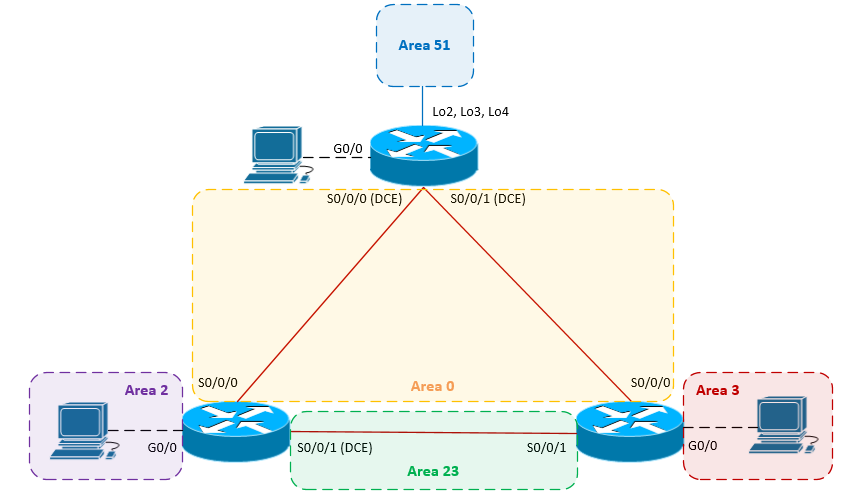
Packet Tracer – IPv6 Dynamic Routing – OSPFv3

(Instructor Version)

**Instructor Note**: Red font color indicate text that appears in the instructor copy only.

Topology



1. Scenario

NetVise Corporation found it too tedious to manage multiple IPv6 static routes across their growing infrastructure. The CEO has requested that dynamic routing is implemented to allow the network to scale and provide for simplified routing configurations. Unfortunately, due mergers you have non-Cisco vendor equipment found throughout your network and you will need to use an open standard routing protocol. Your manager has requested that the IPv6 implementation is fully documented and verified.   
  
Prior to starting this lab, your manager provided you with some supporting training material. You are expected to review the provided material thoroughly before starting this lab.

1. Addressing Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Device | Interface | Type | IP Address | Area | Prefix | Default Gateway |
| S1-RTR | S0/0/0 | Global Unicast | 2001:dd41:34:12::1 | 0 | /64 | N/A |
| S0/0/1 | Global Unicast | 2001:dd41:34:13::1 | 0 | /64 | N/A |
| G0/0 | Global Unicast | 2001:dd41:34:1::1 | 0 | /64 | N/A |
| S1-PC | NIC | EUI-64 |  | 0 | /64 | 2001:dd41:34:1::1 |
| S2-RTR | S0/0/0 | Global Unicast | 2001:dd41:34:12::2 | 0 | /64 | N/A |
| S0/0/1 | Global Unicast | 2001:dd41:34:23::2 | 23 | /64 | N/A |
| G0/0 | Global Unicast | 2001:dd41:34:2::1 | 2 | /64 | N/A |
| S2-PC | NIC | EUI-64 |  | 2 |  | 2001:dd41:34:2::1 |
| S3-RTR | S0/0/0 | Global Unicast | 2001:dd41:34:13::3 | 0 | /64 | N/A |
| S0/0/1 | Global Unicast | 2001:dd41:34:23::3 | 23 | /64 | N/A |
| G0/0 | Global Unicast | 2001:dd41:34:3::1 | 3 | /64 | N/A |
| S3-PC | NIC | EUI-64 |  | 3 |  | 2001:dd41:34:3::1 |

1. Objectives

* Enable IPv6 routing.
* Configure IPv6 Global Unicast Addresses according to the address table.
* Assign IPv6 addresses statefully using (EUI-64).
* Configure dynamic routing using OSPFv3.
  + Assign router-ids
  + Enable routing on the appropriate interfaces and areas according to the topology
  + Network summarization
* Verify routing and network connectivity.

**Task 1: Enable IPv6 routing and assign IPv6 addresses to the appropriate interfaces.**

**Step 1:** Although this step is not required to assign IPv6 addresses to the interfaces, you must enable IPv6 in order to forward IPv6 unicast datagrams (routing).

**S1-RTR(config)#** ipv6 unicast-routing  
!

**S2-RTR(config)#** ipv6 unicast-routing

**!  
S3-RTR(config)#** ipv6 unicast-routing

**Step 2:** Assign IPv6 global unicast addresses according to the table provided.

**S1-RTR**(config)# interface s0/0/0  
S1-RTR(config-if)# ipv6 address 2001:dd41:34:12::1/64   
S1-RTR(config-if)# clock rate 64000  
S1-RTR(config-if)# no shutdown  
!S1-RTR(config-if)# interface s0/0/1  
S1-RTR(config-if)# ipv6 address 2001:dd41:34:13::1/64  
S1-RTR(config-if)# clock rate 64000  
S1-RTR(config-if)# no shutdown  
!  
S1-RTR(config-if)# interface g0/0  
S1-RTR(config-if)# ipv6 address 2001:dd41:34:1::1/64  
S1-RTR(config-if)# no shutdown

**S2-RTR**(config)# interface s0/0/0  
S2-RTR(config-if)# ipv6 address 2001:dd41:34:12::2/64  
S2-RTR(config-if)# no shutdown  
!

S2-RTR(config)# interface s0/0/1  
S2-RTR(config-if)# ipv6 address 2001:dd41:34:23::2/64  
S2-RTR(config-if)# clock rate 64000  
S2-RTR(config-if)# no shutdown  
!  
S2-RTR(config-if)# interface g0/0  
S2-RTR(config-if)# ipv6 address 2001:dd41:34:2::1/64  
S2-RTR(config-if)# no shutdown

**S3-RTR**(config)# interface s0/0/0  
S3-RTR(config-if)# ipv6 address 2001:dd41:34:13::3/64  
S3-RTR(config-if)# no shutdown  
!

S3-RTR(config)# interface s0/0/1  
S3-RTR(config-if)# ipv6 address 2001:dd41:34:23::3/64  
S3-RTR(config-if)# no shutdown  
!  
S3-RTR(config-if)# interface g0/0  
S3-RTR(config-if)# ipv6 address 2001:dd41:34:3::1/64  
S3-RTR(config-if)# no shutdown

**S1-RTR# show ipv6 interface brief**

GigabitEthernet0/0 [up/up]

FE80::2D0:D3FF:FE34:1A01

2001:DD41:34:1::1

Serial0/0/0 [up/up]

FE80::260:3EFF:FE3D:6D01

2001:DD41:34:12::1

Serial0/0/1 [up/up]

FE80::260:3EFF:FE3D:6D02

2001:DD41:34:13::1

**S2-RTR# show ipv6 interface brief**

GigabitEthernet0/0 [up/up]

FE80::2D0:BCFF:FE1D:4501

2001:DD41:34:2::1

Serial0/0/0 [up/up]

FE80::2E0:8FFF:FE22:C901

2001:DD41:34:12::2

Serial0/0/1 [up/up]

FE80::2E0:8FFF:FE22:C902

2001:DD41:34:23::2

**S3-RTR# show ipv6 interface brief**

GigabitEthernet0/0 [up/up]

FE80::207:ECFF:FE26:ED01

2001:DD41:34:3::1

Serial0/0/0 [up/up]

FE80::2E0:8FFF:FEEA:7A01

2001:DD41:34:13::3

Serial0/0/1 [up/up]

FE80::2E0:8FFF:FEEA:7A02

2001:DD41:34:23::3

**Task 2: Assign IPv6 addresses to hosts**

**Step 1:** S1-PC, S2-PC, and S3-PC should be configured using EUI-64 (stateful).

1. Open up S1-PC **>** Config **>** under IPv6 Configuration select “Auto Config”
2. Ensure IPv6 unicast routing is enabled on the directly connected router.
3. Document host configuration and ping the default gateway.

S1-PC>ipv6config

FastEthernet0 Connection:(default port)

Link-local IPv6 Address.........: FE80::2E0:B0FF:FED8:71DA

IPv6 Address....................: 2001:DD41:34:1:2E0:B0FF:FED8:71DA/64

Default Gateway.................: FE80::2D0:D3FF:FE34:1A01

S1-PC>ping 2001:dd41:34:1::1

Pinging 2001:dd41:34:1::1 with 32 bytes of data:

Reply from 2001:DD41:34:1::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:1::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:1::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:1::1: bytes=32 time=0ms TTL=255

Ping statistics for 2001:DD41:34:1::1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

**S2-PC>ipv6config**

FastEthernet0 Connection:(default port)

Link-local IPv6 Address.........: FE80::202:17FF:FE06:49A6

IPv6 Address....................: 2001:DD41:34:2:202:17FF:FE06:49A6/64

Default Gateway.................: FE80::2D0:BCFF:FE1D:4501

**S2-PC>ping 2001:dd41:34:2::1**

Pinging 2001:dd41:34:2::1 with 32 bytes of data:

Reply from 2001:DD41:34:2::1: bytes=32 time=1ms TTL=255

Reply from 2001:DD41:34:2::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:2::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:2::1: bytes=32 time=0ms TTL=255

Ping statistics for 2001:DD41:34:2::1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 1ms, Average = 0ms

**S3-PC>ipv6config**

FastEthernet0 Connection:(default port)

Link-local IPv6 Address.........: FE80::210:11FF:FEC2:36AA

IPv6 Address....................: 2001:DD41:34:3:210:11FF:FEC2:36AA/64

Default Gateway.................: FE80::207:ECFF:FE26:ED01

**S3-PC>ping 2001:dd41:34:3::1**

Pinging 2001:dd41:34:3::1 with 32 bytes of data:

Reply from 2001:DD41:34:3::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:3::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:3::1: bytes=32 time=0ms TTL=255

Reply from 2001:DD41:34:3::1: bytes=32 time=0ms TTL=255

Ping statistics for 2001:DD41:34:3::1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

**Task 2: Configure dynamic routing using OSPFv3**

**Step 1:** Assign the appropriate router-ids to each router, create a loopback for each /32 address.

* S1-RTR: 1.1.1.1
* S2-RTR: 2.2.2.2
* S3-RTR: 3.3.3.3

**S1-RTR(config)#** interface loopback0

S1-RTR(config-if)#ip address 1.1.1.1 255.255.255.255

S1-RTR(config)# ipv6 router ospf 99

S1-RTR(config-rtr)# router-id 1.1.1.1

**S2-RTR(config)#** interface loopback0

S2-RTR(config-if)#ip address 2.2.2.2 255.255.255.255  
  
S2-RTR(config)# ipv6 router ospf 99

S2-RTR(config-rtr)# router-id 2.2.2.2

**S3-RTR(config)#** interface loopback0

S3-RTR(config-if)#ip address 3.3.3.3 255.255.255.255

S2-RTR(config)# ipv6 router ospf 99

S2-RTR(config-rtr)# router-id 2.2.2.2

**S1-RTR# show ipv6 ospf**

Routing Process "ospfv3 99" with ID 1.1.1.1

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

Number of areas in this router is 0. 0 normal 0 stub 0 nssa

Reference bandwidth unit is 100 mbps

**S2-RTR# show ipv6 ospf**

Routing Process "ospfv3 99" with ID 2.2.2.2

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

Number of areas in this router is 0. 0 normal 0 stub 0 nssa

Reference bandwidth unit is 100 mbps

**S3-RTR# show ipv6 ospf**

Routing Process "ospfv3 99" with ID 3.3.3.3

SPF schedule delay 5 secs, Hold time between two SPFs 10 secs

Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs

LSA group pacing timer 240 secs

Interface flood pacing timer 33 msecs

Retransmission pacing timer 66 msecs

Number of external LSA 0. Checksum Sum 0x000000

Number of areas in this router is 0. 0 normal 0 stub 0 nssa

Reference bandwidth unit is 100 mbps

**Step 2:** Enable OSPFv3 routing for all appropriate interfaces according to the address table.

**S1-RTR(config)#** interface s0/0/0

S1-RTR(config-if)# ipv6 ospf 99 area 0  
!

S1-RTR(config)# interface s0/0/1

S1-RTR(config-if)# ipv6 ospf 99 area 0  
!

S1-RTR(config)# interface g0/0

S1-RTR(config-if)# ipv6 ospf 99 area 0

**S2-RTR(config)#** interface s0/0/0

S2-RTR(config-if)# ipv6 ospf 99 area 0

!

S2-RTR(config)# interface g0/0

S2-RTR(config-if)# ipv6 ospf 99 area 2

!

S2-RTR(config)# interface s0/0/1

S2-RTR(config-if)# ipv6 ospf 99 area 23

**S3-RTR(config)#** interface s0/0/0

S3-RTR(config-if)# ipv6 ospf 99 area 0

!

S3-RTR(config)# interface g0/0

S3-RTR(config-if)# ipv6 ospf 99 area 3

!

S3-RTR(config)# interface s0/0/1

S3-RTR(config-if)# ipv6 ospf 99 area 23

**S1-RTR# show ipv6 protocols**

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "static

IPv6 Routing Protocol is "ospf 99"

Interfaces (Area 0)

Serial0/0/0

Serial0/0/1

GigabitEthernet0/0

**S1-RTR# show ipv6 ospf neighbor**

Neighbor ID Pri State Dead Time Interface ID Interface

2.2.2.2 0 FULL/ - 00:00:30 3 Serial0/0/0

3.3.3.3 0 FULL/ - 00:00:35 3 Serial0/0/1

**S2-RTR# show ipv6 protocols**

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "static

IPv6 Routing Protocol is "ospf 99"

Interfaces (Area 0)

Serial0/0/0

Interfaces (Area 2)

GigabitEthernet0/0

Interfaces (Area 23)

Serial0/0/1

**S2-RTR# show ipv6 ospf neighbor**

Neighbor ID Pri State Dead Time Interface ID Interface

1.1.1.1 0 FULL/ - 00:00:31 3 Serial0/0/0

3.3.3.3 0 FULL/ - 00:00:37 4 Serial0/0/1

**S3-RTR# show ipv6 protocols**

IPv6 Routing Protocol is "connected"

IPv6 Routing Protocol is "static

IPv6 Routing Protocol is "ospf 99"

Interfaces (Area 0)

Serial0/0/0

Interfaces (Area 23)

Serial0/0/1

Interfaces (Area 3)

GigabitEthernet0/0

**S3-RTR# show ipv6 ospf neighbor**

Neighbor ID Pri State Dead Time Interface ID Interface

1.1.1.1 0 FULL/ - 00:00:38 4 Serial0/0/0

2.2.2.2 0 FULL/ - 00:00:37 4 Serial0/0/1

**Step 3:** Summarize the following networks sourcing from S1-RTR to both S2-RTR and S3-RTR.

* Create the following loopbacks on S1-RTR, enable them for OSPF within Area 51.
  + **Lo1:** 2001:dd41:34:51::1/64
  + **Lo2:** 2001:dd41:34:52::1/64
  + **Lo3:** 2001:dd41:34:53::1/64

**S1-RTR(config)#** interface Loopback1

S1-RTR(config-if)# ipv6 address 2001:DD41:34:51::1/64

S1-RTR(config-if)# ipv6 ospf 99 area 51

**S1-RTR(config)#** interface Loopback2

S1-RTR(config-if)# ipv6 address 2001:DD41:34:52::1/64

S1-RTR(config-if)# ipv6 ospf 99 area 51

**S1-RTR(config)#** interface Loopback3

S1-RTR(config-if)# ipv6 address 2001:DD41:34:53::1/64

S1-RTR(config-if)# ipv6 ospf 99 area 51

**S1-RTR(config)#** ipv6 router ospf 99

S1-RTR(config-rtr)# area 51 range 2001:dd41:34::/57

**NOTE:** As of July, 2013 summarization cannot be configured in packet tracer 6.0.1 for OSPFv3.

**Task 3: Configure dynamic routing using OSPFv3**

**Step 1:** Verify all routes have been successfully advertised.

**S1-RTR#** show ipv6 route ospf

IPv6 Routing Table - 15 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

D - EIGRP, EX - EIGRP external

OI 2001:DD41:34:3::/64 [110/65]

via FE80::2E0:8FFF:FEEA:7A01, Serial0/0/1

OI 2001:DD41:34:2::/64 [110/65]

via FE80::2E0:8FFF:FE22:C901, Serial0/0/0

OI 2001:DD41:34:23::/64 [110/128]

via FE80::2E0:8FFF:FE22:C901, Serial0/0/0

**S2-RTR#** show ipv6 route ospf

IPv6 Routing Table - 13 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

D - EIGRP, EX - EIGRP external

O 2001:DD41:34:1::/64 [110/65]

via FE80::260:3EFF:FE3D:6D01, Serial0/0/0

OI 2001:DD41:34:3::/64 [110/129]

via FE80::260:3EFF:FE3D:6D01, Serial0/0/0

O 2001:DD41:34:13::/64 [110/128]

via FE80::260:3EFF:FE3D:6D01, Serial0/0/0

O 2001:DD41:34:51::1/128 [110/64]

via FE80::260:3EFF:FE3D:6D01, Serial0/0/0

O 2001:DD41:34:52::1/128 [110/64]

via FE80::260:3EFF:FE3D:6D01, Serial0/0/0

O 2001:DD41:34:53::1/128 [110/64]

via FE80::260:3EFF:FE3D:6D01, Serial0/0/0

**S3-RTR#** show ipv6 route ospf

IPv6 Routing Table - 12 entries

Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP

U - Per-user Static route, M - MIPv6

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

D - EIGRP, EX - EIGRP external

O 2001:DD41:34:1::/64 [110/65]

via FE80::260:3EFF:FE3D:6D02, Serial0/0/0

O 2001:DD41:34:12::/64 [110/128]

via FE80::260:3EFF:FE3D:6D02, Serial0/0/0

O 2001:DD41:34:51::1/128 [110/64]

via FE80::260:3EFF:FE3D:6D02, Serial0/0/0

O 2001:DD41:34:52::1/128 [110/64]

via FE80::260:3EFF:FE3D:6D02, Serial0/0/0

O 2001:DD41:34:53::1/128 [110/64]

via FE80::260:3EFF:FE3D:6D02, Serial0/0/0

**Step 2:** Verify reachability from all hosts within different OSPF areas.

**S1-PC> ping 2001:DD41:34:2:202:17FF:FE06:49A6**

Pinging 2001:DD41:34:2:202:17FF:FE06:49A6 with 32 bytes of data:

Reply from 2001:DD41:34:3:210:11FF:FEC2:36AA: bytes=32 time=9ms TTL=126

**S1-PC> ping 2001:DD41:34:2:202:17FF:FE06:49A6**

Pinging 2001:DD41:34:2:202:17FF:FE06:49A6 with 32 bytes of data:

Reply from 2001:DD41:34:2:202:17FF:FE06:49A6: bytes=32 time=1ms TTL=126

**NOTE:** As of July, 2013 during testing some routing inconsistencies existed when working with multiple areas.