Prefix
22.0.3.2	1476	0x80000001	22:0:1::2/128
22.0.3.2	1476	0x80000001	22:0:2::2/128
22.0.3.2	1476	0x80000001	22:0:3::2/128
22.0.3.2	1476	0x80000001	23::/64
22.0.3.2	1416	0x80000001	33:0:1::3/128
22.0.3.2	1416	0x80000001	33:0:2::3/128
22.0.3.2	1416	0x80000001	33:0:3::3/128
22.0.3.2	1416	0x80000001	44:0:3::4/128
22.0.3.2	1416	0x80000001	44:0:2::4/128
22.0.3.2	1416	0x80000001	44:0:1::4/128
22.0.3.2	1416	0x80000001	34::/64

Link (Type-8) Link States (Area 1)

ADV Router	Age	Seq#	Link ID	Interface
11.0.3.1	1590	0x80000001	11	Se2/0
22.0.3.2	1486	0x80000001	11	Se2/0

Intra Area Prefix Link States (Area 1)

ADV Router	Age	Seq#	Link ID	Ref-lstype	Ref-LSID
11.0.3.1	1547	0x80000003	0	0x2001	0
22.0.3.2	1486	0x80000001	0	0x2001	0

R2:
ipv6 router ospf 1
area 1 range 11::/16
area 0 range 22::/16
exit

telnet 23.0.0.3
password: cisco
R3>enable
password: cisco

R3# show ipv6 ospf database

OSPFv3 Router with ID (33.0.3.3) (Process ID 3)

Router Link States (Area 0)

ADV Router	Age	Seq#	Fragment ID	Link count	Bits
22.0.3.2	1674	0x80000002	0	1	B
33.0.3.3	1673	0x80000002	0	1	B

Net Link States (Area 0)

ADV Router	Age	Seq#	Link ID	Rtr count
33.0.3.3	1673	0x80000001	3	2

Inter Area Prefix Link States (Area 0)

ADV Router	Age	Seq#	Prefix
22.0.3.2	1730	0x80000001	12::/64
22.0.3.2	124	0x80000001	11::/16
33.0.3.3	1704	0x80000001	34::/64
33.0.3.3	1693	0x80000001	44:0:1::4/128
33.0.3.3	1693	0x80000001	44:0:2::4/128
33.0.3.3	1693	0x80000001	44:0:3::4/128

Link (Type-8) Link States (Area 0)

ADV Router	Age	Seq#	Link ID	Interface
22.0.3.2	1740	0x80000001	3	Et0/0
33.0.3.3	1714	0x80000001	3	Et0/0

Intra Area Prefix Link States (Area 0)

ADV Router	Age	Seq#	Link ID	Ref-lstype	Ref-LSID
22.0.3.2	1674	0x80000002	0	0x2001	0
33.0.3.3	1673	0x80000002	0	0x2001	0
33.0.3.3	1673	0x80000001	3072	0x2002	3

Router Link States (Area 2)

ADV Router	Age	Seq#	Fragment ID	Link count	Bits
33.0.3.3	1697	0x80000002	0	1	B
44.0.3.4	1698	0x80000001	0	1	None

Inter Area Prefix Link States (Area 2)

ADV Router	Age	Seq#	Prefix
33.0.3.3	1704	0x80000001	33:0:1::3/128
33.0.3.3	1704	0x80000001	33:0:2::3/128
33.0.3.3	1704	0x80000001	33:0:3::3/128
33.0.3.3	1704	0x80000001	23::/64
33.0.3.3	1669	0x80000001	22:0:1::2/128
33.0.3.3	1669	0x80000001	22:0:2::2/128
33.0.3.3	1669	0x80000001	22:0:3::2/128
33.0.3.3	1669	0x80000001	12::/64
33.0.3.3	123	0x80000001	11::/16

Link (Type-8) Link States (Area 2)

ADV Router	Age	Seq#	Link ID	Interface
33.0.3.3	1714	0x80000001	11	Se2/0
44.0.3.4	1699	0x80000001	11	Se2/0

Intra Area Prefix Link States (Area 2)

ADV Router	Age	Seq#	Link ID	Ref-lstype	Ref-LSID
33.0.3.3	1714	0x80000001	0	0x2001	0
44.0.3.4	1698	0x80000001	0	0x2001	0

R3:

```
ipv6 router ospf 1
area 0 range 22::/16
exit
```

[Connection to 23.0.0.3 closed by foreign host]

Task 2: Verification

Step 1 Verify receipt of summary route in neighbor routing table & verify creation of null interface in routing table by following command:

```
R2#show ipv6  route
! (Shows router's routing table and IPv6 routes entries)

IPv6 Routing Table - default - 23 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
       H - NHRP, I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
       IS - ISIS summary, D - EIGRP, EX - EIGRP external, NM - NEMO
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, l - LISP
O   11::/16 [110/64]
     via Null0, directly connected

O   11:0:1::1/128 [110/64]
     via FE80::A8BB:CCFF:FE00:100, Serial2/0
O   11:0:2::1/128 [110/64]
     via FE80::A8BB:CCFF:FE00:100, Serial2/0
O   11:0:3::1/128 [110/64]
     via FE80::A8BB:CCFF:FE00:100, Serial2/0
C   12::/64 [0/0]
     via Serial2/0, directly connected
L   12::A8BB:CCFF:FE00:200/128 [0/0]
     via Serial2/0, receive
O   22::/16 [110/0]
     via Null0, directly connected
C   22:0:1::/64 [0/0]
     via Loopback1, receive
C   22:0:2::/64 [0/0]
     via Loopback2, directly connected
L   22:0:2::2/128 [0/0]
     via Loopback2, receive
C   22:0:3::/64 [0/0]
     via Loopback3, directly connected
L   22:0:3::2/128 [0/0]
     via Loopback3, receive
C   23::/64 [0/0]
     via Ethernet0/0, directly connected
L   23::A8BB:CCFF:FE00:200/128 [0/0]
     via Ethernet0/0, receive
O   33:0:1::3/128 [110/10]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
O   33:0:2::3/128 [110/10]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
```

```
O   33:0:3::3/128 [110/10]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  34::/64 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  44:0:1::4/128 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  44:0:2::4/128 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
OI  44:0:3::4/128 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Ethernet0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

(ABR Router will send summary routes from one area to other areas. When summarization is configured on a router, same router immediately created a routing point to Null 0 for loop prevention. Hence Null 0 will be created only on ABR routers in OSPF.)

```
R4#show ipv6 route
```
! (Shows router's routing table and IPv6 routes entries)

```
IPv6 Routing Table - default - 16 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
       H - NHRP, I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
       IS - ISIS summary, D - EIGRP, EX - EIGRP external, NM - NEMO
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, l - LISP
OI  11::/16 [110/138]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
OI  12::/64 [110/138]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
OI  22::/16 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
OI  23::/64 [110/74]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
OI  33:0:1::3/128 [110/64]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
OI  33:0:2::3/128 [110/64]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
OI  33:0:3::3/128 [110/64]
     via FE80::A8BB:CCFF:FE00:300, Serial2/0
C   34::/64 [0/0]
     via Serial2/0, directly connected
L   34::A8BB:CCFF:FE00:400/128 [0/0]
     via Serial2/0, receive
C   44:0:1::/64 [0/0]
     via Loopback1, directly connected
L   44:0:1::4/128 [0/0]
```

```
    via Loopback1, receive
C   44:0:2::/64 [0/0]
    via Loopback2, directly connected
L   44:0:2::4/128 [0/0]
    via Loopback2, receive
C   44:0:3::/64 [0/0]
    via Loopback3, directly connected
L   44:0:3::4/128 [0/0]
    via Loopback3, receive
L   FF00::/8 [0/0]
    via Null0, receive
```

(Summarized routes are received from inter-area.)