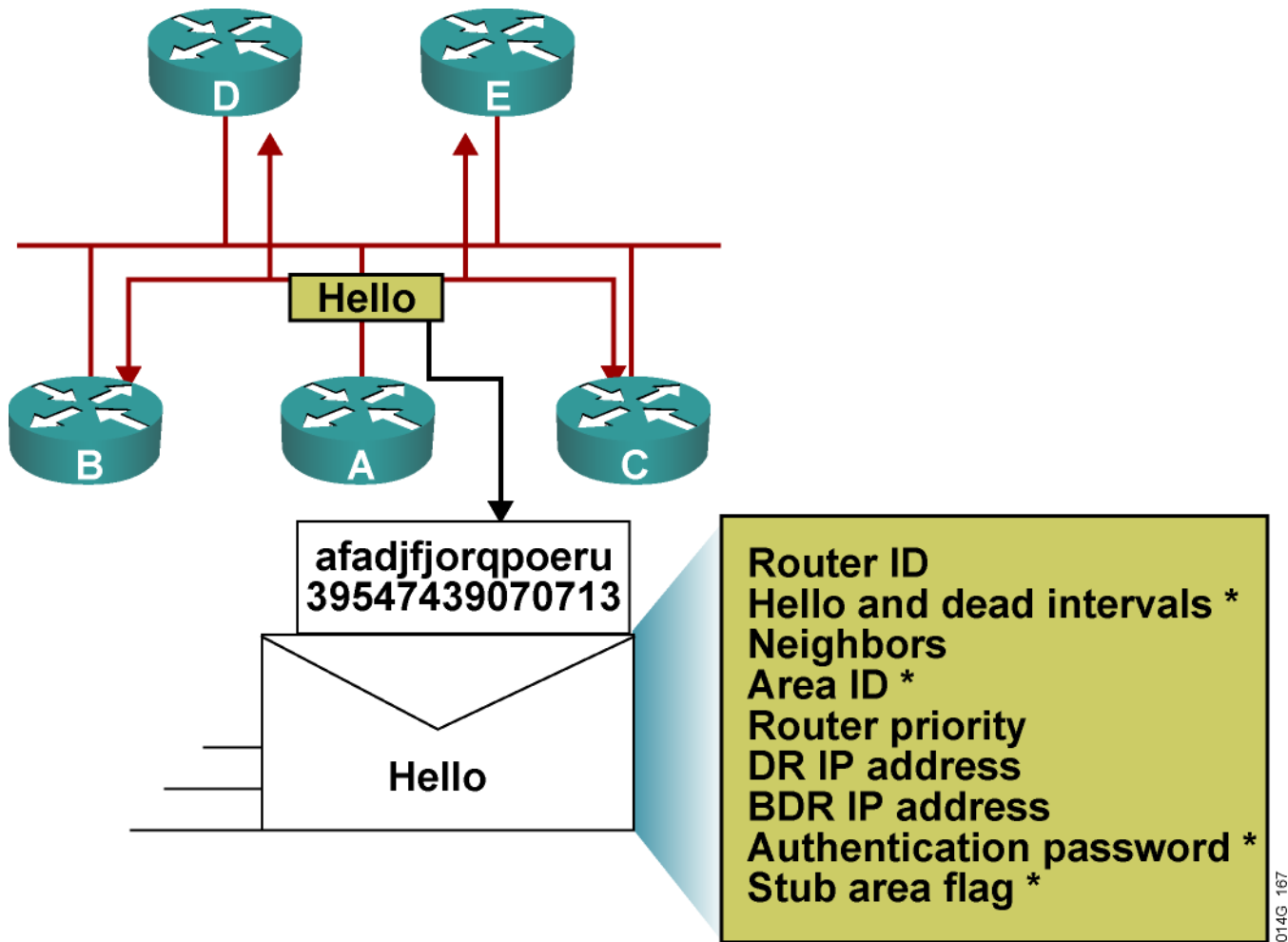




Configuring OSPF

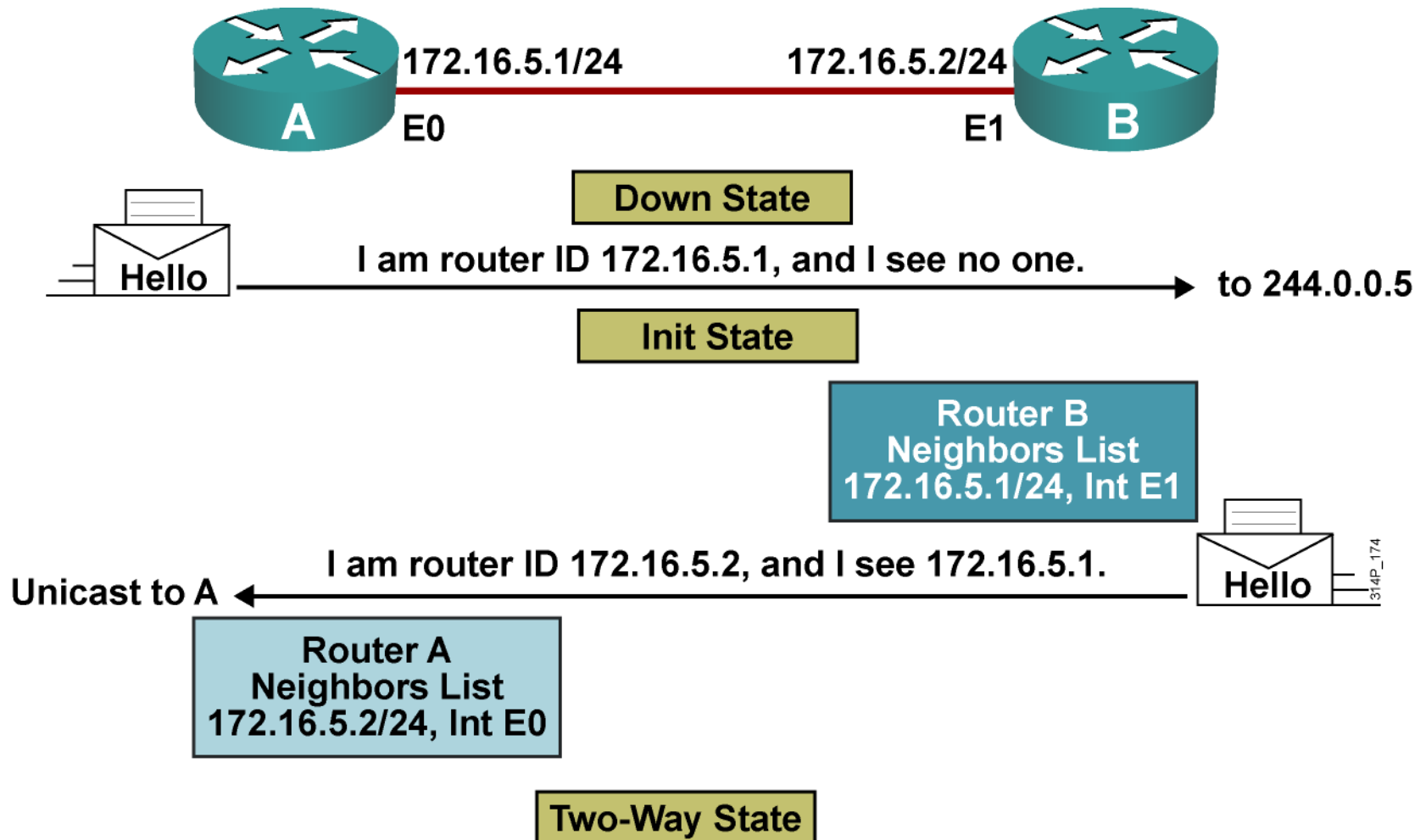
OSPF Neighbors

Neighborhood: The Hello Packet

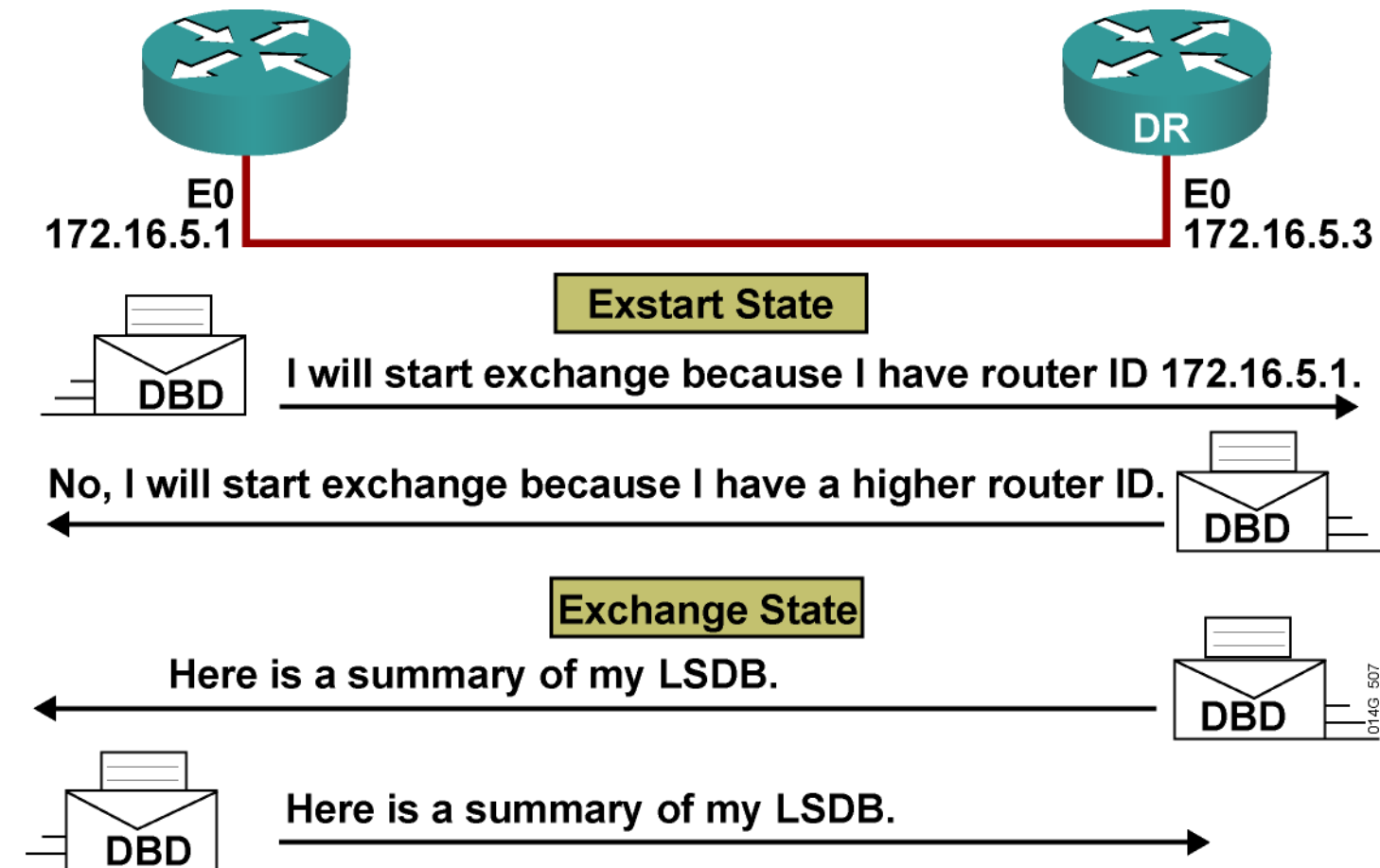


* Entry must match on neighboring routers

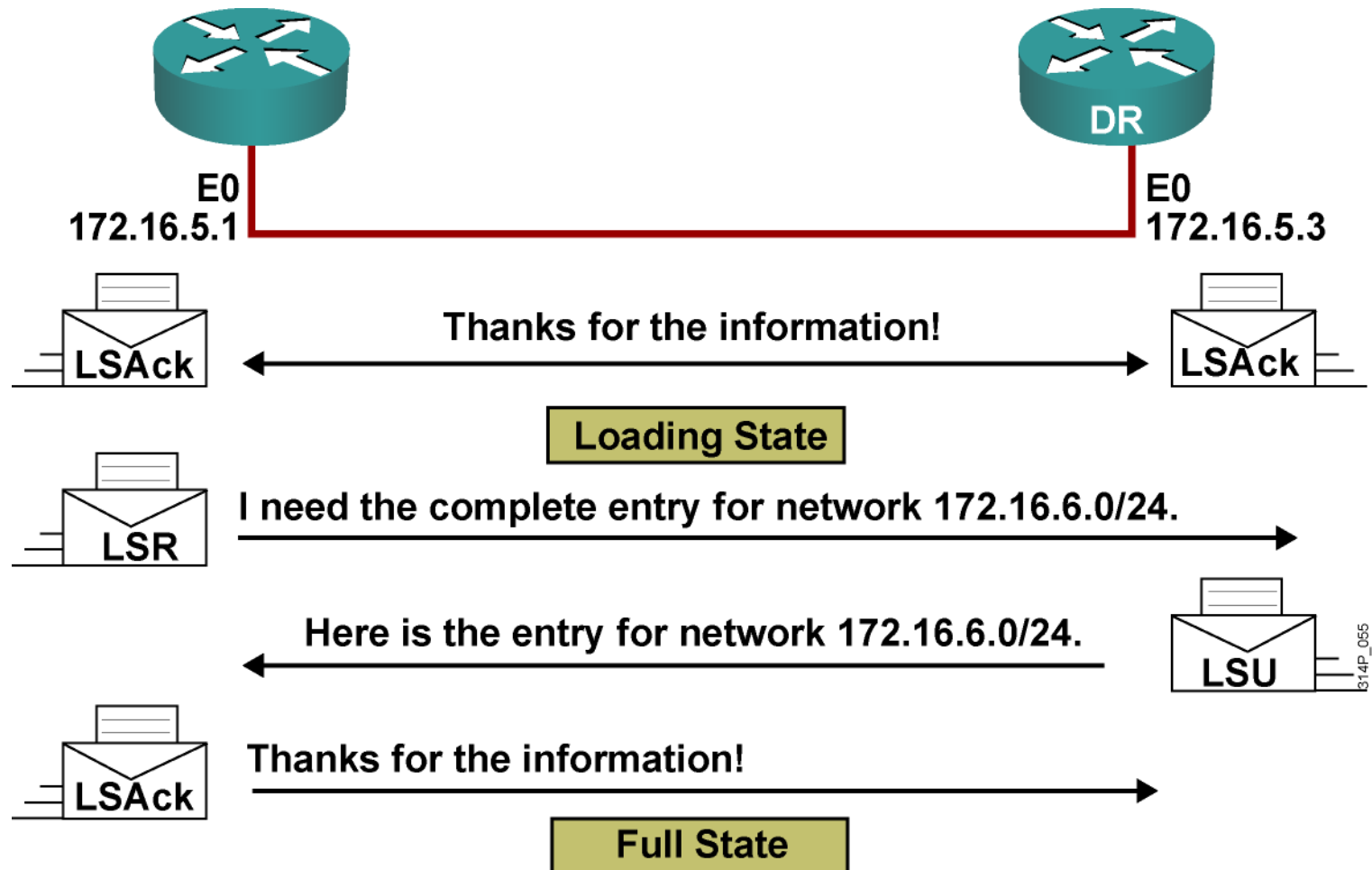
Establishing Bidirectional Communication



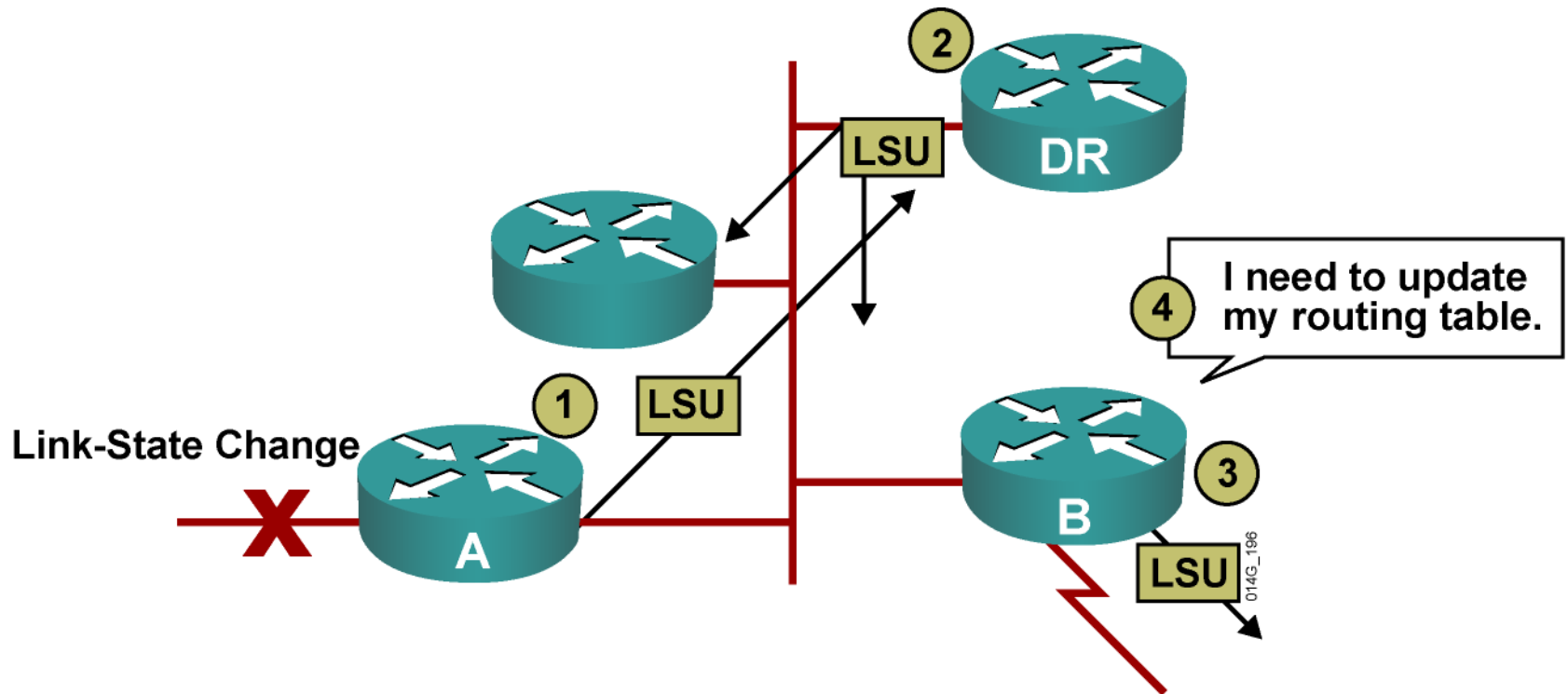
Discovering the Network Routes



Adding the Link-State Entries



Maintaining Routing Information



- Router A notifies all OSPF DRs on 224.0.0.6.
- DR notifies others on 224.0.0.5.

debug ip ospf packet

Debug of a single packet

```
R1#debug ip ospf packet
OSPF packet debugging is on
R1#
*Feb 16 11:03:51.206: OSPF: rcv. v:2 t:1 l:48 rid:10.0.0.12
      aid:0.0.0.1 chk:D882 aut:0 auk: from Serial0/0/0.2
```

- Shows fields in OSPF header



Configuring OSPF

OSPF Network Types

OSPF Network Types

The three types of networks defined by OSPF are:

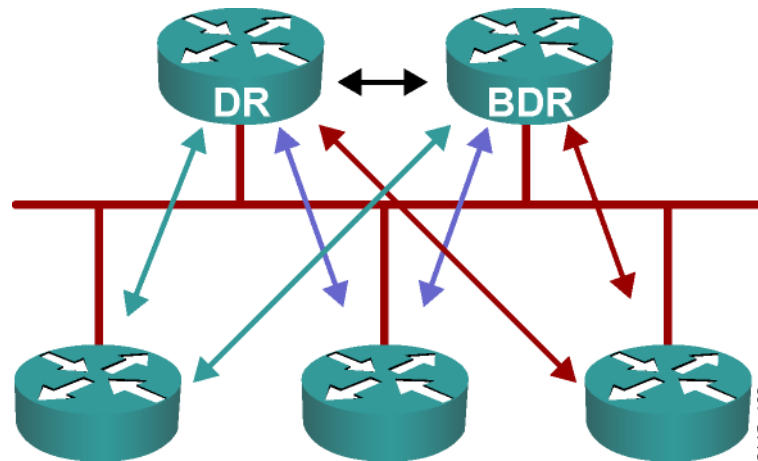
- **Point-to-point:** A network that joins a single pair of routers.
- **Broadcast:** A multiaccess broadcast network, such as Ethernet.
- **Nonbroadcast multiaccess (also called NBMA):** A network that interconnects more than two routers but that has no broadcast capability. Frame Relay, ATM, and X.25 are examples of NBMA networks.
 - **Five modes of OSPF operation are available for NBMA networks.**

Point-to-Point Links



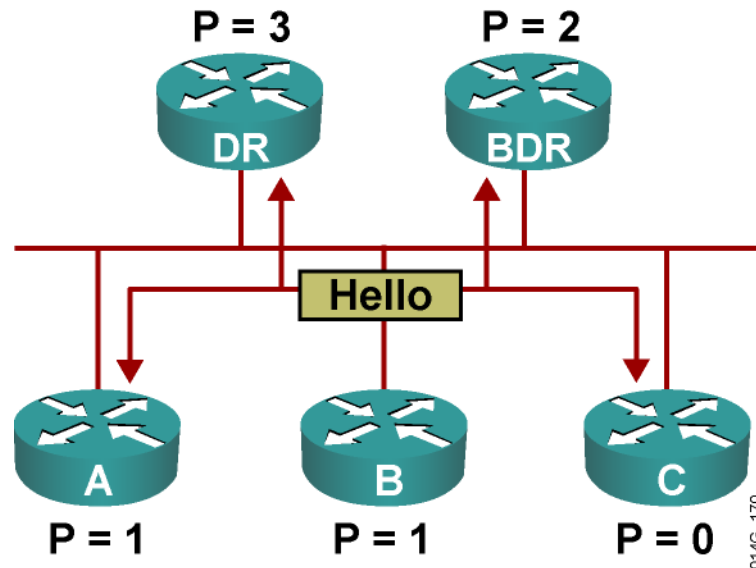
- Usually a serial interface running either PPP or HDLC.
- May also be a point-to-point subinterface running Frame Relay or ATM.
- No DR or BDR election required.
- OSPF autodetects this interface type.
- OSPF packets are sent using multicast 224.0.0.5.

Multiaccess Broadcast Network



- Generally these are, LAN technologies like Ethernet and Token Ring.
- DR and BDR selection are required.
- All neighbor routers form full adjacencies with the DR and BDR only.
- Packets to the DR and the BDR use 224.0.0.6.
- Packets from DR to all other routers use 224.0.0.5.

Electing the DR and BDR



- Hello packets are exchanged via IP multicast.
- The router with the highest OSPF priority is selected as the DR. The router with the second-highest priority value is the BDR.
- Use the OSPF router ID as the tiebreaker.
- The DR election is nonpreemptive.

Setting Priority for DR Election

```
Router(config-if)#ip ospf priority number
```

- This interface configuration command assigns the OSPF priority to an interface.
- Different interfaces on a router may be assigned different values.
- The default priority is 1. The range is from 0 to 255.
- 0 means the router cannot be the DR or BDR.
- A router that is not the DR or BDR is DROTHER.

Creation of Adjacencies for Point-to-Point Mode

```
RouterA# debug ip ospf adj
OSPF: Interface Serial0/0/0.1 going Up
OSPF: Build router LSA for area 0, router ID 192.168.1.1, seq 0x80000023
OSPF: Rcv DBD from 192.168.1.2 on Serial0/0/0.1 seq 0xCF0 opt 0x52 flag 0x7 len 32
mtu 1500 state INIT
OSPF: 2 Way Communication to 192.168.1.2 on Serial0/0/0.1, state 2WAY
OSPF: Send DBD to 192.168.1.2 on Serial0/0/0.1 seq 0xF4D opt 0x52 flag 0x7 len 32
OSPF: NBR Negotiation Done. We are the SLAVE
OSPF: Send DBD to 192.168.1.2 on Serial0/0/0.1 seq 0xCF0 opt 0x52 flag 0x2 len 132
OSPF: Rcv DBD from 192.168.1.2 on Serial0/0/0.1 seq 0xCF1 opt 0x52 flag 0x3 len 132
mtu 1500 state EXCHANGE
OSPF: Send DBD to 192.168.1.2 on Serial0/0/0.1 seq 0xCF1 opt 0x52 flag 0x0 len 32
OSPF: Database request to 192.168.1.2
OSPF: sent LS REQ packet to 192.168.1.2, length 12
OSPF: Rcv DBD from 192.168.1.2 on Serial0/0/0.1 seq 0xCF2 opt 0x52 flag 0x1 len 32
mtu 1500 state EXCHANGE
OSPF: Exchange Done with 192.168.1.2 on Serial0/0/0.1
OSPF: Send DBD to 192.168.1.2 on Serial0/0/0.1 seq 0xCF2 opt 0x52 flag 0x0 len 32
OSPF: Synchronized with 192.168.1.2 on Serial0/0/0.1, state FULL
%OSPF-5-ADJCHG: Process 100, Nbr 192.168.1.2 on Serial0/0/0.1 from LOADING to FULL,
Loading Done
OSPF: Build router LSA for area 0, router ID 192.168.1.1, seq 0x80000024
```

Creation of Adjacencies for Broadcast Mode

```
RouterA# debug ip ospf adj
```

```
OSPF: Interface FastEthernet0/0 going Up
```

```
OSPF: Build router LSA for area 0, router ID 192.168.1.1,seq 0x80000008
```

```
OSPF: 2 Way Communication to 172.16.1.1 on FastEthernet0/0, state 2WAY
```

```
OSPF: end of Wait on interface FastEthernet0/0
```

```
<output omitted>
```

```
OSPF: Neighbor change Event on interface FastEthernet0/0
```

```
OSPF: DR/BDR election on FastEthernet0/0
```

```
OSPF: Elect BDR 172.16.1.1
```

```
OSPF: Elect DR 192.168.1.1
```

```
DR: 192.168.1.1 (Id)    BDR: 172.16.1.1 (Id)
```

```
OSPF: Rcv DBD from 172.16.1.1 on FastEthernet0/0 seq 0x14B 7 opt 0x52 flag 0x7  
len 32  mtu 1500 state EXSTART
```

```
OSPF: First DBD and we are not SLAVE-if)#
```

```
OSPF: Send DBD to 172.16.1.1 on FastEthernet0/0 seq 0xDCE opt 0x52 flag 0x7  
len 32
```

```
OSPF: Retransmitting DBD to 172.16.1.1 on FastEthernet0/0[1]
```

```
OSPF: Rcv DBD from 172.16.1.1 on FastEthernet0/0 seq 0xDCE  
opt 0x52 flag 0x2 len 152  mtu 1500 state EXSTART
```

```
<output omitted>
```

