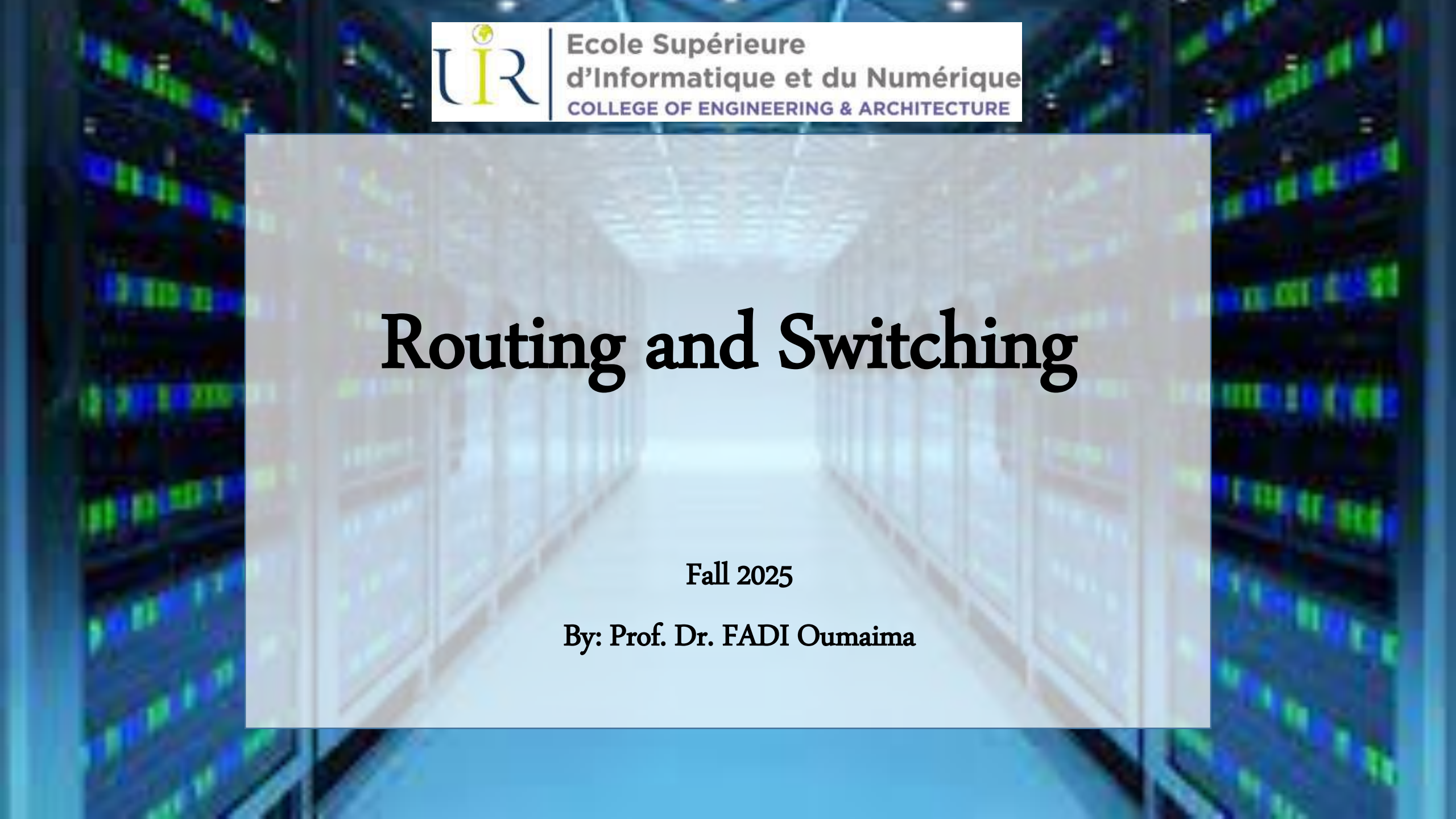

Routing and Switching

Fall 2025

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Evaluation

Lab Report+ Quiz:**10%**

CC: **20%**

CF: **50%**

HCIA-certification: **20%**

Chapter 6 : Static Routing

Goals:

- ✓ **Explain the advantages and disadvantages of static routing.**
- ✓ **Explain the purpose of different types of static routes.**
- ✓ **Configure IPv4 and IPv6 static routes by specifying a next-hop address.**
- ✓ **Configure an IPv4 and IPv6 default routes.**

Static Routing

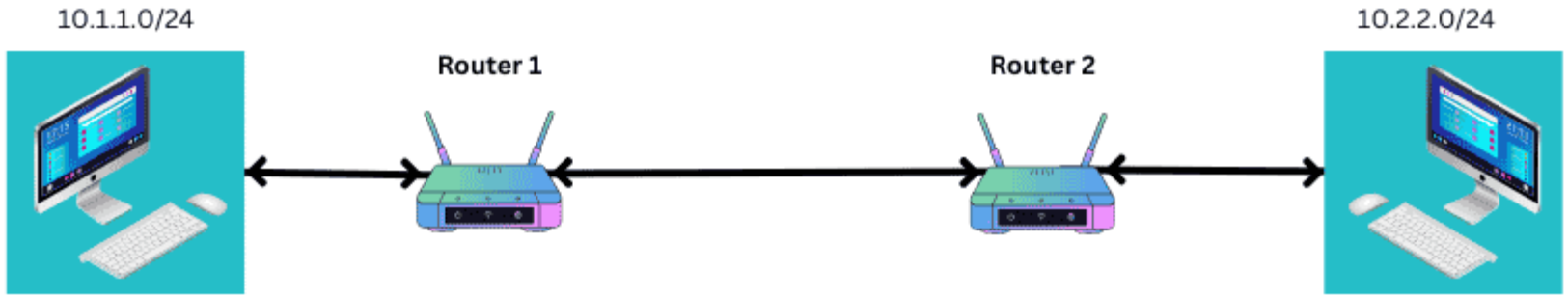
A router can learn about remote networks in one of two ways:

- Manually - Remote networks are manually entered into the route table using static routes.
- Dynamically - Remote routes are automatically learned using a dynamic routing protocol.

Why Use Static Routing?

Static routing provides some advantages over dynamic routing, including:

- ✓ Static routes are not advertised over the network, resulting in better security.
- ✓ Static routes use less bandwidth than dynamic routing protocols, no CPU cycles are used to calculate and communicate routes.
- ✓ The path a static route uses to send data is known.



Static Routing disadvantages

- Initial configuration and maintenance is time consuming.
- Configuration is error-prone, especially in large networks.
- Administrator intervention is required to maintain changing route information
- Does not scale well with growing networks; maintenance becomes cumbersome.
- Requires complete knowledge of the whole network for proper implementation.

When to use static routes?

Static routing has multiple primary uses:

- Providing ease of routing table maintenance in smaller networks that are not expected to grow significantly.
- Routing to and from stub networks. A stub network is a network accessed by a single route, and the router has no other neighbors.
- Using a single default route to represent a path to any network that does not have a more specific match with another route in the routing table.
- Default routes are used to send traffic to any destination beyond the next upstream router.

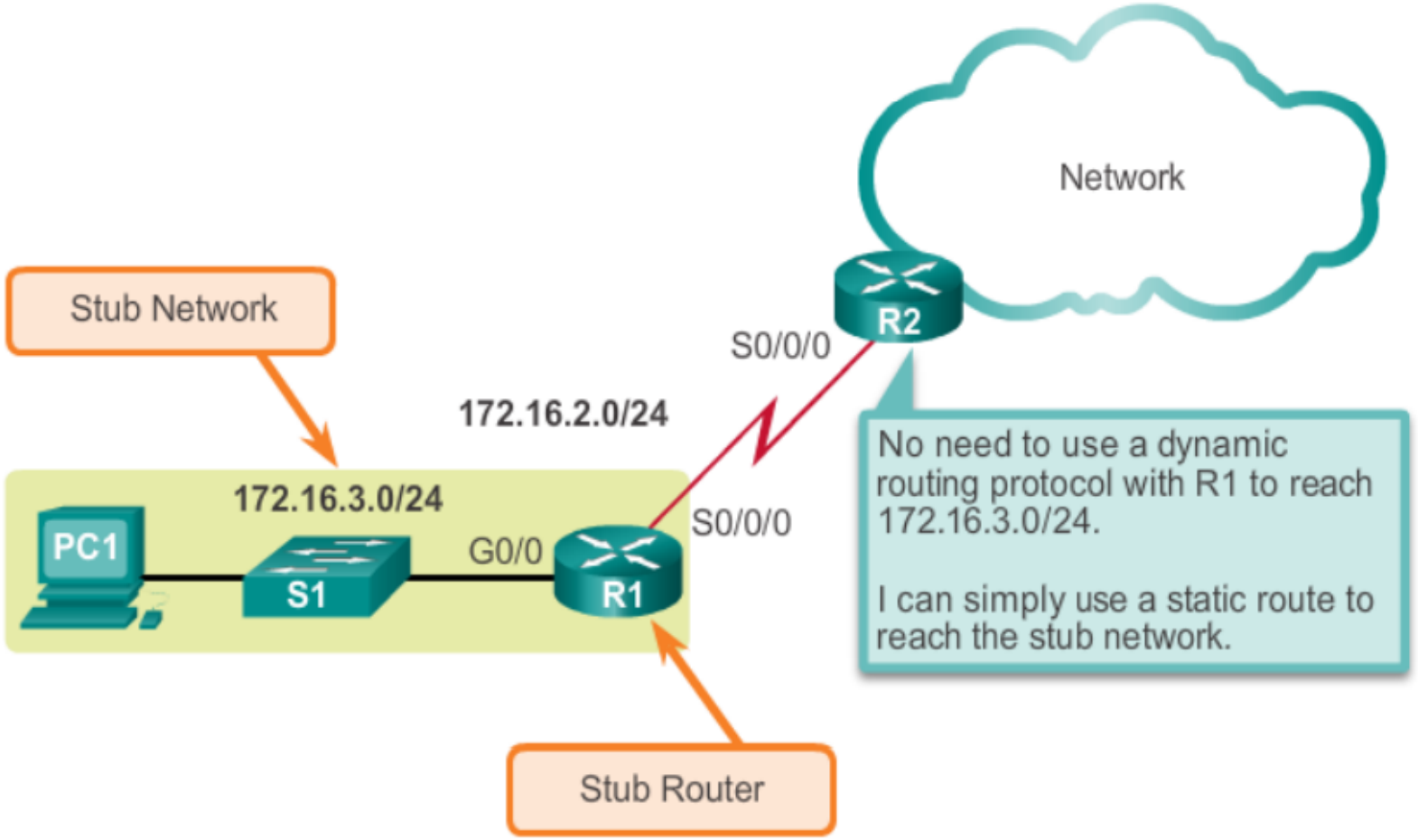
Static route Applications

Static Routes are often used to:

- ✓ Connect to a specific network.
- ✓ Provide a Gateway of Last Resort for a stub network.
- ✓ Reduce the number of routes advertised by summarizing several contiguous networks as one static route.
- ✓ Create a backup route in case a primary route link fails.

Standard Static Route

Connecting to a Stub network

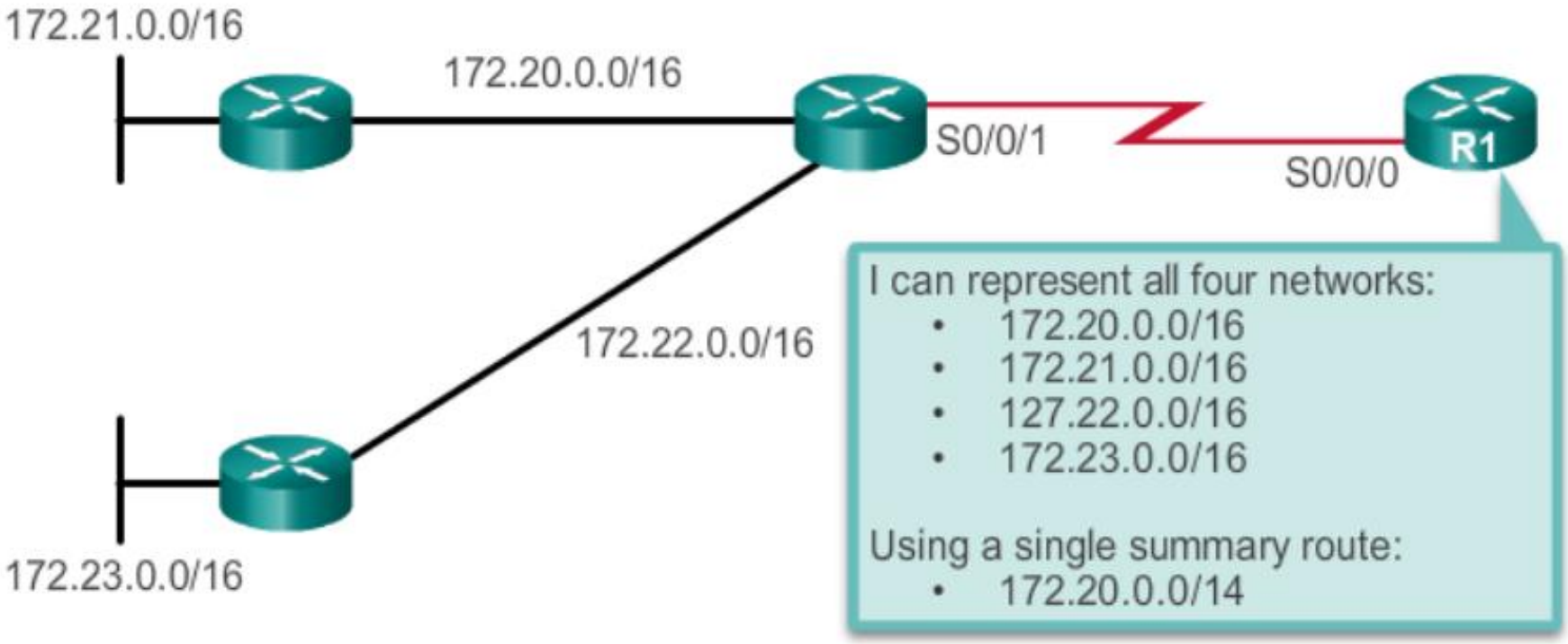


Default Static Route

- ✓ A default static route is a route that matches all packets.
- ✓ A default route identifies the gateway IP address to which the router sends all IP packets that it does not have a learned or static route.
- ✓ A default static route is simply a static route with 0.0.0.0/0 as the destination IPv4 address.

Summary Static Route

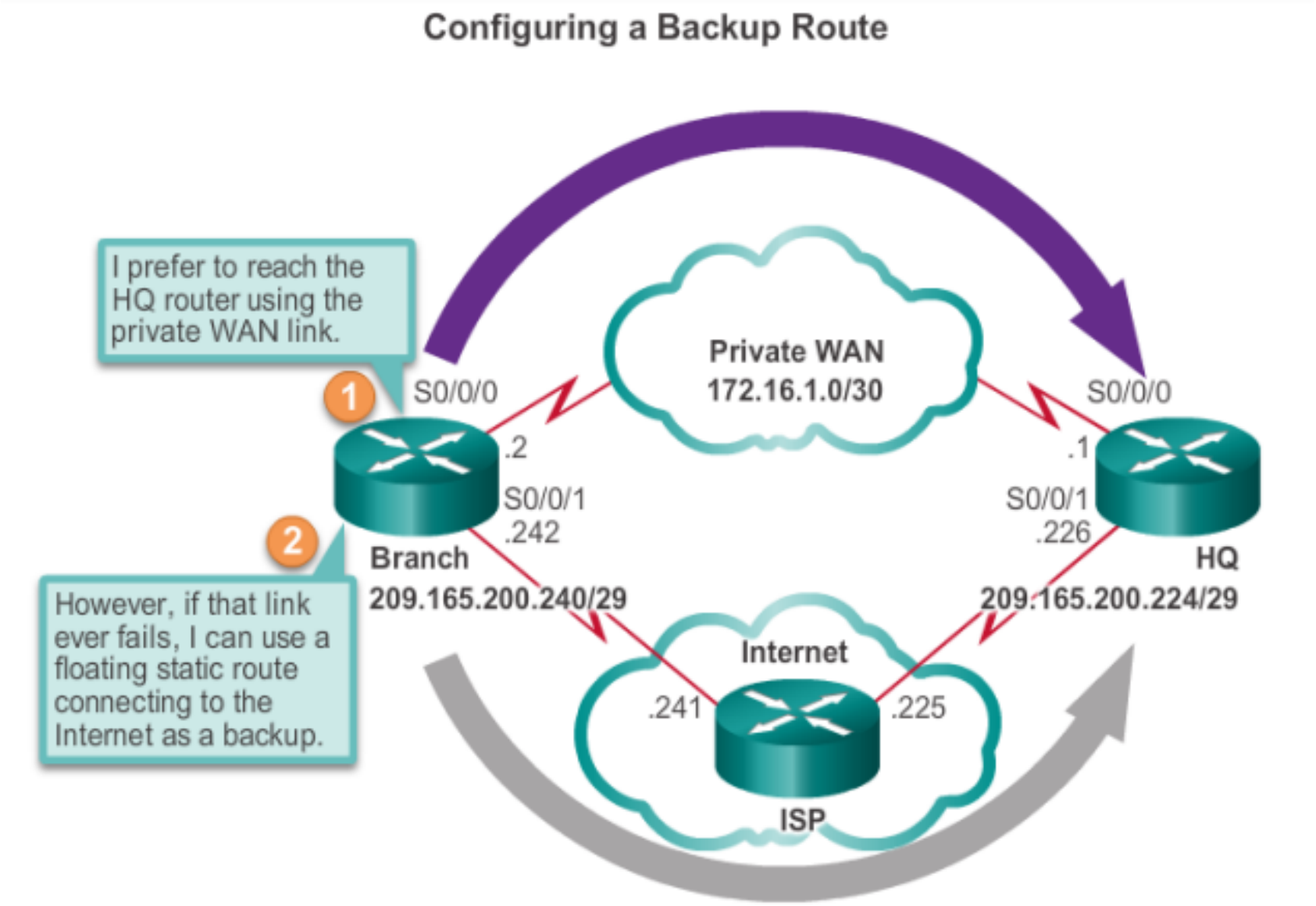
Using one summary Static Route



Floating Static Route

- ✓ Floating static routes are static routes that are used to provide a backup path to a primary static or dynamic route, in the event of a link failure.
- ✓ The floating static route is only used when the primary route is not available.
- ✓ To accomplish this, the floating static route is configured with a higher administrative distance than the primary route.

Floating Static Route



Configure IPv4 Static Routes

ip route command

```
Router(config)#ip route network-address subnet-mask
{ip-address | exit-intf}
```

Parameter	Description
network-address	Destination network address of the remote network to be added to the routing table.
subnet-mask	• Subnet mask of the remote network to be added to the routing table. • The subnet mask can be modified to summarize a group of networks.
ip-address	• Commonly referred to as the next-hop router's IP address. • Typically used when connecting to a broadcast media (i.e., Ethernet). • Commonly creates a recursive lookup.
exit-intf	• Use the outgoing interface to forward packets to the destination network. • Also referred to as a directly attached static route. • Typically used when connecting in a point-to-point configuration.

Configure IPv4 Static Routes

Next Hop options

The next hop can be identified by an IP address, exit interface, or both. How the destination is specified creates one of the three following route types:

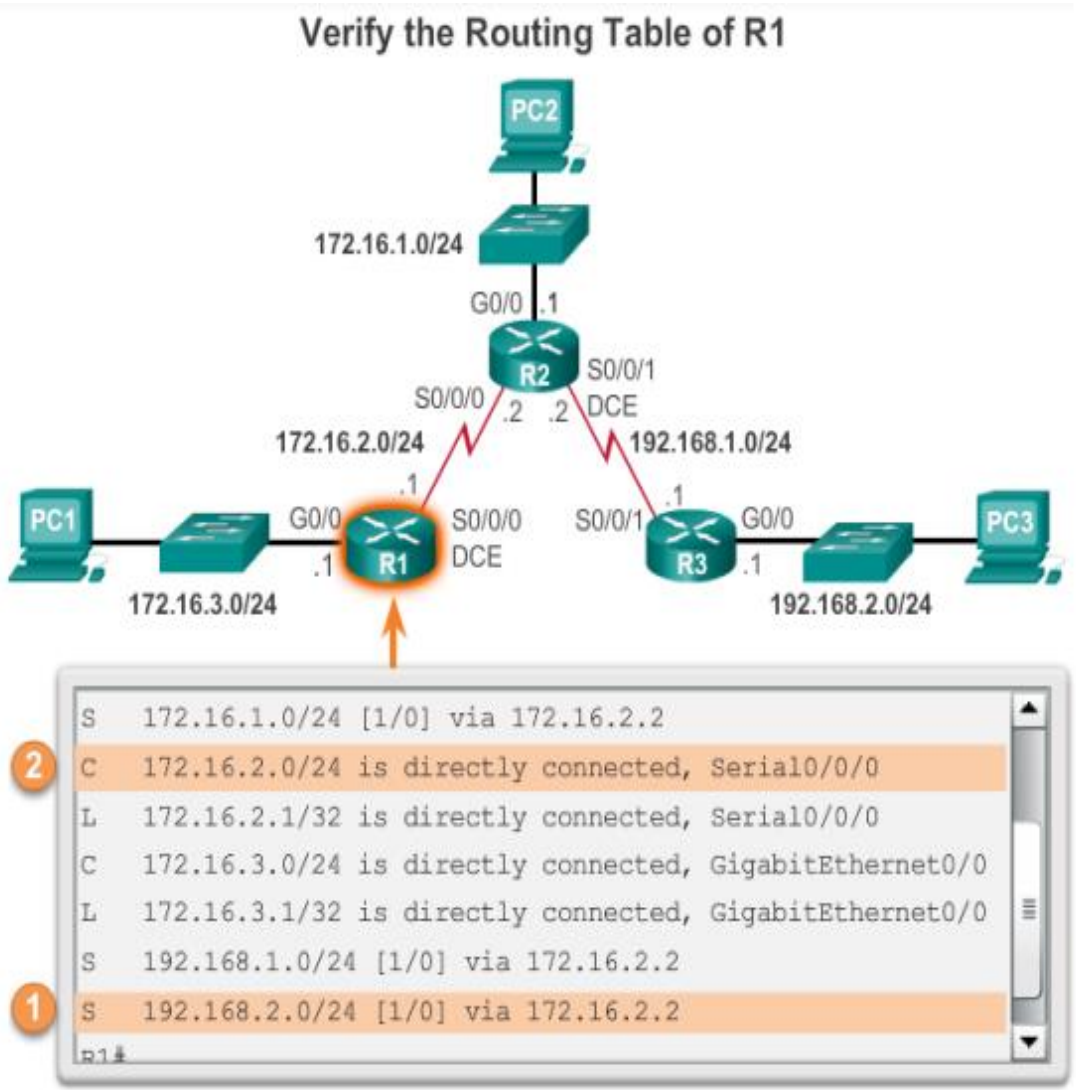
- ✓ Next-hop route - Only the next-hop IP address is specified.
- ✓ Directly connected static route - Only the router exit interface is specified.
- ✓ Fully specified static route - The next-hop IP address and exit interface are specified.

Configure IPv4 Static Routes

Configure a Next-Hop Static Route

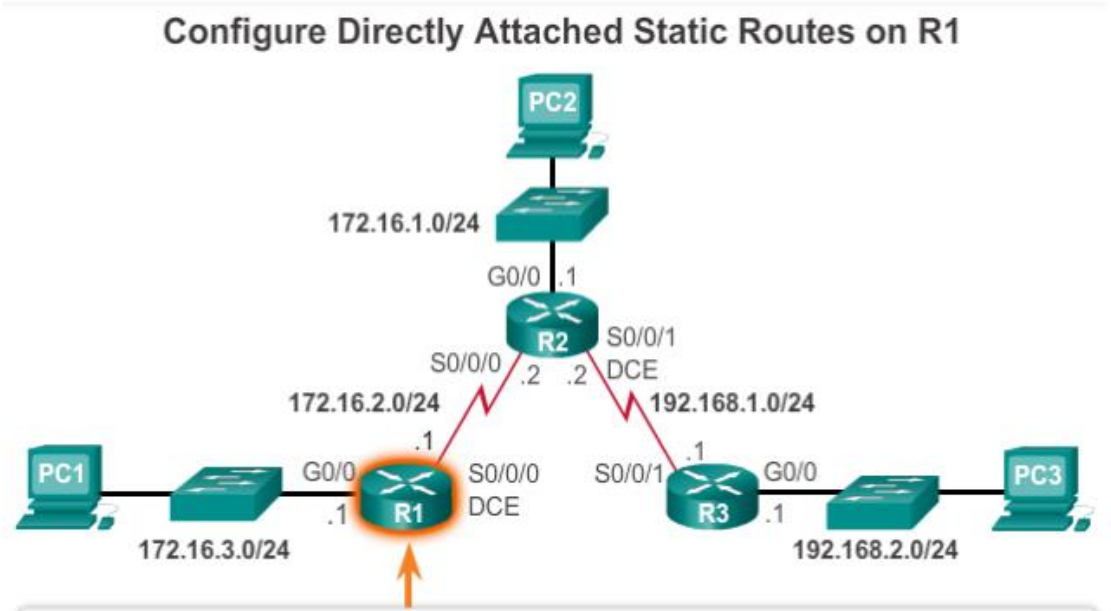
When a packet is destined for the 192.168.2.0/24 network, R1:

1. Looks for a match in the routing table and finds that it has to forward the packets to the next-hop IPv4 address 172.16.2.2.
2. R1 must now determine how to reach 172.16.2.2; therefore, it searches a second time for a 172.16.2.2 match.



Configure IPv4 Static Routes

Configure Directly Connected Static Route




```
R1(config)#ip route 172.16.1.0 255.255.255.0 s0/0/0
R1(config)#ip route 192.168.1.0 255.255.255.0 s0/0/0
R1(config)#ip route 192.168.2.0 255.255.255.0 s0/0/0
R1(config)#
```

```
S       172.16.1.0/24 is directly connected, Serial0/0/0
C       172.16.2.0/24 is directly connected, Serial0/0/0
L       172.16.2.1/32 is directly connected, Serial0/0/0
C       172.16.3.0/24 is directly connected, GigabitEthernet0/0
L       172.16.3.1/32 is directly connected, GigabitEthernet0/0
S    192.168.1.0/24 is directly connected, Serial0/0/0
S    192.168.2.0/24 is directly connected, Serial0/0/0
R1#
```

Configure IPv4 Static Routes

Configure a Fully Specified Static Route

In a fully specified static route:

- ✓ Both the output interface and the next-hop IP address are specified.
- ✓ This form of static route is used when the output interface is a multi-access interface and it is necessary to explicitly identify the next hop.
- ✓ The next hop must be directly connected to the specified exit interface.

Configure IPv4 Static Routes

Verify a static route

Along with ping and traceroute, useful commands to verify static routes include:

- **`show ip route`**
- **`show ip route static`**
- **`show ip route network`**

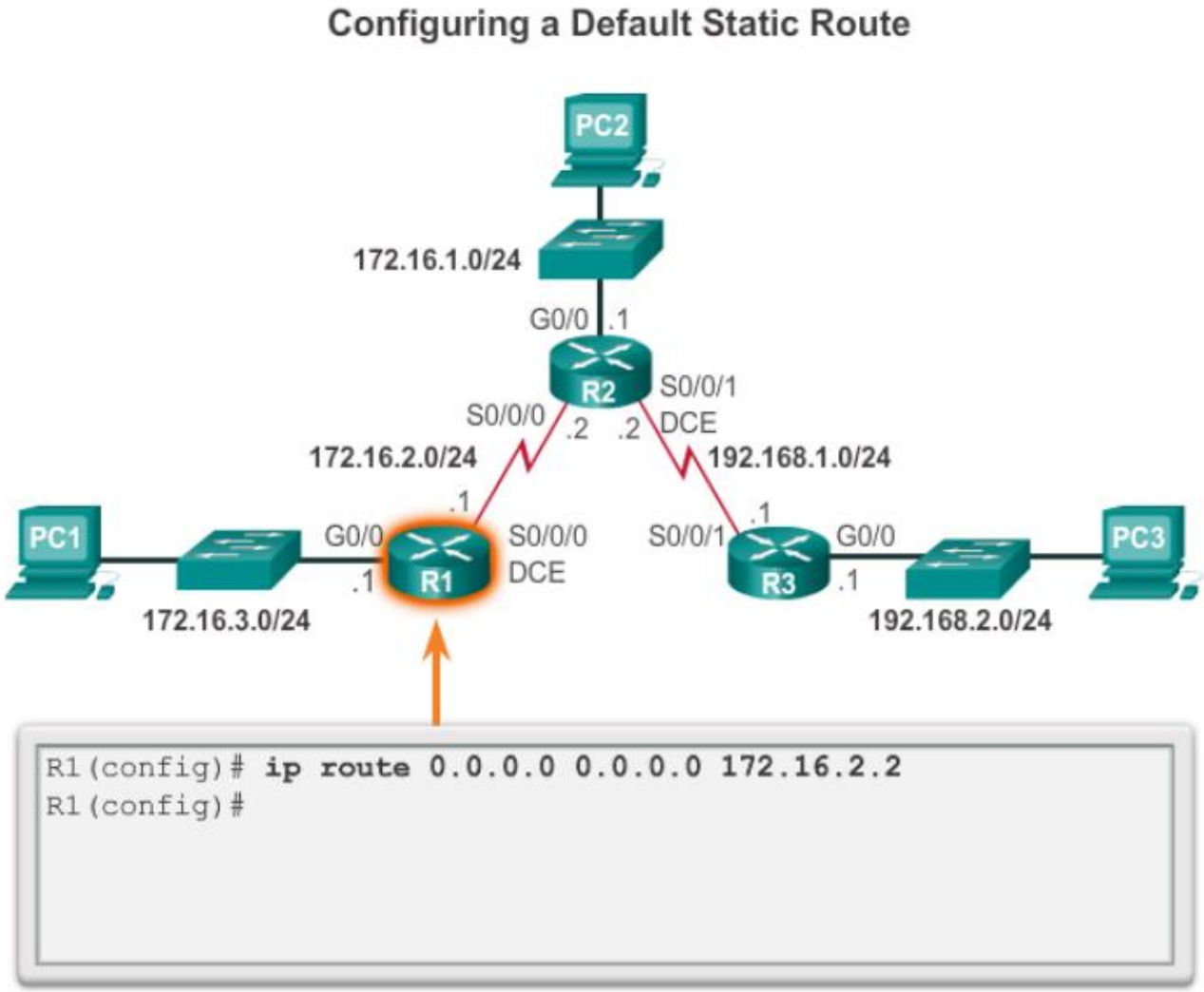
Default Static Route

Default static route syntax

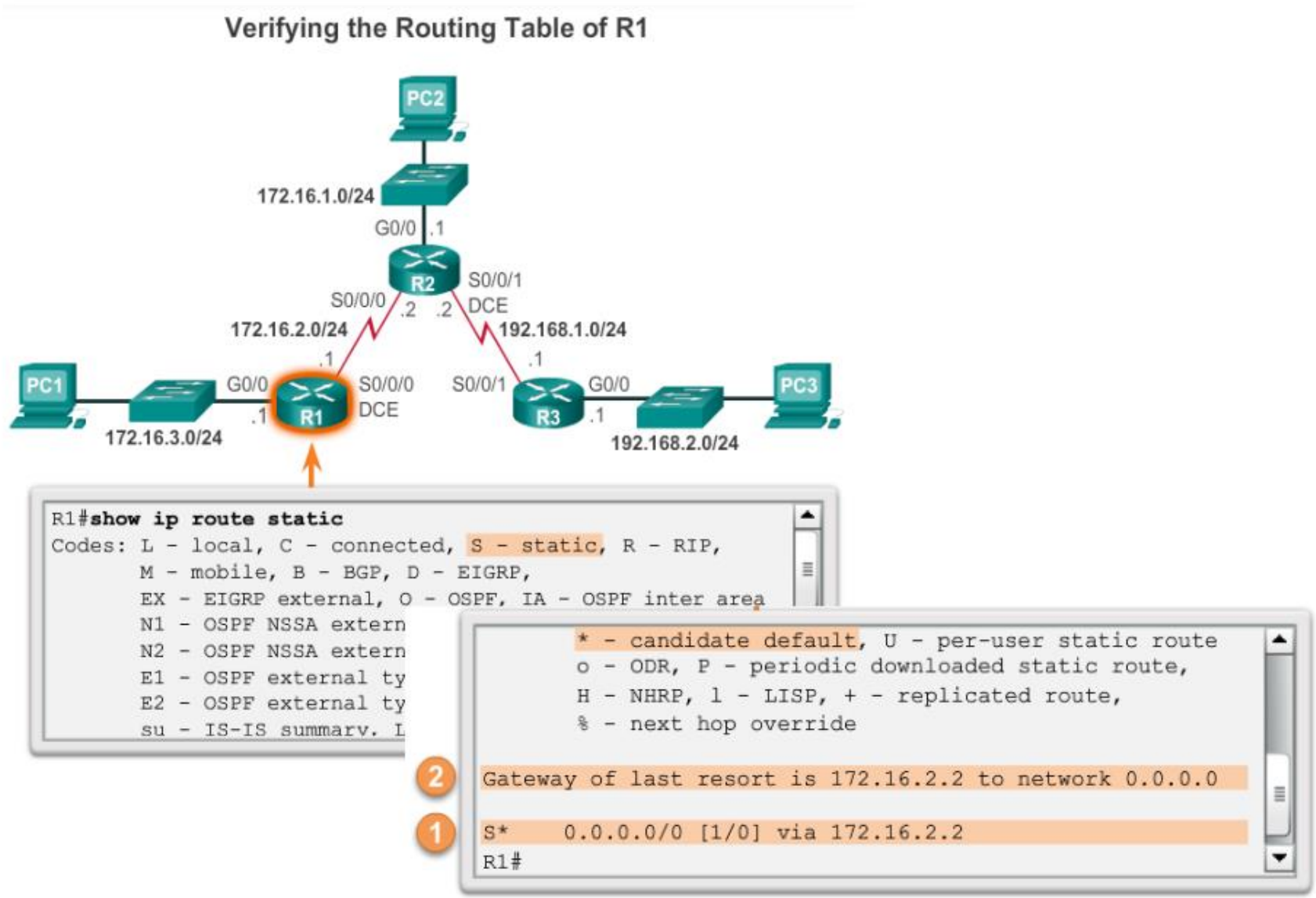
```
Router(config)#ip route 0.0.0.0 0.0.0.0 {ip-address | exit-intf}
```

Parameter	Description
0.0.0.0	Matches any network address.
0.0.0.0	Matches any subnet mask.
ip-address	• Commonly referred to as the next-hop router's IP address. • Typically used when connecting to a broadcast media (i.e., Ethernet). • Commonly creates a recursive lookup.
exit-intf	• Use the outgoing interface to forward packets to the destination network. • Also referred to as a directly attached static route. • Typically used when connecting in a point-to-point configuration.

Configure a default static route



Verify a default route



The ipv6 route Command

Most of parameters are identical to the IPv4 version of the command. IPv6 static routes can also be implemented as:

- Standard IPv6 static route
- Default IPv6 static route
- Summary IPv6 static route
- Floating IPv6 static route

```
Router(config)#ipv6 route ipv6-prefix/ipv6-mask
{ipv6-address | exit-intf}
```

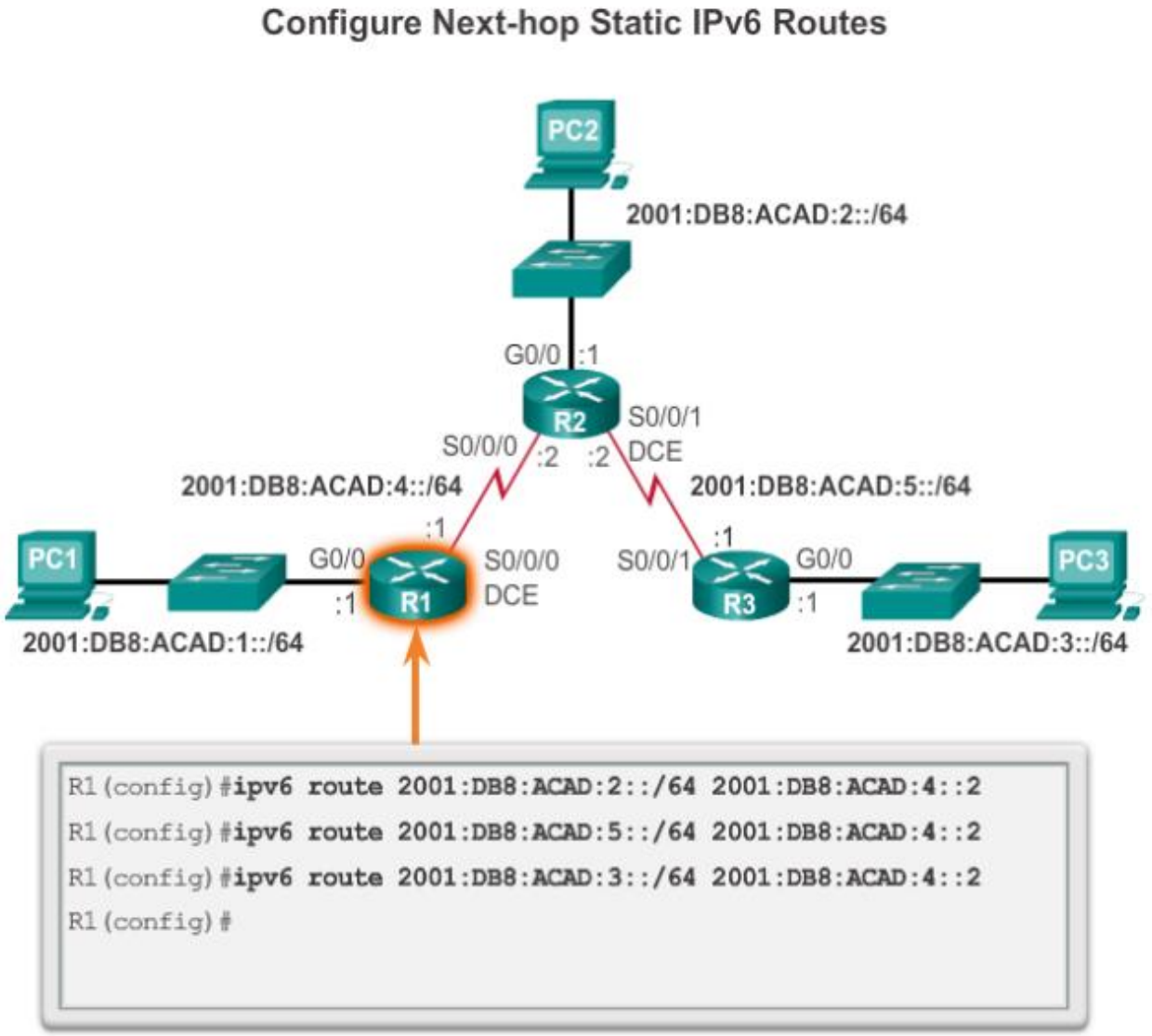
The ipv6 route Command

Next Hop options

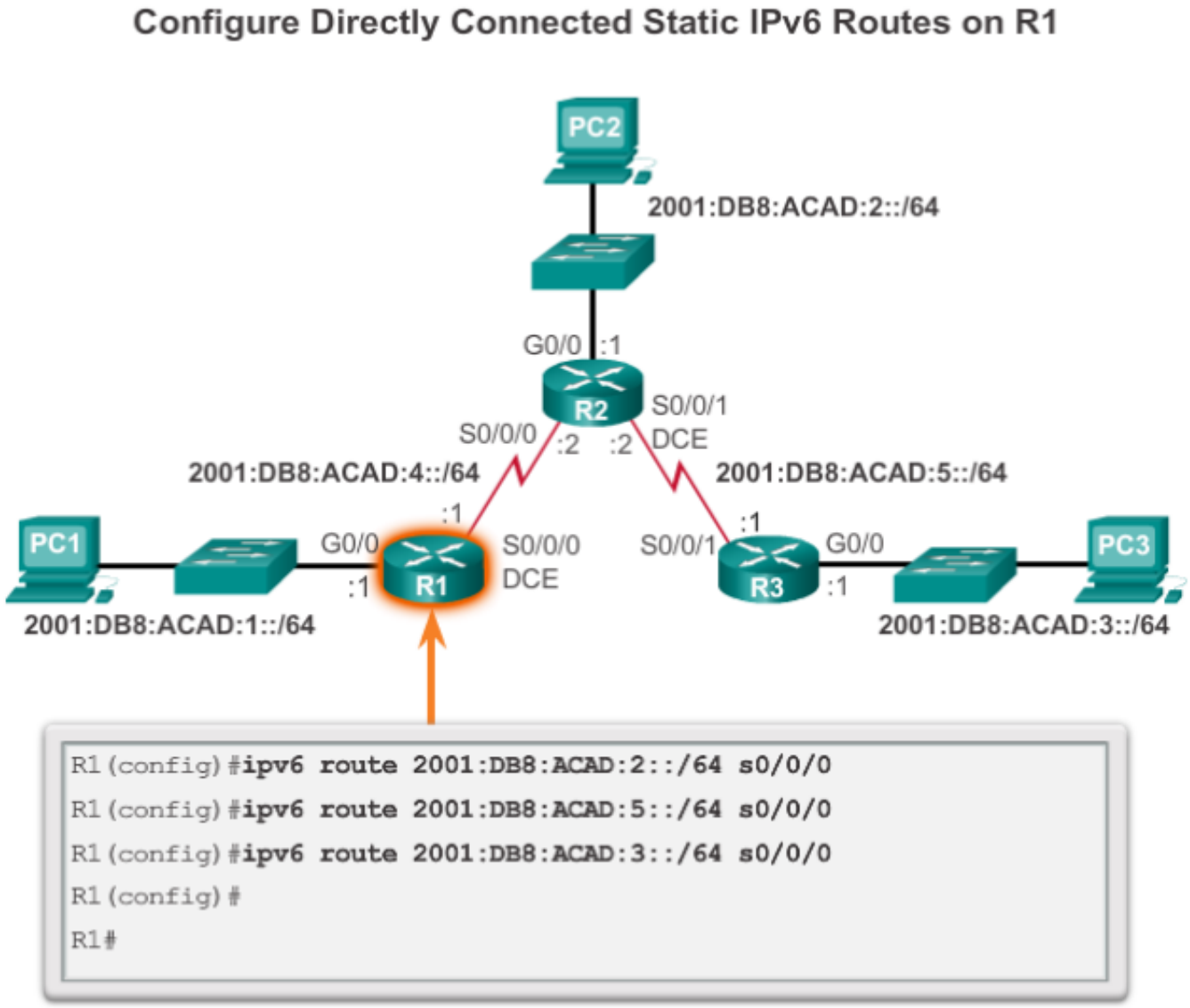
The next hop can be identified by an IPv6 address, exit interface, or both. How the destination is specified creates one of three route types:

- Next-hop IPv6 route - Only the next-hop IPv6 address is specified.
- Directly connected static IPv6 route - Only the router exit interface is specified.
- Fully specified static IPv6 route - The next-hop IPv6 address and exit interface are specified.

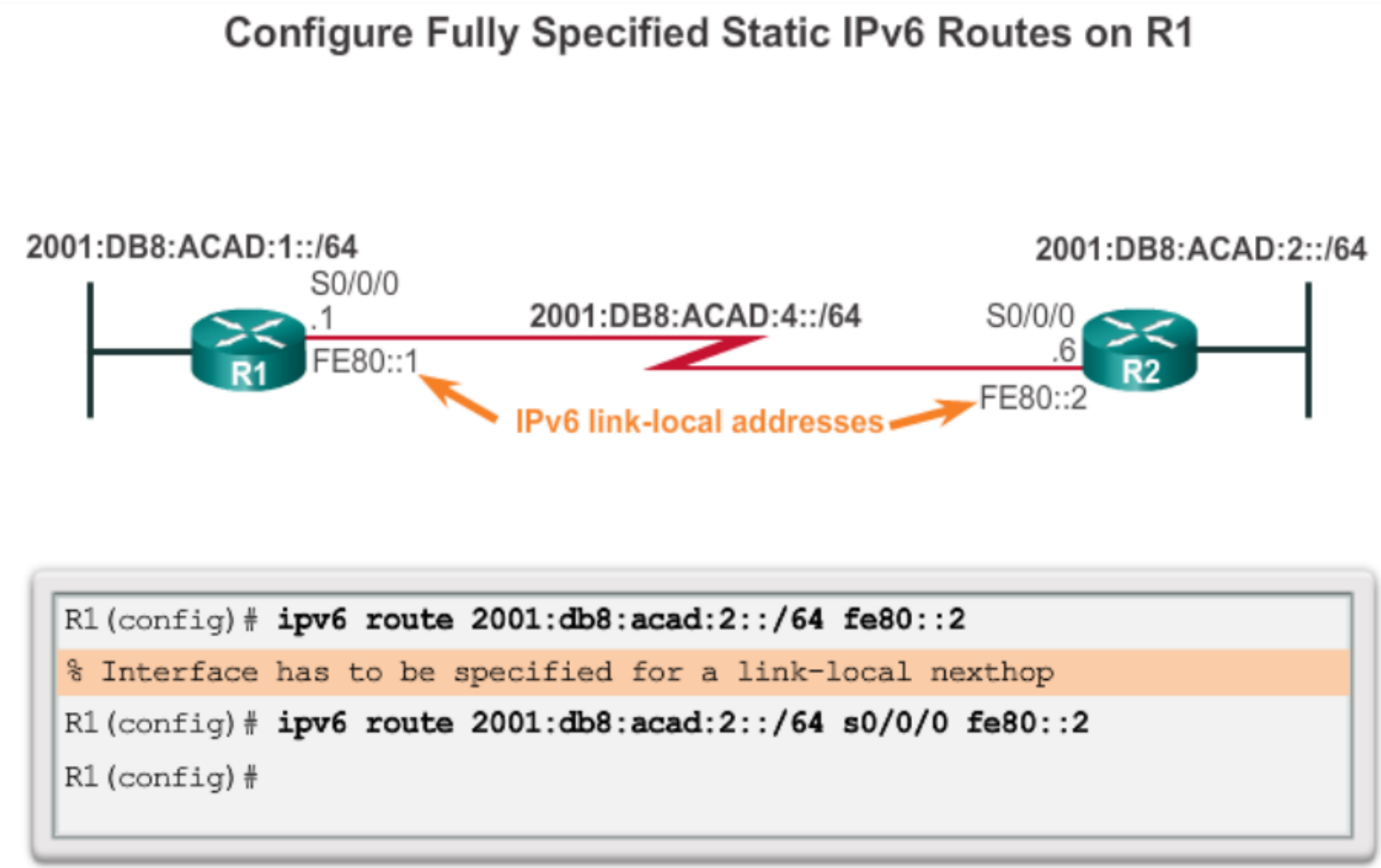
Configure a Next-Hop Static IPv6 Route



Configure Directly Connected Static IPv6 Route



Configure Fully Specified Static IPv6 Route




```
R1(config)# ipv6 route 2001:db8:acad:2::/64 fe80::2
% Interface has to be specified for a link-local nexthop
R1(config)# ipv6 route 2001:db8:acad:2::/64 s0/0/0 fe80::2
R1(config)#
```

Verify IPv6 Static Routes

Along with ping and traceroute, useful commands to verify static routes include :

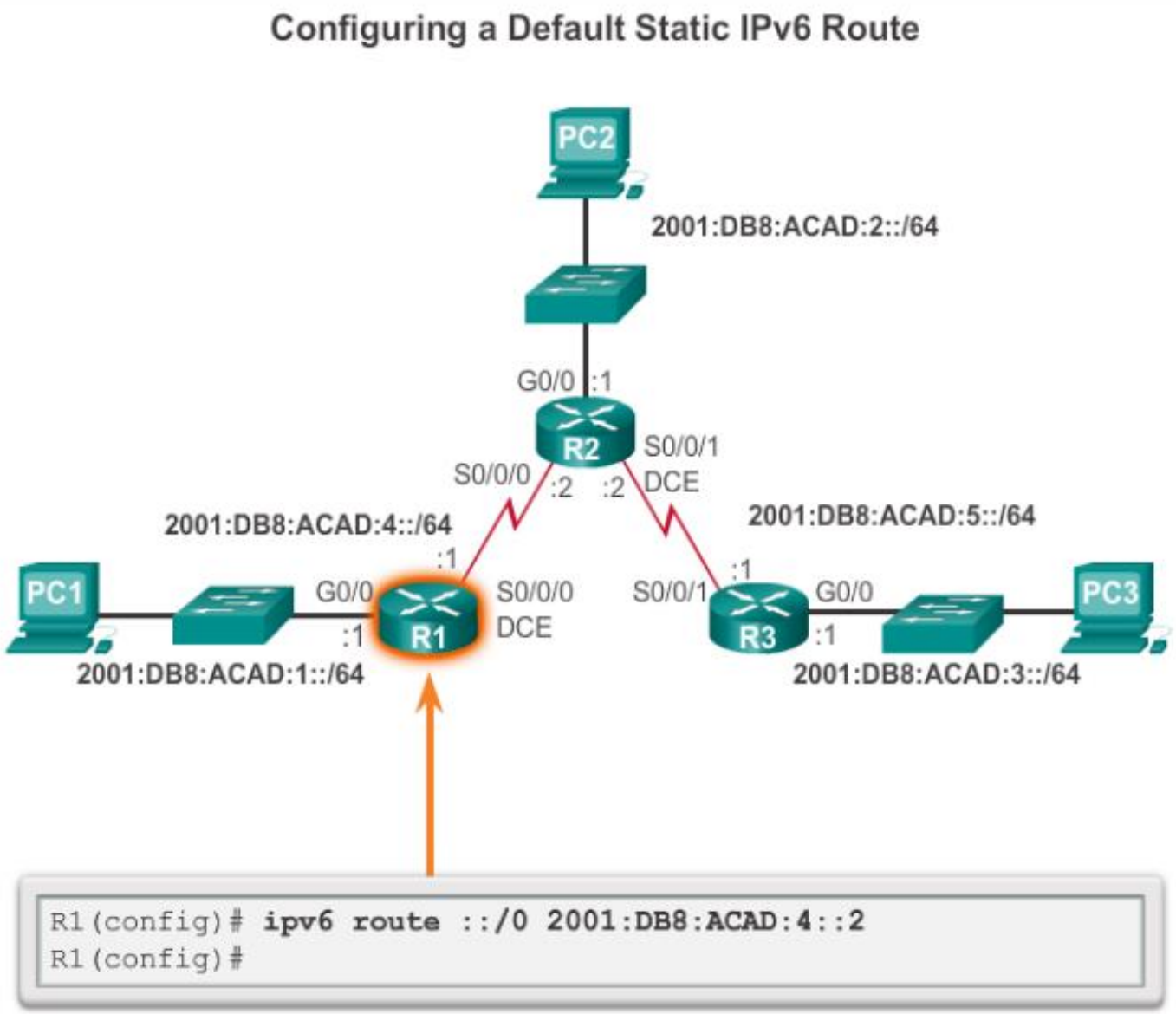
- `show ipv6 route`
- `show ipv6 route static`
- `show ipv6 route network`

Default Static IPv6 Route

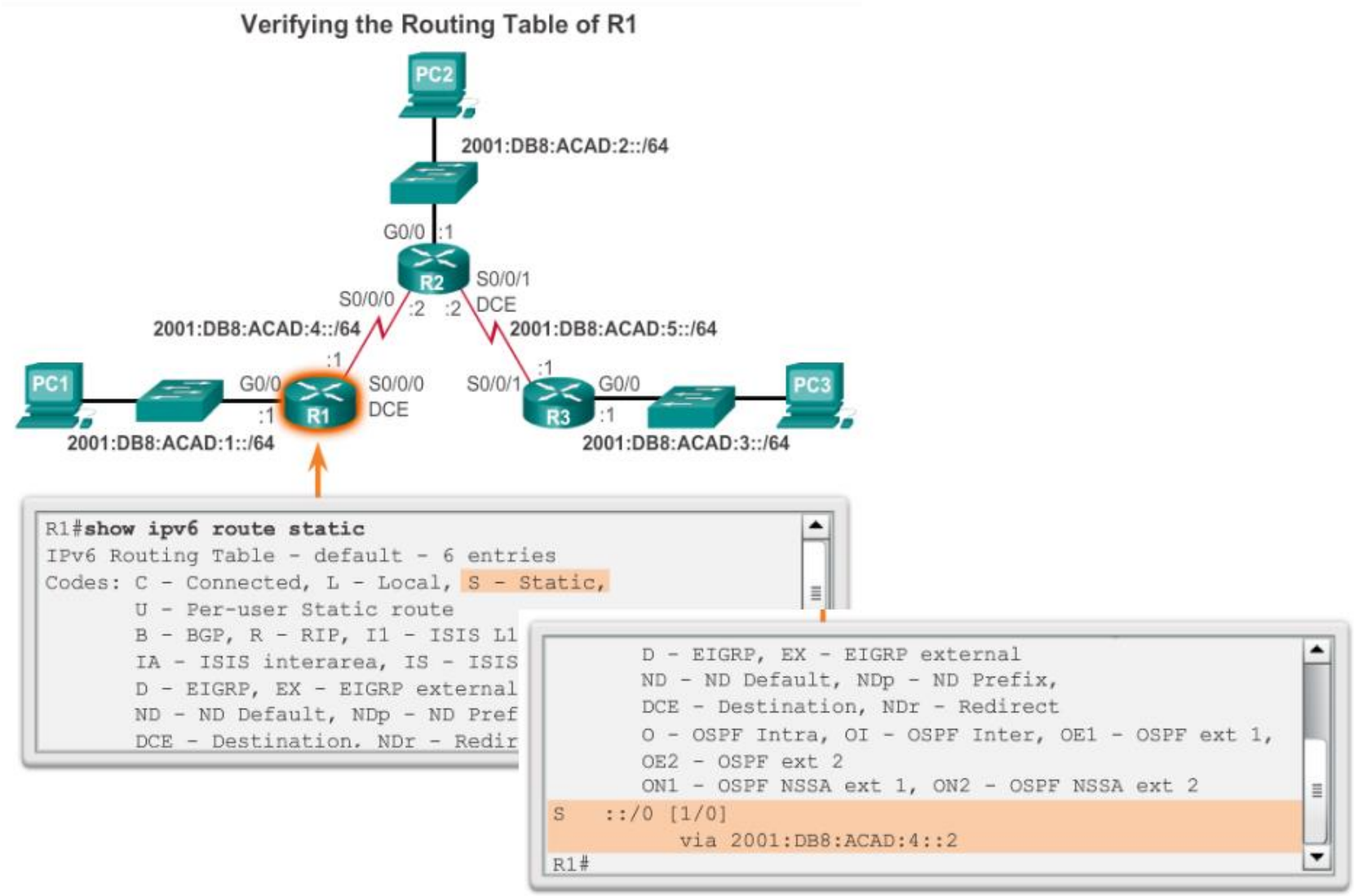
```
Router(config)#ipv6 route ::/0 {ipv6-address | exit-intf}
```

Parameter	Description
::/0	Matches any IPv6 prefix regardless of IPv6 mask.
ip-address	• Commonly referred to as the next-hop router's IPv6 address. • Typically used when connecting to a broadcast media (i.e., Ethernet). • Commonly creates a recursive lookup.
exit-intf	• Use the outgoing interface to forward packets to the destination network. • Also referred to as a directly attached static route. • Typically used when connecting in a point-to-point configuration.

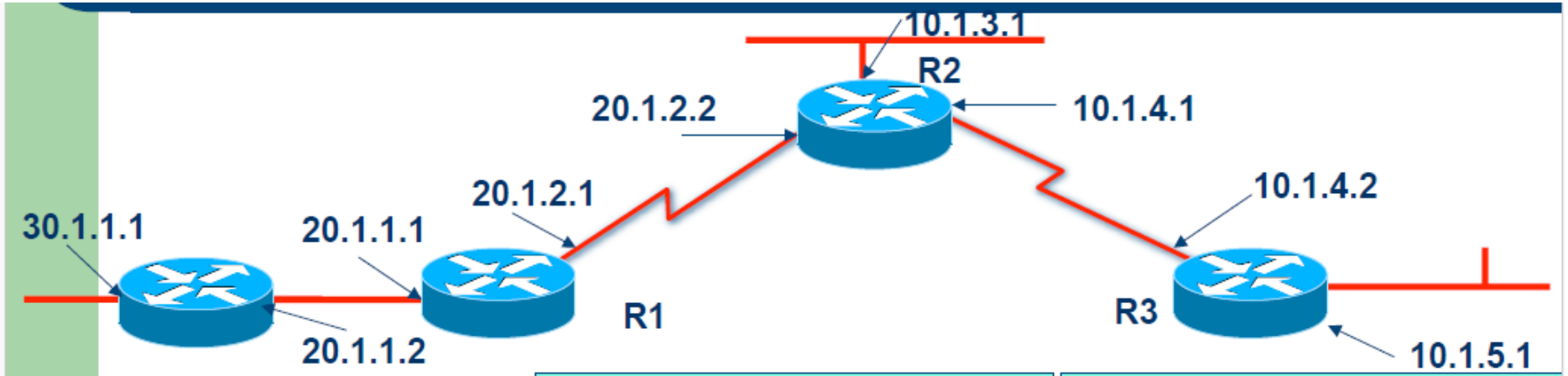
Configure a Default Static IPv6 Route



Verify a Default Static IPv6 Route



Quiz time



Configuration R1

IP route 10.1.3.0 255.255.255.0 20.1.2.2
IP route 10.1.4.0 255.255.255.0 20.1.2.2
IP route 10.1.5.0 255.255.255.0 20.1.2.2

Configuration R2

IP route 10.1.5.0 255.255.255.0 10.1.4.2
IP route 10.1.1.0 255.255.255.0 20.1.2.1

Configuration R3

IP route 10.1.3.0 255.255.255.0 10.1.4.1
IP route 10.1.1.0 255.255.255.0 10.1.4.1

Table de routage de R1

C 20.1.1.0 255.255.255.0 is directly connected, Ethernet0
C 20.1.2.0 255.255.255.0 is directly connected, Serial0
S 10.1.3.0 255.255.255.0 [1/0] via 20.1.2.2
S 10.1.4.0 255.255.255.0 [1/0] via 20.1.2.2
S 10.1.5.0 255.255.255.0 [1/0] via 20.1.2.2

Table de routage de R3

C 10.1.5.0 255.255.255.0 is directly connected, Ethernet0
C 10.1.4.0 255.255.255.0 is directly connected, Serial0
S 10.1.3.0 255.255.255.0 [1/0] via 10.1.4.1
S 10.1.1.0 255.255.255.0 [1/0] via 10.1.4.1

Table de routage de R2

C 10.1.3.0 255.255.255.0 is directly connected, Ethernet0
C 10.1.4.0 255.255.255.0 is directly connected, Serial0
C 20.1.2.0 255.255.255.0 is directly connected, Serial1
S 10.1.5.0 255.255.255.0 [1/0] via 10.1.4.2
S 10.1.1.0 255.255.255.0 [1/0] via 20.1.2.1