IP Routing
Static, Default, & RIP

SDC CNW (CSE 4541)

CSE, FET, ITER
SOA University, BBSR-30

References

Glen E. Clarke & Richard Deal

CCT/CCNA

Routing & Switching Exam Guide

McGrawHll

Todd Lammle

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Routing & Switching Study Guide

SYBEX, A Wiley Brand

Discussion Flow

- Introduction
- Routing basics
- Different routing methods
- Static routing
- Default routing
- Dynamic routing

Review Questions

Introduction

- IP routing is the process of moving packets from one network to another network using routers.
- Routers use routing protocols to dynamically find all networks within the greater internetwork and to ensure that all routers have the same routing table.
- Routing protocols are also employed to determine the best path a packet should take through an internetwork to get to its destination most efficiently.
- Examples of the most common routing protocols: RIP, RIPv2, EIGRP, and OSPF
- Once all routers know about all networks, a routed protocol can be used to send user data (packets) through the established enterprise.
- Routed protocols are assigned to an interface and determine the method of packet delivery. Examples of routed protocols are IP and IPv6.

Routing Basics

- Routing refers to taking a packet from one device and sending it through the network to another device on a different network.
- Once an internetwork is created by connecting WANs and LANs to a router, it would be needed to configure logical network addresses, like IP addresses, to all hosts on that internetwork for them to communicate successfully throughout it.
- Routers don't really care about hosts. They only care about networks and the best path to each one of them rather
- The logical network address of the destination host is key to getting packets through a routed network.
- It's the hardware address of the host that's used to deliver the packet from a router and ensure it arrives at the correct destination host.
- Routing is irrelevant if the network has no routers because their job is to route traffic to all the networks in the internetwork.

Factors a Router Must Know

The list of minimum factors a router must know to be able to effectively route packets:

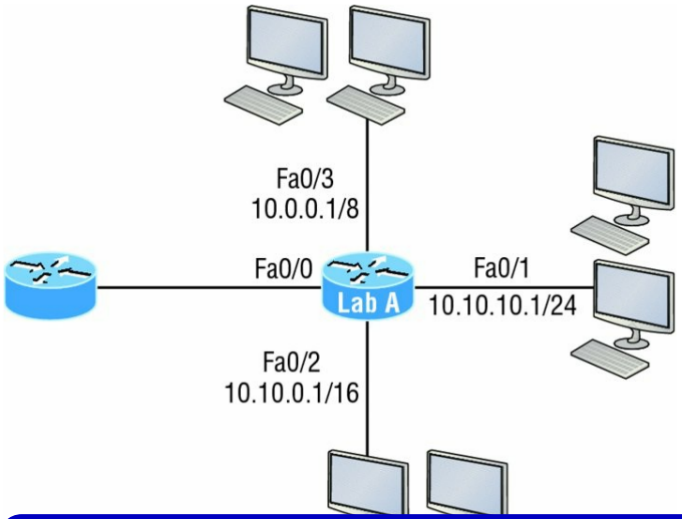
- Destination address
- Neighbor routers from which it can learn about remote networks
- Possible routes to all remote networks
- The best route to each remote network
- How to maintain and verify routing information?

How router works?

The router learns about remote networks from neighboring routers or from an administrator. The router then builds a routing table, which is basically a map of the internetwork, and it describes how to find remote networks. If a network is directly connected, then the router already knows how to get to it.

If a network isn't directly connected to the router, the router must use one of two ways (*i.e static routing or dynamic routing*) to learn how to get to the remote network.

Uses of Routing Table



Commands

- Lab_A has four interfaces.
- which interface will be used to forward an IP datagram to a host with a destination IP address of 10.10.10.30?
- To show routing table

```
Lab_A# show ip route
```

Routing Table at Lab_A

10.0.0.0/8 is variably subnetted, 6 subnets, 4 masks

C 10.0.0.0/8 is directly connected, FastEthernet0/3

L 10.0.0.1/32 is directly connected, FastEthernet0/3

C 10.10.0.0/16 is directly connected, FastEthernet0/2

L 10.10.0.1/32 is directly connected, FastEthernet0/2

C 10.10.10.0/24 is directly connected, FastEthernet0/1

L 10.10.10.1/32 is directly connected, FastEthernet0/1

S* 0.0.0.0/0 is directly connected, FastEthernet0/0

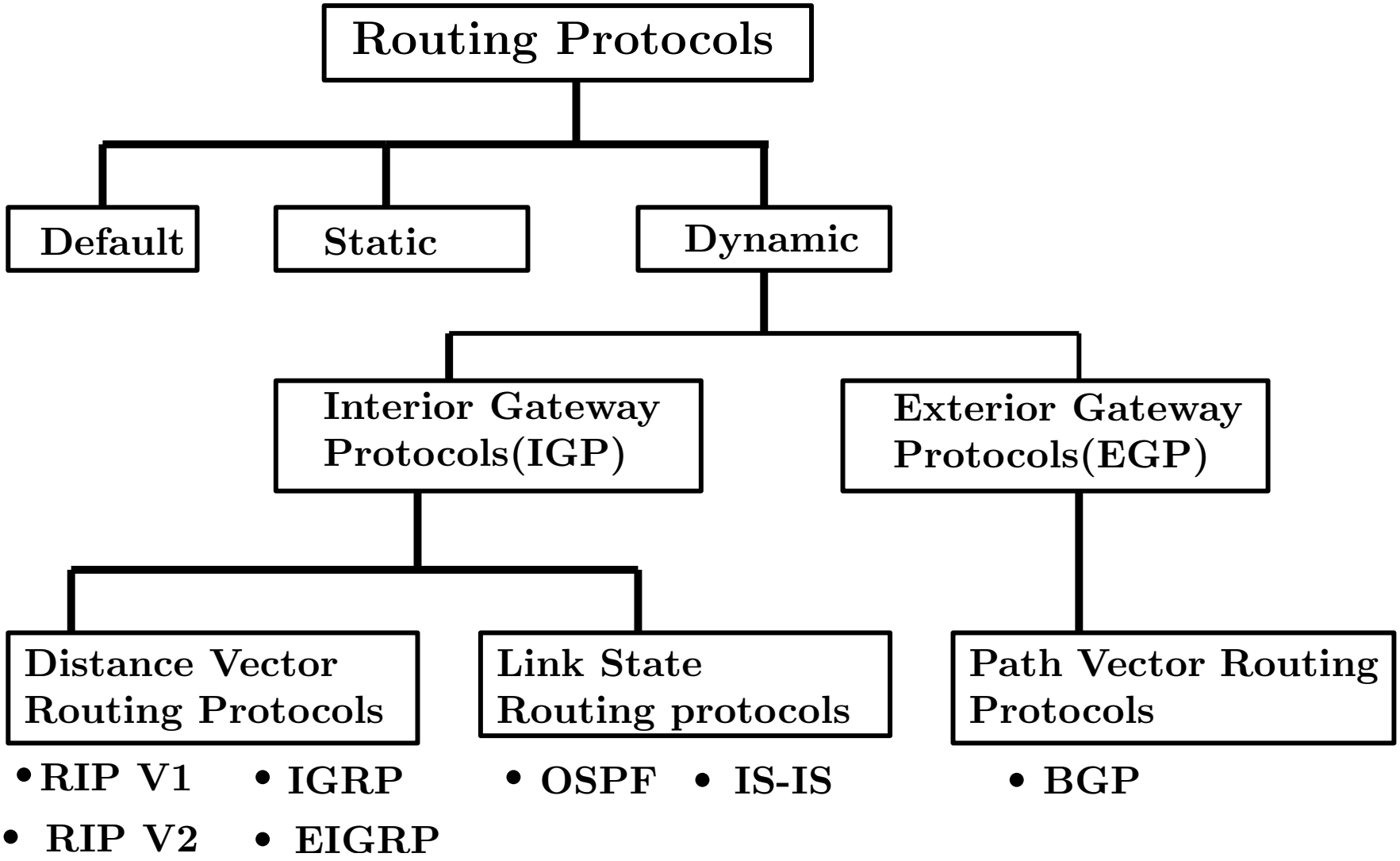
Routing

C- Directly connected
L- Local

- new Cisco IOS 15 code.
- called a local host route.
- Each local route has a /32 prefix, defining a route just for the one address.
- Forward packets to the router itself.

The router will forward the packet to interface FastEthernet 0/1. **How ??**

Different Routing Methods

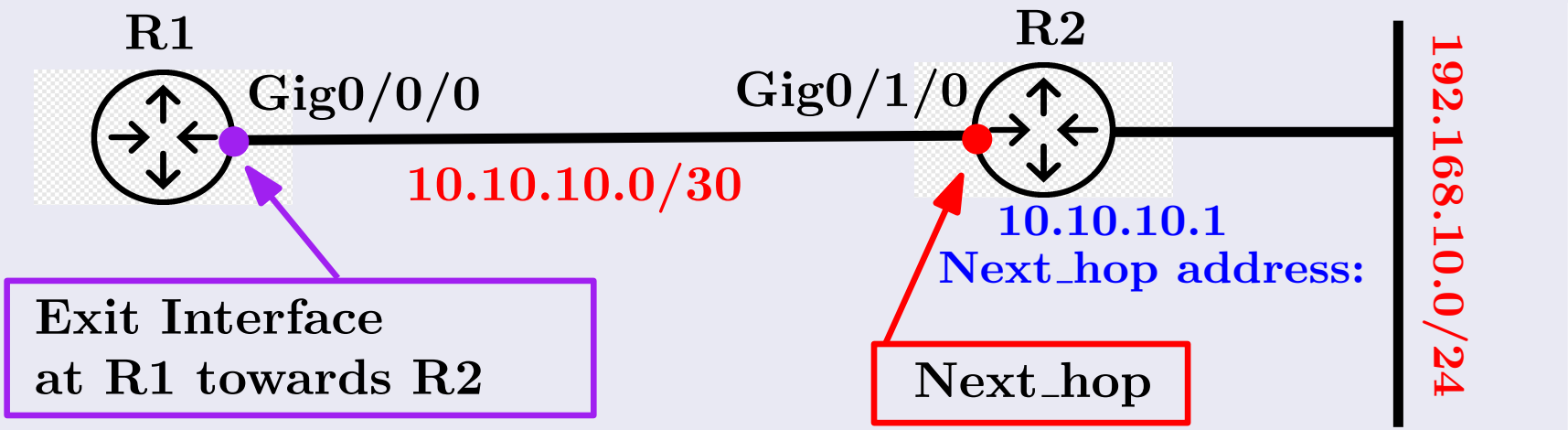


Static Routing

- The process of adding manual routes in each router's routing table.
- **Syntax:**

```
ip route [destination_network] [mask]
         [next-hop_address or ExitInterface Name]
         [administrative_distance] [permanent]
```

Example: Static Route at R1




```
ip route 192.168.10.0 255.255.255.0 10.10.10.1
or
ip route 192.168.10.0 255.255.255.0 Gig0/0/0
```

Syntax Static Routing

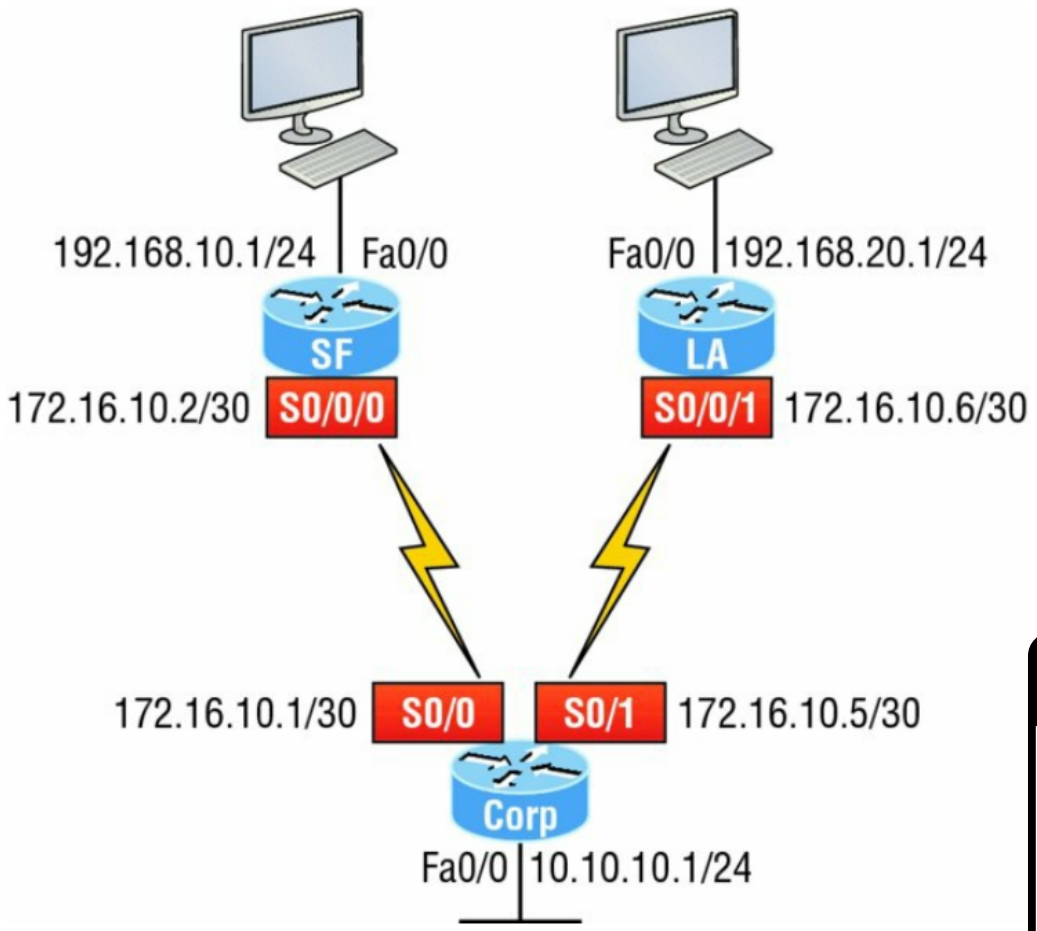
```
ip route [destination_network] [mask]
        [next-hop_address or ExitInterface Name]
          [administrative_distance] [permanent]
```

- **ip_route:** The command used to create the static route.
- **destination_network:** The network required to be placed in the routing table.
- **mask:** The subnet mask being used on the network
- **next-hop_address:** This is the IP address of the next-hop router that will receive packets and forward them to the remote network.
- **exitinterface Name:** An alternate to use in place of the next-hop address.
- **administrative_distance:** By default, static routes have an administrative distance of 1 or 0 if you use an exit interface instead of a next-hop address. The default value can be changed by adding an administrative weight at the end of the command.
- **permanent:** If the interface is shut down or the router can't communicate to the next-hop router, the route will automatically be discarded from the routing table by default. Choosing the permanent option keeps the entry in the routing table no matter what happens.

Example:

```
Router(config)#ip route 172.16.3.0 255.255.255.0 192.16.2.4 150 permanent
```

Configure Static Routing



- Configure all PCs with IP , sub-net mask and default gateway
- Configure the routers interfaces
- Add static route at **`Corp`** Router
- Add static route at **`SF`** Router
- Add static route at **`LA`** Router
- Verify the configuration through ping or simulation

Network Loops ???

Default Routing

- Remove the static route at **`SF`** router
- Add default route at **`SF`** router
- Verify the configuration
- Differentiate static vs default route

Static Route at Corp Router

The Corp router is connected to three networks. For the Corp router to be able to route to all networks, the following networks have to be configured into its routing table:

- 192.168.10.0/24
- 192.168.20.0/24

```
Corp#config t
Corp(config)#ip route 192.168.10.0 255.255.255.0 172.16.10.2 150
Corp(config)#ip route 192.168.20.0 255.255.255.0 s0/1 150
```

To show static routes on the Corp router

```
   1) Corp(config)#do show run
or
   1) Corp(config)#do show run | begin ip route

   2) Corp(config)#do show ip route
```

Static Route at SF Router

The SF router is directly connected to networks 172.16.10.0/30 and 192.168.10.0/24, which means the following static routes to be configured on the SF router:

- 10.10.10.0/24
- 192.168.20.0/24
- 172.16.10.4/30

```
SF# config t
SF(config)#ip route 10.10.10.0 255.255.255.0 172.16.10.1 150
SF(config)#ip route 172.16.10.4 255.255.255.252 172.16.10.1 150
SF(config)#ip route 192.168.20.0 255.255.255.0 172.16.10.1 150
```

To show static routes on the Corp router

```
   1) SF(config)#do show run
or
   1) SF(config)#do show run | begin ip route

   2) SF(config)#do show ip route
```

Static Route at LA Router

The LA router is directly connected to 192.168.20.0/24 and 172.16.10.4/30, so these are the routes that must be added:

- 10.10.10.0/24
- 172.16.10.0/30
- 192.168.10.0/24

```
LA#config t
LA(config)#ip route 10.10.10.0 255.255.255.0 172.16.10.5 150
LA(config)#ip route 172.16.10.0 255.255.255.252 172.16.10.5 150
LA(config)#ip route 192.168.10.0 255.255.255.0 172.16.10.5 150
```

To show static routes on the Corp router

```
   1) LA(config)#do show run
or
   1) LA(config)#do show run | begin ip route

   2) LA(config)#do show ip route
```

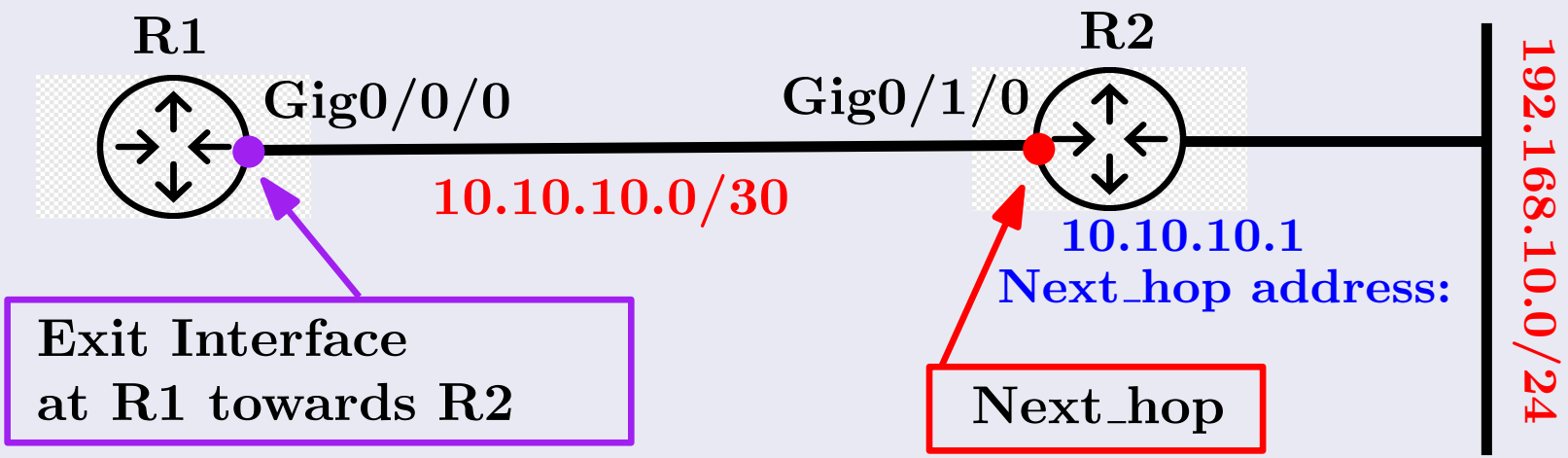
Default Routing

Default route is used by IP to forward any packet with a destination not found in the routing table, which is why it is also called a **gateway of last resort**.

- **Syntax:**

```
ip route 0.0.0.0 0.0.0.0
         [next-hop_address or ExitInterface Name]
         [administrative_distance] [permanent]
```

Example: Default Route at R1




```
ip route 0.0.0.0 0.0.0.0 10.10.10.1
or
ip route 0.0.0.0 0.0.0.0 Gig0/0/0
```

Default Route at LA Router

To remove static route: no ip route command

```
LA#config t
LA(config)#no ip route 10.10.10.0 255.255.255.0 172.16.10.5 150
LA(config)#no ip route 172.16.10.0 255.255.255.252 172.16.10.5
    150
LA(config)#no ip route 192.168.10.0 255.255.255.0 172.16.10.5 150
```

Adding default route:ip route command

```
LA#config t
LA(config)#ip route 0.0.0.0 0.0.0.0 172.16.10.5
```

To show Routing Table:

```
LA#config t
LA(config)#do sho ip route
```

Verifying Configuration at Routers

show ip route and ping command

```
(1) Corp#do sho ip route

(2) Corp#ping 192.168.10.1

(3) Corp#ping 192.168.20.1
```

Dynamic Routing

- Dynamic routing is when protocols are used to find networks and update routing tables on routers.
- This is whole lot easier than using static or default routing, but it will cost you in terms of router CPU processing and bandwidth on network links.
- A routing protocol defines the set of rules used by a router when it communicates routing information between neighboring routers.
- Two types of routing protocols are used in internetworks: interior gateway protocols (IGPs) and exterior gateway protocols (EGPs).
- IGPs are used to exchange routing information with routers in the same autonomous system (AS). An AS is either a single network or a collection of networks under a common administrative domain, which basically means that all routers sharing the same routing-table information are in the same AS. Examples: RIP, OSPF etc.
- EGPs are used to communicate between ASs. An example of an EGP is Border Gateway Protocol (BGP)

RIP at Corp Router

Static Route:

```
Corp#config t
Corp(config)#ip route 192.168.10.0 255.255.255.0 172.16.10.2 150
Corp(config)#ip route 192.168.20.0 255.255.255.0 s0/1 150
```

Now shifted to RIP routing in stead of static route:

```
Corp#config t
Corp(config)#router rip
Corp(config-router)#network 10.0.0.0
Corp(config-router)#network 172.16.0.0
Corp(config-router)#version 2
```

How RIP Works?

How RIP Works?

How RIP Works?

Review Questions

1. You are viewing the routing table and you see an entry 10.1.1.1/32. What legend code would you expect to see next to this route?

   (A) C
   (B) L
   (C) S
   (D) D

2. Which of the following is not an advantage of static routing?

   (A) Less overhead on the router CPU
   (B) No bandwidth usage between routers
   (C) Adds security
   (D) Recovers automatically from lost routes

3. If your routing table has a static, an RIP, and an EIGRP route to the same network, which route will be used to route packets by default?

   (A) Any available route
   (B) RIP route
   (C) Static route
   (D) EIGRP route
   (E) They will all load-balance.

Routing: The begin $\longrightarrow$