TEL3214
Computer Communication Networks

Lecture 7b

Routing – IPv6 routing with OSPFv3

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

OSPFv3

Changes between OSPFv2, and OSPFv3 include:

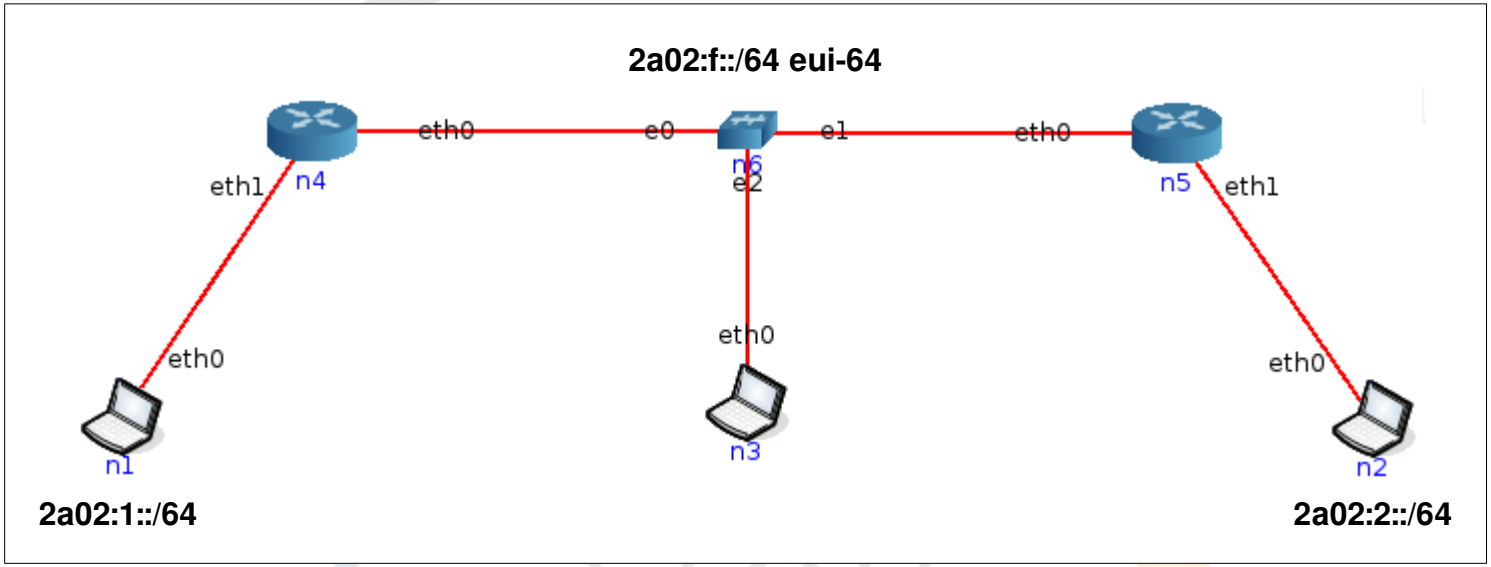
- Addressing semantics have been removed from OSPF packets and the basic LSAs.
- New LSAs have been created to carry IPv6 addresses and prefixes.
- OSPF now runs on a per-link basis rather than on a per-IP-subnet basis.
- Flooding scope for LSAs has been generalised.
- Authentication removed and instead relies on IPv6's underlying AH and ESP.

IPv6 Configuration

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com

IPv6 Network



Configure Router n4

```
n4# conf t
n4(config)# hostname RTR_n4

RTR_n4(config)# ipv6 forwarding

RTR_n4(config-if)# int eth0
RTR_n4(config-if)# ipv6 address 2a02:f::/64
RTR_n4(config-if)# ipv6 nd suppress-ra
RTR_n4(config-if)# ipv6 ospf6 network point-to-point



RTR_n4(config-if)# int lo
RTR_n4(config-if)# ip address 10.0.0.1/32
RTR_n4(config-if)# ipv6 address 2a00:0::1/128
```

Configure Router n4

```
RTR_n4(config)# int eth1
RTR_n4(config-if)# ipv6 address 2a02:1::1/64
RTR_n4(config-if)# ipv6 nd prefix 2a02:1::/64 86400 86400
RTR_n4(config-if)# ipv6 nd reachable-time 5000
RTR_n4(config-if)# no ipv6 nd suppress-ra


RTR_n4(config-if)# ipv6 ospf6 network broadcast
RTR_n4(config-if)# ipv6 ospf6 passive
```

Configure Router n5

```
n5# conf t
n5(config)# hostname RTR_n5
RTR_n5(config)# ipv6 forwarding

RTR_n5(config)# int eth0
RTR_n5(config-if)# ipv6 a 2a02:f::/64
RTR_n5(config-if)# ipv6 nd s
RTR_n5(config-if)# ipv6 ospf6 n p

RTR_n5(config-if)# int eth1
RTR_n5(config-if)# ipv6 a 2a02:2::1/64
RTR_n5(config-if)# ipv6 nd p 2a02:2::/64 86400 86400
RTR_n5(config-if)# ipv6 nd re 5000

RTR_n5(config-if)# ipv6 ospf6 n b
RTR_n5(config-if)# ipv6 ospf6 pa
RTR_n5(config-if)# no ipv6 nd s

RTR_n5(config-if)# int lo
RTR_n5(config-if)# ip a 10.0.0.2/32
RTR_n5(config-if)# ipv6 a 2a00:0::2/128
```

Testing SLAAC

Host n1

```
root@n1:/tmp/pycore.52704/n1.conf# ip -6 addr list
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
73: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qlen 1000
    inet6 2a02:1::200:ff:feaa:0/64 scope global mngtmpaddr dynamic
       valid_lft 86055sec preferred_lft 86055sec
    inet6 fe80::200:ff:feaa:0/64 scope link
       valid_lft forever preferred_lft forever
```

Host n2

```
root@n2:/tmp/pycore.52704/n2.conf# ip -6 addr list
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
84: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qlen 1000
    inet6 2a02:2::200:ff:feaa:5/64 scope global mngtmpaddr dynamic
       valid_lft 86088sec preferred_lft 86088sec
    inet6 fe80::200:ff:feaa:5/64 scope link
       valid_lft forever preferred_lft forever
```

OSPFv3 Configuration

Router n4

```
RTR_n4(config-if)# router ospf6
RTR_n4(config-router)# router-id 10.0.0.1
RTR_n4(config-router)# interface eth0 area 0.0.0.0
RTR_n4(config-router)# interface eth1 area 0.0.0.0
```

Router n5

```
RTR_n5(config-if)# router ospf6
RTR_n5(config-router)# router-id 10.0.0.2
RTR_n5(config-router)# int eth0 a 0.0.0.0
RTR_n5(config-router)# int eth1 a 0.0.0.0
```

Reviewing IPv6 Configuration in Router n4

```
RTR_n4# show ipv6 ospf6 neighbor

Neighbor ID     Pri    DeadTime  State/IfState         Duration I/F[State]
10.0.0.2          1    00:00:37   Full/DROther         00:52:20 eth0[PointToPoint]
```

Reviewing IPv6 Configuration in Router n4

RTR_n4# **show ipv6 ospf6 database**

```
        Area Scoped Link State Database (Area 0.0.0.0)

Type LSId            AdvRouter       Age   SeqNum                  Payload
Rtr  0.0.0.0         0.0.0.0        1702 8000000b            10.0.0.2/0.0.0.79
Rtr  0.0.0.0         10.0.0.1       1368 80000003            10.0.0.2/0.0.0.79
Rtr  0.0.0.0         10.0.0.2       1339 8000000b            10.0.0.1/0.0.0.77
INP  0.0.0.0         0.0.0.0        1708 80000005                 2a02:1::/64
INP  0.0.0.0         0.0.0.0        1708 80000005                 2a02:f::/64
INP  0.0.0.0         10.0.0.1       1371 80000002                 2a02:1::/64
INP  0.0.0.0         10.0.0.1       1371 80000002                 2a02:f::/64
INP  0.0.0.0         10.0.0.2        161 80000004                 2a02:2::/64
INP  0.0.0.0         10.0.0.2        161 80000004                 2a02:f::/64

        I/F Scoped Link State Database (I/F eth0 in Area 0.0.0.0)

Type LSId            AdvRouter       Age   SeqNum                  Payload
Lnk  0.0.0.75        0.0.0.0         871 80000003          fe80::200:ff:feaa:1

        I/F Scoped Link State Database (I/F eth1 in Area 0.0.0.0)

Type LSId            AdvRouter       Age   SeqNum                  Payload
Lnk  0.0.0.77        0.0.0.0         867 80000003          fe80::200:ff:feaa:2
Lnk  0.0.0.79        10.0.0.2        162 80000005          fe80::200:ff:feaa:3

        AS Scoped Link State Database

Type LSId            AdvRouter       Age   SeqNum                  Payload
```

Reviewing IPv6 Configuration in Router n4

```
RTR_n4# show ipv6 ospf6 route
*N IA 2a02:1::/64                 ::                        eth0 00:53:37
*N IA 2a02:2::/64                 fe80::200:ff:feaa:3       eth1 00:53:33
*N IA 2a02:f::/64                 ::                        eth1 00:53:37
 N IA 2a02:f::/64                 fe80::200:ff:feaa:3       eth1 00:53:33
```

```
RTR_n4# sh 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
C>* 2a00::1/128 is directly connected, lo
O   2a02:1::/64 [110/10] is directly connected, eth0, 00:54:05
C>* 2a02:1::/64 is directly connected, eth0
O>* 2a02:2::/64 [110/20] via fe80::200:ff:feaa:3, eth1, 00:54:02
O   2a02:f::/64 [110/10] is directly connected, eth1, 00:54:05
C>* 2a02:f::/64 is directly connected, eth1
C * fe80::/64 is directly connected, eth1
C>* fe80::/64 is directly connected, eth0
```

Reviewing IPv6 Configuration in Router n5

```
RTR_n5# show ipv6 ospf6 neighbor
Neighbor ID     Pri    DeadTime  State/IfState         Duration I/F[State]
10.0.0.1          1    00:00:36   Full/DROther         00:55:55 eth0[PointToPoint]
```

Reviewing IPv6 Configuration in Router n5

```
RTR_n5# show ipv6 ospf6 database

        Area Scoped Link State Database (Area 0.0.0.0)

Type LSId            AdvRouter       Age   SeqNum                  Payload
Rtr  0.0.0.0         0.0.0.0          108 8000000c          10.0.0.2/0.0.0.79
Rtr  0.0.0.0         10.0.0.1        1574 80000003          10.0.0.2/0.0.0.79
Rtr  0.0.0.0         10.0.0.2        1543 8000000b          10.0.0.1/0.0.0.77
INP  0.0.0.0         0.0.0.0          114 80000006               2a02:1::/64
INP  0.0.0.0         0.0.0.0          114 80000006               2a02:f::/64
INP  0.0.0.0         10.0.0.1        1577 80000002               2a02:1::/64
INP  0.0.0.0         10.0.0.1        1577 80000002               2a02:f::/64
INP  0.0.0.0         10.0.0.2         365 80000004               2a02:2::/64
INP  0.0.0.0         10.0.0.2         365 80000004               2a02:f::/64

        I/F Scoped Link State Database (I/F eth0 in Area 0.0.0.0)

Type LSId            AdvRouter       Age   SeqNum                  Payload
Lnk  0.0.0.77        0.0.0.0         1073 80000003       fe80::200:ff:feaa:2
Lnk  0.0.0.79        10.0.0.2         366 80000005       fe80::200:ff:feaa:3

        I/F Scoped Link State Database (I/F eth1 in Area 0.0.0.0)

Type LSId            AdvRouter       Age   SeqNum                  Payload
Lnk  0.0.0.82        0.0.0.0          623 80000004       fe80::200:ff:feaa:4
Lnk  0.0.0.82        10.0.0.2         365 80000005       fe80::200:ff:feaa:4

        AS Scoped Link State Database

Type LSId            AdvRouter       Age   SeqNum                  Payload
```

Reviewing IPv6 Configuration in Router n5

```
RTR_n5# show ipv6 ospf6 route
*N IA 2a02:1::/64                   ::                          0 00:56:35
*N IA 2a02:2::/64                   ::                       eth1 01:06:33
*N IA 2a02:f::/64                   ::                       eth0 01:06:33
 N IA 2a02:f::/64                   ::                          0 00:56:35


RTR_n5# sh 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
C>* 2a00::2/128 is directly connected, lo
O>* 2a02:1::/64 [110/20] via fe80::200:ff:feaa:2, eth0, 01:02:28
O   2a02:2::/64 [110/10] is directly connected, eth1, 01:06:52
C>* 2a02:2::/64 is directly connected, eth1
O   2a02:f::/64 [110/10] is directly connected, eth0, 01:06:52
C>* 2a02:f::/64 is directly connected, eth0
C * fe80::/64 is directly connected, eth1
C>* fe80::/64 is directly connected, eth0
```

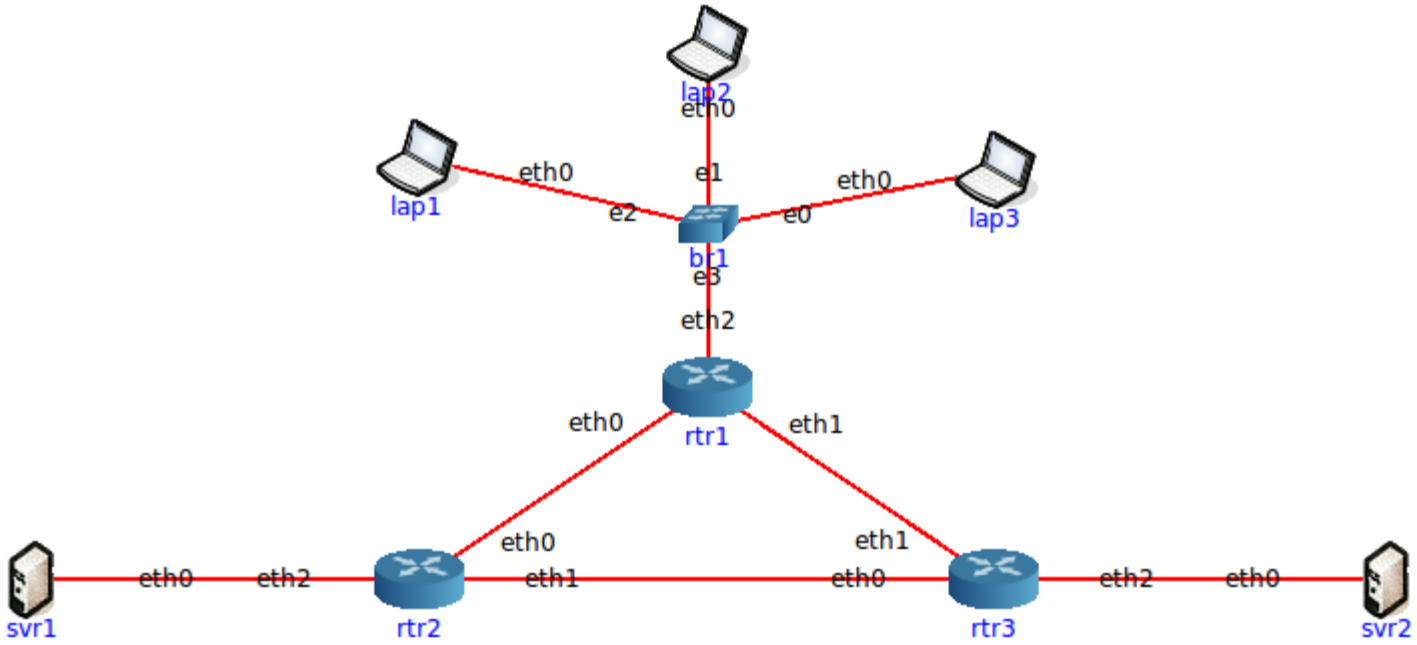
Testing the IPv6 network

```
root@n1:/tmp/pycore.52704/n1.conf# ping6 -c1 2a02:2::200:ff:feaa:5
PING 2a02:2::200:ff:feaa:5(2a02:2::200:ff:feaa:5) 56 data bytes
64 bytes from 2a02:2::200:ff:feaa:5: icmp_seq=1 ttl=62 time=0.066 ms

--- 2a02:2::200:ff:feaa:5 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.066/0.066/0.066/0.000 ms


root@n1:/tmp/pycore.52704/n1.conf# traceroute6 2a02:2::200:ff:feaa:5
traceroute to 2a02:2::200:ff:feaa:5, 30 hops max, 80 byte packets
 1  2a02:1::1 (2a02:1::1)  0.029 ms  0.007 ms  0.006 ms
 2  2a02:2::1 (2a02:2::1)  0.021 ms  0.011 ms  0.011 ms
 3  2a02:2::200:ff:feaa:5  0.018 ms  0.012 ms  0.012 ms
```

Routing Lab


lap2
eth0
lap1
eth0
e1
eth0
e2
e0
lap3
br1
e3
eth2
rtr1
eth0
eth1
eth0
eth1
svr1
eth0
eth2
rtr2
eth1
eth0
rtr3
eth2
eth0
svr2

Thank you

Diarmuid Ó Briain
CEng, FIEI, FIET, CISSP

diarmuid@obriain.com