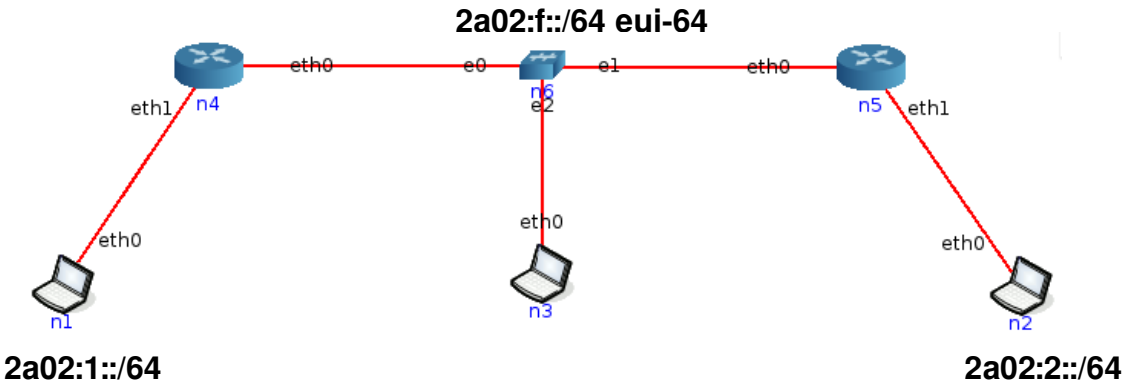
Routing IPv6 worked example



Initial service configuration

Before starting network. Right-click on each router, select services and enable:

- zebra
- OSPFv3
- vtysh
- IPForward

It is unnecessary to configure the hosts as they will receive IP addresses from the StateLess Address Auto-Configuration (SLAAC) process.

Run the network with the "start the session" button.

Configuration of Router n4

```
n4# conf t
```

Enable IPv6 forwarding, this enable IPv6 routing.

```
n4(config)# ipv6 forwarding
```

Configure an IP address for the point to point link. I left this as a /64 as per the diagram the MAC address is used by the router to build the host portion of the IPv6 address. I also made it OSPF6 point to Point which reduces OSPF6 traffic when there are only two devices on the link.

```
n4(config)# int eth0
n4(config-if)# ipv6 address 2a02:f::/64
n4(config-if)# no ipv6 nd suppress-ra
n4(config-if)# ipv6 ospf6 network point-to-point
```

The eth1 interface is facing the network with Node n1. This is configured to assign a prefix to hosts as part of the SLAAC process. I also make the interface OSPF6 passive which means the router will not try and form neighbour relationships with other routers on this network. Why ? Because there are no other routers on the network and this reduces unnecessary traffic.

```
n4(config)# int eth1
n4(config-if)# ipv6 address 2a02:1::1/64
n4(config-if)# ipv6 nd prefix 2a02:1::/64 86400 86400
n4(config-if)# ipv6 nd reachable-time 5000
n4(config-if)# no ipv6 nd suppress-ra
n4(config-if)# ipv6 ospf6 passive
```

On the loopback interface an IPv4 address was configured despite the fact IPv4 is not being routed. This is not strictly necessary but it is a handy to copy this address as the OSPF router-id. There is also an IPv6 IP address configured as a host route that is also routed, this makes it east to identify routers within other routers IPv6 route tables.

```
n4(config-if)# interface lo
n4(config-if)# ip address 10.0.0.1/32
n4(config-if)# ipv6 address 2001::1/128
```

Then the OSPFv6 configuration. The IPv4 loopback address is used as the OSPFv6 router-id. By default the eth0 and eth1 interfaces are included within OSPFv6 configuration so only the loopback interface needs to be added.

```
n4(config-if)# router ospf6
n4(config-ospf6)# router-id 10.0.0.1
n4(config-ospf6)# interface lo area 0.0.0.0
```

Here are the full command set for Router n4 to make it easy to copy and paste.

```
conf t
ipv6 forwarding
int eth0
ipv6 address 2a02:f::/64
no ipv6 nd suppress-ra
ipv6 ospf6 network point-to-point
int eth1
ipv6 address 2a02:1::1/64
ipv6 nd prefix 2a02:1::/64 86400 86400
ipv6 nd reachable-time 5000
no ipv6 nd suppress-ra
ipv6 ospf6 passive
interface lo
ip address 10.0.0.1/32
ipv6 address 2001::1/128
router ospf6
router-id 10.0.0.1
interface lo area 0.0.0.0
```

Configuration of Router n5

The configuration of Router n5 is a mirror of router n4.

```
n5# conf t
n5(config)# ipv6 forwarding

n5(config)# int eth0
n5(config-if)# ipv6 address 2a02:f::/64
n5(config-if)# no ipv6 nd suppress-ra
n5(config-if)# ipv6 ospf6 network point-to-point

n5(config)# int eth1
n5(config-if)# ipv6 address 2a02:2::1/64
n5(config-if)# ipv6 nd prefix 2a02:2::/64 86400 86400
n5(config-if)# ipv6 nd reachable-time 5000
n5(config-if)# no ipv6 nd suppress-ra
n5(config-if)# ipv6 ospf6 passive


n5(config-if)# interface lo
n5(config-if)# ip address 10.0.0.2/32
n5(config-if)# ipv6 address 2001::2/128

n5(config-if)# router ospf6
n5(config-ospf6)# router-id 10.0.0.2
n5(config-ospf6)# interface lo area 0.0.0.0
```

Here are the full command set for Router n5 to make it easy to copy and paste.

```
conf t
ipv6 forwarding
int eth0
ipv6 address 2a02:f::/64
no ipv6 nd suppress-ra
ipv6 ospf6 network point-to-point
int eth1
ipv6 address 2a02:2::1/64
ipv6 nd prefix 2a02:2::/64 86400 86400
ipv6 nd reachable-time 5000
no ipv6 nd suppress-ra
ipv6 ospf6 passive
interface lo
ip address 10.0.0.2/32
ipv6 address 2001::2/128
router ospf6
router-id 10.0.0.2
interface lo area 0.0.0.0
```

Review Router n4

Check the IPv6 neighbour relationship state. A relationship with router-id 10.0.0.2 exists, which corresponds to Router n5.

```
n4# show ipv6 ospf6 neighbor
Neighbor ID     Pri    DeadTime  State/IfState         Duration I/F[State]
10.0.0.2          1    00:00:34   Full/DROther         00:00:55 eth0[PointToPoint]
```

Checking the IPv6 routes table confirms that routes have been learnt from Router n5. I have highlighted the two routes learnt from Router n5, the networks on the loopback and eth1 interfaces respectfully.

```
n4# show ipv6 route
Codes: K - kernel route, C - connected, S - static, R - RIPng,
       O - OSPFv6, I - IS-IS, B - BGP, A - Babel,
       > - selected route, * - FIB route

C>* ::1/128 is directly connected, lo
O   2001::1/128 [110/10] is directly connected, lo, 00:03:32
C>* 2001::1/128 is directly connected, lo
O>* 2001::2/128 [110/20] via fe80::200:ff:feaa:0, eth0, 00:00:57
O   2a02:1::/64 [110/10] is directly connected, eth1, 00:03:32
C>* 2a02:1::/64 is directly connected, eth1
O>* 2a02:2::/64 [110/20] via fe80::200:ff:feaa:0, eth0, 00:00:57
O   2a02:f::/64 [110/10] is directly connected, eth0, 00:03:32
C>* 2a02:f::/64 is directly connected, eth0
C * fe80::/64 is directly connected, eth1
C>* fe80::/64 is directly connected, eth0
```

IP Address on Node n1

Checking the IPv6 address on Node n1 shows a link local address and a global scope address, the latter being formed by the prefix given out from the Router N4 and its own MAC address via SLAAC process.

```
root@n1:/tmp/pycore.33365/n1.conf# ip -6 addr | grep inet6
    inet6 ::1/128 scope host
    inet6 2a02:1::200:ff:feaa:6/64 scope global mngtmpaddr dynamic
    inet6 fe80::200:ff:feaa:6/64 scope link
```

Review Router n5

Carry out the same checks on Router n5 as was just carried out on Router n4.

```
n5# show ipv6 ospf6 neighbor
Neighbor ID     Pri    DeadTime  State/IfState         Duration I/F[State]
10.0.0.1          1    00:00:33   Full/DROther         00:00:04 eth0[PointToPoint]

n5# show ipv6 route
Codes: K - kernel route, C - connected, S - static, R - RIPng,
       O - OSPFv6, I - IS-IS, B - BGP, A - Babel,
       > - selected route, * - FIB route

C>* ::1/128 is directly connected, lo
O>* 2001::1/128 [110/20] via fe80::200:ff:feaa:4, eth0, 00:00:06
O   2001::2/128 [110/10] is directly connected, lo, 00:00:19
C>* 2001::2/128 is directly connected, lo
O>* 2a02:1::/64 [110/20] via fe80::200:ff:feaa:4, eth0, 00:00:06
O   2a02:2::/64 [110/10] is directly connected, eth1, 00:00:19
C>* 2a02:2::/64 is directly connected, eth1
O   2a02:f::/64 [110/10] is directly connected, eth0, 00:00:19
C>* 2a02:f::/64 is directly connected, eth0
C * fe80::/64 is directly connected, eth1
C>* fe80::/64 is directly connected, eth0
```

IP Address on Node n2

```
root@n2:/tmp/pycore.33365/n2.conf# ip -6 addr | grep inet6
    inet6 ::1/128 scope host
    inet6 2a02:2::200:ff:feaa:2/64 scope global mngtmpaddr dynamic
    inet6 fe80::200:ff:feaa:2/64 scope link
```

Testing network via the Nodes n1 and n2

From Node n1 ping the router interface eth1 on Router n5.

```
root@n1:/tmp/pycore.33365/n1.conf# ping6 -c1 2a02:2::1
PING 2a02:2::1(2a02:2::1) 56 data bytes
64 bytes from 2a02:2::1: icmp_seq=1 ttl=63 time=0.052 ms

--- 2a02:2::1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.052/0.052/0.052/0.000 ms
```

From Node n1 ping the Node n2.

```
root@n1:/tmp/pycore.33365/n1.conf# ping6 -c1 2a02:2::200:ff:feaa:2
PING 2a02:2::200:ff:feaa:2(2a02:2::200:ff:feaa:2) 56 data bytes
64 bytes from 2a02:2::200:ff:feaa:2: icmp_seq=1 ttl=62 time=0.113 ms

--- 2a02:2::200:ff:feaa:2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.113/0.113/0.113/0.000 ms
```

Trace the route from Node n1 to Node n2.

```
root@n1:/tmp/pycore.33365/n1.conf# traceroute6 2a02:2::200:ff:feaa:2
traceroute to 2a02:2::200:ff:feaa:2 (2a02:2::200:ff:feaa:2), 30 hops max, 80 byte packets
 1  2a02:1::1 (2a02:1::1)  0.037 ms  0.007 ms  0.005 ms
 2  2a02:2::1 (2a02:2::1)  0.026 ms  0.011 ms  0.010 ms
 3  2a02:2::200:ff:feaa:2 (2a02:2::200:ff:feaa:2)  0.020 ms  0.012 ms  0.011 ms
```

Repeat the process from Node n2.

```
root@n2:/tmp/pycore.33365/n2.conf# ping6 -c1 2a02:1::1
PING 2a02:1::1(2a02:1::1) 56 data bytes
64 bytes from 2a02:1::1: icmp_seq=1 ttl=63 time=0.055 ms

--- 2a02:1::1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.055/0.055/0.055/0.000 ms

root@n2:/tmp/pycore.33365/n2.conf# ping6 -c1 2a02:1::200:ff:feaa:6
PING 2a02:1::200:ff:feaa:6(2a02:1::200:ff:feaa:6) 56 data bytes
64 bytes from 2a02:1::200:ff:feaa:6: icmp_seq=1 ttl=62 time=0.048 ms

--- 2a02:1::200:ff:feaa:6 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.048/0.048/0.048/0.000 ms

root@n2:/tmp/pycore.33365/n2.conf# traceroute6 2a02:1::200:ff:feaa:6
traceroute to 2a02:1::200:ff:feaa:6 (2a02:1::200:ff:feaa:6), 30 hops max, 80 byte packets
 1  2a02:2::1 (2a02:2::1)  0.043 ms  0.009 ms  0.017 ms
 2  2a02:f:: (2a02:f::)  0.026 ms  0.010 ms  0.010 ms
 3  2a02:1::200:ff:feaa:6 (2a02:1::200:ff:feaa:6)  0.021 ms  0.012 ms  0.018 ms
```