Migrating from OSPF to ISIS

ISP Workshops

Introduction

- With the advent of IPv6 and dual stack networks, more ISPs expressing interest to migrate to ISIS
  - This is not as difficult as it sounds
- Presentation describes the process
  - Based on several successful migrations
  - Uses Cisco IOS and IOS-XR CLI as examples

Motivation

- “Security”
  - ISIS runs on link layer, while OSPF runs on IP
- “Reliability”
  - ISIS has long been used by the majority of the world’s biggest ISPs
  - Belief that equipment vendors pay more attention to ISIS reliability, scalability, and features
- Migration to IPv6
  - IPv6 requires OSPFv2 and OSPFv3 in network
    - Two protocols, two sets of identical configuration
  - ISIS simply requires the addition of the IPv6 address-family
    - Most networks operate single topology for IPv4 and IPv6

Migration Plan

1. Verify OSPF configuration and operation
2. Deploy ISIS over entire backbone
3. Set OSPF admin distance to be higher than ISIS
4. Check for remnants in OSPF
5. Remove OSPF from entire backbone
6. Confirm IGP operation

Verify OSPF Configuration

- **`next-hop-self`** for iBGP
  - No external point-to-point links need to be carried on OSPF
  - If external point-to-point links are required (for monitoring), carry in iBGP tagged with specific community visible to monitoring system only
- Remove surplus OSPF **`network`** statements
  - Only Loopback and internal point-to-point links should remain
  - (For Cisco IOS 12.4 onwards and IOS-XR ensure that OSPF is only activated on internal and loopback interfaces – same for OSPFv3 configuration)

Configuration Example: IOS <12.4

```
interface loopback 0
 ip addr 172.16.1.1 255.255.255.255
interface fastethernet 0/0
 ip address 172.16.0.1 255.255.255.252
interface fastethernet 0/1
 ip address 172.16.0.5 255.255.255.252
…
router ospf 100
 max-metric router-lsa on-startup wait-for-bgp
 passive-interface default
 no passive-interface fastethernet 0/0
 no passive-interface fastethernet 0/1
 network 172.16.0.0 mask 0.0.0.3.area 0
 network 172.16.0.4 mask 0.0.0.3 area 0
 network 172.16.1.1 mask 0.0.0.0 area 0
```

Configuration Example: IOS 12.4

```
interface loopback 0
 ip addr 172.16.1.1 255.255.255.255
 ip ospf 100 area 0
interface fastethernet 0/0
 ip address 172.16.0.1 255.255.255.252
 ip ospf 100 area 0
interface fastethernet 0/1
 ip address 172.16.0.5 255.255.255.252
 ip ospf 100 area 0
…
router ospf 100
 max-metric router-lsa on-startup wait-for-bgp
 passive-interface default
 no passive-interface fastethernet 0/0
 no passive-interface fastethernet 0/1
```

Configuration Example: IOS-XR

```
interface loopback 0
 ip addr 172.16.1.1 255.255.255.255
interface fastethernet 0/0
 ip address 172.16.0.1 255.255.255.252
interface fastethernet 0/1
 ip address 172.16.0.5 255.255.255.252
…
router ospf ISP
 area 0
  interface Loopback0
   passive enable
  !
  interface fastethernet 0/0
  !
  interface fastethernet 0/1
```

IPv6 configuration

- If IPv6 has already been deployed
  - OSPFv3 configuration also needs to be tidied up
- For IOS:
  - **`router ospf 100`** configuration should look identical to the **`ipv6 router ospf 100`** configuration
- For IOS-XR:
  - **`router ospf ISP`** configuration should look identical to the **`router ospfv3 ISP`** configuration
- Check that the IPv4 adjacencies match the IPv6 adjacencies

Verifying OSPF operation

- Verifying operation is important after clean up
  - iBGP peers all stable
  - Next hop values are all valid
  - Check OSPF routing table
- If OSPFv3 deployed for IPv6, compare with OSPFv2
  - As well as adjacencies, compare routing table entries

Deploy ISIS over entire backbone

- Ten years ago ISPs were experimenting with partial IPv6 deployments before extending over entire backbone
  - Fears about router code stability
  - Uncertainty about need to deploy IPv6 (given lack of “market demand” and continued abundance of IPv4 addresses)

Deploy ISIS over entire backbone

- Today, IPv6 deployment is fundamentally important to ensure continued network and Internet growth
  - Which means that ISPs will deploy dual-stack
  - And every device running an IPv4 IGP will also require to run an IPv6 IGP
  - ⇒ Single congruent topology (no multi-topology ISIS)

Deploy ISIS over entire backbone

- ISIS deployment:
  - Leave distance at default of 115 (higher than OSPF's 110)
  - Use wide metrics (required for IPv6 address family support)
  - Only using Level-2 IS (IOS default is L1L2)
  - Deploy both IPv4 and IPv6 at the same time
  - Passive interface configuration means ISIS is not run on the interface, but the address is announced in the IGP
- IPv6 addressing in backbone – choice of:
  - Global unicast addresses
  - Link local addressing/unnumbered interfaces

Configuration Example: IOS

```
interface loopback 0
 ip address 172.16.1.1 255.255.255.255
 ipv6 address 2001:db8::1/128
!
interface fastethernet 0/0
 ip address 172.16.0.1 255.255.255.252
 ipv6 unnumbered loopback 0
 ip router isis ISP
 isis metric 20 level-2
 ipv6 router isis ISP
 isis ipv6 metric 20 level-2
!
(next slide)
```

Configuration Example: IOS (cont)

```
interface fastethernet 0/1
 ip address 172.16.0.5 255.255.255.252
 ipv6 unnumbered loopback 0
 ip router isis ISP
 isis metric 20 level-2
 ipv6 router isis ISP
 isis ipv6 metric 20 level-2
!
router isis ISP
 net 49.0001.1720.1600.1001.00
 passive-interface Loopback 0
 is-type level-2-only
 metric-style wide
 set-overload-bit on-startup wait-for-bgp
!
 address-family ipv6
  set-overload-bit on-startup wait-for-bgp
 exit-address-family
!
```

Configuration Example: IOS-XR

```
interface loopback 0
 ip address 172.16.1.1 255.255.255.255
 ipv6 address 2001:db8::1/128
interface fastethernet 0/0
 ip address 172.16.0.1 255.255.255.252
 ipv6 enable
interface fastethernet 0/1
 ip address 172.16.0.5 255.255.255.252
 ipv6 enable
…
router isis ISP
 set-overload-bit on-startup wait-for-bgp
 is-type level-2-only
 net 49.0001.1720.1600.1001.00
 address-family ipv4 unicast
  metric-style wide
 address-family ipv6 unicast
  metric-style wide
  single-topology
(next slide)
```

Configuration Example: IOS-XR (cont)

```
router isis ISP
 !
 interface Loopback0
  passive
  address-family ipv4 unicast
   metric 1 level 2
  address-family ipv6 unicast
   metric 1 level 2
 !
 interface fastethernet 0/0
  address-family ipv4 unicast
   metric 20 level 2
  address-family ipv6 unicast
   metric 20 level 2
 !
 interface fastethernet 0/1
  address-family ipv4 unicast
   metric 20 level 2
  address-family ipv6 unicast
   metric 20 level 2
 !
```

Set OSPF Admin Distance High

- Once ISIS is deployed over entire backbone set OSPF's admin distance above that of ISIS
  - For all routers across the backbone
- Example:

```
router ospf 100
 distance 120
!
ipv6 router ospf 100
 distance 120
```

- All ISIS paths learned by the router now take priority over the OSPF paths
  - For both IPv4 and IPv6

OSPF remnants

- As ISIS is now responsible for interior routing, if all the preparation work was completed, there should be no prefixes left in OSPF
  - If there are, check what they are, and what caused them
- Remnant prefixes could include:
  - Forgotten passive interfaces for ISIS
  - Forgotten active adjacencies

OSPF remnants

- Check adjacencies across the backbone
  - Compare **`show ip ospf neigh`** with **`show isis neigh`**
  - There should be the same number of neighbours
  - If not, fix the problem
- End result of tidying up work should mean:
  - **No more prefixes left in OSPF**
  - **A successful deployment of ISIS**

Remove OSPF

- OSPF can now be safely removed from the entire backbone
- IOS:

```
no router ospf 100
no ipv6 router ospf 100
```

  - Will also need to go to each interface and remove ospf metric, link type, and authentication configuration
    - IOS does not remove these when the routing process is removed
- IOS-XR

```
no router ospf ISP
no router ospfv3 ISP
```

  - Performs a clean removal

Confirm IGP operation

- ISIS should now be functioning normally
- Verify iBGP sessions
  - Should have been completely unaffected by the entire migration process
- Verify next hop values
  - Adjacencies should be known in ISIS
- Verify customer and external access
- Task complete

Conclusion

- Migration from OSPFv2 and OSPFv3 to ISIS is straightforward
  - With planning
  - With adherence to procedure developed during planning
- Can be carried out any time
  - (but planned maintenance slots strongly recommended)
- Now running single multi-address family IGP to support both IPv4 and IPv6

Footnote

- Migrating from ISIS to OSPF
  - Use the reverse of the described process
  - But why would anyone?
- Migrating from EIGRP to ISIS
  - Follow the same procedures described here
  - EIGRP's administrative distance is either 90 or 170, depending on prefix origin ⇒ set ISIS admin distance appropriately

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