NANYANG POLYTECHNIC

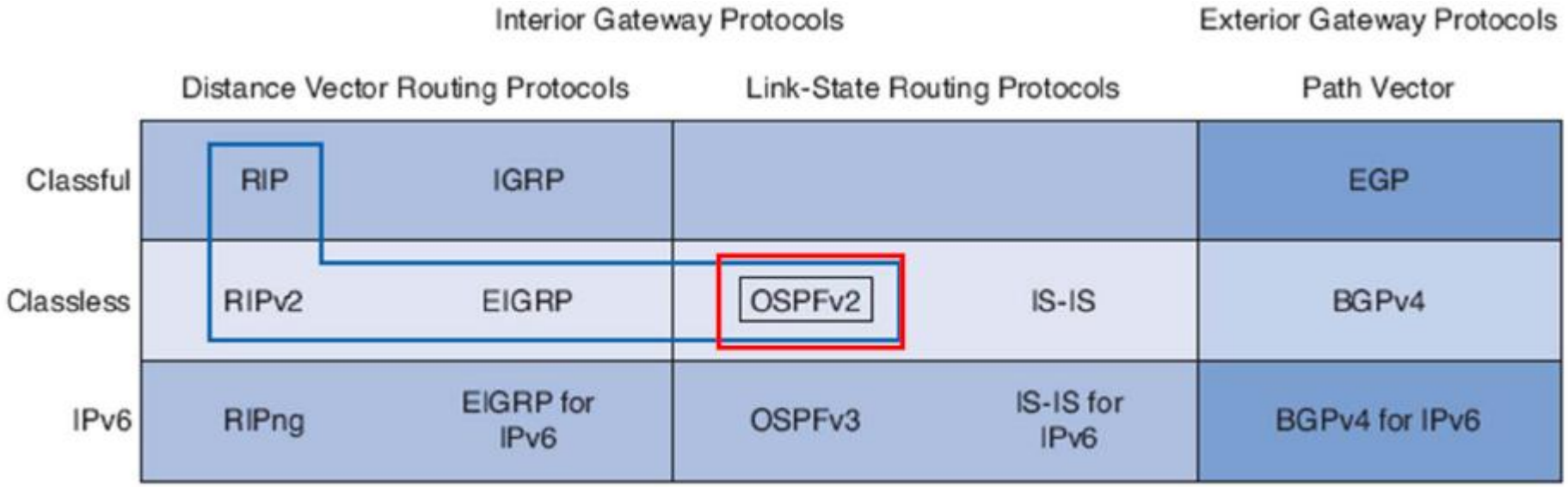
# OSPF Routing

Chapter 4

# Learning Outcomes

- Explain the function of OSPFv2 and OSPFv3 Routing
- Implement a network with OSPF routing

# Introduction to OSPF

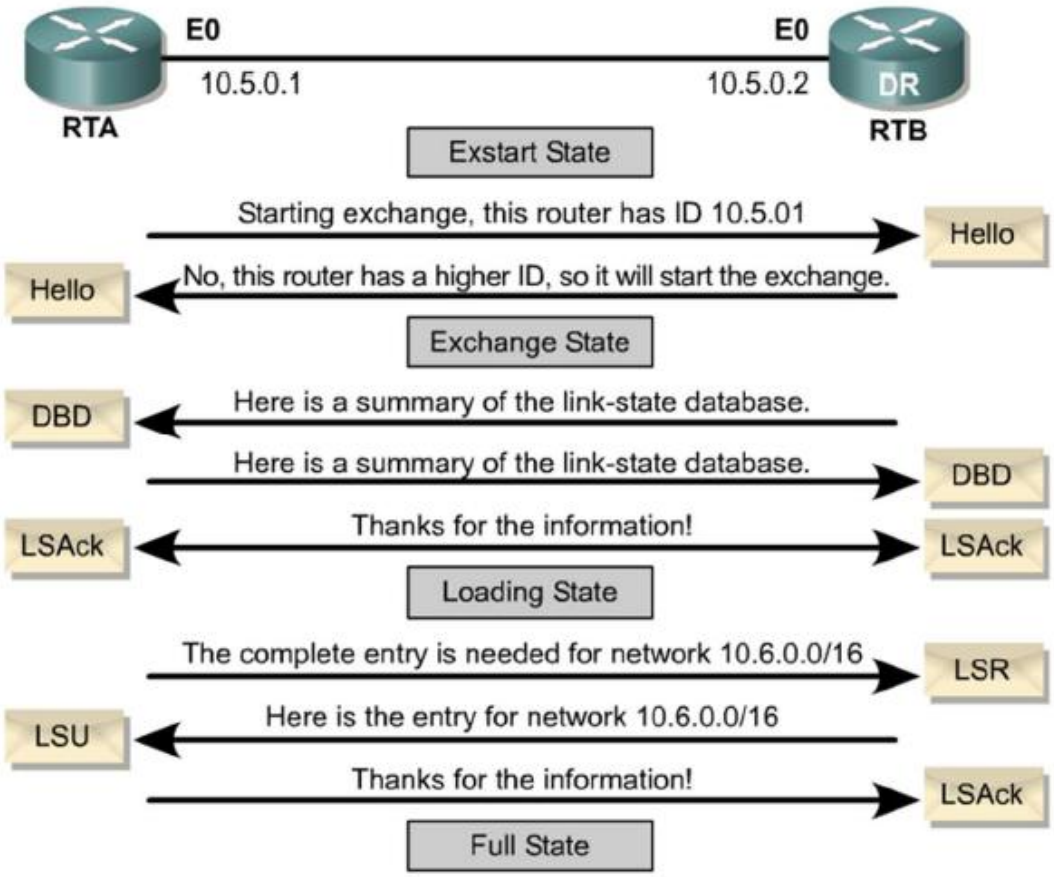



- OSPF is a classless, link-state routing protocol
  - Classless routing causes a router to use its default routes for any packet that does not match some other route
  - Link-State - each node independently calculates the next best logical path
- It is an open standard and inter-operate across multi vendor environments
- It is known for it's scalability.

# OSPF Packet Types

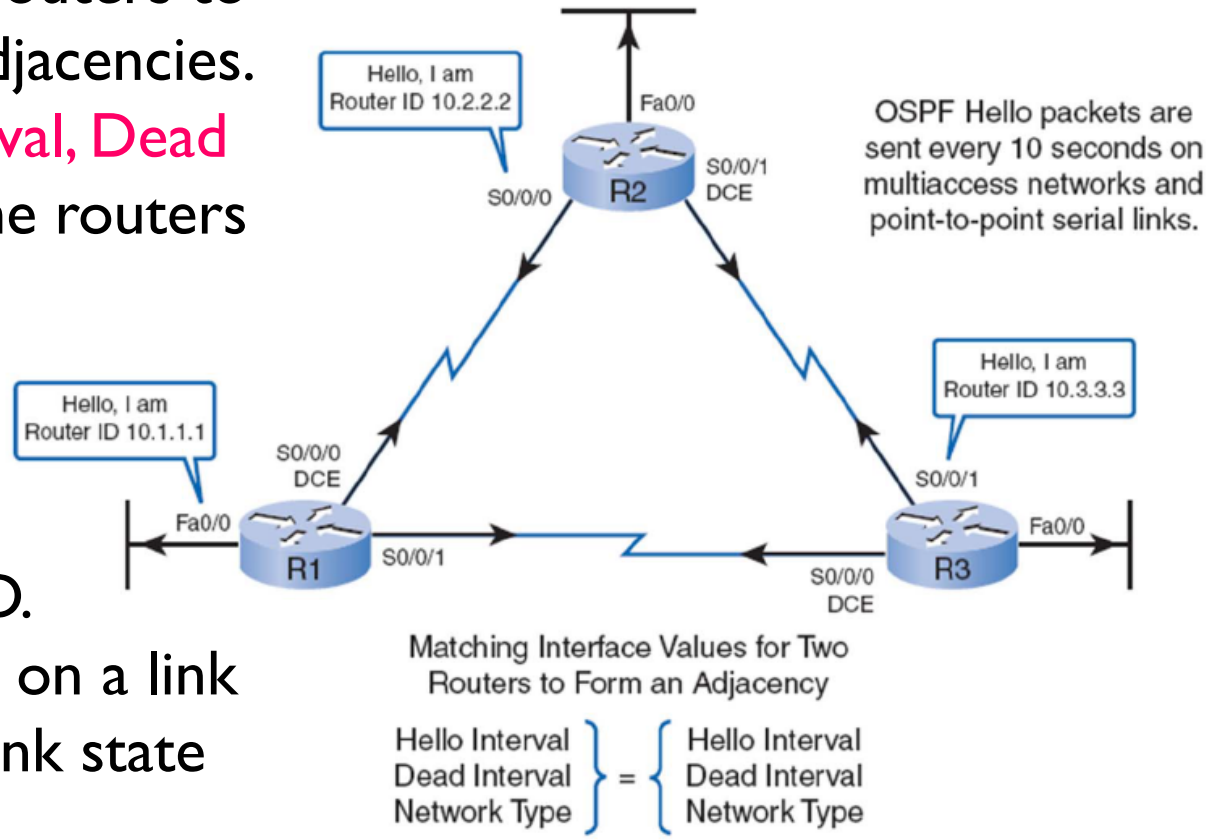
Five types of OSPF LSPs (link-state packets).

- Hello: Used to establish and maintain adjacency.
- DBD (Database Description): Abbreviated list of the sending router's linkstate database.
- LSR (Link-State Request) : Used by routers to request more information about any entry in the DBD.
- LSU (Link-State Update): Link-state information.
- LSAck (LSA Acknowledgment): Router sends a link-state (LSAck) to confirm receipt of the LSU.



# Hello Packet and Neighbour Establishment

- Hello Packets are sent by OSPF enabled routers to discover their neighbours and establish adjacencies.
- Only when the 3 parameters (Hello interval, Dead interval and Network Type) are agreed, the routers can become neighbours




- Now the routers can exchange their DBD.
- Full adjacency happens after both routers on a link have exchanged LSUs and have identical link state databases.

# Hello Packet and Neighbour Establishment

- Hello interval: this defines how often we send the hello packet.

- Dead interval:  this defines how long we should wait for hello packets before we declare the neighbor dead.

The hello and dead interval values can be different depending on the OSPF network type.

On Ethernet interfaces you will see a 10 second hello interval and a 40 second dead interval.

# Administrative Distance

- Administrative distance (AD) is the trustworthiness (or preference) of the route source.
- OSPF has a default AD of 110.

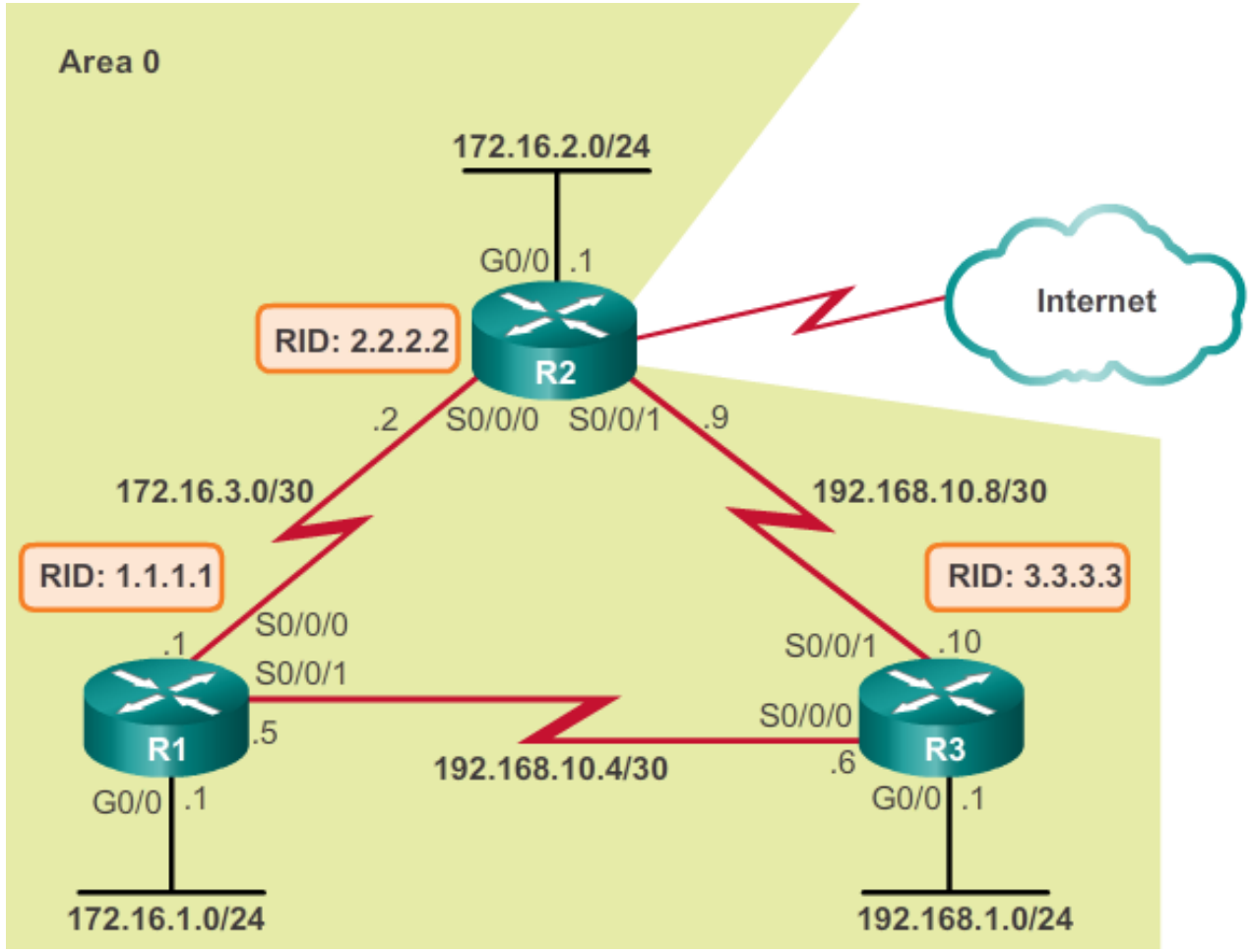
- So let's say I want to reach destination 10.1.1.1

Both OSPF and Static routes on the router can technically get me there. But which one will the router choose?

| Route Source | AD |
|---|---|
| Connected | 0 |
| Static | 1 |
| EIGRP summary route | 5 |
| External BGP | 20 |
| Internal EIGRP | 90 |
| IGRP | 100 |
| OSPF | 110 |
| IS-IS | 115 |
| RIP | 120 |
| External EIGRP | 170 |
| Internal BGP | 200 |

# OSPFv2 Configuration

- Let's use this sample configuration
- Every router has a Router ID
- Every link has 2 IP Addresses
- Every Router has 3 connected ports



# Enabling OSPFv2 Routing

R1(config)# router ospf [ process-id ]

- This command enables OSPF on the router using process-id of 10 in this example
- Note that process-id is of local significance only. It doesn't have to be the same across all routers.

```
R1(config)# router ospf 10
R1(config-router)# ?
Router configuration commands:
  auto-cost               Calculate OSPF interface cost
                          according to bandwidth
  network                 Enable routing on an IP network
  no                      Negate a command or set its defaults
  passive-interface       Suppress routing updates on an
                          interface
  priority                OSPF topology priority
  router-id               router-id for this OSPF process
```

**Note:** Output has been altered to display only the commands that will be used in this chapter.

# Router ID and Network statement

R1(config)#router ospf 10

R1(config-router)#router-id 1.1.1.1

- A Router ID uniquely identifies a router.

R1(config-router)#network 172.16.3.0 255.255.255.252 area 0

- Identify all the router's connected networks (you can do this by issuing a "show ip route")
- Then use the network statement to advertise to other routers what R1 is connected to.
- If you do not advertise a route using the network statement, the other routers will not know that R1 has that connection to the network.
- Area 0 is the backbone area

# OSPF Passive Interface

- This is a kind of interface on which OSPF LSAs(Link State Advertisements) will not be sent out. LSAs are only useful to other OSPF Enabled routers, so why waste bandwidth by sending them on link which connect switches and PCs?

R1(config-router)# passive-interface g0/0

Inside the routing configuration, you can define any interface to be a passive interface. This interface will then not receive any LSAs.

# Verifying OSPFv2 operation

## #show ip ospf neighbors

- Verify that the router has formed an adjacency with its neighbouring routers.

```
R1# show ip ospf neighbor

Neighbor ID  Pri  State   Dead Time Address        Interface
3.3.3.3      0    FULL/-  00:00:37  192.168.10.6   Serial0/0/1
2.2.2.2      0    FULL/-  00:00:30  172.16.3.2     Serial0/0/0
R1#
```

## #show ip route

- Verify if the router is learning remote routes

```
R1#
R1#show ip route ospf
     172.16.0.0/16 is variably subnetted, 5 subnets, 3 masks
O       172.16.2.0/24 [110/65] via 172.16.3.2, 00:06:22, Serial0/0/0
O    192.168.1.0/24 [110/65] via 192.168.10.6, 00:03:08, Serial0/0/1
     192.168.10.0/24 is variably subnetted, 3 subnets, 2 masks
O       192.168.10.8/30 [110/128] via 172.16.3.2, 00:03:08, Serial0/0/0
                        [110/128] via 192.168.10.6, 00:03:08, Serial0/0/1
R1#
```

# Verify OSPFv2 Operation

#show ip protocols

Process ID

Router ID

Networks advertised

Neighbour routers

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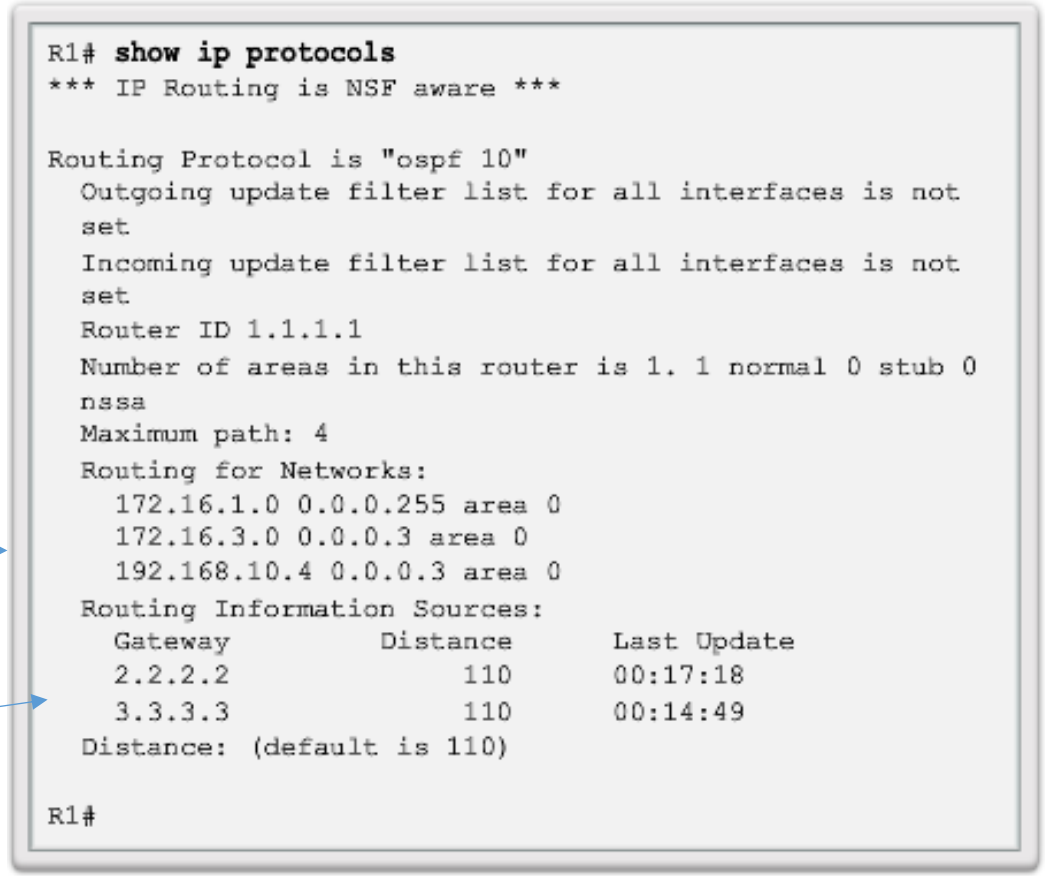

# Similarities between OSPFv3 and OSPFv2

| OSPFv2 and OSPFv3 | |
|---|---|
| Link-State | Yes |
| Routing Algorithm | SPF |
| Metric | Cost |
| Areas | Supports the same two-level hierarchy |
| Packet Types | Same Hello, DBD, LSR, LSU and LSAck packets |
| Neighbor Discovery | Transitions through the same states using Hello packets |
| DR and BDR | Function and election process is the same |
| Router ID | 32-bit router ID: determined by the same process in both protocols |

# Differences between OSPFv2 and OSPFv3

| | OSPFv2 | OSPFv3 |
|---|---|---|
| Advertises | IPv4 networks | IPv6 prefixes |
| Source Address | IPv4 source address | IPv6 link-local address |
| Destination Address | Choice of:<br>• Neighbor IPv4 unicast address<br>• 224.0.0.5 all-OSPF-routers multicast address<br>• 224.0.0.6 DR/BDR multicast address | Choice of:<br>• Neighbor IPv6 link-local address<br>• FF02::5 all-OSPFv3-routers multicast address<br>• FF02::6 DR/BDR multicast address |
| Advertise Networks | Configured using the **network** router configuration command | Configured using the **ipv6 ospf** *process-id* **area** *area-id* interface configuration command |
| IP Unicast Routing | IPv4 unicast routing is enabled by default. | IPv6 unicast forwarding is not enabled by default. The **ipv6 unicast-routing** global configuration command must be configured. |
| Authentication | Plain text and MD5 | IPv6 authentication |

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# THE END