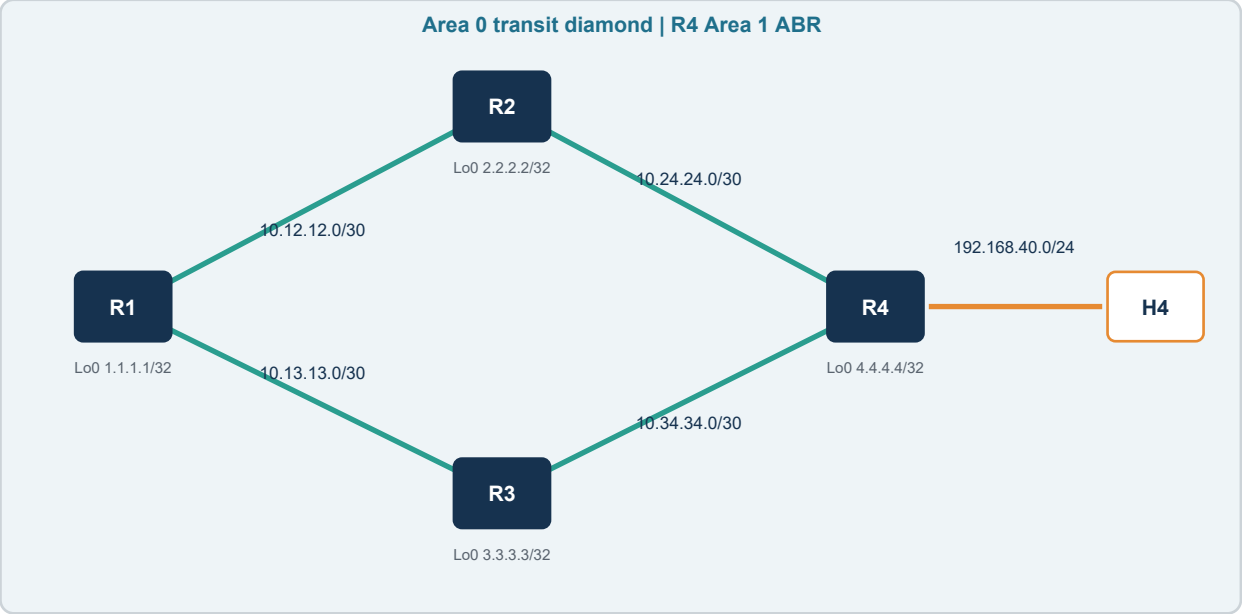
CCNP ENARSI

Lab 08

OSPF Production Troubleshooting Challenge



Shared network | Five independent incidents | 5 approved IOL L3 nodes

Prove the healthy dual-stack reference, then diagnose and restore five separate production tickets.

CLI annotations: GREEN - expected healthy result; YELLOW - warning or interpretation required; RED - fault or failed requirement. Colors are workbook annotations, not native CLI colors. Variable timers and ages may differ. Yellow/red items include a one-line reason.

1. Challenge mission

Operate a shared five-node dual-stack OSPF network. First prove the healthy baseline. Then solve five independent production tickets, each starting from an isolated copy of that exact healthy state. Student incident workbooks give symptoms and guardrails; separate Solution Guides are for use after the investigation. An incident is complete only when the fault is repaired and the entire approved network regression passes.

2. Observable outcomes

Identify OSPFv2 versus OSPFv3 failures, distinguish an adjacency failure from missing prefix advertisement and from a cost-policy deviation, protect unaffected address families, verify failover paths, and restore exact healthy configuration. Show relevant CLI evidence at every decision, not just a final ping.

3. Production scenario

R1 is a core source, R2 and R3 provide diverse transit, R4 is an Area 0/1 ABR and H4 is a branch client. Both IPv4 and IPv6 reach H4 through the diamond. Five independent tickets model a change that damaged one OSPF behavior. Operations allows only minimal edits within the named incident; do not shut an unrelated link to force a symptom.

4. Required knowledge

Complete Labs 01-07. Know OSPFv2/v3 neighbor states, passive-interface behavior, Area 0 and ABR boundaries, intra/inter-area route codes, Type 1 and Type 3 LSAs, interface cost and ECMP, IPv6 link-local next hops, and the difference between local gateway reachability and remote routed service.

5.1 Diagnostic model: scope before cause

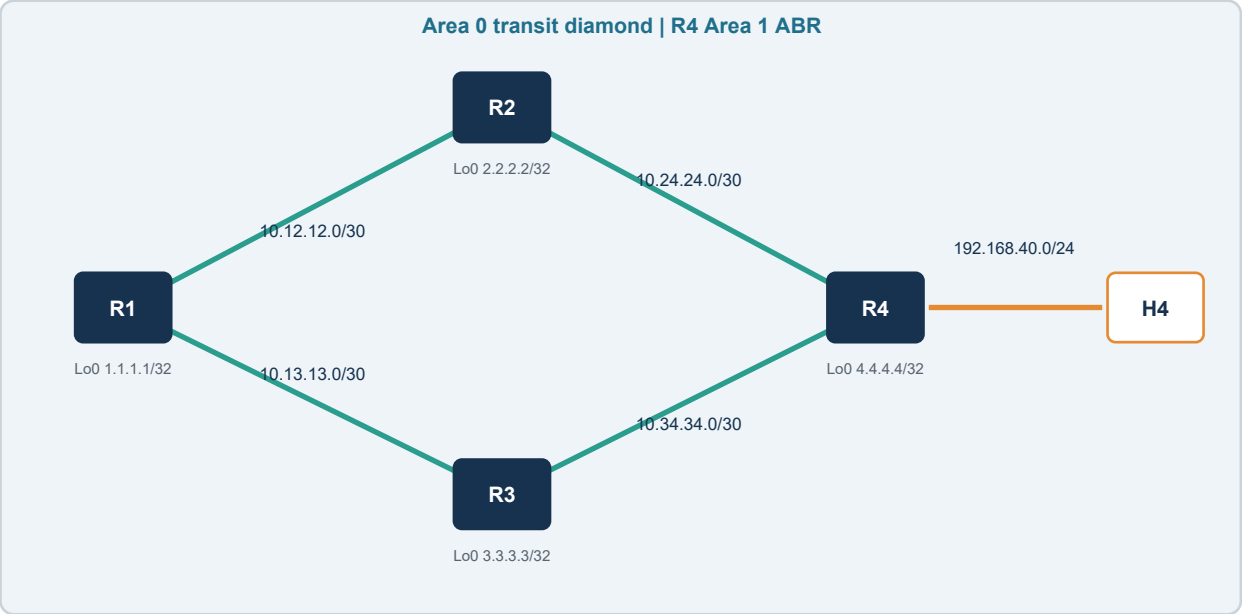
A failed ping is a symptom. First establish which address family, source and destination fail. Then compare the expected and observed neighbor matrix, routing table and interface activation. The redundant diamond can hide an adjacency loss because the alternate path still forwards traffic; a route-table next-hop count therefore matters. A local H4-to-R4 ping that succeeds while a remote prefix disappears points to advertisement or return-path scope, not physical LAN failure. Keep conclusions tied to the observed command stage.

5.2 Safe incident workflow

Before each incident, boot the healthy save-config and run the baseline matrix. Use the separate broken incident UNL, which is derived from the same healthy startup plus exactly one change. Record intended and unaffected service checks before repair. The student may investigate freely, but the Solution Guide uses the smallest corrective command. After repair, rerun both OSPFv2 and OSPFv3 matrices and client pings, then save. Starting the next incident requires a fresh isolated state, never a network carrying residue from a prior ticket.

6. Shared topology and addresses

R1-R2-R4 and R1-R3-R4 form the Area 0 diamond. IPv4 /30s are 10.12.12.0, 10.24.24.0, 10.13.13.0 and 10.34.34.0. The same four links use 2001:DB8:12::/64, :24::/64, :13::/64 and :34::/64. R4 Ethernet0/2 and H4 Ethernet0/0 form Area 1 client LAN 192.168.40.0/24 and 2001:DB8:40::/64. Rn Loopback0 is n.n.n.n/32 and 2001:DB8:n::n/128. H4 gateways are 192.168.40.1 and 2001:DB8:40::1.



Connection and address plan

Link	IPv4 endpoints	IPv6 endpoints
R1 e0/0 - R2 e0/0	10.12.12.1/30 | 10.12.12.2/30	2001:DB8:12::1/64 | 2001:DB8:12::2/64
R2 e0/1 - R4 e0/0	10.24.24.1/30 | 10.24.24.2/30	2001:DB8:24::1/64 | 2001:DB8:24::2/64
R1 e0/1 - R3 e0/0	10.13.13.1/30 | 10.13.13.2/30	2001:DB8:13::1/64 | 2001:DB8:13::2/64
R3 e0/1 - R4 e0/1	10.34.34.1/30 | 10.34.34.2/30	2001:DB8:34::1/64 | 2001:DB8:34::2/64
R4 e0/2 - H4 e0/0	192.168.40.1/24 | .10/24	2001:DB8:40::1/64 | ::10/64

Router Loopback0: Rn uses n.n.n.n/32 and 2001:DB8:n::n/128. R4 is Area 0/1 ABR. H4 has static default routes to R4.

7. Starting files

raw has topology only. save-ip-configuration contains names, IPv4/IPv6 addressing and H4 default routes but no OSPF. save-config is the completed healthy reference. Incident 01-05 UNLs are broken starting states and must be opened separately. The five PDFs marked Student Incident hide the root cause; the five Solution Guides disclose it after troubleshooting.

Item	raw	save-ip-configuration	save-config
Topology	Same	Same	Same
Names / IP	Absent	Present	Present

Item	raw	save-ip-configuration	save-config
OSPFv2/v3	Absent	Absent	Healthy
Learner action	Build all	Build routing	Verify only

8.1 Configure R1 dual-stack baseline

Assign both address families and the documented names. H4 needs static IPv4 and IPv6 default routes to R4. These steps prepare the network but do not configure OSPF.

R1

```
enable
conf t
hostname R1
no ip domain lookup
interface Loopback0
description ROUTER_ID_ANCHOR
ip address 1.1.1.1 255.255.255.255
interface Ethernet0/0
description TO_R2
ip address 10.12.12.1 255.255.255.252
no shutdown
interface Ethernet0/1
description TO_R3
ip address 10.13.13.1 255.255.255.252
no shutdown
exit
ipv6 unicast-routing
interface Loopback0
ipv6 address 2001:DB8:1::1/128
interface Ethernet0/0
ipv6 address 2001:DB8:12::1/64
no shutdown
interface Ethernet0/1
ipv6 address 2001:DB8:13::1/64
no shutdown
end
```

8.2 Configure R2 dual-stack baseline

Assign both address families and the documented names. H4 needs static IPv4 and IPv6 default routes to R4. These steps prepare the network but do not configure OSPF.

R2

```
enable
conf t
hostname R2
no ip domain lookup
interface Loopback0
description ROUTER_ID_ANCHOR
ip address 2.2.2.2 255.255.255.255
interface Ethernet0/0
description TO_R1
ip address 10.12.12.2 255.255.255.252
no shutdown
interface Ethernet0/1
description TO_R4
ip address 10.24.24.1 255.255.255.252
no shutdown
exit
ipv6 unicast-routing
interface Loopback0
ipv6 address 2001:DB8:2::2/128
interface Ethernet0/0
ipv6 address 2001:DB8:12::2/64
no shutdown
interface Ethernet0/1
ipv6 address 2001:DB8:24::1/64
no shutdown
end
```

8.3 Configure R3 dual-stack baseline

Assign both address families and the documented names. H4 needs static IPv4 and IPv6 default routes to R4. These steps prepare the network but do not configure OSPF.

R3

```
enable
conf t
hostname R3
no ip domain lookup
interface Loopback0
description ROUTER_ID_ANCHOR
ip address 3.3.3.3 255.255.255.255
interface Ethernet0/0
description TO_R1
ip address 10.13.13.2 255.255.255.252
no shutdown
interface Ethernet0/1
description TO_R4
ip address 10.34.34.1 255.255.255.252
no shutdown
exit
ipv6 unicast-routing
interface Loopback0
ipv6 address 2001:DB8:3::3/128
interface Ethernet0/0
ipv6 address 2001:DB8:13::2/64
no shutdown
interface Ethernet0/1
ipv6 address 2001:DB8:34::1/64
no shutdown
end
```

8.4 Configure R4 dual-stack baseline

Assign both address families and the documented names. H4 needs static IPv4 and IPv6 default routes to R4. These steps prepare the network but do not configure OSPF.

R4

```
enable
conf t
hostname R4
no ip domain lookup
interface Loopback0
description ROUTER_ID_ANCHOR
ip address 4.4.4.4 255.255.255.255
interface Ethernet0/0
description TO_R2
ip address 10.24.24.2 255.255.255.252
no shutdown
interface Ethernet0/1
description TO_R3
ip address 10.34.34.2 255.255.255.252
no shutdown
interface Ethernet0/2
description AREA_1_CLIENT_LAN
ip address 192.168.40.1 255.255.255.0
no shutdown
exit
ipv6 unicast-routing
interface Loopback0
ipv6 address 2001:DB8:4::4/128
interface Ethernet0/0
ipv6 address 2001:DB8:24::2/64
no shutdown
interface Ethernet0/1
ipv6 address 2001:DB8:34::2/64
no shutdown
interface Ethernet0/2
ipv6 address 2001:DB8:40::1/64
no shutdown
end
```

8.5 Configure H4 dual-stack baseline

Assign both address families and the documented names. H4 needs static IPv4 and IPv6 default routes to R4. These steps prepare the network but do not configure OSPF.

H4

```
enable
conf t
hostname H4
no ip domain lookup
interface Ethernet0/0
description CLIENT_TO_R4
ip address 192.168.40.10 255.255.255.0
no shutdown
ip route 0.0.0.0 0.0.0.0 192.168.40.1
ipv6 unicast-routing
interface Ethernet0/0
ipv6 address 2001:DB8:40::10/64
no shutdown
exit
ipv6 route ::/0 2001:DB8:40::1
end
```

Wait at least 20 seconds before recording the next routing observation.

8.6 Verify R1 starting state

Confirm IPv4/IPv6 address and up/up state. OSPF processes must be absent on R1-R4; H4 must have both default routes and reach both local gateways.

R1

```
enable
terminal length 0
show ip interface brief
show ipv6 interface brief
show running-config | section router ospf
show running-config | section ipv6 router ospf
```

Actual CLI output - R1

```
R1# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.12.12.1      YES manual up                    up
Ethernet0/1            10.13.13.1      YES manual up                    up
Ethernet0/2            unassigned      YES unset  administratively down down
Ethernet0/3            unassigned      YES unset  administratively down down
Loopback0              1.1.1.1         YES manual up                    up
```

Actual CLI output - R1

```
R1# show ipv6 interface brief
Ethernet0/0            [up/up]
    2001:DB8:12::1
Ethernet0/1            [up/up]
    2001:DB8:13::1
Ethernet0/2            [administratively down/down]
Ethernet0/3            [administratively down/down]
Loopback0              [up/up]
    2001:DB8:1::1
```

Actual CLI output - R1

```
R1# show running-config | section router ospf
```

Actual CLI output - R1

```
R1# show running-config | section ipv6 router ospf
```

8.7 Verify R2 starting state

Confirm IPv4/IPv6 address and up/up state. OSPF processes must be absent on R1-R4; H4 must have both default routes and reach both local gateways.

R2

```
enable
terminal length 0
show ip interface brief
show ipv6 interface brief
show running-config | section router ospf
show running-config | section ipv6 router ospf
```

Actual CLI output - R2

```
R2# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.12.12.2      YES manual up                    up
Ethernet0/1            10.24.24.1      YES manual up                    up
Ethernet0/2            unassigned      YES unset  administratively down down
Ethernet0/3            unassigned      YES unset  administratively down down
Loopback0              2.2.2.2         YES manual up                    up
```

Actual CLI output - R2

```
R2# show ipv6 interface brief
Ethernet0/0            [up/up]
    2001:DB8:12::2
Ethernet0/1            [up/up]
    2001:DB8:24::1
Ethernet0/2            [administratively down/down]
Ethernet0/3            [administratively down/down]
Loopback0              [up/up]
    2001:DB8:2::2
```

Actual CLI output - R2

```
R2# show running-config | section router ospf
```

Actual CLI output - R2

```
R2# show running-config | section ipv6 router ospf
```

8.8 Verify R3 starting state

Confirm IPv4/IPv6 address and up/up state. OSPF processes must be absent on R1-R4; H4 must have both default routes and reach both local gateways.

R3

```
enable
terminal length 0
show ip interface brief
show ipv6 interface brief
show running-config | section router ospf
show running-config | section ipv6 router ospf
```

Actual CLI output - R3

```
R3# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.13.13.2      YES manual up                    up
Ethernet0/1            10.34.34.1      YES manual up                    up
Ethernet0/2            unassigned      YES unset  administratively down down
Ethernet0/3            unassigned      YES unset  administratively down down
Loopback0              3.3.3.3         YES manual up                    up
```

Actual CLI output - R3

```
R3# show ipv6 interface brief
Ethernet0/0            [up/up]
    2001:DB8:13::2
Ethernet0/1            [up/up]
    2001:DB8:34::1
Ethernet0/2            [administratively down/down]
Ethernet0/3            [administratively down/down]
Loopback0              [up/up]
    2001:DB8:3::3
```

Actual CLI output - R3

```
R3# show running-config | section router ospf
```

Actual CLI output - R3

```
R3# show running-config | section ipv6 router ospf
```

8.9 Verify R4 starting state

Confirm IPv4/IPv6 address and up/up state. OSPF processes must be absent on R1-R4; H4 must have both default routes and reach both local gateways.

R4

```
enable
terminal length 0
show ip interface brief
show ipv6 interface brief
show running-config | section router ospf
show running-config | section ipv6 router ospf
```

Actual CLI output - R4

```
R4# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.24.24.2      YES manual up                    up
Ethernet0/1            10.34.34.2      YES manual up                    up
Ethernet0/2            192.168.40.1    YES manual up                    up
Ethernet0/3            unassigned      YES unset  administratively down down
Loopback0              4.4.4.4         YES manual up                    up
```

Actual CLI output - R4

```
R4# show ipv6 interface brief
Ethernet0/0            [up/up]
    2001:DB8:24::2
Ethernet0/1            [up/up]
    2001:DB8:34::2
Ethernet0/2            [up/up]
    2001:DB8:40::1
Ethernet0/3            [administratively down/down]
Loopback0              [up/up]
    2001:DB8:4::4
```

Actual CLI output - R4

```
R4# show running-config | section router ospf
```

Actual CLI output - R4

```
R4# show running-config | section ipv6 router ospf
```

8.10 Verify H4 starting state

Confirm IPv4/IPv6 address and up/up state. OSPF processes must be absent on R1-R4; H4 must have both default routes and reach both local gateways.

H4

```
enable
terminal length 0
show ip interface brief
show ipv6 interface brief
show ip route 0.0.0.0
show ipv6 route ::/0
ping 192.168.40.1
ping 2001:DB8:40::1 source Ethernet0/0
```

Actual CLI output - H4

```
H4# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            192.168.40.10   YES manual up                    up
Ethernet0/1            unassigned      YES unset  administratively down down
Ethernet0/2            unassigned      YES unset  administratively down down
Ethernet0/3            unassigned      YES unset  administratively down down
```

Actual CLI output - H4

```
H4# show ipv6 interface brief
Ethernet0/0            [up/up]
    2001:DB8:40::10
Ethernet0/1            [administratively down/down]
Ethernet0/2            [administratively down/down]
Ethernet0/3            [administratively down/down]
```

Actual CLI output - H4

```
H4# show ip route 0.0.0.0
Routing entry for 0.0.0.0/0, supernet
  Known via "static", distance 1, metric 0, candidate default path
  Routing Descriptor Blocks:
  * 192.168.40.1
      Route metric is 0, traffic share count is 1
```

Actual CLI output - H4

```
H4# show ipv6 route ::/0
Routing entry for ::/0
  Known via "static", distance 1, metric 0
  Route count is 1/1, share count 0
  Routing paths:
    2001:DB8:40::1
      Route metric is 0, traffic share count is 1
      Last updated 00:00:19 ago
```

Actual CLI output - H4

```
H4# ping 192.168.40.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/23/44 ms
```

Actual CLI output - H4

```
H4# ping 2001:DB8:40::1 source Ethernet0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:40::1, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:40::10
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
```

9.1 Build R1 OSPFv2 and OSPFv3

Activate IPv4 OSPF process 10 and IPv6 OSPFv3 process 30 with explicit router IDs. Router links remain Area 0, R4 client LAN is Area 1, and the LANs are passive. Equal transit costs preserve both healthy paths.

R1

```
enable
conf t
router ospf 10
router-id 1.1.1.1
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
interface Ethernet0/1
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
exit
ipv6 router ospf 30
router-id 1.1.1.1
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ipv6 ospf 30 area 0
interface Ethernet0/0
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
interface Ethernet0/1
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
end
```

9.2 Build R2 OSPFv2 and OSPFv3

Activate IPv4 OSPF process 10 and IPv6 OSPFv3 process 30 with explicit router IDs. Router links remain Area 0, R4 client LAN is Area 1, and the LANs are passive. Equal transit costs preserve both healthy paths.

R2

```
enable
conf t
router ospf 10
router-id 2.2.2.2
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
interface Ethernet0/1
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
exit
ipv6 router ospf 30
router-id 2.2.2.2
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ipv6 ospf 30 area 0
interface Ethernet0/0
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
interface Ethernet0/1
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
end
```

9.3 Build R3 OSPFv2 and OSPFv3

Activate IPv4 OSPF process 10 and IPv6 OSPFv3 process 30 with explicit router IDs. Router links remain Area 0, R4 client LAN is Area 1, and the LANs are passive. Equal transit costs preserve both healthy paths.

R3

```
enable
conf t
router ospf 10
router-id 3.3.3.3
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
interface Ethernet0/1
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
exit
ipv6 router ospf 30
router-id 3.3.3.3
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ipv6 ospf 30 area 0
interface Ethernet0/0
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
interface Ethernet0/1
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
end
```

9.4 Build R4 OSPFv2 and OSPFv3

Activate IPv4 OSPF process 10 and IPv6 OSPFv3 process 30 with explicit router IDs. Router links remain Area 0, R4 client LAN is Area 1, and the LANs are passive. Equal transit costs preserve both healthy paths.

R4

```
enable
conf t
router ospf 10
router-id 4.4.4.4
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
interface Ethernet0/1
ip ospf network point-to-point
ip ospf cost 10
ip ospf 10 area 0
interface Ethernet0/2
ip ospf 10 area 1
exit
ipv6 router ospf 30
router-id 4.4.4.4
passive-interface default
no passive-interface Ethernet0/0
no passive-interface Ethernet0/1
exit
interface Loopback0
ipv6 ospf 30 area 0
interface Ethernet0/0
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
interface Ethernet0/1
ipv6 ospf network point-to-point
ipv6 ospf 30 area 0
interface Ethernet0/2
ipv6 ospf 30 area 1
end
```

Wait at least 50 seconds before recording the next routing observation.

10.1 Verify R1 dual-stack neighbors

Require two FULL neighbors in each address family. This is a control-plane check; the separate route and endpoint checks prove prefix advertisement and forwarding.

R1

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
```

Actual CLI output - R1

```
R1# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/  -        00:00:39    10.13.13.2      Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:38    10.12.12.2      Ethernet0/0
```

Actual CLI output - R1

```
R1# show ipv6 ospf neighbor
            OSPFv3 Router with ID (1.1.1.1) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
3.3.3.3           0   FULL/  -        00:00:32    1               Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:37    1               Ethernet0/0
```

10.2 Verify R2 dual-stack neighbors

Require two FULL neighbors in each address family. This is a control-plane check; the separate route and endpoint checks prove prefix advertisement and forwarding.

R2

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
```

Actual CLI output - R2

```
R2# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
4.4.4.4           0   FULL/  -        00:00:34    10.24.24.2      Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:33    10.12.12.1      Ethernet0/0
```

Actual CLI output - R2

```
R2# show ipv6 ospf neighbor
            OSPFv3 Router with ID (2.2.2.2) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
4.4.4.4           0   FULL/  -        00:00:36    1               Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:34    1               Ethernet0/0
```

10.3 Verify R3 dual-stack neighbors

Require two FULL neighbors in each address family. This is a control-plane check; the separate route and endpoint checks prove prefix advertisement and forwarding.

R3

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
```

Actual CLI output - R3

```
R3# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
4.4.4.4           0   FULL/  -        00:00:34    10.34.34.2      Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:33    10.13.13.1      Ethernet0/0
```

Actual CLI output - R3

```
R3# show ipv6 ospf neighbor
            OSPFv3 Router with ID (3.3.3.3) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
4.4.4.4           0   FULL/  -        00:00:35    2               Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:34    2               Ethernet0/0
```

10.4 Verify R4 dual-stack neighbors

Require two FULL neighbors in each address family. This is a control-plane check; the separate route and endpoint checks prove prefix advertisement and forwarding.

R4

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
```

Actual CLI output - R4

```
R4# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/  -        00:00:39    10.34.34.1      Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:36    10.24.24.1      Ethernet0/0
```

Actual CLI output - R4

```
R4# show ipv6 ospf neighbor
            OSPFv3 Router with ID (4.4.4.4) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
3.3.3.3           0   FULL/  -        00:00:31    2               Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:38    2               Ethernet0/0
```

11.1 Verify R1 IPv4/IPv6 branch routes

The branch LAN must be learned as an Area 1 inter-area route. The healthy diamond has two equal-cost next hops per family; record both and their outgoing interfaces.

R1

```
enable
terminal length 0
show ip route 192.168.40.0
show ipv6 route 2001:DB8:40::/64
```

Actual CLI output - R1

```
R1# show ip route 192.168.40.0
Routing entry for 192.168.40.0/24
  Known via "ospf 10", distance 110, metric 30, type inter area
  Last update from 10.13.13.2 on Ethernet0/1, 00:00:43 ago
  Routing Descriptor Blocks:
    10.13.13.2, from 4.4.4.4, 00:00:43 ago, via Ethernet0/1
      Route metric is 30, traffic share count is 1
  * 10.12.12.2, from 4.4.4.4, 00:00:48 ago, via Ethernet0/0
      Route metric is 30, traffic share count is 1
```

Actual CLI output - R1

```
R1# show ipv6 route 2001:DB8:40::/64
Routing entry for 2001:DB8:40::/64
  Known via "ospf 30", distance 110, metric 30, type inter area
  Route count is 2/2, share count 0
  Routing paths:
    FE80::A8BB:CCFF:FE00:3000, Ethernet0/1
      Route metric is 30, traffic share count is 1
      From FE80::A8BB:CCFF:FE00:3000
      Last updated 00:00:50 ago
    FE80::A8BB:CCFF:FE00:2000, Ethernet0/0
      Route metric is 30, traffic share count is 1
      From FE80::A8BB:CCFF:FE00:2000
      Last updated 00:00:50 ago
```

11.2 Verify R4 return routes

R4 must learn R1 loopback in both address families. These routes provide the return leg for source-loopback tests and client traffic.

R4

```
enable
terminal length 0
show ip route 1.1.1.1
show ipv6 route 2001:DB8:1::1/128
```

Actual CLI output - R4

```
R4# show ip route 1.1.1.1
Routing entry for 1.1.1.1/32
  Known via "ospf 10", distance 110, metric 21, type intra area
  Last update from 10.34.34.1 on Ethernet0/1, 00:00:49 ago
  Routing Descriptor Blocks:
    10.34.34.1, from 1.1.1.1, 00:00:49 ago, via Ethernet0/1
      Route metric is 21, traffic share count is 1
  * 10.24.24.1, from 1.1.1.1, 00:00:51 ago, via Ethernet0/0
      Route metric is 21, traffic share count is 1
```

Actual CLI output - R4

```
R4# show ipv6 route 2001:DB8:1::1/128
Routing entry for 2001:DB8:1::1/128
  Known via "ospf 30", distance 110, metric 20, type intra area
  Route count is 2/2, share count 0
  Routing paths:
    FE80::A8BB:CCFF:FE00:3010, Ethernet0/1
      Route metric is 20, traffic share count is 1
      From FE80::A8BB:CCFF:FE00:3010
      Last updated 00:00:52 ago
    FE80::A8BB:CCFF:FE00:2010, Ethernet0/0
      Route metric is 20, traffic share count is 1
      From FE80::A8BB:CCFF:FE00:2010
      Last updated 00:00:52 ago
```

11.3 Verify Area 1 advertisement

Inspect the IPv4 Summary LSA for 192.168.40.0 and the OSPFv3 database for the inter-area prefix LSA of 2001:DB8:40::/64. R4 must be the advertiser. This evidence distinguishes a missing LAN advertisement from a broken neighbor.

R1

```
enable
terminal length 0
show ip ospf database summary 192.168.40.0
show ipv6 ospf database
```

Actual CLI output - R1

```
R1# show ip ospf database summary 192.168.40.0
            OSPF Router with ID (1.1.1.1) (Process ID 10)
Summary Net Link States (Area 0)
  LS Type: Summary Links(Network)
  Link State ID: 192.168.40.0 (summary Network Number)
  Advertising Router: 4.4.4.4
  Network Mask: /24
MTID: 0  Metric: 10
```

Actual CLI output - R1

```
R1# show ipv6 ospf database
Inter Area Prefix Link States (Area 0)
ADV Router       Age         Seq#        Prefix
 4.4.4.4         54          0x80000001  2001:DB8:40::/64
```

12.1 Verify R1 dual-stack forwarding

Require five of five replies for both address families. H4 tests include static default, ABR return routing and the alternate transit paths.

R1

```
enable
terminal length 0
ping 192.168.40.10 source Loopback0
ping 2001:DB8:40::10 source Loopback0
```

Actual CLI output - R1

```
R1# ping 192.168.40.10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.10, timeout is 2 seconds:
Packet sent with a source address of 1.1.1.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Actual CLI output - R1

```
R1# ping 2001:DB8:40::10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:40::10, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:1::1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

12.4 Verify R4 dual-stack forwarding

Require five of five replies for both address families. H4 tests include static default, ABR return routing and the alternate transit paths.

R4

```
enable
terminal length 0
ping 1.1.1.1 source Loopback0
ping 2001:DB8:1::1 source Loopback0
```

Actual CLI output - R4

```
R4# ping 1.1.1.1 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
Packet sent with a source address of 4.4.4.4
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/5 ms
```

Actual CLI output - R4

```
R4# ping 2001:DB8:1::1 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1::1, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:4::4
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/3 ms
```

12.5 Verify H4 dual-stack forwarding

Require five of five replies for both address families. H4 tests include static default, ABR return routing and the alternate transit paths.

H4

```
enable
terminal length 0
ping 1.1.1.1
ping 2001:DB8:1::1 source Ethernet0/0
```

Actual CLI output - H4

```
H4# ping 1.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/4/6 ms
```

Actual CLI output - H4

```
H4# ping 2001:DB8:1::1 source Ethernet0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1::1, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:40::10
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

13.1 Healthy reference regression on R1

Preserve this exact dual-stack baseline before opening any broken Incident UNL. Both families, all neighbors and all client paths must match.

R1

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
show ip route 192.168.40.0
show ipv6 route 2001:DB8:40::/64
ping 192.168.40.10 source Loopback0
ping 2001:DB8:40::10 source Loopback0
```

Actual CLI output - R1

```
R1# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/  -        00:00:35    10.13.13.2      Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:34    10.12.12.2      Ethernet0/0
```

Actual CLI output - R1

```
R1# show ipv6 ospf neighbor
            OSPFv3 Router with ID (1.1.1.1) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
3.3.3.3           0   FULL/  -        00:00:38    1               Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:33    1               Ethernet0/0
```

Actual CLI output - R1

```
R1# show ip route 192.168.40.0
Routing entry for 192.168.40.0/24
  Known via "ospf 10", distance 110, metric 30, type inter area
  Last update from 10.13.13.2 on Ethernet0/1, 00:00:46 ago
  Routing Descriptor Blocks:
    10.13.13.2, from 4.4.4.4, 00:00:46 ago, via Ethernet0/1
      Route metric is 30, traffic share count is 1
  * 10.12.12.2, from 4.4.4.4, 00:00:51 ago, via Ethernet0/0
      Route metric is 30, traffic share count is 1
```

Actual CLI output - R1

```
R1# show ipv6 route 2001:DB8:40::/64
Routing entry for 2001:DB8:40::/64
  Known via "ospf 30", distance 110, metric 30, type inter area
  Route count is 2/2, share count 0
  Routing paths:
    FE80::A8BB:CCFF:FE00:3000, Ethernet0/1
      Route metric is 30, traffic share count is 1
      From FE80::A8BB:CCFF:FE00:3000
      Last updated 00:00:53 ago
    FE80::A8BB:CCFF:FE00:2000, Ethernet0/0
      Route metric is 30, traffic share count is 1
      From FE80::A8BB:CCFF:FE00:2000
      Last updated 00:00:53 ago
```

Actual CLI output - R1

```
R1# ping 192.168.40.10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.10, timeout is 2 seconds:
Packet sent with a source address of 1.1.1.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/3 ms
```

Actual CLI output - R1

```
R1# ping 2001:DB8:40::10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:40::10, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:1::1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/5 ms
```

13.2 Healthy reference regression on R2

Preserve this exact dual-stack baseline before opening any broken Incident UNL. Both families, all neighbors and all client paths must match.

R2

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
ping 192.168.40.10 source Loopback0
ping 2001:DB8:40::10 source Loopback0
```

Actual CLI output - R2

```
R2# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
4.4.4.4           0   FULL/  -        00:00:39    10.24.24.2      Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:39    10.12.12.1      Ethernet0/0
```

Actual CLI output - R2

```
R2# show ipv6 ospf neighbor
            OSPFv3 Router with ID (2.2.2.2) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
4.4.4.4           0   FULL/  -        00:00:32    1               Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:39    1               Ethernet0/0
```

Actual CLI output - R2

```
R2# ping 192.168.40.10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.10, timeout is 2 seconds:
Packet sent with a source address of 2.2.2.2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Actual CLI output - R2

```
R2# ping 2001:DB8:40::10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:40::10, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:2::2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/2 ms
```

13.3 Healthy reference regression on R3

Preserve this exact dual-stack baseline before opening any broken Incident UNL. Both families, all neighbors and all client paths must match.

R3

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
ping 192.168.40.10 source Loopback0
ping 2001:DB8:40::10 source Loopback0
```

Actual CLI output - R3

```
R3# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
4.4.4.4           0   FULL/  -        00:00:39    10.34.34.2      Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:38    10.13.13.1      Ethernet0/0
```

Actual CLI output - R3

```
R3# show ipv6 ospf neighbor
           OSPFv3 Router with ID (3.3.3.3) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
4.4.4.4           0   FULL/  -        00:00:30    2               Ethernet0/1
1.1.1.1           0   FULL/  -        00:00:39    2               Ethernet0/0
```

Actual CLI output - R3

```
R3# ping 192.168.40.10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.10, timeout is 2 seconds:
Packet sent with a source address of 3.3.3.3
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/3/4 ms
```

Actual CLI output - R3

```
R3# ping 2001:DB8:40::10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:40::10, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:3::3
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/3/3 ms
```

13.4 Healthy reference regression on R4

Preserve this exact dual-stack baseline before opening any broken Incident UNL. Both families, all neighbors and all client paths must match.

R4

```
enable
terminal length 0
show ip ospf neighbor
show ipv6 ospf neighbor
ping 192.168.40.10 source Loopback0
ping 2001:DB8:40::10 source Loopback0
```

Actual CLI output - R4

```
R4# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/  -        00:00:34    10.34.34.1      Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:31    10.24.24.1      Ethernet0/0
```

Actual CLI output - R4

```
R4# show ipv6 ospf neighbor
            OSPFv3 Router with ID (4.4.4.4) (Process ID 30)
Neighbor ID     Pri   State           Dead Time   Interface ID    Interface
3.3.3.3           0   FULL/  -        00:00:36    2               Ethernet0/1
2.2.2.2           0   FULL/  -        00:00:33    2               Ethernet0/0
```

Actual CLI output - R4

```
R4# ping 192.168.40.10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.10, timeout is 2 seconds:
Packet sent with a source address of 4.4.4.4
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Actual CLI output - R4

```
R4# ping 2001:DB8:40::10 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:40::10, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:4::4
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

13.5 Healthy reference regression on H4

Preserve this exact dual-stack baseline before opening any broken Incident UNL. Both families, all neighbors and all client paths must match.

H4

```
enable
terminal length 0
ping 1.1.1.1
ping 2001:DB8:1::1 source Ethernet0/0
```

Actual CLI output - H4

```
H4# ping 1.1.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Actual CLI output - H4

```
H4# ping 2001:DB8:1::1 source Ethernet0/0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:1::1, timeout is 2 seconds:
Packet sent with a source address of 2001:DB8:40::10
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

14.1 Save R1 healthy state

Save after all reference checks pass. The separate save-config file already contains the completed state and is independently cold-boot tested.

R1

```
enable
write memory
```

14.2 Save R2 healthy state

Save after all reference checks pass. The separate save-config file already contains the completed state and is independently cold-boot tested.

R2

```
enable
write memory
```

14.3 Save R3 healthy state

Save after all reference checks pass. The separate save-config file already contains the completed state and is independently cold-boot tested.

R3

```
enable
write memory
```

14.4 Save R4 healthy state

Save after all reference checks pass. The separate save-config file already contains the completed state and is independently cold-boot tested.

R4

```
enable
write memory
```

14.5 Save H4 healthy state

Save after all reference checks pass. The separate save-config file already contains the completed state and is independently cold-boot tested.

H4

```
enable
write memory
```

15. Incident workflow and handoff

For each ticket, open only that Incident UNL and its student workbook. Establish the documented symptom and unaffected service matrix, collect device evidence, write a hypothesis, make the minimum repair, and rerun the full reference regression. Consult the matching Solution Guide only after completing the investigation. Reset from the healthy reference before the next ticket.

16. Ticket inventory

Incident 01: OSPFv2 Transit Neighbor Loss. IPv4 route diversity to the branch has fallen after a maintenance change. IPv4 client traffic may still work through a surviving path; IPv6 service must remain normal.

Incident 02: OSPFv3 Area Mismatch. One IPv6 OSPF transit adjacency disappeared and IPv6 route diversity fell. IPv4 OSPF and IPv4 branch service must remain normal.

Incident 03: IPv4 Area 1 Prefix Withdrawal. The branch IPv4 gateway works locally but other sites have lost the branch IPv4 prefix. IPv6 to the same client remains healthy.

Incident 04: IPv6 Area 1 Prefix Withdrawal. The branch IPv6 gateway works locally but other sites have lost the branch IPv6 /64. IPv4 to the same client remains healthy.

Incident 05: IPv4 Preferred Path Drift. Branch IPv4 reachability remains up but the approved R1-R2 equal-cost route has changed to a single R1-R3 path. IPv6 path diversity is normal.

17. Release scope and source

All displayed master CLI came from the matching RAW stage on the approved IOL image. The five broken starting states and their repair/regression evidence are in the separately named Incident and Solution files. Variable timers and packet times may differ.

Reference: Cisco 300-410 ENARSI v1.1 blueprint.