Module 2 – OSPF Configuration for Training Lab Network

Objective: All the workshop lab routers are configured with required basic & interface configuration according to the topology diagram below. Network level reachability testing between directly connected point-to-point links are successfully done in our previous module (Module 1). Participants will require to configure OSPF related configuration on this module for both IPv6 and IPv4 protocol. Workshop instructor will be presenting OSPF design goal & specification for this module. Workshop team has already been build and participants have got access to their designated routers.

Prerequisites: Basic routing concept, IP addressing, Huawei router CLI, Telnet/SSH software etc.

The following will be the common topology and IP address plan used for the labs.

Figure 1 – ISP Lab Topology
**Lab Notes**

This workshop is intended to be run on a real Huawei routers or eNSP (Enterprise Network Simulation Platform) with the above lab topologies set up. The routers are using both IPv4 and IPv6 supported Huawei VRP software (VRP software, Version 5.130) software. Participants should do their workshop module two configuration to achieve following goals.

1. After finishing the required interface configuration in module one we only can ping those directly connected interfaces. Loopback, and point-to-point interfaces are still not reachable (ping) from remote routers.
2. For the scalability purpose of IGP (i.e. OSPF) it is advisable to advertise only infrastructure prefixes to OSPF. It includes loopback, infrastructure point-to-point, and transport prefixes only. Please note customer site point-to-point (i.e. link between R1 to r13-CAR1 etc) and data centre (i.e. R1 e1/3 etc) prefixes are not advertised to OSPF. Because it might restrict your network growth as it will cause the growth of your OSPF.
3. For the same purpose we are using hierarchical OSPF areas to create separate topology database for different regional networks. On all four core routers loopback address is published to OSPF area 0.
4. There will not be any OSPF protocol running with the customer routers. So no OSPF configuration is required on those.
5. After finishing OSPF configuration we would like to see following 26 new prefixes in all infrastructure routers routing table.

<table>
<thead>
<tr>
<th>Loopback</th>
<th>Point-to-point</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1=&gt; 2406:6400::1/128</td>
<td>R2-R1=&gt; 2406:6400:e::/64</td>
<td>Purple=&gt; 2406:6400:2::/48</td>
</tr>
<tr>
<td>R2=&gt; 2406:6400::2/128</td>
<td>R2-R3=&gt; 2406:6400:e:1::/64</td>
<td>Green=&gt; 2406:6400:3::/48</td>
</tr>
<tr>
<td>R3=&gt; 2406:6400::3/128</td>
<td>R1-R3=&gt; 2406:6400:e:2::/64</td>
<td></td>
</tr>
<tr>
<td>R4=&gt; 2406:6400::4/128</td>
<td>R5-R4=&gt; 2406:6400:e:10::/64</td>
<td></td>
</tr>
<tr>
<td>R5=&gt; 2406:6400::5/128</td>
<td>R5-R6=&gt; 2406:6400:e:11::/64</td>
<td></td>
</tr>
<tr>
<td>R6=&gt; 2406:6400::6/128</td>
<td>R4-R6=&gt; 2406:6400:e:12::/64</td>
<td></td>
</tr>
<tr>
<td>R7=&gt; 2406:6400::7/128</td>
<td>R8-R7=&gt; 2406:6400:e:20::/64</td>
<td></td>
</tr>
<tr>
<td>R8=&gt; 2406:6400::8/128</td>
<td>R8-R9=&gt; 2406:6400:e:21::/64</td>
<td></td>
</tr>
<tr>
<td>R9=&gt; 2406:6400::9/128</td>
<td>R7-R9=&gt; 2406:6400:e:22::/64</td>
<td></td>
</tr>
<tr>
<td>R10=&gt; 2406:6400::10/128</td>
<td>R11-R10=&gt; 2406:6400:e:30::/64</td>
<td></td>
</tr>
<tr>
<td>R11=&gt; 2406:6400::11/128</td>
<td>R11-R12=&gt; 2406:6400:e:31::/64</td>
<td></td>
</tr>
<tr>
<td>R12=&gt; 2406:6400::12/128</td>
<td>R11-R12=&gt; 2406:6400:e:32::/64</td>
<td></td>
</tr>
</tbody>
</table>

6. Due to time restriction in workshop OSPF analysis and example will cover IPv6 prefixes only. You can check IPv4 prefixes for your own understanding purpose.
Lab Exercise

1. IPv6 OSPF (OSPFv3) Configuration: This configuration on Huawei VRP can be done from interface configuration mode. This configuration will activate a separate OSPF process on your Huawei router if you already have OSPFv2 running. For a dual stack router you need to run both OSPFv2 and v3 at the same time. Please notice OSPFv3 router ID which is still 32bit number.

   Example Config on a Router:

   ```
   system-view
   To enter into a Huawei router system view.

   ospfv3 17821
   Create ospfv3 process 17821

   router-id 172.16.15.1
   The router ID of OSPFv3 must be manually set. If no router ID is set, OSPFv3 fails to run normally.

   interface loopback 0
   ospfv3 17821 area 1
   ospfv3 17821 area 1
   ospfv3 network-type p2p
   We are using Ethernet interface which is broadcast multi-access type of network for OSPF. By default OSPF will automatically detect the interface type and elect DR/BDR. If we use this command then OSPF will consider it as point to point link and no DR/BDR will be elected.

   interface gigabitethernet2/0/0
   ospfv3 17821 area 1
   ospfv3 network-type p2p
   quit
   quit
   save
   ```

   Interface loopback 0, gigabitethernet2/0/0 and gigabitethernet2/0/1 will be participating in OSPFv3 process ID 17821 area 1. Prefixes configured on these interfaces will be advertised.

2. IPv4 OSPF (OSPFv2) Configuration: This configuration can be done from the global configuration mode of a Huawei router. Same process ID can be used but still it is unique because same process id is used for 2 different service i.e OSPFv2 and OSPFv3.

   Example Config on a Router:

   ```
   system-view
   To enter into a Huawei router system view.

   router id 172.16.15.2
   Configure router id for each OSPF router.

   ospf 17821
   Create ospfv2 process 17821
   ```
silent-interface all
Do not create hello message by default to all interface. This approach is very effective if we would like to build OSPF adjacency on the selected interface. Specially if there is an external facing interface and no OSPF routing to them.

area 0
network 172.16.15.2 0.0.0.0
Loopback interface is not generating any hello but adding prefixes to OSPF

network 172.16.12.0 0.0.0.255
network 172.16.13.0 0.0.0.255
Advertise network 172.16.12.0 & 172.16.13.0 mask 255.255.255.252 to area 0. Wildcard mask is reverse to subnet mask.

area 1
network 172.16.10.0 0.0.0.3
network 172.16.10.4 0.0.0.3
quit
And advertise network 172.16.10.0 mask 255.255.255.252 to area 1. Wildcard mask is reverse to subnet mask.

undo silent-interface gigabitethernet2/0/0
Interface gigabitethernet2/0/0 will generate hello to build adjacency with connected link.

undo silent-interface gigabitethernet2/0/1
undo silent-interface gigabitethernet4/0/0
undo silent-interface gigabitethernet4/0/1
quit

interface gigabitethernet2/0/0
ospf network-type p2p
We are using Ethernet interface which is broadcast multi-access type of network for OSPF. By default OSPF will automatically detect the interface type and elect DR/BDR. If we use this command then OSPF will consider it as point to point link and no DR/BDR will be elected.

interface gigabitethernet2/0/1
ospf network-type p2p
quit
save

3. Verify IPv6 OSPF Configuration:

Example IPv6 protocol verification on a Router:

display ospfv3 peer [To check OSPFv3 neighbor table]
display ospfv3 lsdb [To check OSPFv3 topology table]
display ipv6 routing protocol ospfv3 [To check ipv6 routing table prefixes learn by OSPFv3]

ping ipv6 [router1….up to router12 loopback] ----reachable
ping ipv6 [all WAN interface & transport interface] ----reachable
ping ipv6 [any datacenter prefix] ----unreachable
ping ipv6 [any customer prefix] ----unreachable
debugging ospfv3 packet all
debugging ospfv3 nfsm status [enable ospfv3 neighbor state machine debugging]
You need to replace router name with the loopback address. Please look at the topology diagram on page 1 for further detail.

Example IPv4 protocol verification on a Router:

display ospf peer [To check OSPFv2 neighbor table]
display ospf lsdb [To check OSPFv2 topology table]
display ip routing protocol ospf [To check ipv4 routing table prefixes learn by OSPFv2]

ping [router1...up to router12 loopback] ----reachable
ping [all WAN interface & transport interface] ----reachable
ping [any datacenter prefix] ----unreachable
ping [any customer prefix] ----unreachable
debugging ospf packet

END OF MODULE TWO……
Next pages for reference template used on different routers....
Configuration of OSPF in training ISP network Region1:

IPv4 OSPF Conf Router1:

```
system-view
router id 172.16.15.1
ospf 17821
silent-interface all
area 1
network 172.16.15.1 0.0.0.0
network 172.16.10.0 0.0.0.3
network 172.16.10.8 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
quit
save
```

IPv6 OSPF Conf Router1:
IPv4 OSPF Conf Router2:

```
system-view
ospfv3 17821
router-id 172.16.15.1
quit
interface loopback 0
ospfv3 17821 area 1
interface gigabitethernet2/0/0
ospfv3 17821 area 1
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 1
ospfv3 network-type p2p
quit
quit
save
```

IPv6 OSPF Conf Router2:

```
system-view
ospfv3 17821
router-id 172.16.15.2
silent-interface all
area 0
network 172.16.15.2 0.0.0.0
network 172.16.12.0 0.0.0.255
network 172.16.13.0 0.0.0.255
area 1
network 172.16.10.0 0.0.0.3
network 172.16.10.4 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
undo silent-interface gigabitethernet4/0/0
undo silent-interface gigabitethernet4/0/1
quit
interface gigabitethernet2/0/0
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 network-type p2p
quit
quit
save
```
IPv4 OSPF Conf Router3:

```
system-view
router id 172.16.15.3
ospf 17821
silent-interface all
area 1
network 172.16.15.3 0.0.0.0
network 172.16.10.4 0.0.0.3
network 172.16.10.8 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
quit
interface gigabitethernet2/0/1
ospf network-type p2p
quit
save
```

IPv6 OSPF Conf Router3:

```
system-view
ospfv3 17821
router-id 172.16.15.3
quit
interface loopback 0
ospfv3 17821 area 1
interface gigabitethernet2/0/0
ospfv3 17821 area 1
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 1
ospfv3 network-type p2p
quit
quit
save
```
Configuration of OSPF in training ISP network Region2:

IPv4 OSPF Conf Router4:

```
system-view
router id 172.16.15.4
ospf 17821
silent-interface all
area 2
network 172.16.15.4 0.0.0.0
network 172.16.10.24 0.0.0.3
network 172.16.10.32 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
save
```

IPv6 OSPF Conf Router4:

```
system-view
ospfv3 17821
router-id 172.16.15.4
quit
```
interface loopback 0
ospfv3 17821 area 2
interface gigabitethernet2/0/0
ospfv3 17821 area 2
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 2
ospfv3 network-type p2p
quit
quit
save

**IPv4 OSPF Conf Router5:**

```
system-view
router id 172.16.15.5
ospf 17821
silent-interface all
area 0
  network 172.16.15.5 0.0.0.0
  network 172.16.12.0 0.0.0.255
  network 172.16.13.0 0.0.0.255
area 2
  network 172.16.10.24 0.0.0.3
  network 172.16.10.28 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
undo silent-interface gigabitethernet4/0/0
undo silent-interface gigabitethernet4/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
quit
save
```

**IPv6 OSPF Conf Router5:**

```
system-view
ospfv3 17821
router-id 172.16.15.5
quit
interface loopback 0
ospfv3 17821 area 0
interface gigabitethernet4/0/0
ospfv3 17821 area 0
interface gigabitethernet4/0/1
ospfv3 17821 area 0
interface gigabitethernet2/0/0
ospfv3 17821 area 2
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 2
ospfv3 network-type p2p
quit
quit
save
```
IPv4 OSPF Conf Router6:

system-view
router id 172.16.15.6
ospf 17821
silent-interface all
area 2
network 172.16.15.6 0.0.0.0
network 172.16.10.28 0.0.0.3
network 172.16.10.32 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
quit
interface gigabitethernet2/0/1
ospf network-type p2p
quit
save

IPv6 OSPF Conf Router6:

system-view
ospfv3 17821
router-id 172.16.15.6
quit
interface loopback 0
ospfv3 17821 area 2
interface gigabitethernet2/0/0
ospfv3 17821 area 2
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 2
ospfv3 network-type p2p
quit
quit
save
**Configuration of OSPF in training ISP network Region3:**

**IPv4 OSPF Conf Router7:**

```
system-view
router id 172.16.15.7
ospf 17821
silent-interface all
area 3
network 172.16.15.7 0.0.0.0
network 172.16.10.48 0.0.0.3
network 172.16.10.56 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
quit
save
```

**IPv6 OSPF Conf Router7:**

```
system-view
ospfv3 17821
router-id 172.16.15.7
```
quit
interface loopback 0
ospfv3 17821 area 3
interface gigabitethernet2/0/0
ospfv3 17821 area 3
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 3
ospfv3 network-type p2p
quit
quit
save

IPv4 OSPF Conf Router8:

system-view
router id 172.16.15.8
ospf 17821
silent-interface all
area 0
network 172.16.15.8 0.0.0.0
network 172.16.12.0 0.0.0.255
network 172.16.13.0 0.0.0.255
area 3
network 172.16.10.48 0.0.0.3
network 172.16.10.52 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
undo silent-interface gigabitethernet4/0/0
undo silent-interface gigabitethernet4/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
quit
save

IPv6 OSPF Conf Router8:

system-view
ospfv3 17821
router-id 172.16.15.8
quit
interface loopback 0
ospfv3 17821 area 0
interface gigabitethernet4/0/0
ospfv3 17821 area 0
interface gigabitethernet4/0/1
ospfv3 17821 area 0
interface gigabitethernet2/0/0
ospfv3 17821 area 3
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 3
ospfv3 network-type p2p
quit
quit
save
IPv4 OSPF Conf Router9:

system-view
router id 172.16.15.9
ospf 17821
silent-interface all
area 3
network 172.16.15.9 0.0.0.0
network 172.16.10.52 0.0.0.3
network 172.16.10.56 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
quit
save

IPv6 OSPF Conf Router9:

system-view
ospfv3 17821
router-id 172.16.15.9
quit
interface loopback 0
ospfv3 17821 area 3
interface gigabitethernet2/0/0
ospfv3 17821 area 3
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 3
ospfv3 network-type p2p
quit
quit
save
IPv4 OSPF Conf Router10:

system-view
router id 172.16.15.10
ospf 17821
silent-interface all
area 4
network 172.16.15.10 0.0.0.0
network 172.16.10.72 0.0.0.3
network 172.16.10.80 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
save

IPv6 OSPF Conf Router10:

system-view
ospfv3 17821
router-id 172.16.15.10
quit
interface loopback 0
ospfv3 17821 area 4
interface gigabitethernet2/0/0
ospfv3 17821 area 4
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 4
ospfv3 network-type p2p
quit
quit
save

IPv4 OSPF Conf Router11:

system-view
router id 172.16.15.11
ospf 17821
silent-interface all
area 0
network 172.16.15.11 0.0.0.0
network 172.16.12.0 0.0.0.255
network 172.16.13.0 0.0.0.255
area 4
network 172.16.10.72 0.0.0.3
network 172.16.10.76 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
undo silent-interface gigabitethernet4/0/0
undo silent-interface gigabitethernet4/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
interface gigabitethernet2/0/1
ospf network-type p2p
quit
quit
save

IPv6 OSPF Conf Router11:

system-view
ospfv3 17821
router-id 172.16.15.11
quit
interface loopback 0
ospfv3 17821 area 0
interface gigabitethernet4/0/0
ospfv3 17821 area 0
interface gigabitethernet4/0/1
ospfv3 17821 area 0
interface gigabitethernet2/0/0
ospfv3 17821 area 4
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 4
ospfv3 network-type p2p
quit
quit
save
IPv4 OSPF Conf Router12:

```
system-view
router id 172.16.15.12
ospf 17821
silent-interface all
area 4
network 172.16.15.12 0.0.0.0
network 172.16.10.78 0.0.0.3
network 172.16.10.80 0.0.0.3
quit
undo silent-interface gigabitethernet2/0/0
undo silent-interface gigabitethernet2/0/1
quit
interface gigabitethernet2/0/0
ospf network-type p2p
quit
interface gigabitethernet2/0/1
ospf network-type p2p
quit
save
```

IPv6 OSPF Conf Router12:

```
system-view
ospfv3 17821
router-id 172.16.15.12
quit
interface loopback 0
ospfv3 17821 area 4
interface gigabitethernet2/0/0
ospfv3 17821 area 4
ospfv3 network-type p2p
interface gigabitethernet2/0/1
ospfv3 17821 area 4
ospfv3 network-type p2p
quit
quit
save
```