Exploring the Functions of Routing

Routers

Cisco 2800 Series Router

- **Routers have the following components:**
  - **CPU**
  - **Motherboard**
  - **RAM**
  - **ROM**
- **Routers have network adapters to which IP addresses are assigned.**
- **Routers may have the following two kinds of ports:**
  - **Console: For the attachment of a terminal used for management**
  - **Network: Different LAN or WAN media ports**
- **Routers forward packets based upon a routing table.**

Router Functions

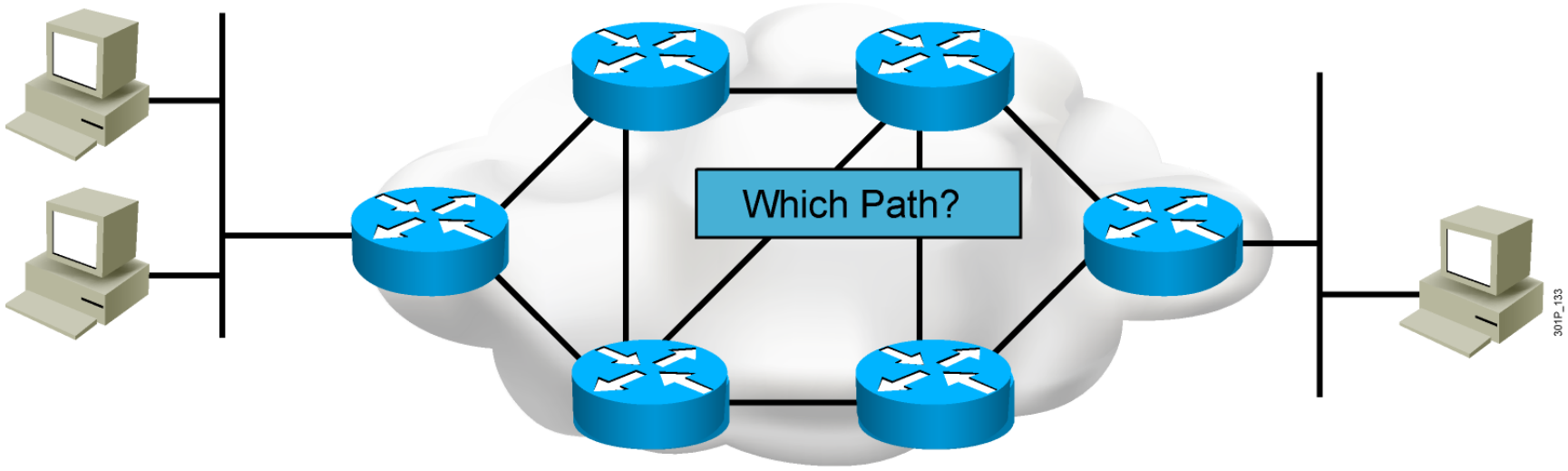
```
RouterX# show ip route
D 192.168.1.0/24 [90/25789217] via 10.1.1.1
R 192.168.2.0/24 [120/4] via 10.1.1.2
O 192.168.3.0/24 [110/229840] via 10.1.1.3
```

1

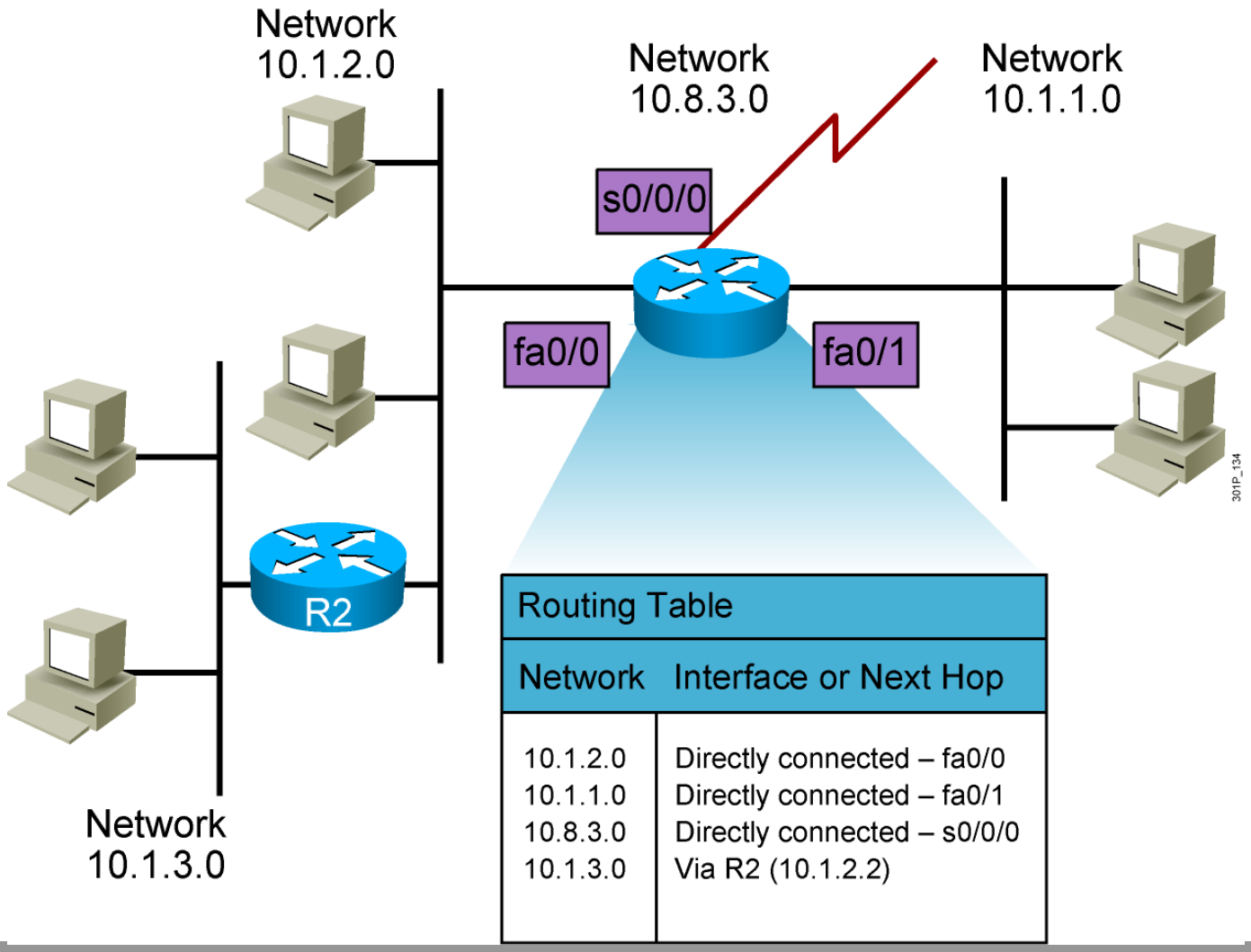
2

1. Lets other routers know about changes
2. Determines where to forward packets

Path Determination



Routing Tables

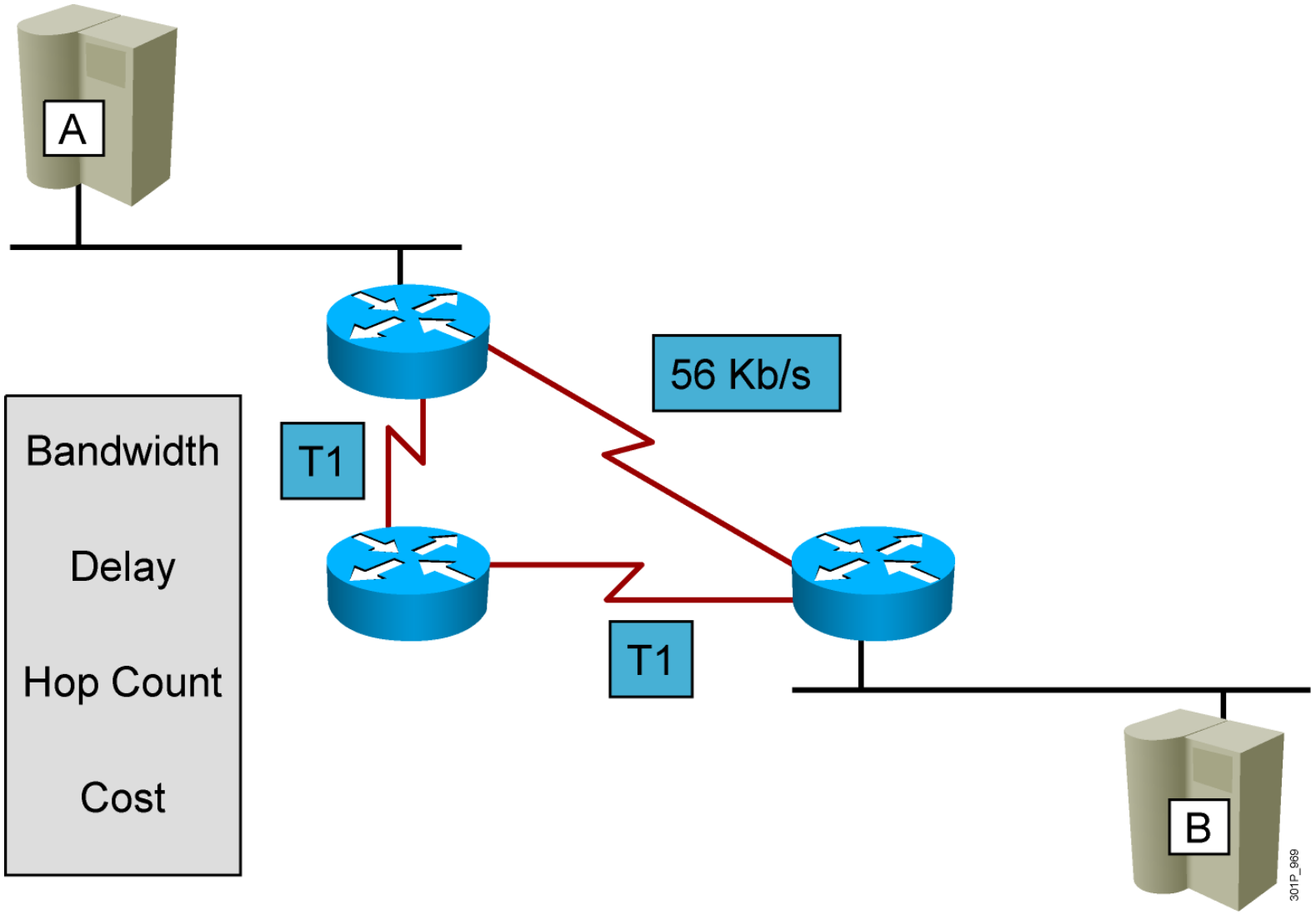


Routing Table	
Network	Interface or Next Hop
10.1.2.0	Directly connected – fa0/0
10.1.1.0	Directly connected – fa0/1
10.8.3.0	Directly connected – s0/0/0
10.1.3.0	Via R2 (10.1.2.2)

Routing Table Entries

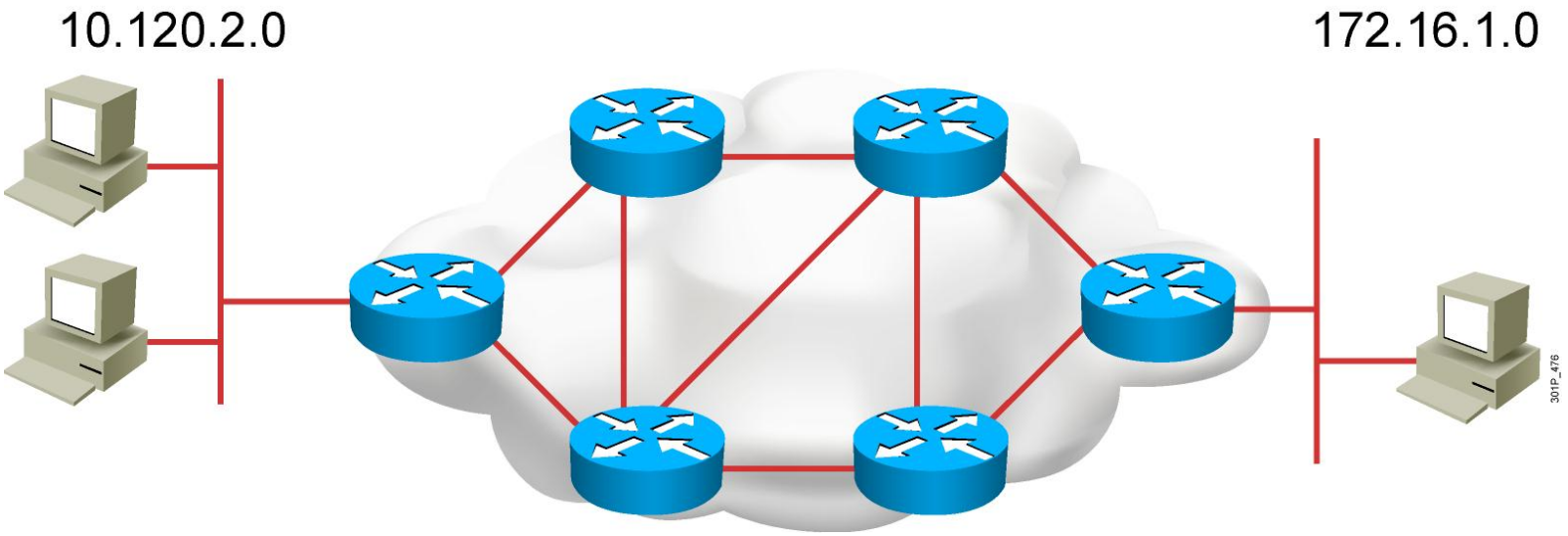
- **Directly connected: Router attaches to this network**
- **Static routing: Entered manually by a system administrator**
- **Dynamic routing: Learned by exchange of routing information**
- **Default route: Statically or dynamically learned; used when no explicit route to network is known**

Routing Metrics



Enabling Static Routing

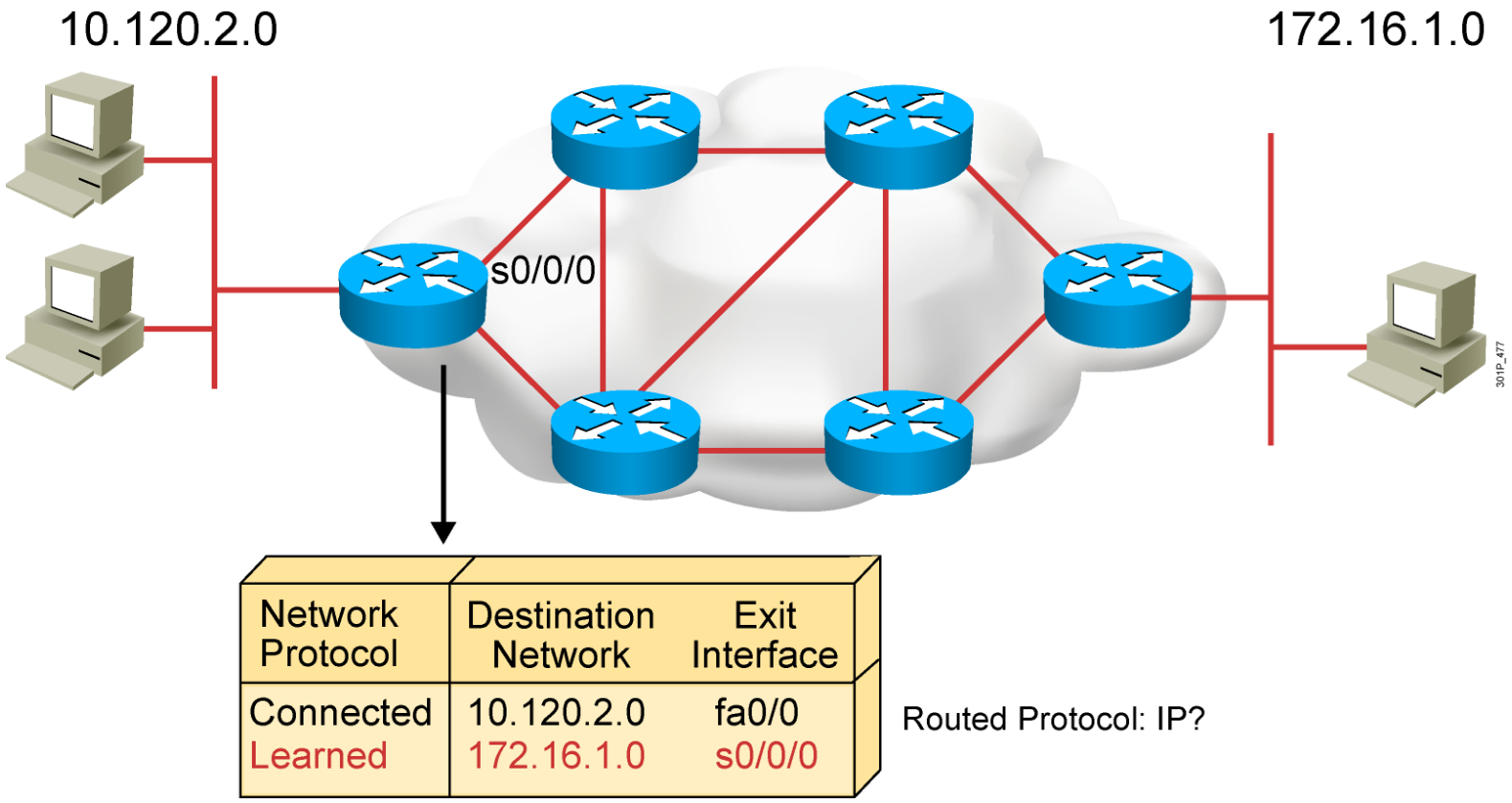
Router Operations



A router needs to do the following:

- **Know the destination address.**
- **Identify the sources from which the router can learn.**
- **Discover possible routes to the intended destination.**
- **Select the best route.**
- **Maintain and verify routing information.**

Router Operations (Cont.)



- Routers must learn destinations that are not directly connected.

Identifying Static and Dynamic Routes

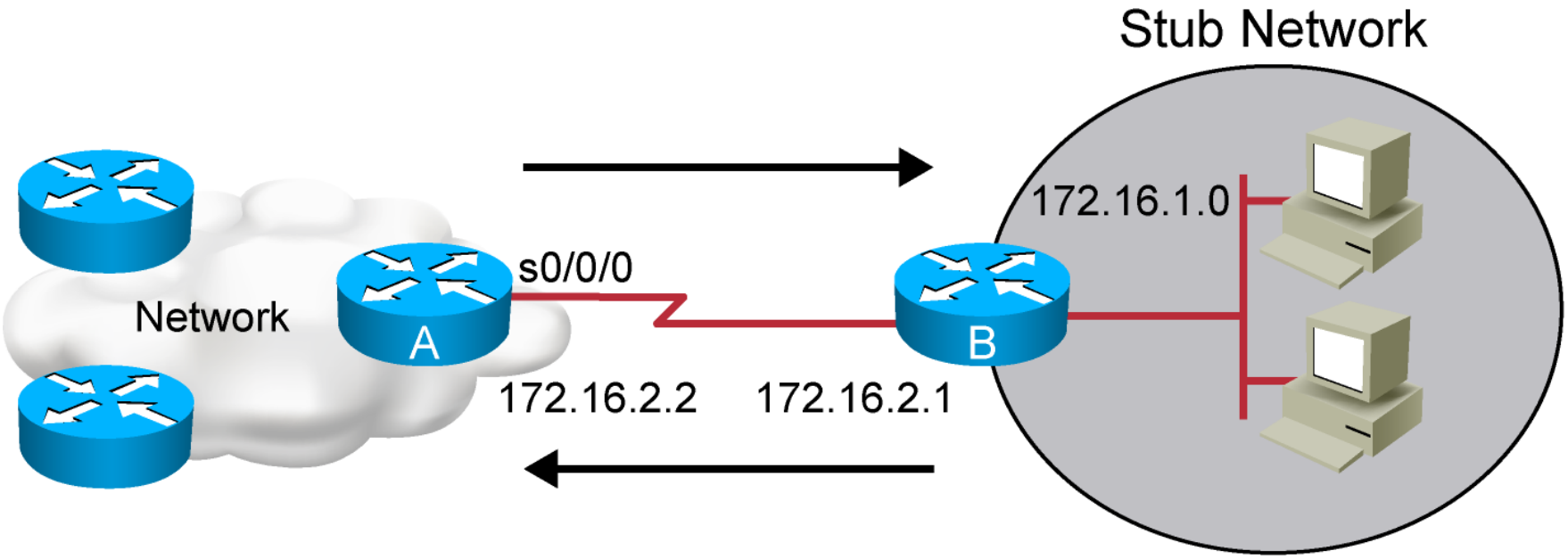
Static route

- **Uses a route that a network administrator enters into the router manually**

Dynamic route

- **Uses a route that a network routing protocol adjusts automatically for topology or traffic changes**

Static Routes



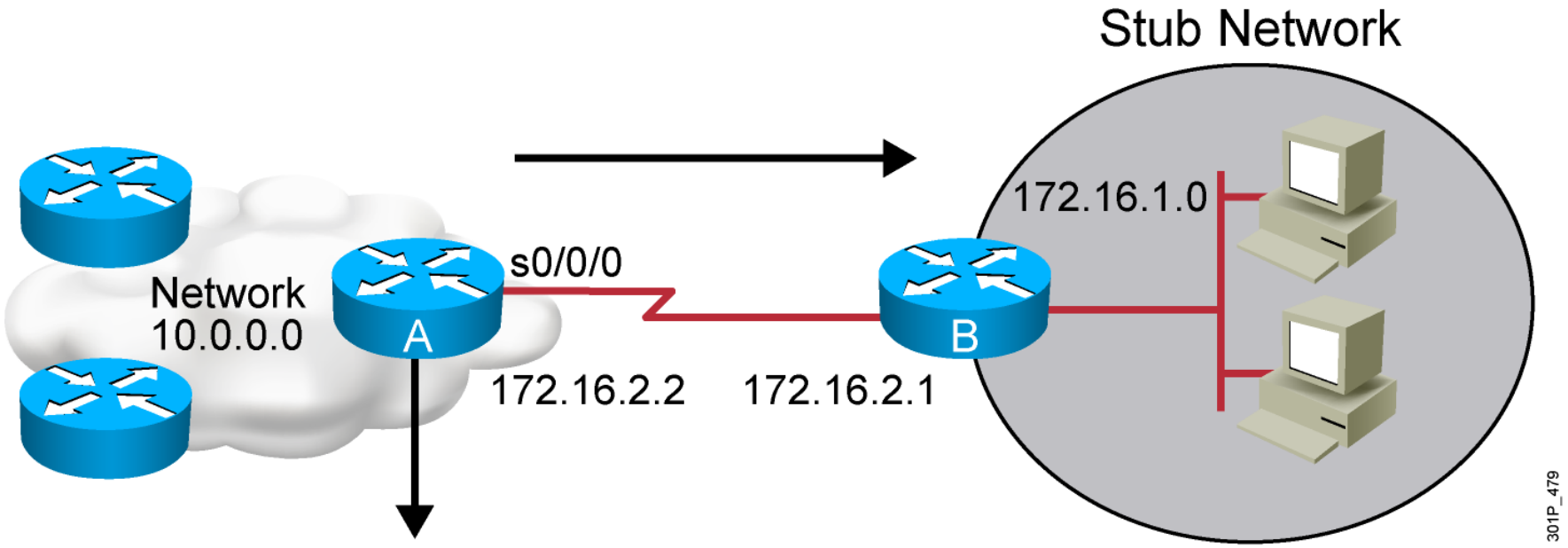
Configure unidirectional static routes to and from a stub network to allow communications to occur.

Static Route Configuration

```
RouterX(config)# ip route network  [mask]
{address | interface}[distance] [permanent]
```

- Defines a path to an IP destination network or subnet or host
- Address = IP address of the next hop router
- Interface = outbound interface of the local router

Static Route Example



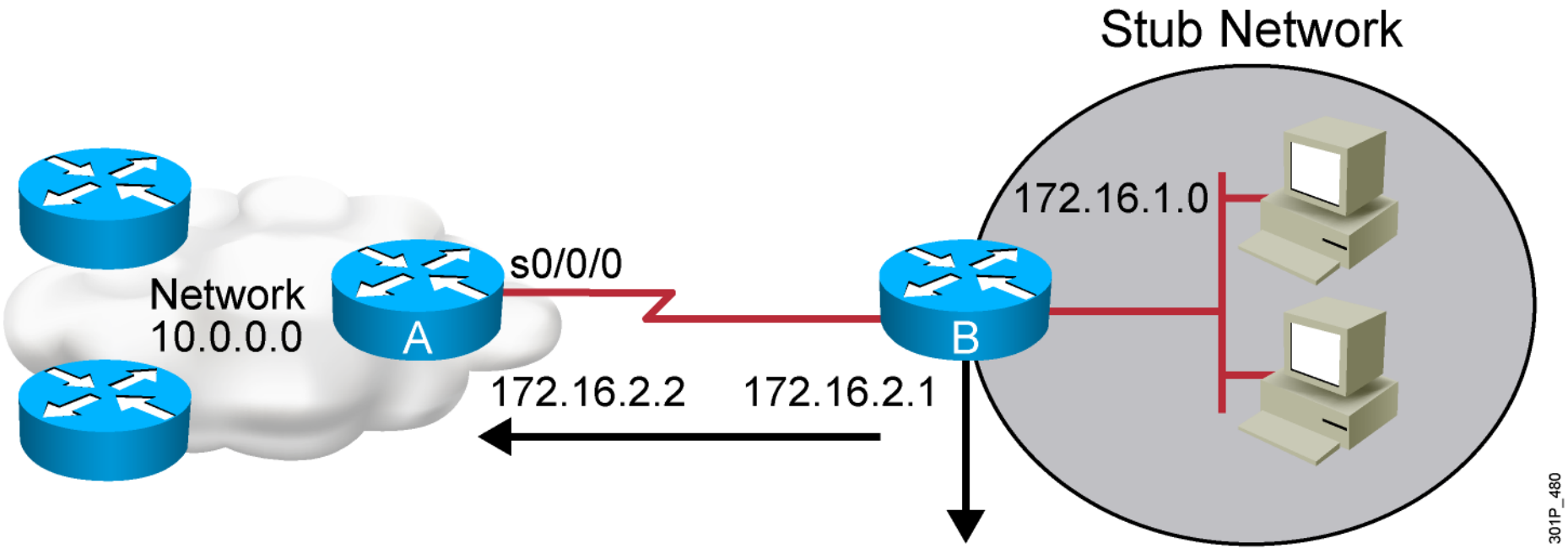

```
RouterX(config)# ip route 172.16.1.0 255.255.255.0 172.16.2.1
```

or

```
Router(config)#ip route 172.16.1.0 255.255.255.0 s0/0/0
```

- This is a unidirectional route. You must have a route configured in the opposite direction.

Default Routes




```
RouterX(config)# ip route 0.0.0.0 0.0.0.0 172.16.2.2
```

- This route allows the stub network to reach all known networks beyond Router A.

Verifying the Static Route Configuration

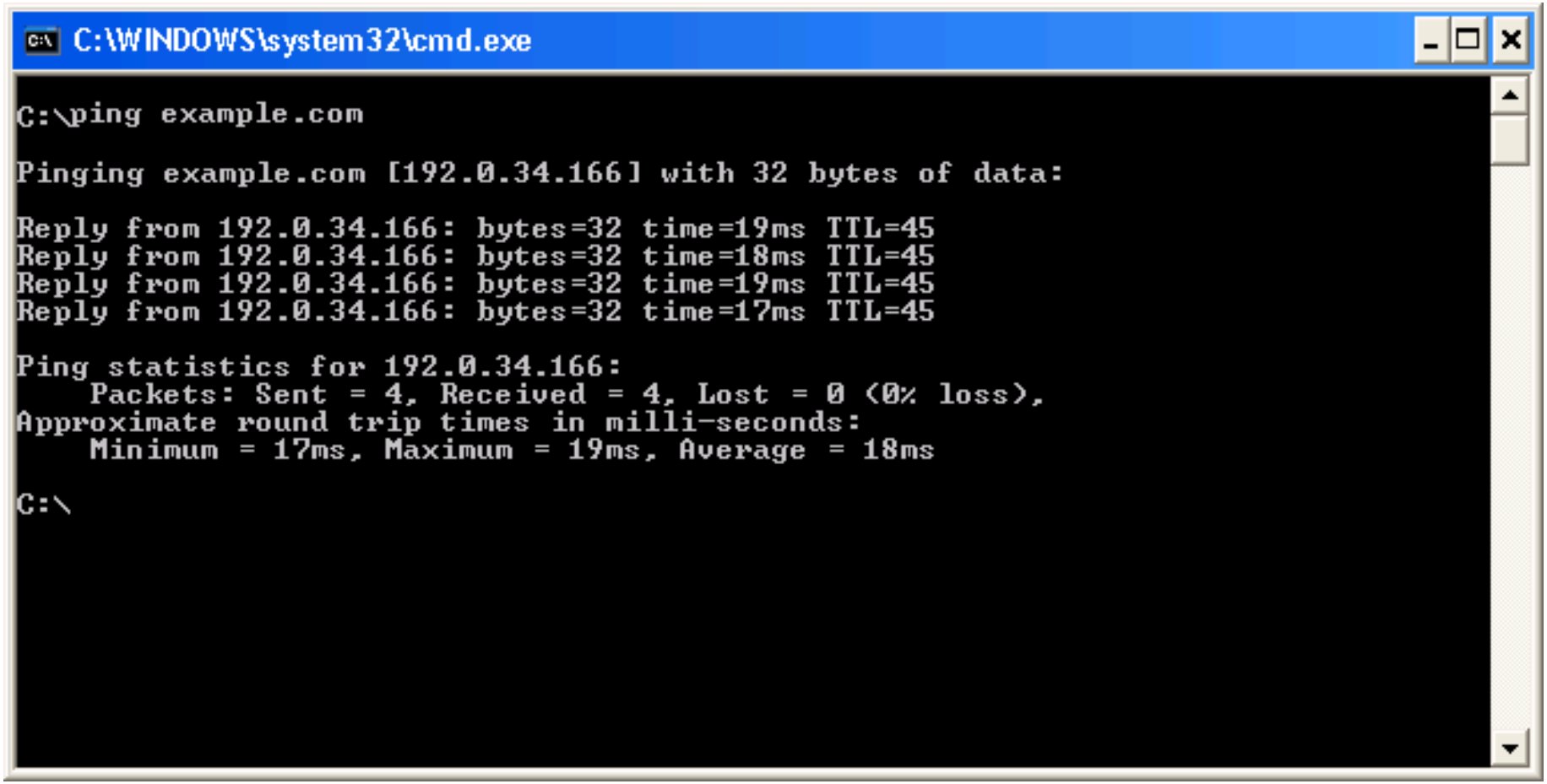
```
RouterX# show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

     10.0.0.0/8 is subnetted, 1 subnets
C       10.1.1.0 is directly connected, Serial0/0/0
S*   0.0.0.0/0 is directly connected, Serial0
```

ICMP and Traceroute

Host-Based Tools: ping

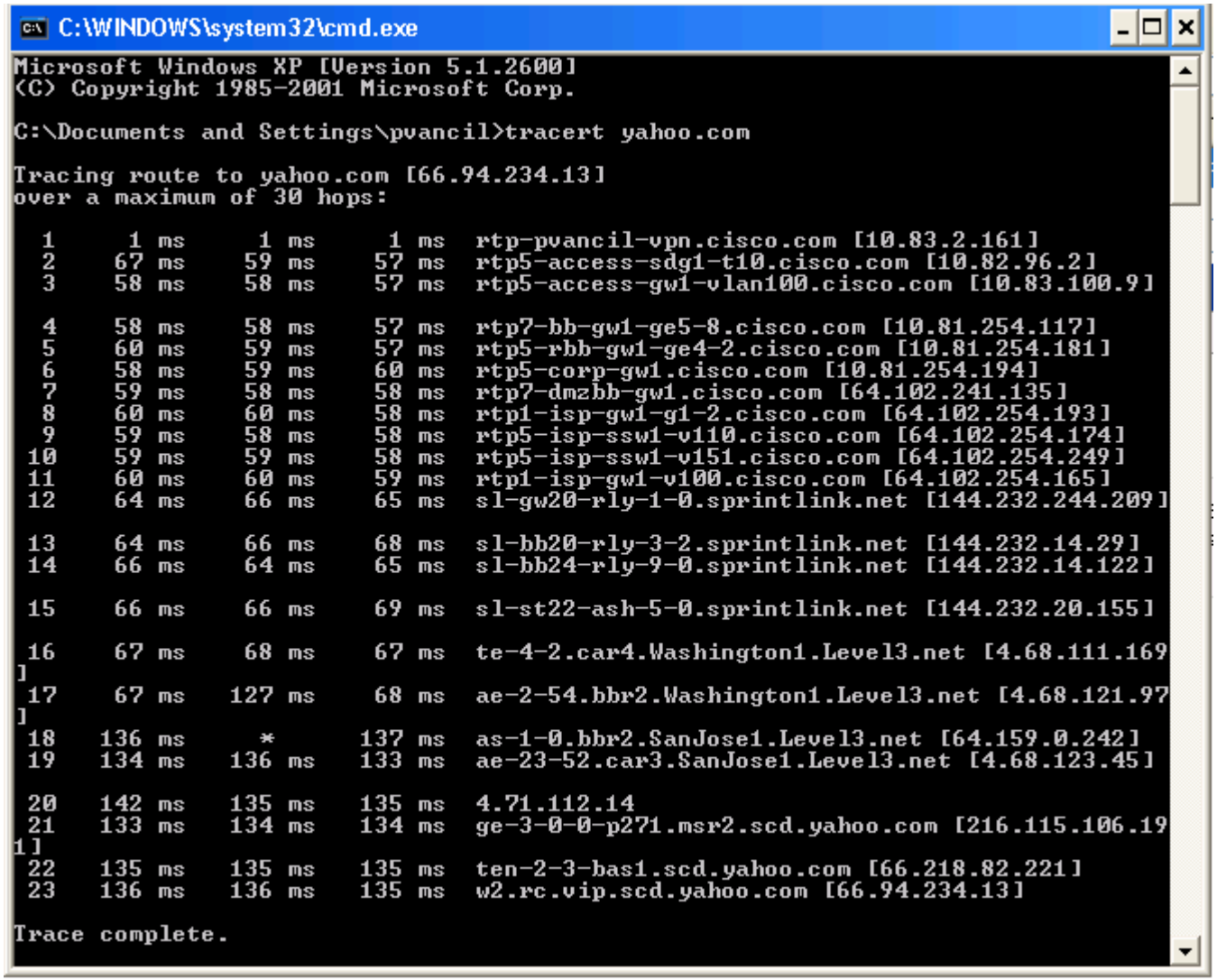


ping

```
Router#
ping [[protocol {host-name | system-address}]
```

- **To diagnose basic network connectivity, use the ping command in user EXEC or privileged EXEC mode.**

Host-Based Tools: tracert



traceroute

```
Router#
traceroute [protocol] destination
```

- **To discover the routes that packets will actually take when traveling to their destination address, use the traceroute command in user EXEC or privileged EXEC mode.**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