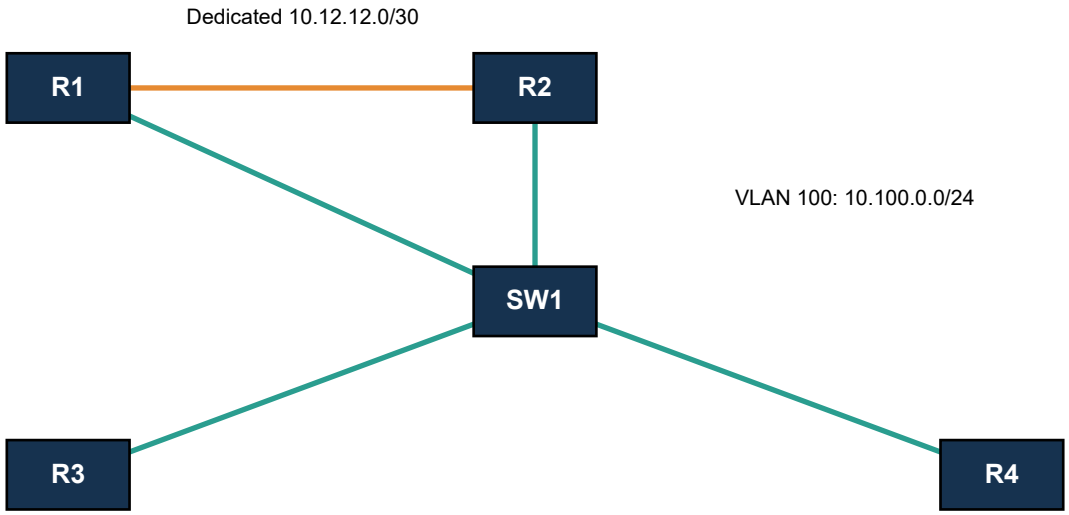
CCNP ENARSI

Lab 02

OSPF Network Types, DR/BDR & Neighbor States



Guided workbook | 4 IOL L3 routers + 1 IOL L2 switch

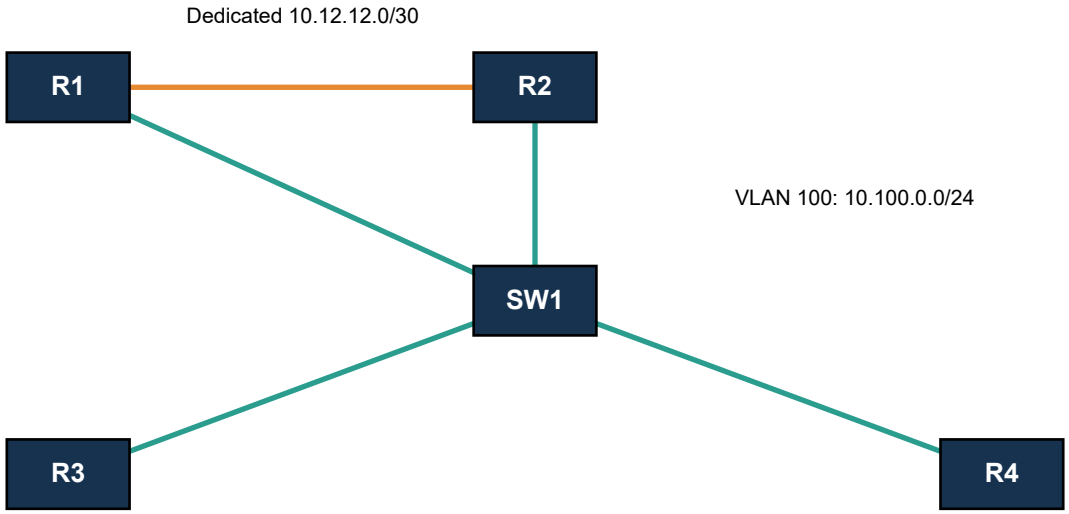
CLI annotations: GREEN - expected healthy result; YELLOW - warning or interpretation required; RED - fault or failed requirement. Colors are workbook annotations, not native CLI colors. Variable timers and ages may differ. Yellow/red items include a one-line reason.

1. Lab overview

Practice Ethernet broadcast OSPF, election eligibility, election history, normal 2-WAY relationships, failover and a dedicated point-to-point link. The production scenario is a shared transit VLAN connecting four routing devices. A network engineer must distinguish a healthy DROTHER relationship from a failed adjacency and must predict the effect of a maintenance change. This is a guided lab; disruptive steps affect only this isolated lab. Estimated time: 150-180 minutes. Prerequisite: Lab 01, IPv4 /24 and /30 addressing, router IDs, passive interfaces and OSPF route verification. Blueprint coverage: OSPF neighbor relationships and network types. Interview value: explain why highest priority does not immediately replace an established DR, why 2-WAY can be healthy, and why DR is not a default gateway.

2. Topology and addressing

Five infrastructure nodes: R1-R4 use approved IOL L3; SW1 uses approved IOL L2. All routers E0/0 connect to SW1 E0/0-E0/3 respectively in VLAN 100. Shared addresses are 10.100.0.1-4/24. Loopback addresses/router IDs are 1.1.1.1 through 4.4.4.4/32. R1 E0/1 directly connects to R2 E0/1 using 10.12.12.1/30 and 10.12.12.2/30. In RAW and save-ip-configuration, the direct link is initially outside OSPF. RAW has no startup configuration. Save-ip-configuration contains baseline addresses, hostnames and VLAN/access ports only. Final save-config contains the completed healthy state: shared DR R4, BDR R3, and R1-R2 point-to-point adjacency. Boot it, allow 60 seconds for convergence, then run sections 20, 22 and 26 without entering configuration commands. All three variants share the same topology. This lab has no VPCS endpoints.



Device	Shared E0/0	Loopback0	Dedicated E0/1
R1	10.100.0.1/24	1.1.1.1/32	10.12.12.1/30
R2	10.100.0.2/24	2.2.2.2/32	10.12.12.2/30
R3	10.100.0.3/24	3.3.3.3/32	Unused
R4	10.100.0.4/24	4.4.4.4/32	Unused

Node connection table

Endpoint A	Endpoint B	Purpose
R1 Ethernet0/0	SW1 Ethernet0/0	VLAN 100 access
R2 Ethernet0/0	SW1 Ethernet0/1	VLAN 100 access
R3 Ethernet0/0	SW1 Ethernet0/2	VLAN 100 access
R4 Ethernet0/0	SW1 Ethernet0/3	VLAN 100 access
R1 Ethernet0/1	R2 Ethernet0/1	Dedicated routed /30

3. Technical deep dive: neighbor versus adjacency

A Hello packet identifies the sender and lists neighbors it has heard. Seeing your own router ID in a received Hello establishes bidirectional communication (2-WAY). Full adjacency additionally requires database description exchange, requests and synchronization. On a broadcast segment, every DROTHER forms full adjacencies with DR and BDR, while two DROTHER peers normally remain 2-WAY. With four routers and a DR plus BDR, each DROTHER sees two FULL peers and one 2-WAY peer. DR and BDR see three FULL peers. Do not repair this healthy 2-WAY state. INIT means one-way Hello communication; persistent EXSTART/EXCHANGE needs investigation of parameters such as MTU and router identity. Brief transitional states during convergence are expected.

4. Technical deep dive: elections and maintenance

Election eligibility is per interface. Priority zero removes a router from DR/BDR eligibility without disabling OSPF or route learning. Among competing eligible candidates, higher priority wins; equal priorities use higher router ID. Existing roles are non-preemptive: a late arrival with higher priority does not evict the current DR/BDR. Startup order therefore matters. A failed DR is replaced by the BDR; remaining eligible routers elect a new BDR. A returning former DR normally becomes DROTHER when both roles already exist. To obtain a clean repeatable election, shut the shared OSPF interfaces on all four routers, set parameters, then activate them within one Hello interval and wait for convergence. This reset deliberately interrupts the lab shared transit and must never be copied into a production network without a maintenance plan.

5. Technical deep dive: network type and evidence

Ethernet defaults to broadcast OSPF, commonly Hello 10 and Dead/Wait 40 seconds. Point-to-point OSPF creates no DR/BDR and displays FULL/- for its peer. In this lab change only the dedicated two-router link; do not use point-to-point on the four-router VLAN. The network type describes OSPF behavior, not whether the underlying Ethernet cable is physically shared. DR/BDR roles optimize control-plane adjacency and LSA flooding; the DR does not forward all user traffic. Verify interface type, priority, local role and elected IDs with show ip ospf interface, then compare neighbors, LSDB and routes. Route reachability must be verified separately from election roles.

6. RAW first boot

On a factory-clean router or switch answer no to the initial configuration dialog, accept termination of autoinstall and press Return. For save-ip-configuration, verify the baseline and skip baseline entry. For final save-config, skip build/failure-injection steps and run the final read-only checks. The IP baseline deliberately leaves OSPF unconfigured.

RAW startup

```
no
yes
```

7.1 Baseline R1

Address the links and loopbacks; on SW1 place only the four router-facing ports in VLAN 100. PortFast is appropriate here for standalone routed endpoints, not switch-to-switch links. Verify interface up/up and VLAN membership before OSPF.

R1

```
enable
conf t
hostname R1
no ip domain lookup
interface Loopback0
ip address 1.1.1.1 255.255.255.255
interface Ethernet0/0
description VLAN100_SHARED_OSPF
ip address 10.100.0.1 255.255.255.0
no shutdown
interface Ethernet0/1
description DEDICATED_R1_R2
ip address 10.12.12.1 255.255.255.252
no shutdown
end
```

7.2 Baseline R2

Address the links and loopbacks; on SW1 place only the four router-facing ports in VLAN 100. PortFast is appropriate here for standalone routed endpoints, not switch-to-switch links. Verify interface up/up and VLAN membership before OSPF.

R2

```
enable
conf t
hostname R2
no ip domain lookup
interface Loopback0
ip address 2.2.2.2 255.255.255.255
interface Ethernet0/0
description VLAN100_SHARED_OSPF
ip address 10.100.0.2 255.255.255.0
no shutdown
interface Ethernet0/1
description DEDICATED_R1_R2
ip address 10.12.12.2 255.255.255.252
no shutdown
end
```

7.3 Baseline R3

Address the links and loopbacks; on SW1 place only the four router-facing ports in VLAN 100. PortFast is appropriate here for standalone routed endpoints, not switch-to-switch links. Verify interface up/up and VLAN membership before OSPF.

R3

```
enable
conf t
hostname R3
no ip domain lookup
interface Loopback0
ip address 3.3.3.3 255.255.255.255
interface Ethernet0/0
description VLAN100_SHARED_OSPF
ip address 10.100.0.3 255.255.255.0
no shutdown
end
```

7.4 Baseline R4

Address the links and loopbacks; on SW1 place only the four router-facing ports in VLAN 100. PortFast is appropriate here for standalone routed endpoints, not switch-to-switch links. Verify interface up/up and VLAN membership before OSPF.

R4

```
enable
conf t
hostname R4
no ip domain lookup
interface Loopback0
ip address 4.4.4.4 255.255.255.255
interface Ethernet0/0
description VLAN100_SHARED_OSPF
ip address 10.100.0.4 255.255.255.0
no shutdown
end
```

7.5 Baseline SW1

Address the links and loopbacks; on SW1 place only the four router-facing ports in VLAN 100. PortFast is appropriate here for standalone routed endpoints, not switch-to-switch links. Verify interface up/up and VLAN membership before OSPF. After the last switch port is configured, allow 40 seconds for initial VLAN/port forwarding to settle before the first connectivity check. PortFast does not replace checking actual forwarding readiness.

SW1

```
enable
conf t
hostname SW1
no ip domain lookup
vlan 100
name OSPF_SHARED
interface Ethernet0/0
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
interface Ethernet0/1
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
interface Ethernet0/2
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
interface Ethernet0/3
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
end
```

Wait at least 40 seconds before proceeding.

Actual SW1 PortFast advisory

```
SW1(config-if)# spanning-tree portfast
%Warning: portfast should only be enabled on ports connected to a single
 host. Connecting hubs, concentrators, switches, bridges, etc... to this
 interface  when portfast is enabled, can cause temporary bridging loops.
 Use with CAUTION
%Portfast has been configured on Ethernet0/0 but will only
 have effect when the interface is in a non-trunking mode.
```

WARNING - PortFast bypasses normal STP startup waiting; these ports connect only to routed endpoints.

8.1 Verify R1 baseline

The shared segment must work before routing is configured. Connected pings exercise VLAN membership and local addressing. The first ping may lose a packet while ARP resolves; repeat it and require 5/5 replies once the neighbor mapping exists.

R1

```
enable
terminal length 0
show ip interface brief
ping 10.100.0.2
ping 10.100.0.2
show running-config | section router ospf
```

Expected: Repeated shared ping succeeds 5/5; no OSPF process.

Actual CLI output - R1

```
R1# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.100.0.1      YES manual up                    up
Ethernet0/1            10.12.12.1      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# ping 10.100.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.2, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/1/2 ms
```

WARNING - Some initial probes were lost; repeat the test and require the subsequent five replies before continuing.

Actual CLI output - R1

```
R1# ping 10.100.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Actual CLI output - R1

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

8.2 Verify R2 baseline

The shared segment must work before routing is configured. Connected pings exercise VLAN membership and local addressing. The first ping may lose a packet while ARP resolves; repeat it and require 5/5 replies once the neighbor mapping exists.

R2

```
enable
terminal length 0
show ip interface brief
ping 10.100.0.3
ping 10.100.0.3
show running-config | section router ospf
```

Expected: Repeated shared ping succeeds 5/5; no OSPF process.

Actual CLI output - R2

```
R2# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.100.0.2      YES manual up                    up
Ethernet0/1            10.12.12.2      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# ping 10.100.0.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.3, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/2/4 ms
```

WARNING - Some initial probes were lost; repeat the test and require the subsequent five replies before continuing.

Actual CLI output - R2

```
R2# ping 10.100.0.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/3 ms
```

Actual CLI output - R2

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

8.3 Verify R3 baseline

The shared segment must work before routing is configured. Connected pings exercise VLAN membership and local addressing. The first ping may lose a packet while ARP resolves; repeat it and require 5/5 replies once the neighbor mapping exists.

R3

```
enable
terminal length 0
show ip interface brief
ping 10.100.0.4
ping 10.100.0.4
show running-config | section router ospf
```

Expected: Repeated shared ping succeeds 5/5; no OSPF process.

Actual CLI output - R3

```
R3# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.100.0.3      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
Loopback0              3.3.3.3         YES manual up                    up
```

Actual CLI output - R3

```
R3# ping 10.100.0.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.4, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/1/1 ms
```

WARNING - Some initial probes were lost; repeat the test and require the subsequent five replies before continuing.

Actual CLI output - R3

```
R3# ping 10.100.0.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Actual CLI output - R3

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

8.4 Verify R4 baseline

The shared segment must work before routing is configured. Connected pings exercise VLAN membership and local addressing. The first ping may lose a packet while ARP resolves; repeat it and require 5/5 replies once the neighbor mapping exists.

R4

```
enable
terminal length 0
show ip interface brief
ping 10.100.0.1
ping 10.100.0.1
show running-config | section router ospf
```

Expected: Repeated shared ping succeeds 5/5; no OSPF process.

Actual CLI output - R4

```
R4# show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            10.100.0.4      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
Loopback0              4.4.4.4         YES manual up                    up
```

Actual CLI output - R4

```
R4# ping 10.100.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.1, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 2/2/3 ms
```

WARNING - Some initial probes were lost; repeat the test and require the subsequent five replies before continuing.

Actual CLI output - R4

```
R4# ping 10.100.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.100.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Actual CLI output - R4

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

8.5 Verify VLAN

Confirm SW1 has four access ports in VLAN 100. A router ping failure at this stage is not an OSPF problem.

SW1

```
enable
terminal length 0
show vlan brief
show interfaces status
```

Expected: E0/0-E0/3 in VLAN 100.

Actual CLI output - SW1

```
SW1# show vlan brief
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active
100  OSPF_SHARED                      active    Et0/0, Et0/1, Et0/2, Et0/3
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```

Actual CLI output - SW1

```
SW1# show interfaces status
Port         Name               Status       Vlan       Duplex  Speed Type
Et0/0                           connected    100          full   auto 10/100/1000BaseTX
Et0/1                           connected    100          full   auto 10/100/1000BaseTX
Et0/2                           connected    100          full   auto 10/100/1000BaseTX
Et0/3                           connected    100          full   auto 10/100/1000BaseTX
```

9.1 Prepare broadcast OSPF on R1

Stage all shared interfaces down before starting the election. R1 priority 100 and R2 priority 50 are eligible; R3/R4 priority zero cannot win despite their higher router IDs. Loopbacks remain passive and are advertised.

R1

```
enable
conf t
router ospf 10
router-id 1.1.1.1
passive-interface default
no passive-interface Ethernet0/0
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
shutdown
ip ospf network broadcast
ip ospf priority 100
ip ospf 10 area 0
end
```

9.2 Prepare broadcast OSPF on R2

Stage all shared interfaces down before starting the election. R1 priority 100 and R2 priority 50 are eligible; R3/R4 priority zero cannot win despite their higher router IDs. Loopbacks remain passive and are advertised.

R2

```
enable
conf t
router ospf 10
router-id 2.2.2.2
passive-interface default
no passive-interface Ethernet0/0
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
shutdown
ip ospf network broadcast
ip ospf priority 50
ip ospf 10 area 0
end
```

9.3 Prepare broadcast OSPF on R3

Stage all shared interfaces down before starting the election. R1 priority 100 and R2 priority 50 are eligible; R3/R4 priority zero cannot win despite their higher router IDs. Loopbacks remain passive and are advertised.

R3

```
enable
conf t
router ospf 10
router-id 3.3.3.3
passive-interface default
no passive-interface Ethernet0/0
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
shutdown
ip ospf network broadcast
ip ospf priority 0
ip ospf 10 area 0
end
```

9.4 Prepare broadcast OSPF on R4

Stage all shared interfaces down before starting the election. R1 priority 100 and R2 priority 50 are eligible; R3/R4 priority zero cannot win despite their higher router IDs. Loopbacks remain passive and are advertised.

R4

```
enable
conf t
router ospf 10
router-id 4.4.4.4
passive-interface default
no passive-interface Ethernet0/0
exit
interface Loopback0
ip ospf 10 area 0
interface Ethernet0/0
shutdown
ip ospf network broadcast
ip ospf priority 0
ip ospf 10 area 0
end
```

10.1 Activate shared interface R1

After all four configurations are staged, activate these interfaces consecutively within ten seconds. Then wait at least 60 seconds. This controlled start avoids a low-priority router becoming DR before the intended candidate participates.

R1

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

10.2 Activate shared interface R2

After all four configurations are staged, activate these interfaces consecutively within ten seconds. Then wait at least 60 seconds. This controlled start avoids a low-priority router becoming DR before the intended candidate participates.

R2

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

10.3 Activate shared interface R3

After all four configurations are staged, activate these interfaces consecutively within ten seconds. Then wait at least 60 seconds. This controlled start avoids a low-priority router becoming DR before the intended candidate participates.

R3

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

10.4 Activate shared interface R4

After all four configurations are staged, activate these interfaces consecutively within ten seconds. Then wait at least 60 seconds. This controlled start avoids a low-priority router becoming DR before the intended candidate participates.

R4

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

Wait at least 60 seconds before proceeding.

11.1 Verify election R1

Read interface role and neighbor suffix independently: neighbor suffix describes the remote router. The R3-R4 2-WAY relationship is healthy. Route learning and ping must still succeed.

R1

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R1 DR; R2 BDR; R3/R4 DROTHER. R3-R4 2-WAY/DROTHER, all DR/BDR peer relationships FULL. Remote loopbacks learned.

Actual CLI output - R1

```
R1# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.1/24, Interface ID 2, Area 0
  Process ID 10, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DR, Priority 100
  Designated Router (ID) 1.1.1.1, Interface address 10.100.0.1
  Backup Designated router (ID) 2.2.2.2, Interface address 10.100.0.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 2.2.2.2  (Backup Designated Router)
    Adjacent with neighbor 3.3.3.3
    Adjacent with neighbor 4.4.4.4
```

Actual CLI output - R1

```
R1# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           50   FULL/BDR        00:00:39    10.100.0.2      Ethernet0/0
3.3.3.3            0   FULL/DROTHER    00:00:39    10.100.0.3      Ethernet0/0
4.4.4.4            0   FULL/DROTHER    00:00:39    10.100.0.4      Ethernet0/0
```

Actual CLI output - R1

```
R1# show ip route ospf
Gateway of last resort is not set
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:19, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:19, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:15, Ethernet0/0
```

Actual CLI output - R1

```
R1# show ip ospf database network
            OSPF Router with ID (1.1.1.1) (Process ID 10)
Net Link States (Area 0)
  LS age: 15
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R1

```
R1# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 3/3/4 ms
```

11.2 Verify election R2

Read interface role and neighbor suffix independently: neighbor suffix describes the remote router. The R3-R4 2-WAY relationship is healthy. Route learning and ping must still succeed.

R2

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R1 DR; R2 BDR; R3/R4 DROTHER. R3-R4 2-WAY/DROTHER, all DR/BDR peer relationships FULL. Remote loopbacks learned.

Actual CLI output - R2

```
R2# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.2/24, Interface ID 2, Area 0
  Process ID 10, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State BDR, Priority 50
  Designated Router (ID) 1.1.1.1, Interface address 10.100.0.1
  Backup Designated router (ID) 2.2.2.2, Interface address 10.100.0.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 1.1.1.1  (Designated Router)
    Adjacent with neighbor 3.3.3.3
    Adjacent with neighbor 4.4.4.4
```

Actual CLI output - R2

```
R2# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1         100   FULL/DR         00:00:36    10.100.0.1      Ethernet0/0
3.3.3.3           0   FULL/DROTHER    00:00:36    10.100.0.3      Ethernet0/0
4.4.4.4           0   FULL/DROTHER    00:00:36    10.100.0.4      Ethernet0/0
```

Actual CLI output - R2

```
R2# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:00:21, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:17, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:14, Ethernet0/0
```

Actual CLI output - R2

```
R2# show ip ospf database network
            OSPF Router with ID (2.2.2.2) (Process ID 10)
Net Link States (Area 0)
  LS age: 19
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R2

```
R2# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 2/2/3 ms
```

11.3 Verify election R3

Read interface role and neighbor suffix independently: neighbor suffix describes the remote router. The R3-R4 2-WAY relationship is healthy. Route learning and ping must still succeed.

R3

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R1 DR; R2 BDR; R3/R4 DROTHER. R3-R4 2-WAY/DROTHER, all DR/BDR peer relationships FULL. Remote loopbacks learned.

Actual CLI output - R3

```
R3# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.3/24, Interface ID 2, Area 0
  Process ID 10, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 0
  Designated Router (ID) 1.1.1.1, Interface address 10.100.0.1
  Backup Designated router (ID) 2.2.2.2, Interface address 10.100.0.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 1.1.1.1  (Designated Router)
    Adjacent with neighbor 2.2.2.2  (Backup Designated Router)
```

Actual CLI output - R3

```
R3# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1         100   FULL/DR         00:00:33    10.100.0.1      Ethernet0/0
2.2.2.2          50   FULL/BDR        00:00:33    10.100.0.2      Ethernet0/0
4.4.4.4           0   2WAY/DROTHER    00:00:31    10.100.0.4      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R3

```
R3# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:00:25, Ethernet0/0
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:20, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:18, Ethernet0/0
```

Actual CLI output - R3

```
R3# show ip ospf database network
            OSPF Router with ID (3.3.3.3) (Process ID 10)
Net Link States (Area 0)
  LS age: 22
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R3

```
R3# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 2/2/3 ms
```

11.4 Verify election R4

Read interface role and neighbor suffix independently: neighbor suffix describes the remote router. The R3-R4 2-WAY relationship is healthy. Route learning and ping must still succeed.

R4

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R1 DR; R2 BDR; R3/R4 DROTHER. R3-R4 2-WAY/DROTHER, all DR/BDR peer relationships FULL. Remote loopbacks learned.

Actual CLI output - R4

```
R4# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.4/24, Interface ID 2, Area 0
  Process ID 10, Router ID 4.4.4.4, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 0
  Designated Router (ID) 1.1.1.1, Interface address 10.100.0.1
  Backup Designated router (ID) 2.2.2.2, Interface address 10.100.0.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 1.1.1.1  (Designated Router)
    Adjacent with neighbor 2.2.2.2  (Backup Designated Router)
```

Actual CLI output - R4

```
R4# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1         100   FULL/DR         00:00:39    10.100.0.1      Ethernet0/0
2.2.2.2          50   FULL/BDR        00:00:39    10.100.0.2      Ethernet0/0
3.3.3.3           0   2WAY/DROTHER    00:00:38    10.100.0.3      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R4

```
R4# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:00:23, Ethernet0/0
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:23, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:23, Ethernet0/0
```

Actual CLI output - R4

```
R4# show ip ospf database network
            OSPF Router with ID (4.4.4.4) (Process ID 10)
Net Link States (Area 0)
  LS age: 24
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R4

```
R4# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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
```

12. Increase R4 priority

A priority change does not preempt the established DR/BDR. R4 becomes eligible but remains DROTHER after at least 45 seconds.

R4

```
enable
conf t
interface Ethernet0/0
ip ospf priority 200
end
```

Wait at least 45 seconds before proceeding.

13. Verify non-preemption

Check that R1 and R2 still hold their roles and R4 remains DROTHER. Priority is now 200; observed role reflects election history.

R4

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R1 DR, R2 BDR, R4 DROTHER with priority 200.

Actual CLI output - R4

```
R4# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.4/24, Interface ID 2, Area 0
  Process ID 10, Router ID 4.4.4.4, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 200
  Designated Router (ID) 1.1.1.1, Interface address 10.100.0.1
  Backup Designated router (ID) 2.2.2.2, Interface address 10.100.0.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 1.1.1.1  (Designated Router)
    Adjacent with neighbor 2.2.2.2  (Backup Designated Router)
```

WARNING - Priority 200 makes R4 eligible but does not preempt the already elected DR/BDR.

Actual CLI output - R4

```
R4# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1         100   FULL/DR         00:00:38    10.100.0.1      Ethernet0/0
2.2.2.2          50   FULL/BDR        00:00:37    10.100.0.2      Ethernet0/0
3.3.3.3           0   2WAY/DROTHER    00:00:36    10.100.0.3      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R4

```
R4# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:01:13, Ethernet0/0
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:01:13, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:01:13, Ethernet0/0
```

Actual CLI output - R4

```
R4# show ip ospf database network
            OSPF Router with ID (4.4.4.4) (Process ID 10)
Net Link States (Area 0)
  LS age: 74
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R4

```
R4# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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
```

14. Fail the DR shared interface

Shut only R1 E0/0. R1 loses its shared-segment attachment. Wait 50 seconds so all surviving routers detect the absence. The dedicated link is not yet in OSPF.

R1

```
enable
conf t
interface Ethernet0/0
shutdown
end
```

Wait at least 50 seconds before proceeding.

15.2 Verify failover R2

BDR R2 is promoted to DR; eligible R4 becomes BDR. Priority-zero R3 stays DROTHER. R1 loopback is withdrawn; R2-R4 loopbacks remain reachable.

R2

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
show ip route 1.1.1.1
ping 3.3.3.3 source Loopback0
```

Expected: R2 DR; R4 BDR; R3 DROTHER. R1 loopback missing; unaffected loopbacks reachable.

Actual CLI output - R2

```
R2# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.2/24, Interface ID 2, Area 0
  Process ID 10, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DR, Priority 50
  Designated Router (ID) 2.2.2.2, Interface address 10.100.0.2
  Backup Designated router (ID) 4.4.4.4, Interface address 10.100.0.4
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 2, Adjacent neighbor count is 2
    Adjacent with neighbor 3.3.3.3
    Adjacent with neighbor 4.4.4.4  (Backup Designated Router)
```

Actual CLI output - R2

```
R2# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
3.3.3.3           0   FULL/DROTHER    00:00:39    10.100.0.3      Ethernet0/0
4.4.4.4         200   FULL/BDR        00:00:39    10.100.0.4      Ethernet0/0
```

Actual CLI output - R2

```
R2# show ip route ospf
Gateway of last resort is not set
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:16, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:16, Ethernet0/0
```

Actual CLI output - R2

```
R2# show ip ospf database network
            OSPF Router with ID (2.2.2.2) (Process ID 10)
Net Link States (Area 0)
  LS age: 128
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
  LS age: 16
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.2 (address of Designated Router)
  Advertising Router: 2.2.2.2
  LS Seq Number: 80000001
  Checksum: 0x495
  Length: 36
  Network Mask: /24
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R2

```
R2# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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# show ip route 1.1.1.1
% Network not in table
```

WARNING - This route is intentionally withdrawn while R1 is disconnected in this step.

Actual CLI output - R2

```
R2# ping 3.3.3.3 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, 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 = 4/4/5 ms
```

15.3 Verify failover R3

BDR R2 is promoted to DR; eligible R4 becomes BDR. Priority-zero R3 stays DROTHER. R1 loopback is withdrawn; R2-R4 loopbacks remain reachable.

R3

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
show ip route 1.1.1.1
ping 3.3.3.3 source Loopback0
```

Expected: R2 DR; R4 BDR; R3 DROTHER. R1 loopback missing; unaffected loopbacks reachable.

Actual CLI output - R3

```
R3# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.3/24, Interface ID 2, Area 0
  Process ID 10, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 0
  Designated Router (ID) 2.2.2.2, Interface address 10.100.0.2
  Backup Designated router (ID) 4.4.4.4, Interface address 10.100.0.4
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 2, Adjacent neighbor count is 2
    Adjacent with neighbor 2.2.2.2  (Designated Router)
    Adjacent with neighbor 4.4.4.4  (Backup Designated Router)
```

Actual CLI output - R3

```
R3# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           50   FULL/DR         00:00:37    10.100.0.2      Ethernet0/0
4.4.4.4          200   FULL/BDR        00:00:37    10.100.0.4      Ethernet0/0
```

Actual CLI output - R3

```
R3# show ip route ospf
Gateway of last resort is not set
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:20, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:20, Ethernet0/0
```

Actual CLI output - R3

```
R3# show ip ospf database network
            OSPF Router with ID (3.3.3.3) (Process ID 10)
Net Link States (Area 0)
  LS age: 132
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
  LS age: 21
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.2 (address of Designated Router)
  Advertising Router: 2.2.2.2
  LS Seq Number: 80000001
  Checksum: 0x495
  Length: 36
  Network Mask: /24
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R3

```
R3# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 2/2/3 ms
```

Actual CLI output - R3

```
R3# show ip route 1.1.1.1
% Network not in table
```

WARNING - This route is intentionally withdrawn while R1 is disconnected in this step.

Actual CLI output - R3

```
R3# ping 3.3.3.3 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, 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 = 1/1/1 ms
```

15.4 Verify failover R4

BDR R2 is promoted to DR; eligible R4 becomes BDR. Priority-zero R3 stays DROTHER. R1 loopback is withdrawn; R2-R4 loopbacks remain reachable.

R4

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
show ip route 1.1.1.1
ping 3.3.3.3 source Loopback0
```

Expected: R2 DR; R4 BDR; R3 DROTHER. R1 loopback missing; unaffected loopbacks reachable.

Actual CLI output - R4

```
R4# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.4/24, Interface ID 2, Area 0
  Process ID 10, Router ID 4.4.4.4, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State BDR, Priority 200
  Designated Router (ID) 2.2.2.2, Interface address 10.100.0.2
  Backup Designated router (ID) 4.4.4.4, Interface address 10.100.0.4
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 2, Adjacent neighbor count is 2
    Adjacent with neighbor 2.2.2.2  (Designated Router)
    Adjacent with neighbor 3.3.3.3
```

Actual CLI output - R4

```
R4# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           50   FULL/DR         00:00:34    10.100.0.2      Ethernet0/0
3.3.3.3            0   FULL/DROTHER    00:00:34    10.100.0.3      Ethernet0/0
```

Actual CLI output - R4

```
R4# show ip route ospf
Gateway of last resort is not set
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:23, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:23, Ethernet0/0
```

Actual CLI output - R4

```
R4# show ip ospf database network
            OSPF Router with ID (4.4.4.4) (Process ID 10)
Net Link States (Area 0)
  LS age: 135
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.1 (address of Designated Router)
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000002
  Checksum: 0xE4B0
  Length: 40
  Network Mask: /24
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
  LS age: 24
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.2 (address of Designated Router)
  Advertising Router: 2.2.2.2
  LS Seq Number: 80000001
  Checksum: 0x495
  Length: 36
  Network Mask: /24
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R4

```
R4# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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# show ip route 1.1.1.1
% Network not in table
```

WARNING - This route is intentionally withdrawn while R1 is disconnected in this step.

Actual CLI output - R4

```
R4# ping 3.3.3.3 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, 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 = 1/2/3 ms
```

16. Restore R1

Restore the failed interface and wait for synchronization. R1 returns as DROTHER because R2/R4 already occupy the roles.

R1

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

Wait at least 50 seconds before proceeding.

17. Verify returning former DR

Election does not automatically restore historical roles. Confirm R1 FULL to R2/R4 and 2-WAY to R3, then verify loopback reachability.

R1

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R1 DROTHER; R2 DR; R4 BDR. All four loopbacks reachable.

Actual CLI output - R1

```
R1# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.1/24, Interface ID 2, Area 0
  Process ID 10, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 100
  Designated Router (ID) 2.2.2.2, Interface address 10.100.0.2
  Backup Designated router (ID) 4.4.4.4, Interface address 10.100.0.4
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 2.2.2.2  (Designated Router)
    Adjacent with neighbor 4.4.4.4  (Backup Designated Router)
```

WARNING - Returning R1 remains DROTHER because the elected DR/BDR do not lose their roles.

Actual CLI output - R1

```
R1# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           50   FULL/DR         00:00:36    10.100.0.2      Ethernet0/0
3.3.3.3            0   2WAY/DROTHER    00:00:33    10.100.0.3      Ethernet0/0
4.4.4.4          200   FULL/BDR        00:00:33    10.100.0.4      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R1

```
R1# show ip route ospf
Gateway of last resort is not set
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:44, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:44, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:44, Ethernet0/0
```

Actual CLI output - R1

```
R1# show ip ospf database network
            OSPF Router with ID (1.1.1.1) (Process ID 10)
Net Link States (Area 0)
  LS age: 45
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.2 (address of Designated Router)
  Advertising Router: 2.2.2.2
  LS Seq Number: 80000002
  Checksum: 0xACE3
  Length: 40
  Network Mask: /24
Attached Router: 2.2.2.2
Attached Router: 1.1.1.1
Attached Router: 3.3.3.3
Attached Router: 4.4.4.4
```

Actual CLI output - R1

```
R1# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 1/2/5 ms
```

18.1 Stage equal-priority election

Take every shared interface down before making all four priorities equal. This explicitly creates a new election in an isolated lab.

R1

```
enable
conf t
interface Ethernet0/0
shutdown
ip ospf priority 1
end
```

18.2 Stage equal-priority election

Take every shared interface down before making all four priorities equal. This explicitly creates a new election in an isolated lab.

R2

```
enable
conf t
interface Ethernet0/0
shutdown
ip ospf priority 1
end
```

18.3 Stage equal-priority election

Take every shared interface down before making all four priorities equal. This explicitly creates a new election in an isolated lab.

R3

```
enable
conf t
interface Ethernet0/0
shutdown
ip ospf priority 1
end
```

18.4 Stage equal-priority election

Take every shared interface down before making all four priorities equal. This explicitly creates a new election in an isolated lab.

R4

```
enable
conf t
interface Ethernet0/0
shutdown
ip ospf priority 1
end
```

19.1 Start equal-priority election

Activate all four within ten seconds, then wait 60 seconds. With equal priorities the highest router ID should win.

R1

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

19.2 Start equal-priority election

Activate all four within ten seconds, then wait 60 seconds. With equal priorities the highest router ID should win.

R2

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

19.3 Start equal-priority election

Activate all four within ten seconds, then wait 60 seconds. With equal priorities the highest router ID should win.

R3

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

19.4 Start equal-priority election

Activate all four within ten seconds, then wait 60 seconds. With equal priorities the highest router ID should win.

R4

```
enable
conf t
interface Ethernet0/0
no shutdown
end
```

Wait at least 60 seconds before proceeding.

20.1 Verify Router ID tie-break R1

Confirm a clean election chose R4 as DR and R3 as BDR. R1-R2 should now be 2-WAY on the shared VLAN.

R1

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R4 DR; R3 BDR; R1/R2 DROTHER.

Actual CLI output - R1

```
R1# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.1/24, Interface ID 2, Area 0
  Process ID 10, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 1
  Designated Router (ID) 4.4.4.4, Interface address 10.100.0.4
  Backup Designated router (ID) 3.3.3.3, Interface address 10.100.0.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 3.3.3.3  (Backup Designated Router)
    Adjacent with neighbor 4.4.4.4  (Designated Router)
```

Actual CLI output - R1

```
R1# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           1   2WAY/DROTHER    00:00:37    10.100.0.2      Ethernet0/0
3.3.3.3           1   FULL/BDR        00:00:39    10.100.0.3      Ethernet0/0
4.4.4.4           1   FULL/DR         00:00:36    10.100.0.4      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R1

```
R1# show ip route ospf
Gateway of last resort is not set
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:13, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:15, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:15, Ethernet0/0
```

Actual CLI output - R1

```
R1# show ip ospf database network
            OSPF Router with ID (1.1.1.1) (Process ID 10)
Net Link States (Area 0)
  LS age: 16
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.4 (address of Designated Router)
  Advertising Router: 4.4.4.4
  LS Seq Number: 80000002
  Checksum: 0xC7A
  Length: 40
  Network Mask: /24
Attached Router: 4.4.4.4
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
```

Actual CLI output - R1

```
R1# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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
```

20.3 Verify Router ID tie-break R3

Confirm a clean election chose R4 as DR and R3 as BDR. R1-R2 should now be 2-WAY on the shared VLAN.

R3

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R4 DR; R3 BDR; R1/R2 DROTHER.

Actual CLI output - R3

```
R3# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.3/24, Interface ID 2, Area 0
  Process ID 10, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 4.4.4.4, Interface address 10.100.0.4
  Backup Designated router (ID) 3.3.3.3, Interface address 10.100.0.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 2.2.2.2
    Adjacent with neighbor 4.4.4.4  (Designated Router)
```

Actual CLI output - R3

```
R3# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/DROTHER    00:00:34    10.100.0.1      Ethernet0/0
2.2.2.2           1   FULL/DROTHER    00:00:34    10.100.0.2      Ethernet0/0
4.4.4.4           1   FULL/DR         00:00:33    10.100.0.4      Ethernet0/0
```

Actual CLI output - R3

```
R3# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:00:16, Ethernet0/0
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:16, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:18, Ethernet0/0
```

Actual CLI output - R3

```
R3# show ip ospf database network
            OSPF Router with ID (3.3.3.3) (Process ID 10)
Net Link States (Area 0)
  LS age: 19
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.4 (address of Designated Router)
  Advertising Router: 4.4.4.4
  LS Seq Number: 80000002
  Checksum: 0xC7A
  Length: 40
  Network Mask: /24
Attached Router: 4.4.4.4
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
```

Actual CLI output - R3

```
R3# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 1/1/2 ms
```

20.4 Verify Router ID tie-break R4

Confirm a clean election chose R4 as DR and R3 as BDR. R1-R2 should now be 2-WAY on the shared VLAN.

R4

```
enable
terminal length 0
show ip ospf interface Ethernet0/0
show ip ospf neighbor
show ip route ospf
show ip ospf database network
ping 4.4.4.4 source Loopback0
```

Expected: R4 DR; R3 BDR; R1/R2 DROTHER.

Actual CLI output - R4

```
R4# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.4/24, Interface ID 2, Area 0
  Process ID 10, Router ID 4.4.4.4, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 4.4.4.4, Interface address 10.100.0.4
  Backup Designated router (ID) 3.3.3.3, Interface address 10.100.0.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 2.2.2.2
    Adjacent with neighbor 3.3.3.3  (Backup Designated Router)
```

Actual CLI output - R4

```
R4# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/DROTHER    00:00:32    10.100.0.1      Ethernet0/0
2.2.2.2           1   FULL/DROTHER    00:00:32    10.100.0.2      Ethernet0/0
3.3.3.3           1   FULL/BDR        00:00:33    10.100.0.3      Ethernet0/0
```

Actual CLI output - R4

```
R4# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:00:20, Ethernet0/0
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:20, Ethernet0/0
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:21, Ethernet0/0
```

Actual CLI output - R4

```
R4# show ip ospf database network
            OSPF Router with ID (4.4.4.4) (Process ID 10)
Net Link States (Area 0)
  LS age: 20
  Options: (No TOS-capability, DC)
  LS Type: Network Links
  Link State ID: 10.100.0.4 (address of Designated Router)
  Advertising Router: 4.4.4.4
  LS Seq Number: 80000002
  Checksum: 0xC7A
  Length: 40
  Network Mask: /24
Attached Router: 4.4.4.4
Attached Router: 1.1.1.1
Attached Router: 2.2.2.2
Attached Router: 3.3.3.3
```

Actual CLI output - R4

```
R4# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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
```

21.1 Activate dedicated point-to-point OSPF R1

Activate OSPF only on the dedicated E0/1 link and set point-to-point on both ends. Approve E0/1 as non-passive. Shared VLAN remains broadcast.

R1

```
enable
conf t
router ospf 10
no passive-interface Ethernet0/1
exit
interface Ethernet0/1
ip ospf network point-to-point
ip ospf 10 area 0
end
```

21.2 Activate dedicated point-to-point OSPF R2

Activate OSPF only on the dedicated E0/1 link and set point-to-point on both ends. Approve E0/1 as non-passive. Shared VLAN remains broadcast.

R2

```
enable
conf t
router ospf 10
no passive-interface Ethernet0/1
exit
interface Ethernet0/1
ip ospf network point-to-point
ip ospf 10 area 0
end
```

Wait at least 20 seconds before proceeding.

22.1 Verify two distinct relationships R1

The same remote router appears twice: 2-WAY/DROTHER on E0/0 and FULL/- on E0/1. Do not infer adjacency failure from one row. Dedicated /30 and loopback route preferences must be checked.

R1

```
enable
terminal length 0
show ip ospf neighbor
show ip ospf interface Ethernet0/1
show ip ospf interface Ethernet0/0
show ip route ospf
ping 4.4.4.4 source Loopback0
ping 10.12.12.2
```

Expected: R1-R2 FULL/- on E0/1, 2-WAY/DROTHER on E0/0. Shared DR R4, BDR R3 unchanged.

Actual CLI output - R1

```
R1# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           0   FULL/  -        00:00:36    10.12.12.2      Ethernet0/1
2.2.2.2           1   2WAY/DROTHER    00:00:32    10.100.0.2      Ethernet0/0
3.3.3.3           1   FULL/BDR        00:00:33    10.100.0.3      Ethernet0/0
4.4.4.4           1   FULL/DR         00:00:31    10.100.0.4      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R1

```
R1# show ip ospf interface Ethernet0/1
Ethernet0/1 is up, line protocol is up
  Internet Address 10.12.12.1/30, Interface ID 3, Area 0
  Process ID 10, Router ID 1.1.1.1, Network Type POINT_TO_POINT, Cost: 10
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 2.2.2.2
```

Actual CLI output - R1

```
R1# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.1/24, Interface ID 2, Area 0
  Process ID 10, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 1
  Designated Router (ID) 4.4.4.4, Interface address 10.100.0.4
  Backup Designated router (ID) 3.3.3.3, Interface address 10.100.0.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 3.3.3.3  (Backup Designated Router)
    Adjacent with neighbor 4.4.4.4  (Designated Router)
```

Actual CLI output - R1

```
R1# show ip route ospf
Gateway of last resort is not set
      2.0.0.0/32 is subnetted, 1 subnets
O        2.2.2.2 [110/11] via 10.100.0.2, 00:00:48, Ethernet0/0
                 [110/11] via 10.12.12.2, 00:00:16, Ethernet0/1
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:50, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:50, Ethernet0/0
```

Actual CLI output - R1

```
R1# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 3/3/4 ms
```

Actual CLI output - R1

```
R1# ping 10.12.12.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.12.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

22.2 Verify two distinct relationships R2

The same remote router appears twice: 2-WAY/DROTHER on E0/0 and FULL/- on E0/1. Do not infer adjacency failure from one row. Dedicated /30 and loopback route preferences must be checked.

R2

```
enable
terminal length 0
show ip ospf neighbor
show ip ospf interface Ethernet0/1
show ip ospf interface Ethernet0/0
show ip route ospf
ping 4.4.4.4 source Loopback0
ping 10.12.12.1
```

Expected: R1-R2 FULL/- on E0/1, 2-WAY/DROTHER on E0/0. Shared DR R4, BDR R3 unchanged.

Actual CLI output - R2

```
R2# show ip ospf neighbor
Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           0   FULL/  -        00:00:31    10.12.12.1      Ethernet0/1
1.1.1.1           1   2WAY/DROTHER    00:00:39    10.100.0.1      Ethernet0/0
3.3.3.3           1   FULL/BDR        00:00:30    10.100.0.3      Ethernet0/0
4.4.4.4           1   FULL/DR         00:00:37    10.100.0.4      Ethernet0/0
```

WARNING - These are two DROTHER peers on the broadcast VLAN; 2-WAY is expected and requires no repair.

Actual CLI output - R2

```
R2# show ip ospf interface Ethernet0/1
Ethernet0/1 is up, line protocol is up
  Internet Address 10.12.12.2/30, Interface ID 3, Area 0
  Process ID 10, Router ID 2.2.2.2, Network Type POINT_TO_POINT, Cost: 10
  Transmit Delay is 1 sec, State POINT_TO_POINT
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 1.1.1.1
```

Actual CLI output - R2

```
R2# show ip ospf interface Ethernet0/0
Ethernet0/0 is up, line protocol is up
  Internet Address 10.100.0.2/24, Interface ID 2, Area 0
  Process ID 10, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 10
  Transmit Delay is 1 sec, State DROTHER, Priority 1
  Designated Router (ID) 4.4.4.4, Interface address 10.100.0.4
  Backup Designated router (ID) 3.3.3.3, Interface address 10.100.0.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 3.3.3.3  (Backup Designated Router)
    Adjacent with neighbor 4.4.4.4  (Designated Router)
```

Actual CLI output - R2

```
R2# show ip route ospf
Gateway of last resort is not set
      1.0.0.0/32 is subnetted, 1 subnets
O        1.1.1.1 [110/11] via 10.100.0.1, 00:00:53, Ethernet0/0
                 [110/11] via 10.12.12.1, 00:00:19, Ethernet0/1
      3.0.0.0/32 is subnetted, 1 subnets
O        3.3.3.3 [110/11] via 10.100.0.3, 00:00:53, Ethernet0/0
      4.0.0.0/32 is subnetted, 1 subnets
O        4.4.4.4 [110/11] via 10.100.0.4, 00:00:53, Ethernet0/0
```

Actual CLI output - R2

```
R2# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 2/2/2 ms
```

Actual CLI output - R2

```
R2# ping 10.12.12.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.12.12.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/3 ms
```

23.1 Save verified final state

Save after the election, recovery and dual-link checks in sections 11-22 pass. The delivered save-ip-configuration retains the unsolved baseline; final save-config contains the fully completed healthy state. Section 26 adds a read-only forwarding regression.

R1

```
enable
write memory
```

Actual CLI output - R1

```
R1# write memory
Building configuration...
[OK]
```

23.2 Save verified final state

Save after the election, recovery and dual-link checks in sections 11-22 pass. The delivered save-ip-configuration retains the unsolved baseline; final save-config contains the fully completed healthy state. Section 26 adds a read-only forwarding regression.

R2

```
enable
write memory
```

Actual CLI output - R2

```
R2# write memory
Building configuration...
[OK]
```

23.3 Save verified final state

Save after the election, recovery and dual-link checks in sections 11-22 pass. The delivered save-ip-configuration retains the unsolved baseline; final save-config contains the fully completed healthy state. Section 26 adds a read-only forwarding regression.

R3

```
enable
write memory
```

Actual CLI output - R3

```
R3# write memory
Building configuration...
[OK]
```

23.4 Save verified final state

Save after the election, recovery and dual-link checks in sections 11-22 pass. The delivered save-ip-configuration retains the unsolved baseline; final save-config contains the fully completed healthy state. Section 26 adds a read-only forwarding regression.

R4

```
enable
write memory
```

Actual CLI output - R4

```
R4# write memory
Building configuration...
[OK]
```

23.5 Save verified final state

Save after the election, recovery and dual-link checks in sections 11-22 pass. The delivered save-ip-configuration retains the unsolved baseline; final save-config contains the fully completed healthy state. Section 26 adds a read-only forwarding regression.

SW1

```
enable
write memory
```

Actual CLI output - SW1

```
SW1# write memory
Building configuration...
[OK]
```

24. Common failures and reasoning

All routers priority zero produces no DR/BDR and prevents normal broadcast full adjacencies. Healthy 2-WAY between DROTHERs must not be treated as a fault. An unexpected DR after startup can reflect election history rather than wrong configuration. Check interface type and timers on both ends before blaming the switch. A duplicate Router ID, VLAN mismatch or transit left passive requires a focused correction and verification. This workbook does not require additional undocumented fault injection.

25. Final checklist and interview review

Explain: neighbor versus adjacency; why priority zero still permits route learning; why the highest priority arrival does not preempt; why the returning DR becomes DROTHER; why two relationships can exist with one router ID on different interfaces. Final state: shared DR R4, BDR R3; R1/R2 2-WAY on shared VLAN and FULL/- on dedicated link. All loopbacks reachable. All three topologies are identical. Save-ip-configuration has no OSPF solution; save-config is complete and independently tested after clean boot. Practical PASS results are backed by captured logs.

26.1 Final forwarding regression R1

Verify each remote loopback from the local loopback. This checks bidirectional forwarding for every router pair after all election and network-type changes. Require 5/5 replies for each destination. These checks do not change configuration.

R1

```
enable
terminal length 0
ping 2.2.2.2 source Loopback0
ping 3.3.3.3 source Loopback0
ping 4.4.4.4 source Loopback0
```

Expected: All three remote loopback pings succeed 5/5.

Actual CLI output - R1

```
R1# ping 2.2.2.2 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, 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 = 1/2/4 ms
```

Actual CLI output - R1

```
R1# ping 3.3.3.3 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, 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 = 4/5/6 ms
```

Actual CLI output - R1

```
R1# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 3/3/4 ms
```

26.2 Final forwarding regression R2

Verify each remote loopback from the local loopback. This checks bidirectional forwarding for every router pair after all election and network-type changes. Require 5/5 replies for each destination. These checks do not change configuration.

R2

```
enable
terminal length 0
ping 1.1.1.1 source Loopback0
ping 3.3.3.3 source Loopback0
ping 4.4.4.4 source Loopback0
```

Expected: All three remote loopback pings succeed 5/5.

Actual CLI output - R2

```
R2# 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 2.2.2.2
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/3 ms
```

Actual CLI output - R2

```
R2# ping 3.3.3.3 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, 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 = 1/1/3 ms
```

Actual CLI output - R2

```
R2# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 2/2/3 ms
```

26.3 Final forwarding regression R3

Verify each remote loopback from the local loopback. This checks bidirectional forwarding for every router pair after all election and network-type changes. Require 5/5 replies for each destination. These checks do not change configuration.

R3

```
enable
terminal length 0
ping 1.1.1.1 source Loopback0
ping 2.2.2.2 source Loopback0
ping 4.4.4.4 source Loopback0
```

Expected: All three remote loopback pings succeed 5/5.

Actual CLI output - R3

```
R3# 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 3.3.3.3
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Actual CLI output - R3

```
R3# ping 2.2.2.2 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, 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 = 1/1/1 ms
```

Actual CLI output - R3

```
R3# ping 4.4.4.4 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, 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 = 2/2/3 ms
```

26.4 Final forwarding regression R4

Verify each remote loopback from the local loopback. This checks bidirectional forwarding for every router pair after all election and network-type changes. Require 5/5 replies for each destination. These checks do not change configuration.

R4

```
enable
terminal length 0
ping 1.1.1.1 source Loopback0
ping 2.2.2.2 source Loopback0
ping 3.3.3.3 source Loopback0
```

Expected: All three remote loopback pings succeed 5/5.

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 = 1/1/1 ms
```

Actual CLI output - R4

```
R4# ping 2.2.2.2 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, 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 = 1/1/2 ms
```

Actual CLI output - R4

```
R4# ping 3.3.3.3 source Loopback0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3.3.3.3, 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 = 2/2/2 ms
```

LIVE VALIDATED - PASS. RAW and IP-baseline workflows passed. The actual complete save-config was independently cold-booted without configuration entry: DR R4, BDR R3, shared 2-WAY plus dedicated FULL adjacency, and all 12 directed loopback pings returned 5/5. CLI excerpts are genuine stage-specific output. Tested on EVE-NG 6.2.0-4 with approved IOL L2/L3 images.

References: Cisco ENARSI v1.1 blueprint; Cisco Understand OSPF Neighbor States; Cisco OSPF Interface Evidence.