



Chapter 6: Network Layer



Introduction to Networks

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Chapter 6: Objectives

In this chapter, you will be able to:

- Explain how network layer protocols and services support communications across data networks.
- Explain how routers enable end-to-end connectivity in a small-to-medium-sized business network.
- Determine the appropriate device to route traffic in a small-to-medium-sized business network.
- Configure a router with basic configurations.



Chapter 6

- 6.1 Network Layer Protocols
- 6.2 Routing
- 6.3 Routers
- 6.4 Configuring a Cisco Router
- 6.5 Summary



6.1 Network Layer Protocols



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Network Layer in Communication

The Network Layer

The network layer, or OSI Layer 3, provides services to allow end devices to exchange data across the network. To accomplish this end-to-end transport, the network layer uses four basic processes:

- Addressing end devices
- Encapsulation
- Routing
- De-encapsulating



Network Layer in Communication

Network Layer Protocols

Common network layer protocols include:

- IP version 4 (IPv4)
- IP version 6 (IPv6)

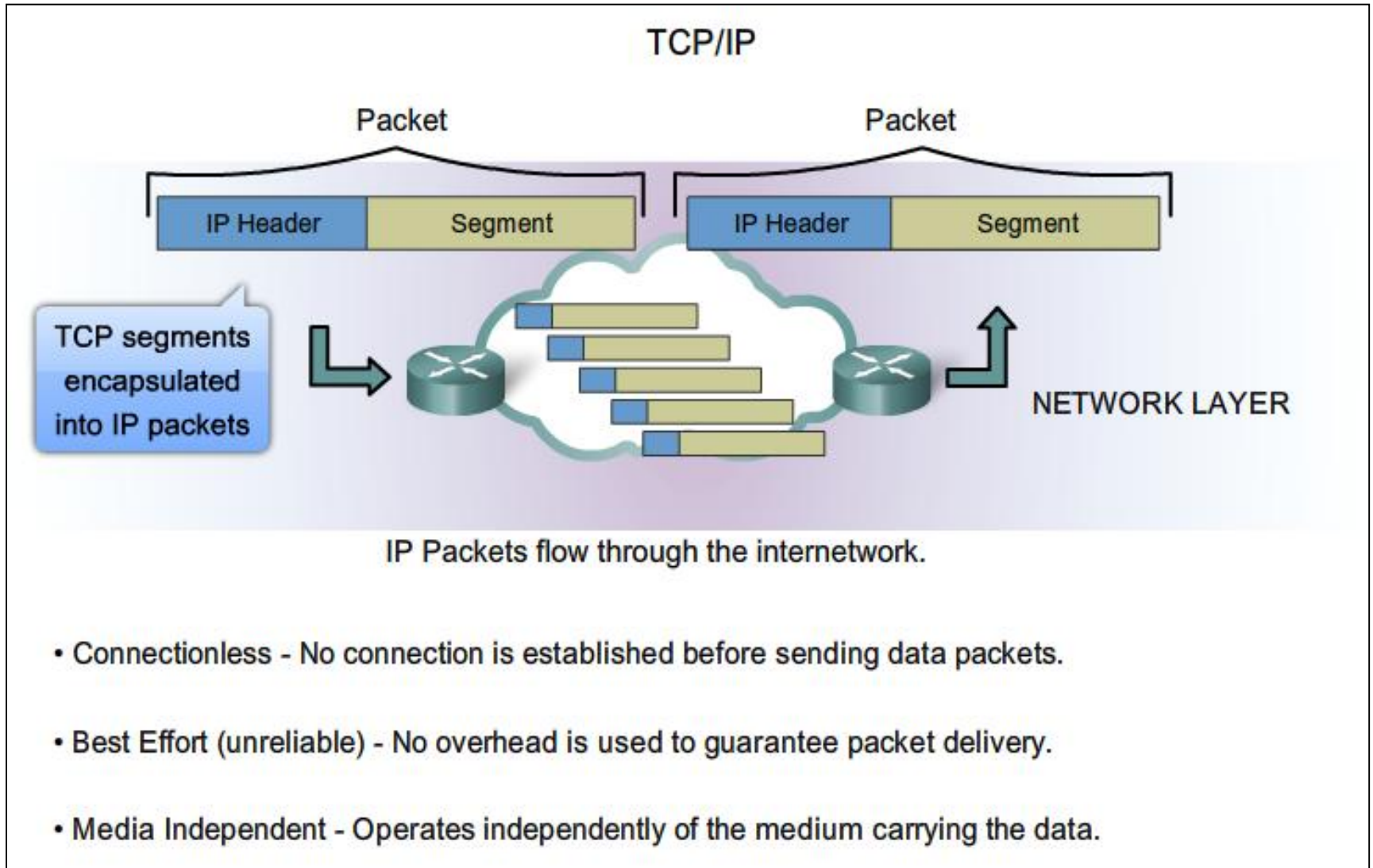
Legacy network layer protocols include:

- Novell Internetwork Packet Exchange (IPX)
- AppleTalk
- Connectionless Network Service (CLNS/DECNet)



IP Characteristics

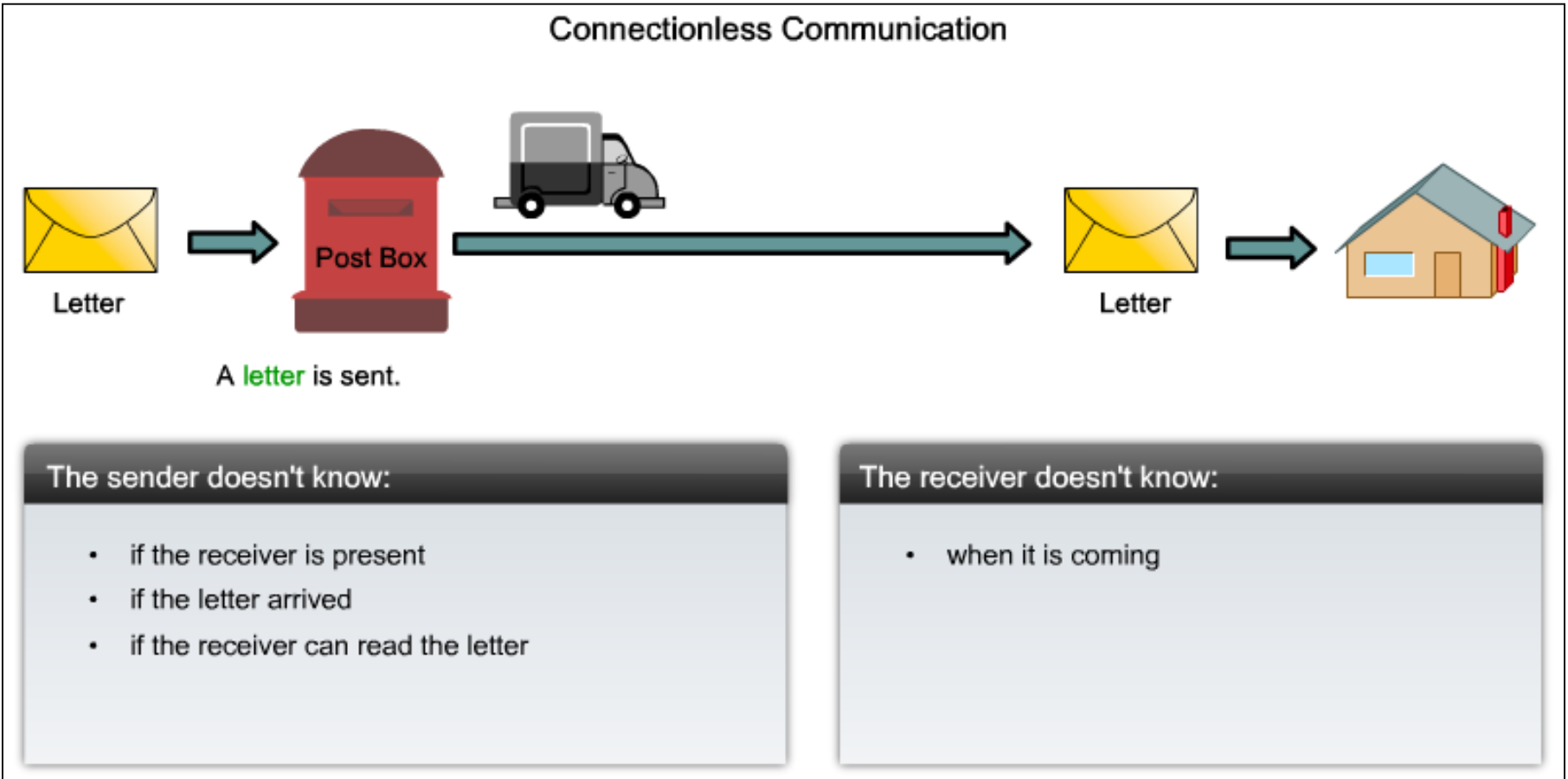
IP Components





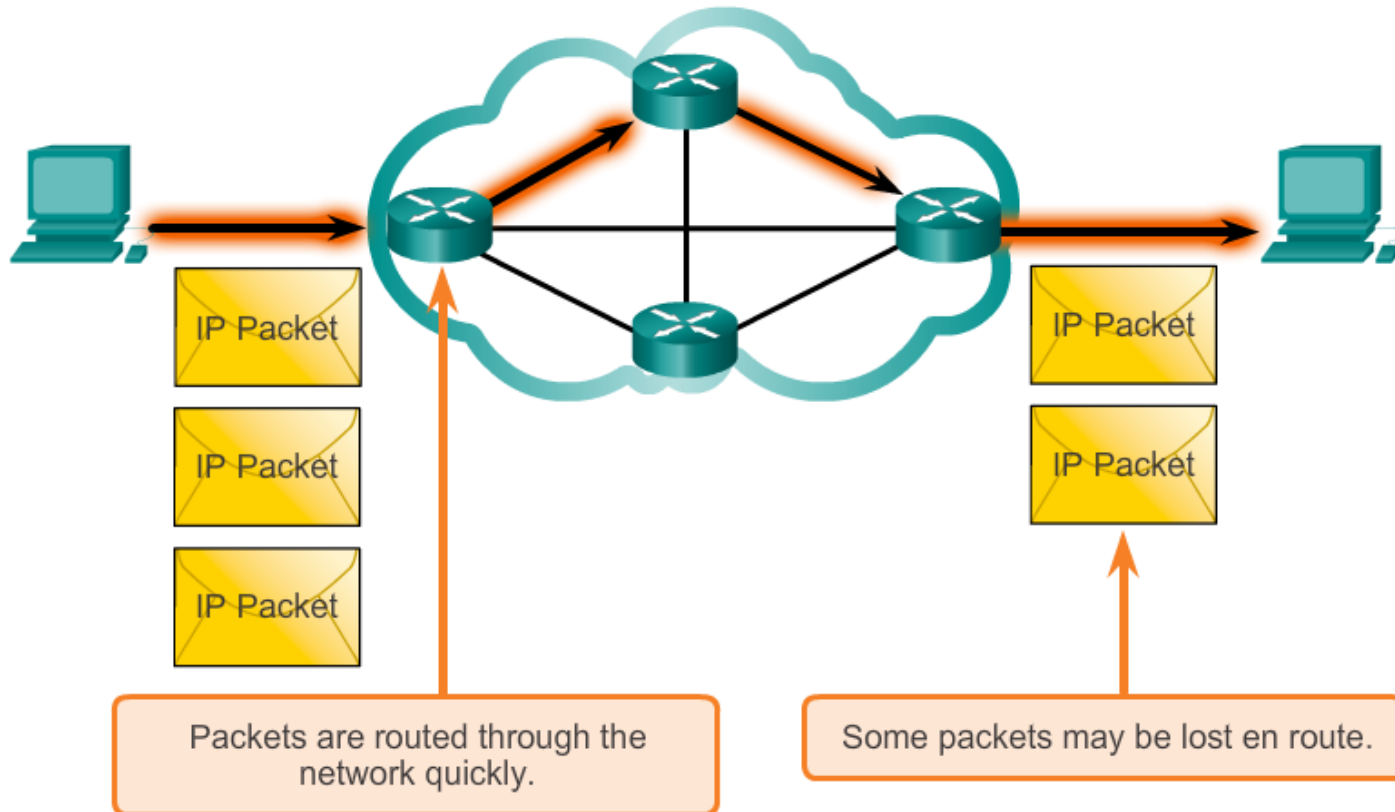
Characteristics of the IP protocol

IP - Connectionless



Characteristics of the IP protocol

Best Effort Delivery

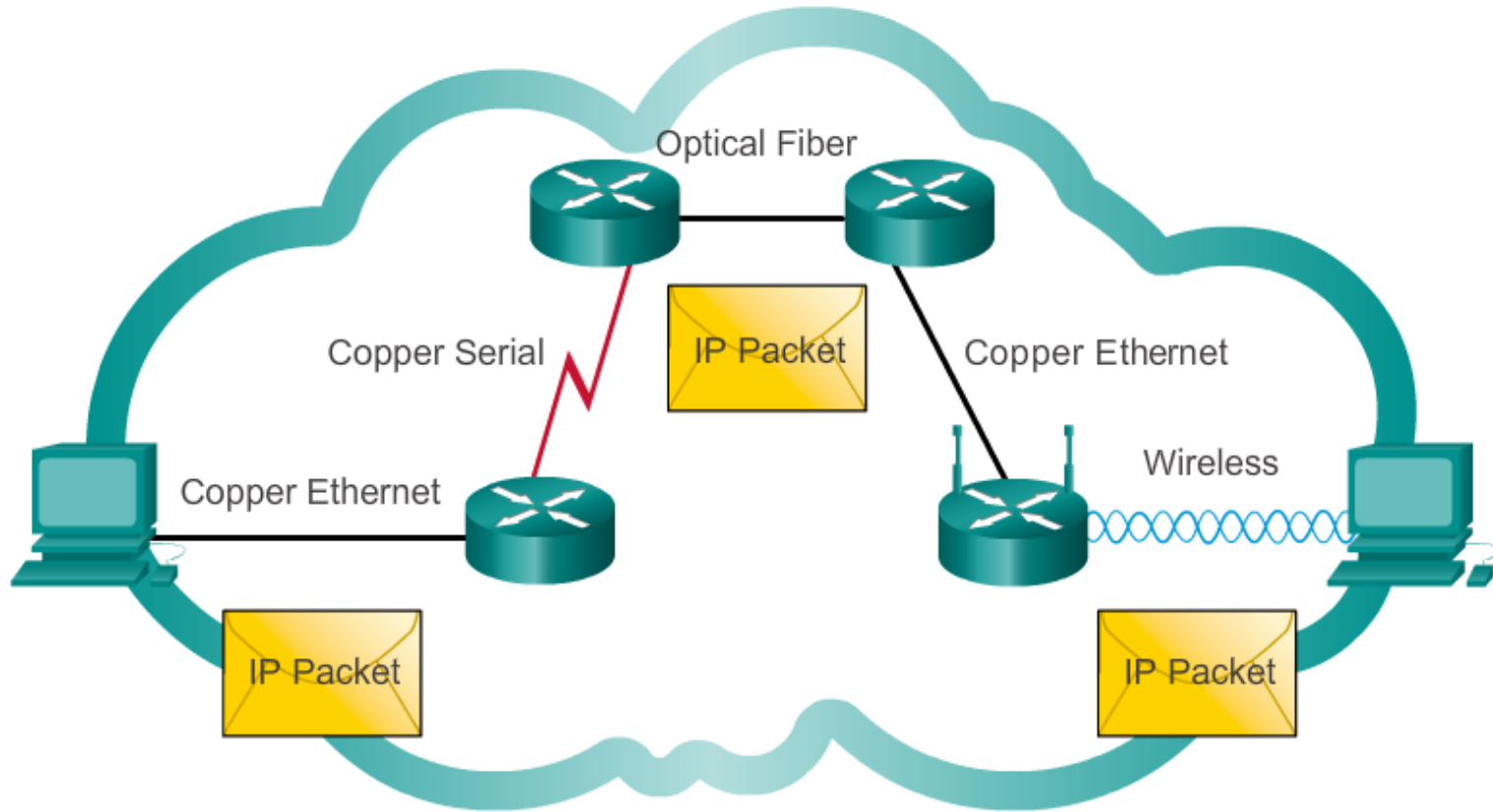


As an unreliable network layer protocol, IP does not guarantee that all sent packets will be received. Other protocols manage the process of tracking packets and ensuring their delivery.



Characteristics of the IP protocol

IP – Media Independent



IP packets can travel over different media.

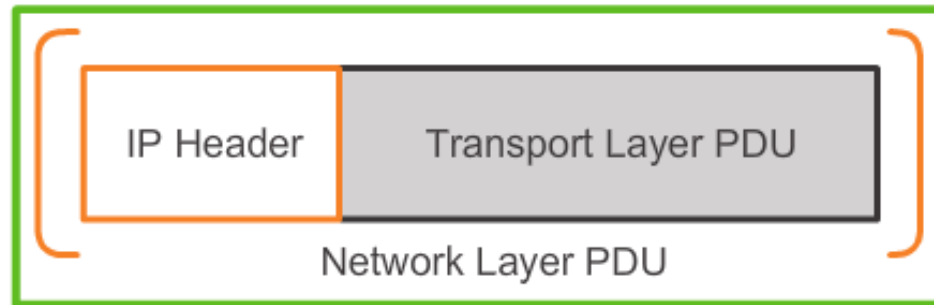


IPv4 Packet Encapsulating IP

Transport Layer Encapsulation



Network Layer Encapsulation



IP Packet

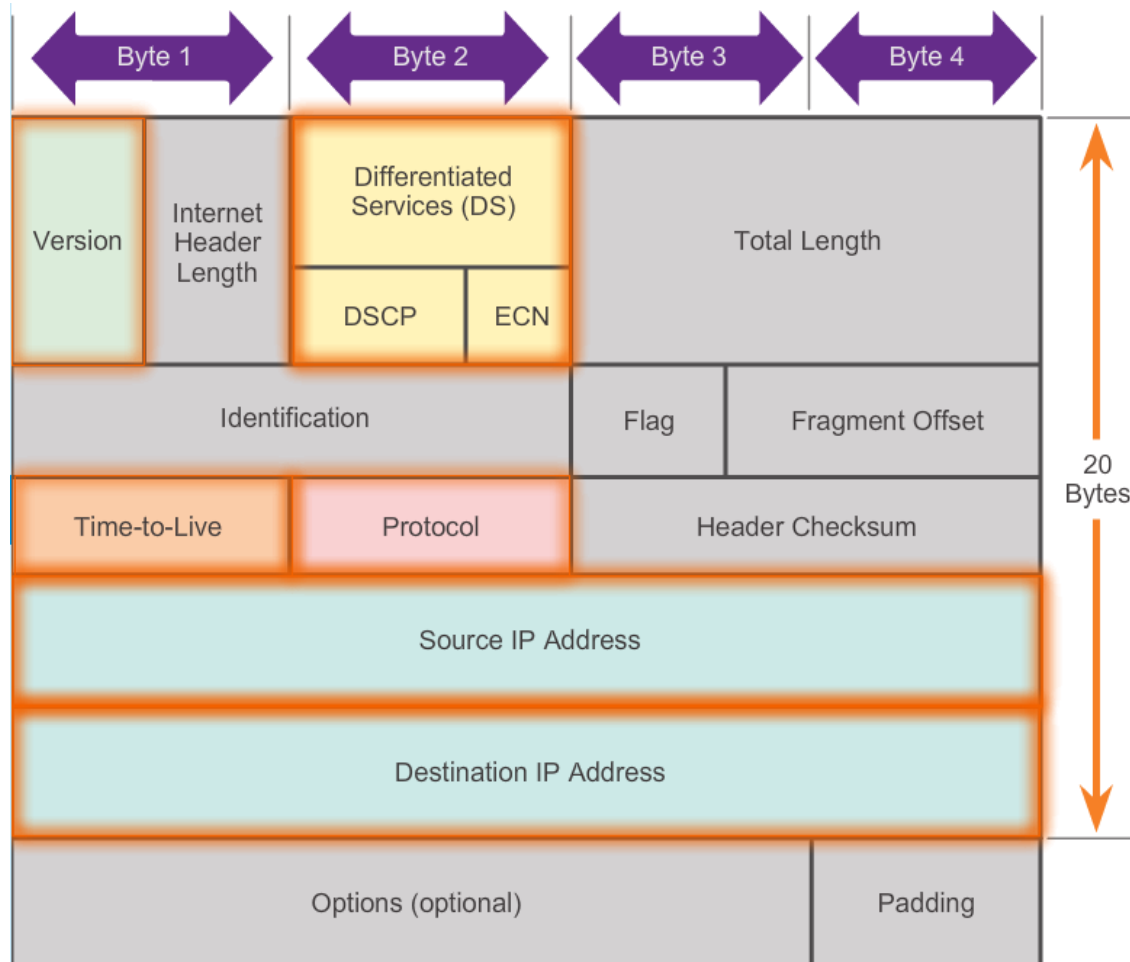
The network layer adds a header so packets can be routed through complex networks and reach their destination. In TCP/IP based networks, the network layer PDU is the IP packet.



IPv4 Packet

IPv4 Packet Header

Contents of the IPv4 packet header

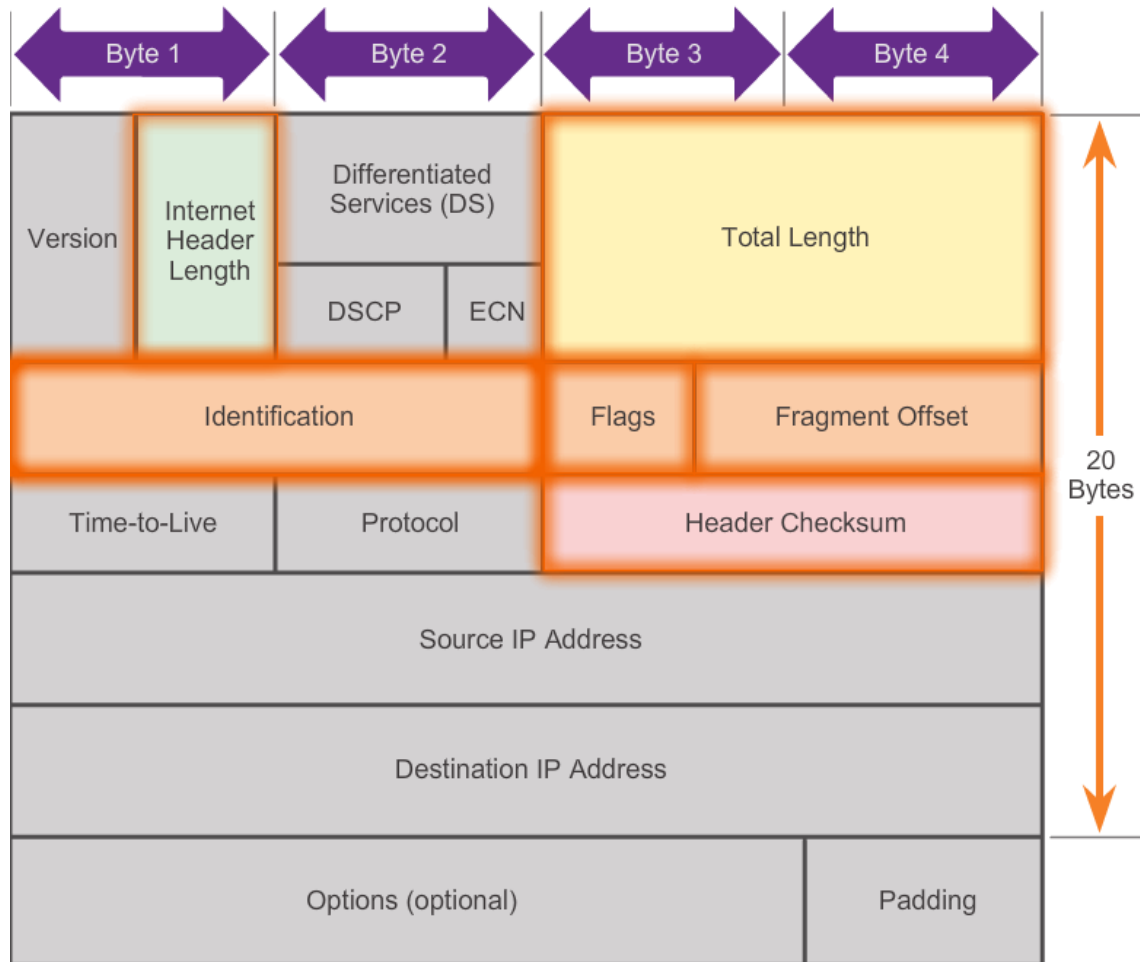




IPv4 Packet

IPv4 Header Fields

Contents of the IPv4 header fields





IPv4 Packet

Sample IPv4 Headers

Microsoft: \Device\NPF_{7BB3C130-30C5-4419-B79E-C0868085ABED} [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
16	3.64050300	192.168.1.109	192.168.1.1	ICMP	74	Echo (ping) request id=0x0001, seq=5/1280, ttl=128
17	3.64506800	192.168.1.1	192.168.1.109	ICMP	74	Echo (ping) reply id=0x0001, seq=5/1280, ttl=64
18	3.68215500	192.168.1.109	38.112.107.53	TCP	54	55502 > https [ACK] Seq=1 Ack=134 Win=16661 Len=0
19	4.19945400	fe80::15ff:98d8:d28ff02::c		SSDP	208	M-SEARCH * HTTP/1.1
20	4.60748800	fe80::15ff:98d8:d28ff02::b1ee:c4ae:a11		SSDP	453	HTTP/1.1 200 OK
21	4.64229900	192.168.1.109	192.168.1.1	ICMP	74	Echo (ping) request id=0x0001, seq=6/1536, ttl=128
22	4.64509200	192.168.1.1	192.168.1.109	ICMP	74	Echo (ping) reply id=0x0001, seq=6/1536, ttl=64
23	4.73605200	192.168.1.109	255.255.255.255	DB-LSP-	154	Droobox LAN svnc Discoverv Protocol

Frame 16: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0

Ethernet II, Src: IntelCor_45:5d:c4 (24:77:03:45:5d:c4), Dst: Cisco-Li_a0:d1:be (00:18:39:a0:d1:be)

Internet Protocol Version 4, Src: 192.168.1.109 (192.168.1.109), Dst: 192.168.1.1 (192.168.1.1)

Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
Total Length: 60
Identification: 0x3704 (14084)
Flags: 0x00
Fragment offset: 0
Time to live: 128
Protocol: ICMP (1)
Header checksum: 0x7ffe [correct]
Source: 192.168.1.109 (192.168.1.109)
Destination: 192.168.1.1 (192.168.1.1)
[Source GeoIP: Unknown]
[Destination GeoIP: Unknown]

Internet Control Message Protocol

```

0000  00 18 39 a0 d1 be 24 77 03 45 5d c4 08 00 45 00  ..9...$w .E]...E.
0010  00 3c 37 04 00 00 80 01 7f fe c0 a8 01 6d c0 a8  .<7.....m...
0020  01 01 08 00 4d 56 00 01 00 05 61 62 63 64 65 66  ...MV.. ..abcdef
0030  67 68 69 6a 6b 6c 6d 6e 6f 70 71 72 73 74 75 76  ghijklmn opqrstuv
0040  77 61 62 63 64 65 66 67 68 69                    wabcdefg hi
  
```

Internet Protocol Version 4 (ip), 20 bytes Packets: 35 Displayed: 35 Marked: 0 Dropped: 0 Profile: Default



Network Layer in Communication

Limitations of IPv4

- IP Address depletion
- Internet routing table expansion
- Lack of end-to-end connectivity





Network Layer in Communication

Introducing IPv6

- Increased address space
- Improved packet handling
- Eliminates the need for NAT
- Integrated security
- 4 billion IPv4 addresses
4,000,000,000
- 340 undecillion IPv6 addresses
340,000,000,000,000,000,000,000,000,000,000,000,000,000,000



IPv6 Packet Encapsulating IPv6

IPv4 and IPv6 Headers

IPv4 Header

Version	IHL	Type of Service	Total Length	
Identification			Flags	Fragment Offset
Time to Live	Protocol		Header Checksum	
Source Address				
Destination Address				
Options			Padding	

IPv6 Header

Version	Traffic Class	Flow Label	
Payload Length		Next Header	Hop Limit
Source Address			
Destination Address			

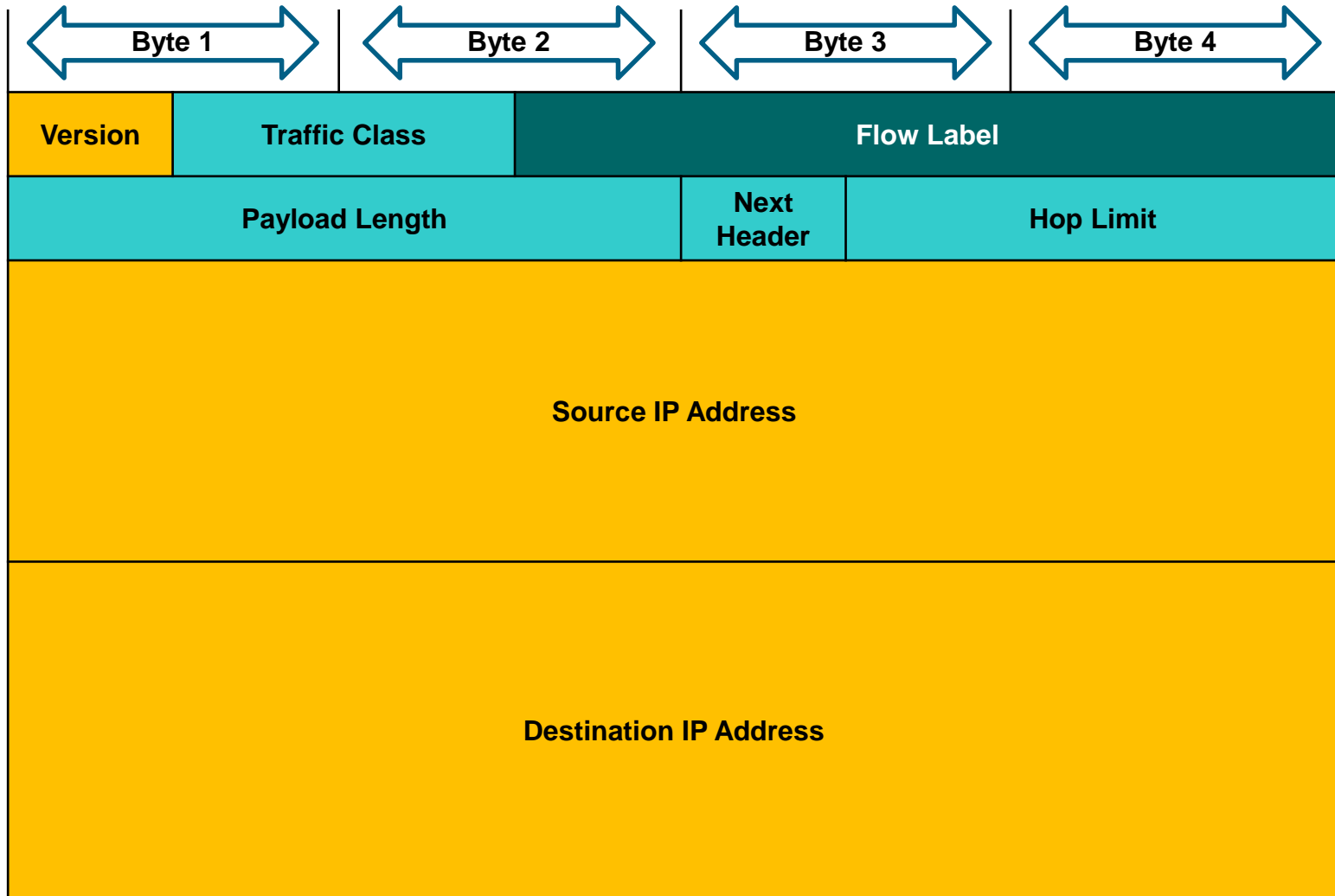
Legend

- Field names kept from IPv4 to IPv6
- Fields not kept in IPv6
- Name & position changed in IPv6
- New field in IPv6



IPv6 Packet

IPv6 Packet Header



IPv6 Packet

Sample IPv6 Header

Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8) interface showing a packet capture of an IPv6 HTTP GET request.

Packet List:

No.	Time	Source	Destination	Protocol	Length	Info
47	325.030878	2001:6f8:900:7c0::2	2001:6f8:102d:0:2d0:9ff:fee3:e8de	TCP	82	59201 > http [ACK] Seq=0 Ack=1 win=6
48	325.031166	2001:6f8:102d:0:2d0:9ff:fee3:e8de	2001:6f8:900:7c0::2	TCP	74	59201 > http [ACK] Seq=1 Ack=1 win=5760
49	325.040411	2001:6f8:102d:0:2d0:9ff:fee3:e8de	2001:6f8:900:7c0::2	HTTP	314	GET / HTTP/1.0
50	325.045496	2001:6f8:900:7c0::2	2001:6f8:102d:0:2d0:9ff:fee3:e8de	TCP	1506	[TCP segment of a reassembled PDU]
51	325.045525	2001:6f8:900:7c0::2	2001:6f8:102d:0:2d0:9ff:fee3:e8de	HTTP	901	HTTP/1.1 200 OK (text/html)
52	325.045627	2001:6f8:900:7c0::2	2001:6f8:102d:0:2d0:9ff:fee3:e8de	TCP	74	http > 59201 [FIN, ACK] Seq=2260 Ack=241

Packet Details (Frame 49):

- Frame 49: 314 bytes on wire (2512 bits), 314 bytes captured (2512 bits)
- Ethernet II, Src: HsingTec_e3:e8:de (00:d0:09:e3:e8:de), Dst: Ibm_82:95:b5 (00:11:25:82:95:b5)
- Internet Protocol Version 6, Src: 2001:6f8:102d:0:2d0:9ff:fee3:e8de (2001:6f8:102d:0:2d0:9ff:fee3:e8de), Dst: 2001:6f8:900:7c0::2 (2001:6f8:900:7c0::2)
 - 0110 = Version: 6
 - 0000 0000 = Traffic class: 0x00000000
 - 0000 0000 0000 0000 = Flowlabel: 0x00000000
 - Payload length: 260
 - Next header: TCP (6)
 - Hop limit: 64
 - Source: 2001:6f8:102d:0:2d0:9ff:fee3:e8de (2001:6f8:102d:0:2d0:9ff:fee3:e8de)
 - [Source SA MAC: HsingTec_e3:e8:de (00:d0:09:e3:e8:de)]
 - Destination: 2001:6f8:900:7c0::2 (2001:6f8:900:7c0::2)
 - [Source GeoIP: Unknown]
 - [Destination GeoIP: Unknown]
- Transmission Control Protocol, Src Port: 59201 (59201), Dst Port: http (80), Seq: 1, Ack: 1, Len: 240
- Hypertext Transfer Protocol

Packet Bytes:

Offset	Hex	ASCII
0000	00 11 25 82 95 b5 00 d0 09 e3 e8 de 86 dd 60 00	..%.
0010	00 00 01 04 06 40 20 01 06 f8 10 2d 00 00 02 d0@ ..-...
0020	09 ff fe e3 e8 de 20 01 06 f8 09 00 07 c0 00 00A .P...a.J
0030	00 00 00 00 00 02 e7 41 00 50 ab dc d6 61 01 4a	s.P....H ..GET /
0040	73 9f 50 18 16 80 f4 48 00 00 47 45 54 20 2f 20	HTTP/1.0 ..Host:
0050	48 54 54 50 2f 31 2e 30 0d 0a 48 6f 73 74 3a 20	cl-1985. ham-01.d
0060	63 6c 2d 31 39 38 35 2e 68 61 6d 2d 30 31 2e 64	e.sixxs. net...Acc
0070	65 2e 73 69 78 78 73 2e 6e 65 74 0d 0a 41 63 63	



6.2 Routing

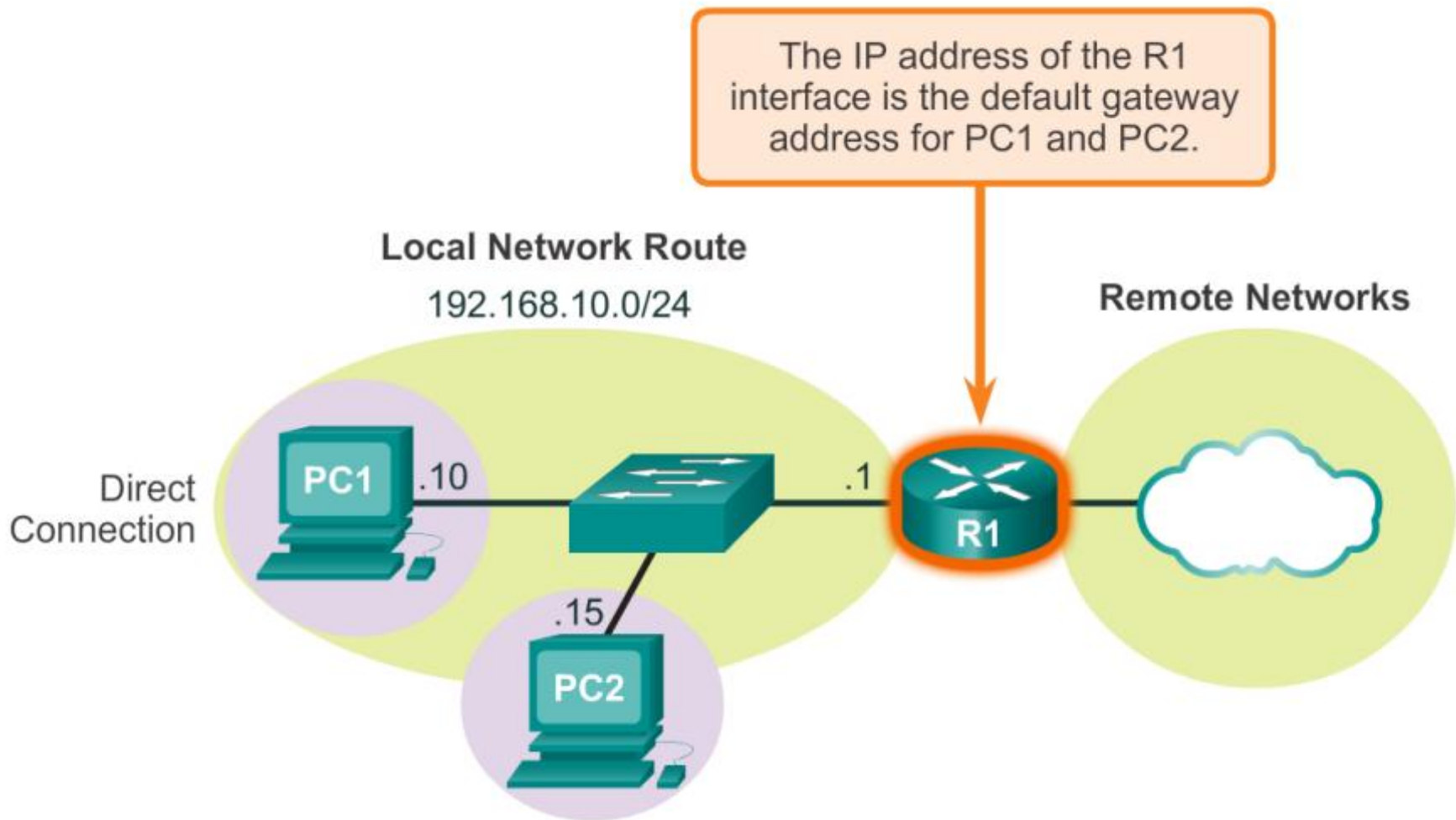


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Host Routing Tables

Host Packet Forwarding Decision





Host Routing Tables

Default Gateway

Hosts must maintain their own, local, routing table to ensure that network layer packets are directed to the correct destination network. The local table of the host typically contains:

- Direct connection
- Local network route
- Local default route



Host Routing Tables

IPv4 Host Routing Table



```
C:\Users\PC1>netstat -r
```

```
<Output omitted>
```

```
IPv4 Route Table
```

```
=====
```

```
Active Routes:
```

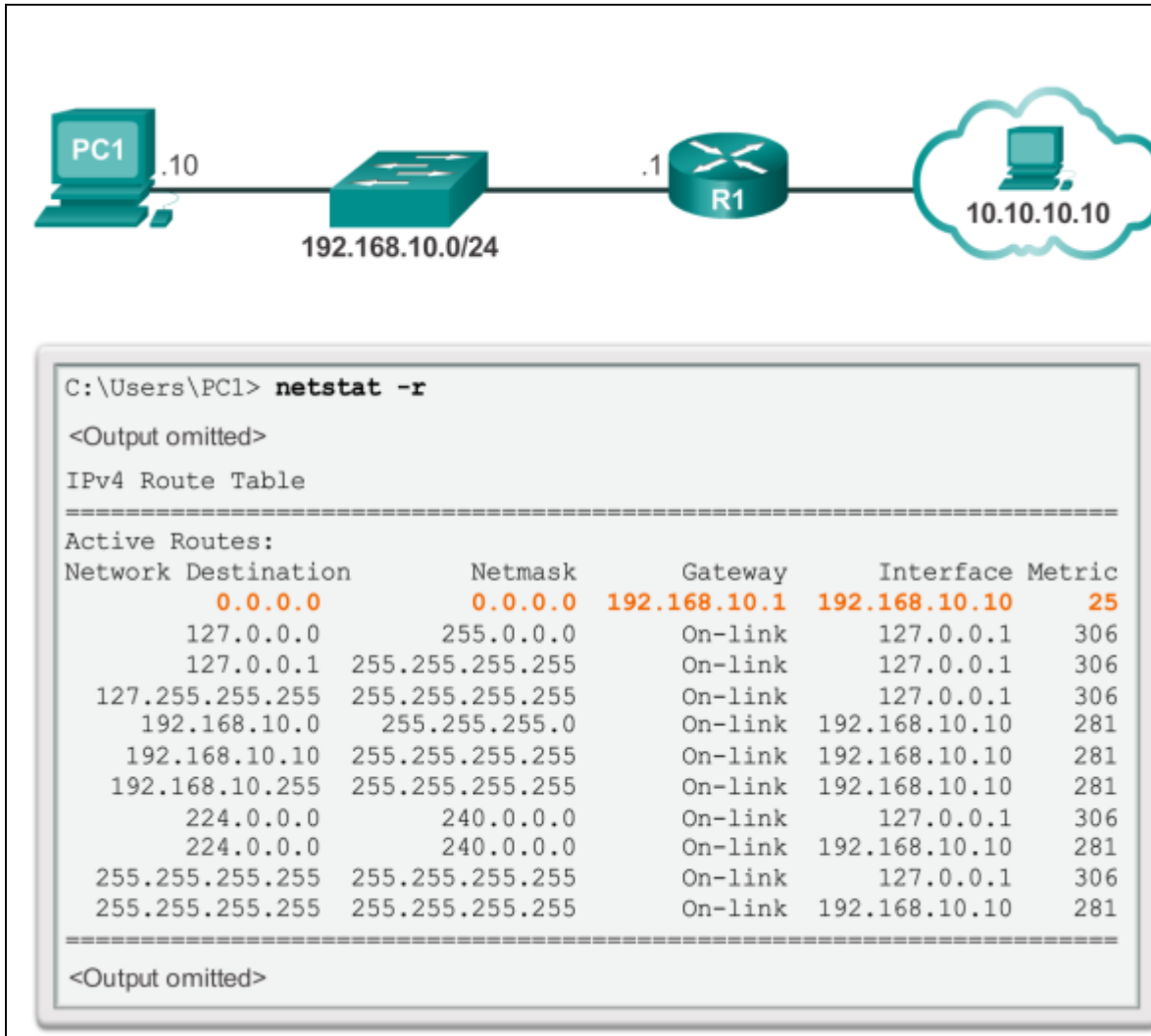
Network	Destination	Netmask	Gateway	Interface	Metric
0.0.0.0		0.0.0.0	192.168.10.1	192.168.10.10	25
127.0.0.0		255.0.0.0	On-link	127.0.0.1	306
127.0.0.1		255.255.255.255	On-link	127.0.0.1	306
127.255.255.255		255.255.255.255	On-link	127.0.0.1	306
192.168.10.0		255.255.255.0	On-link	192.168.10.10	281
192.168.10.10		255.255.255.255	On-link	192.168.10.10	281
192.168.10.255		255.255.255.255	On-link	192.168.10.10	281
224.0.0.0		240.0.0.0	On-link	127.0.0.1	306
224.0.0.0		240.0.0.0	On-link	192.168.10.10	281
255.255.255.255		255.255.255.255	On-link	127.0.0.1	306
255.255.255.255		255.255.255.255	On-link	192.168.10.10	281

```
<Output omitted>
```



Host Routing Tables

Sample IPv4 Host Routing Table





Host Routing Tables

Sample IPv6 Host Routing Table

fe80::2c30:3071:e718:a926/128
2001:db8:9d38:953c:2c30:3071:e718:a926/128



C:\Users\PC1> netstat -r

<Output omitted>

IPv6 Route Table

=====

Active Routes:

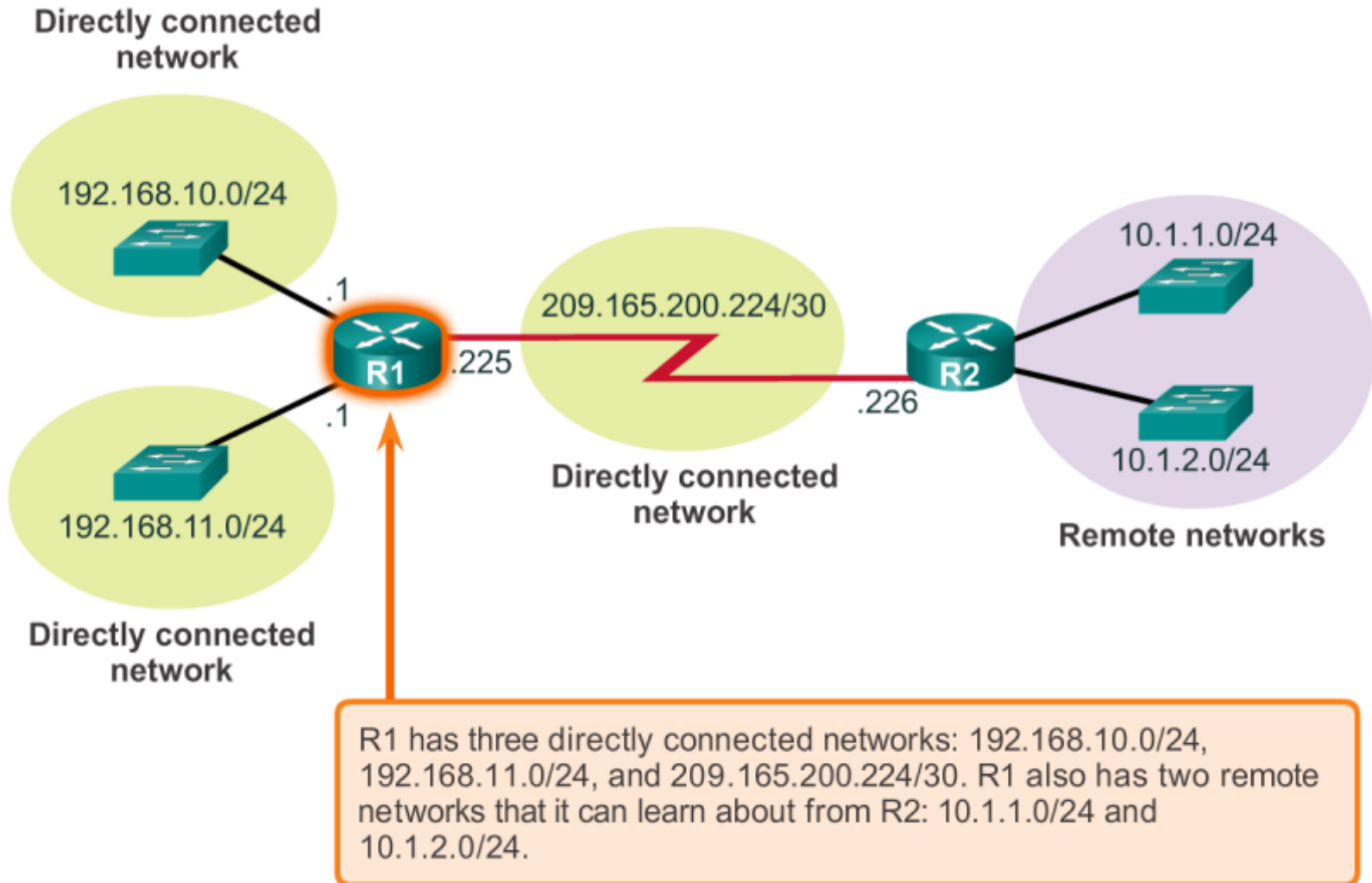
If	Metric	Network	Destination	Gateway
16	58	::/0		On-link
1	306	::1/128		On-link
16	58	2001::/32		On-link
16	306	2001:0:9d38:953c:2c30:3071:e718:a926/128		On-link
15	281	fe80::/64		On-link
16	306	fe80::/64		On-link
16	306	fe80::2c30:3071:e718:a926/128		On-link
15	281	fe80::b1ee:c4ae:a117:271f/128		On-link
1	306	ff00::/8		On-link
16	306	ff00::/8		On-link
15	281	ff00::/8		On-link

<Output omitted>



Router Routing Tables

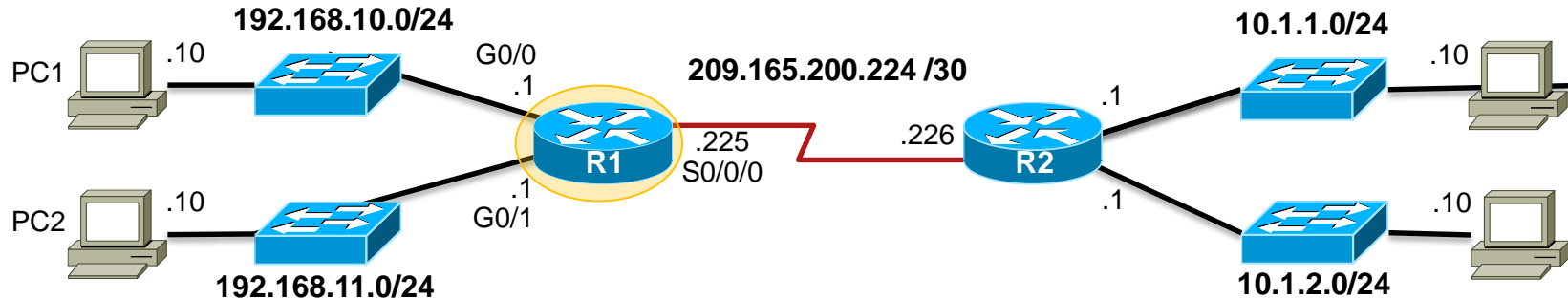
Router Packet Forwarding Decision





Router Routing Tables

IPv4 Router Routing Table



R1#**show ip route**

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
 D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
 N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
 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, ia - IS-IS inter area
 * - candidate default, U - per-user static route, o - ODR
 P - periodic downloaded static route

Gateway of last resort is not set

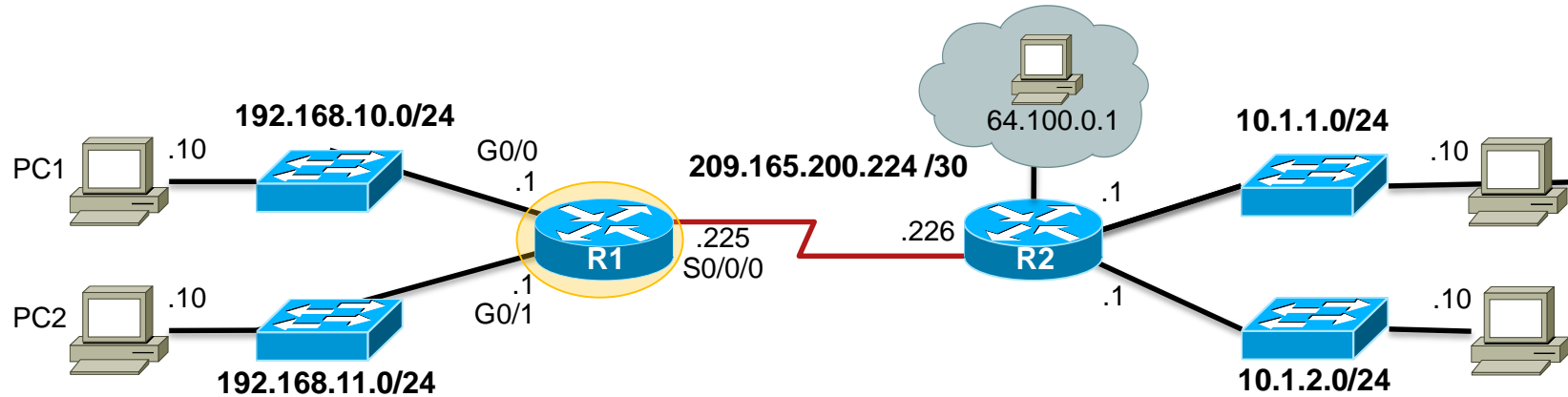
```

10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
D    10.1.1.0/24 [90/2170112] via 209.165.200.226, 00:00:05, Serial0/0/0
D    10.1.2.0/24 [90/2170112] via 209.165.200.226, 00:00:05, Serial0/0/0
192.168.10.0/24 is variably subnetted, 2 subnets, 3 masks
C    192.168.10.0/24 is directly connected, GigabitEthernet0/0
L    192.168.10.1/32 is directly connected, GigabitEthernet0/0
192.168.11.0/24 is variably subnetted, 2 subnets, 3 masks
C    192.168.11.0/24 is directly connected, GigabitEthernet0/1
L    192.168.11.1/32 is directly connected, GigabitEthernet0/1
209.165.200.0/24 is variably subnetted, 2 subnets, 3 masks
C    209.165.200.224/30 is directly connected, Serial0/0/0
L    209.165.200.225/32 is directly connected, Serial0/0/0
R1#
    
```



Router Routing Tables

Directly Connected Routing Table Entries



A

B

C

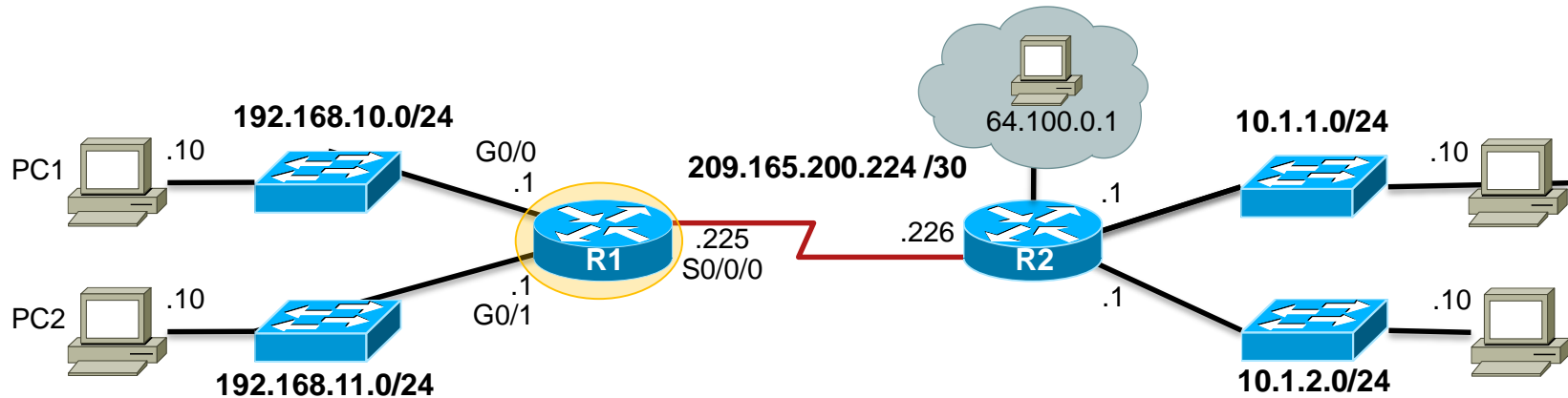
C	192.168.10.0/24 is directly connected,	GigabitEthernet0/0
L	192.168.10.1/32 is directly connected,	GigabitEthernet0/0

A	Identifies how the network was learned by the router.
B	Identifies the destination network and how it is connected.
C	Identifies the interface on the router connected to the destination network.



Router Routing Tables

Remote Network Routing Table Entries

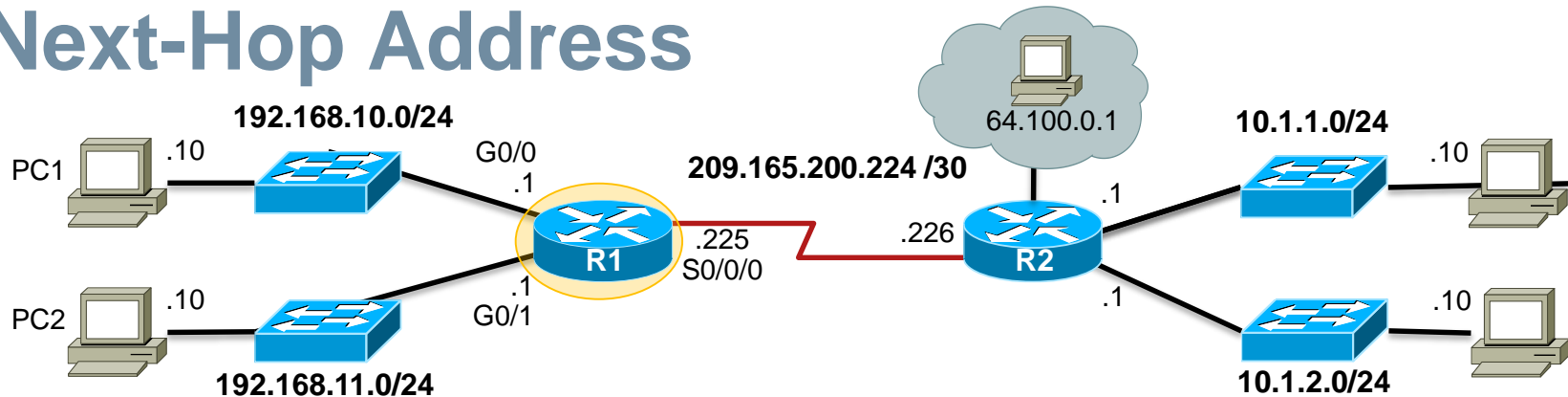


D	10.1.1.0/24	[90/2170112]	via	209.165.200.226,	00:00:05,	Serial10/0/0
---	-------------	--------------	-----	------------------	-----------	--------------

A	Identifies how the network was learned by the router.
B	Identifies the destination network.
C	Identifies the administrative distance (trustworthiness) of the route source.
D	Identifies the metric to reach the remote network.
E	Identifies the next hop IP address to reach the remote network.
F	Identifies the amount of elapsed time since the network was discovered.
G	Identifies the outgoing interface on the router to reach the destination network.

Router Routing Tables

Next-Hop Address



```
R1#show ip route
```

```
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       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, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
```

```
D    10.1.1.0/24 [90/2170112] via 209.165.200.226, 00:00:05, Serial0/0/0
```

```
D    10.1.2.0/24 [90/2170112] via 209.165.200.226, 00:00:05, Serial0/0/0
```

```
192.168.10.0/24 is variably subnetted, 2 subnets, 3 masks
```

```
C    192.168.10.0/24 is directly connected, GigabitEthernet0/0
```

```
L    192.168.10.1/32 is directly connected, GigabitEthernet0/0
```

```
192.168.11.0/24 is variably subnetted, 2 subnets, 3 masks
```

```
C    192.168.11.0/24 is directly connected, GigabitEthernet0/1
```

```
L    192.168.11.1/32 is directly connected, GigabitEthernet0/1
```

```
209.165.200.0/24 is variably subnetted, 2 subnets, 3 masks
```

```
C    209.165.200.224/30 is directly connected, Serial0/0/0
```

```
L    209.165.200.225/32 is directly connected, Serial0/0/0
```

```
R1#
```



6.3 Routers



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Anatomy of a Router

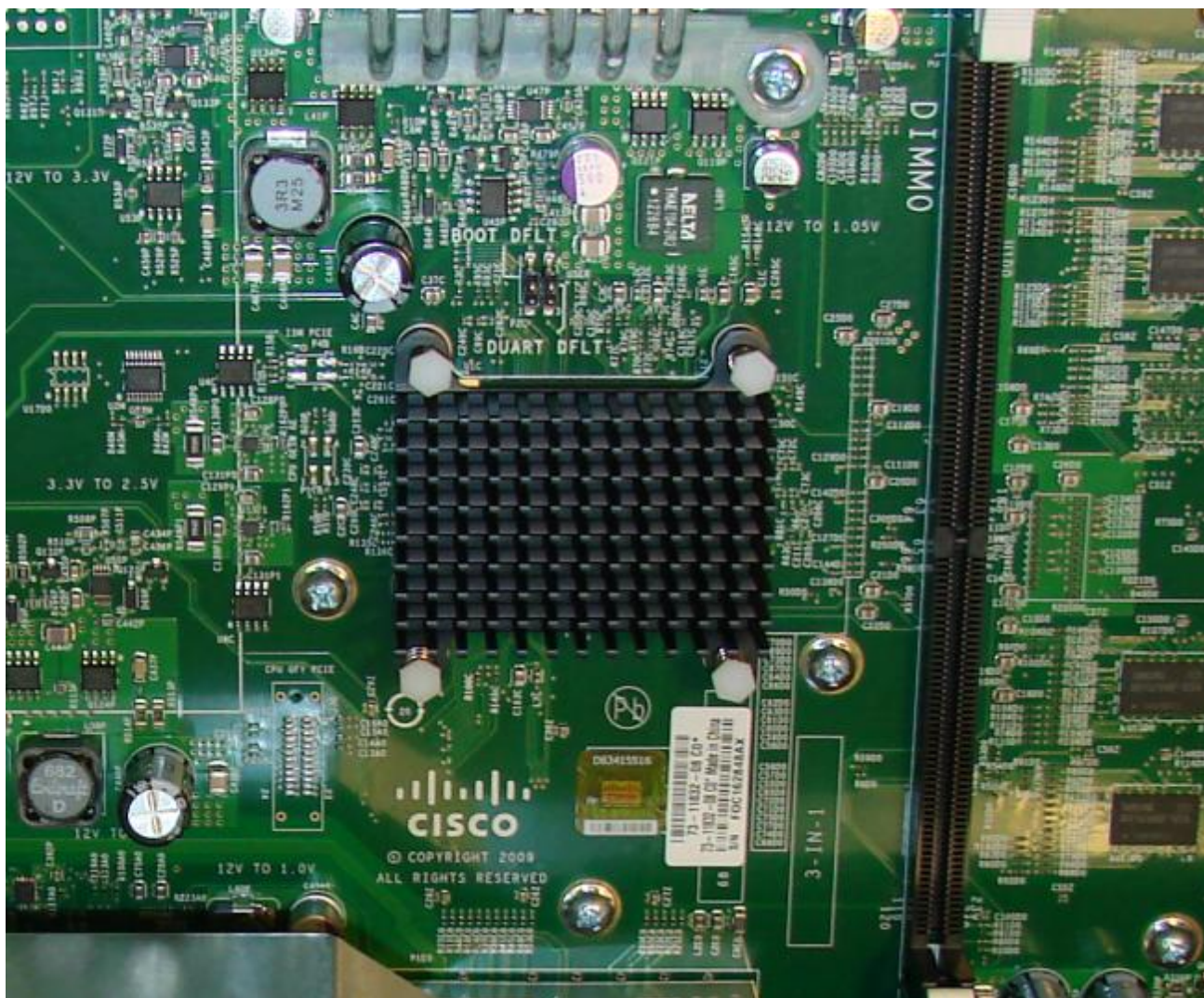
A Router is a Computer





Anatomy of a Router

Router CPU and OS





Anatomy of a Router

Router Memory

Memory	Volatile / Non-Volatile	Stores
RAM	Volatile	<ul style="list-style-type: none"> • Running IOS • Running configuration file • IP routing and ARP tables • Packet buffer
ROM	Non-Volatile	<ul style="list-style-type: none"> • Bootup instructions • Basic diagnostic software • Limited IOS
NVRAM	Non-Volatile	<ul style="list-style-type: none"> • Startup configuration file
Flash	Non-Volatile	<ul style="list-style-type: none"> • IOS • Other system files

Anatomy of a Router

Inside a Router

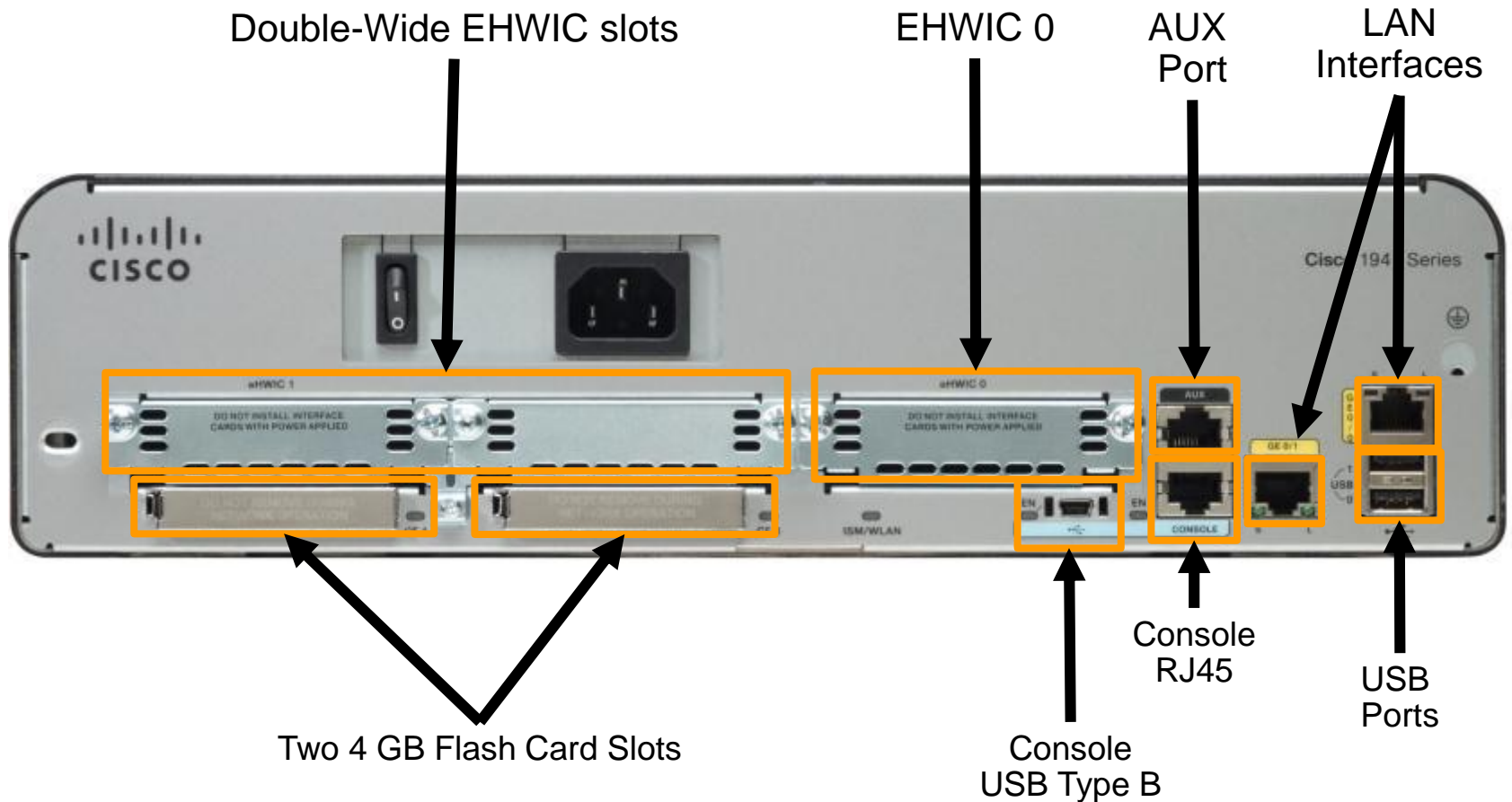
1. Power Supply
2. Shield for WIC
3. Fan
4. SDRAM
5. NVRAM
6. CPU
7. Advanced Integration Module (AIM)





Anatomy of a Router

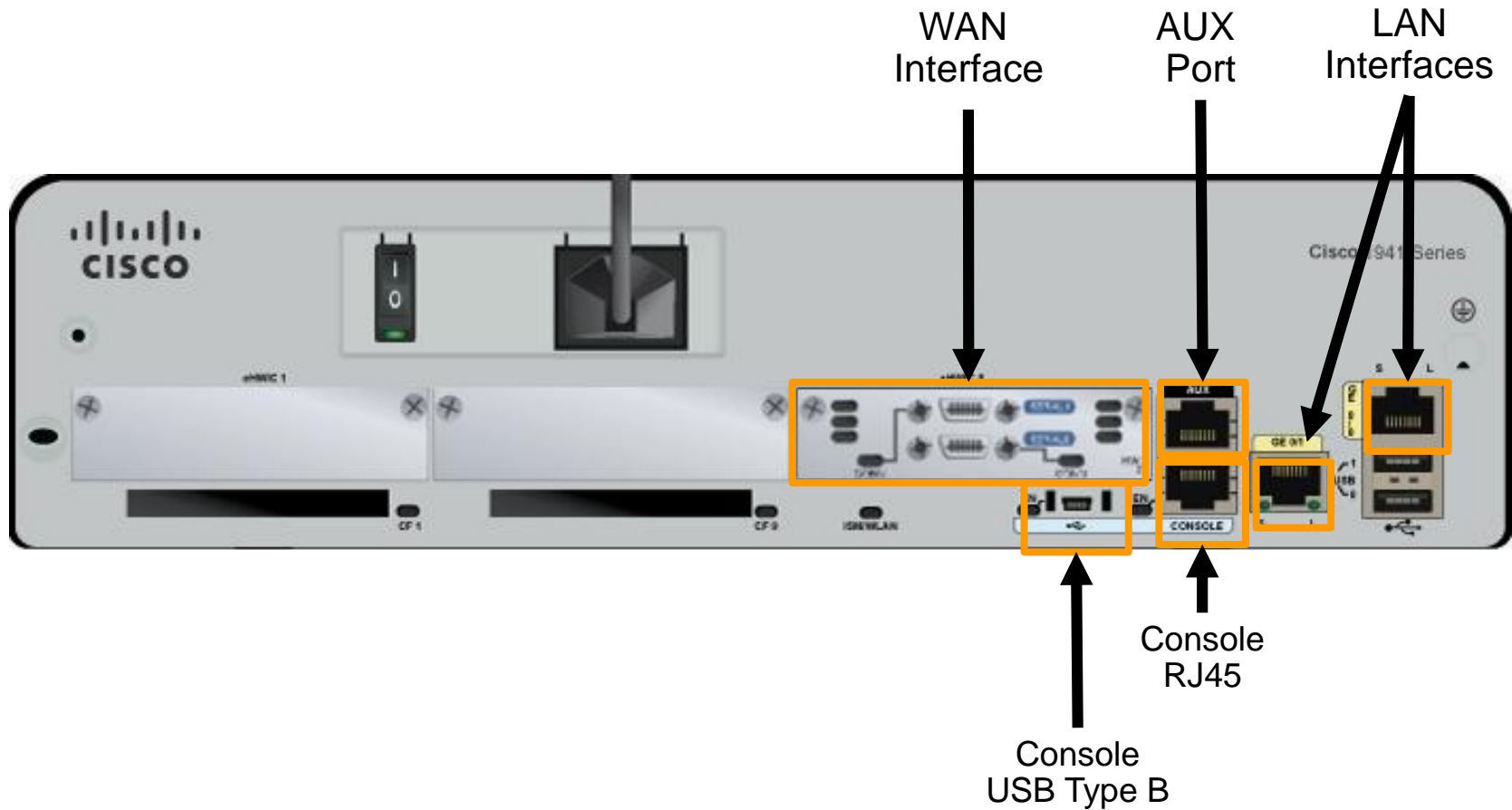
Router Backplane





Anatomy of a Router

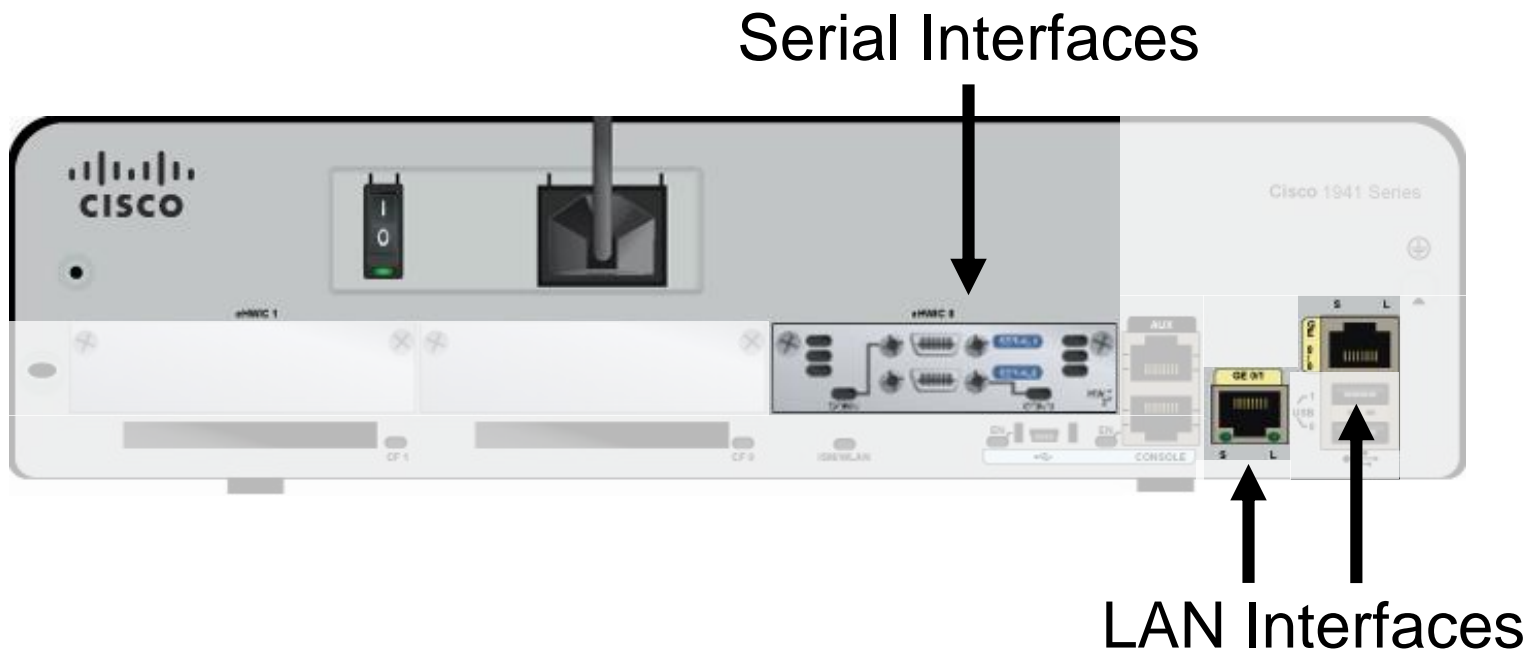
Connecting to a Router





Anatomy of a Router

LAN and WAN Interfaces





Router Boot-up

Cisco IOS

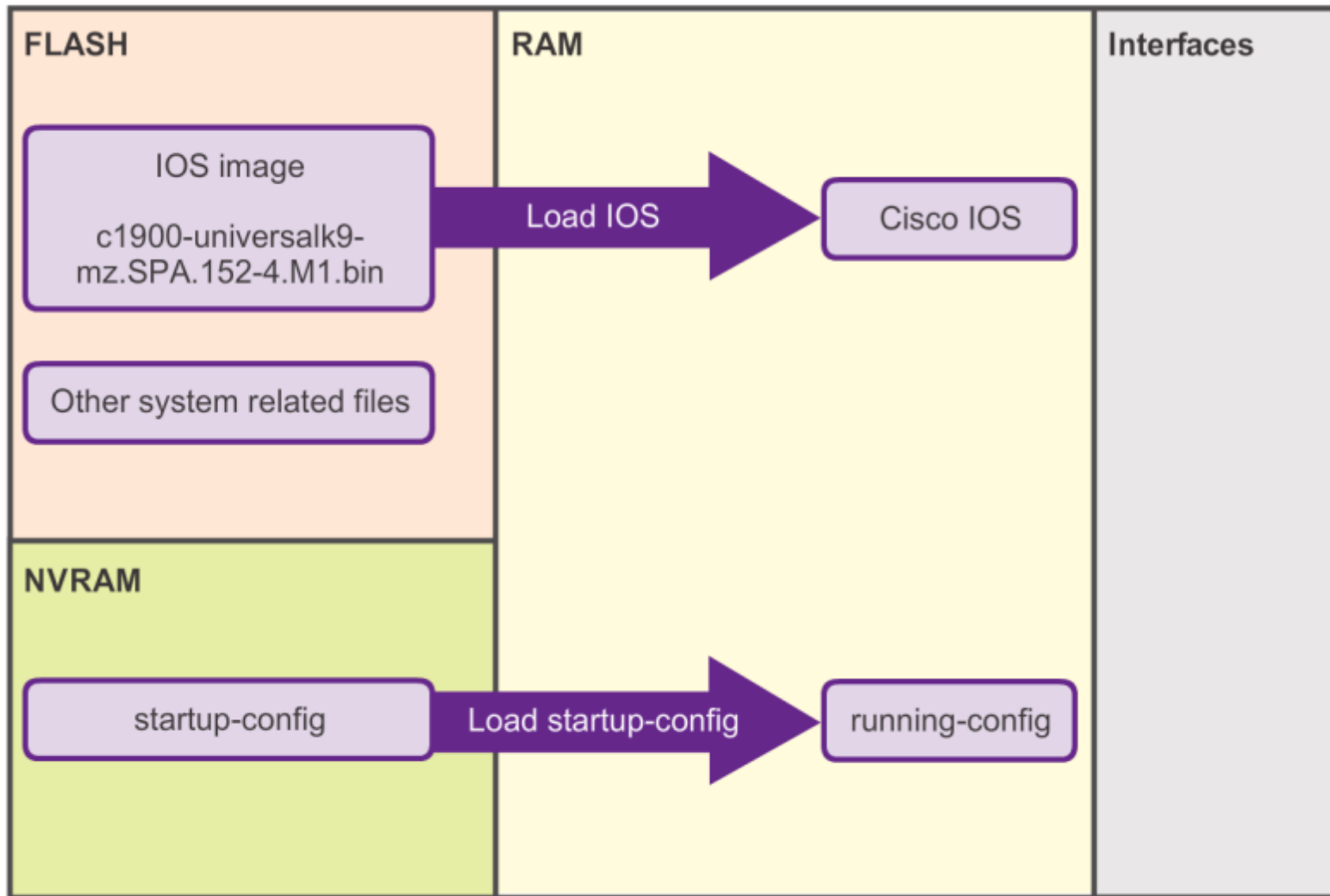
The Cisco IOS operational details vary on different internetworking devices, depending on the device's purpose and feature set. However, Cisco IOS for routers provides the following:

- Addressing
- Interfaces
- Routing
- Security
- QoS
- Resources Management



Router Boot-up

Bootset Files

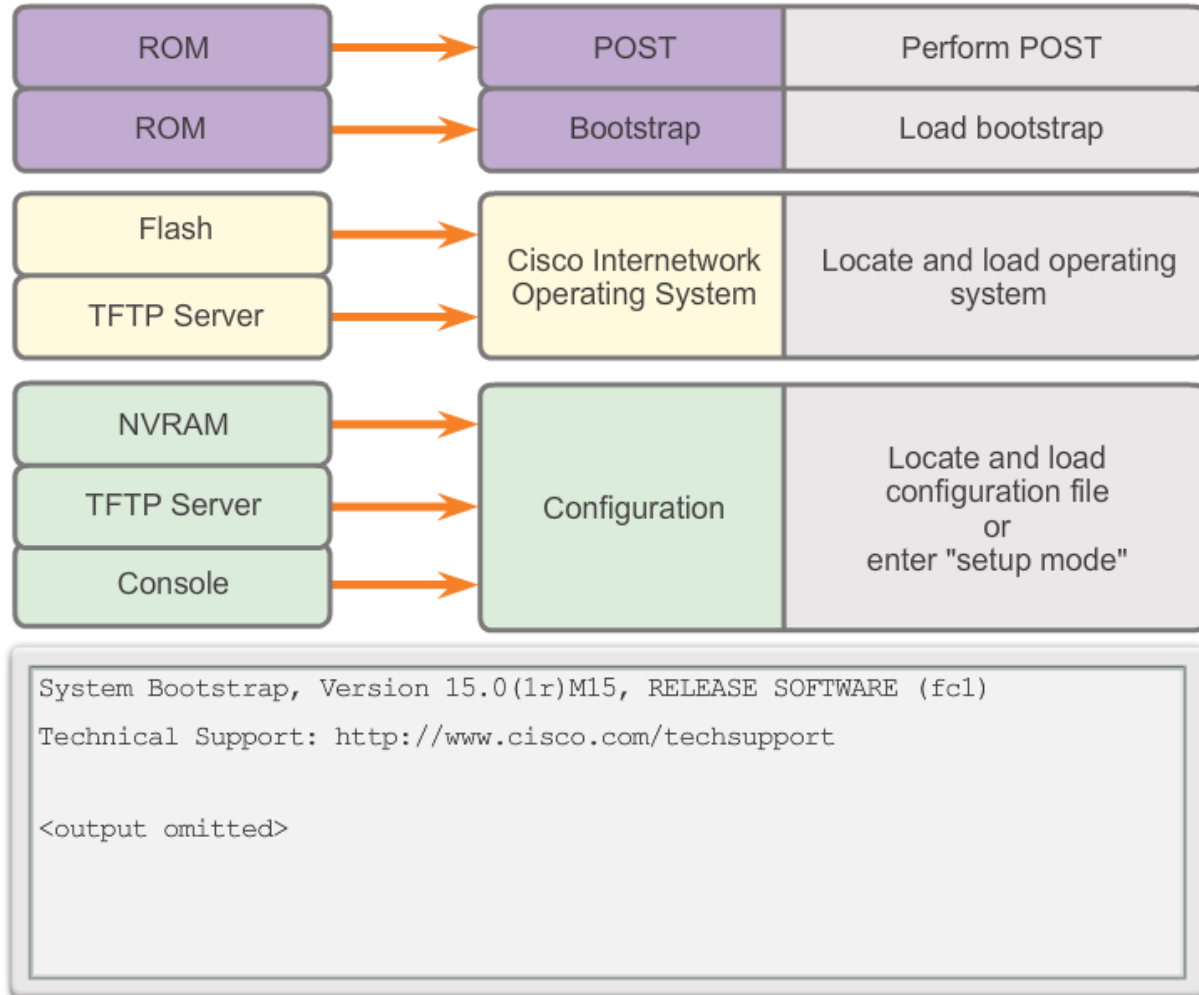




Router Boot-up

Router Bootup Process

How a Router Boots Up





Router Boot-up

Show Versions Output

```
Router# show version
Cisco IOS Software, C1900 Software (C1900-UNIVERSALK9-M), Version 15.2(4)M1, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Thu 26-Jul-12 19:34 by prod_rel_team

ROM: System Bootstrap, Version 15.0(1r)M15, RELEASE SOFTWARE (fc1)

Router uptime is 10 hours, 9 minutes
System returned to ROM by power-on
System image file is "flash0:c1900-universalk9-mz.SPA.152-4.M1.bin"
Last reload type: Normal Reload
Last reload reason: power-on

<Output omitted>

Cisco CISC01941/K9 (revision 1.0) with 446464K/77824K bytes of memory.
Processor board ID FTX1636848Z
2 Gigabit Ethernet interfaces
2 Serial(sync/async) interfaces
1 terminal line
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
250880K bytes of ATA System CompactFlash 0 (Read/Write)

<Output omitted>

Technology Package License Information for Module:'c1900'

-----
Technology      Technology-package      Technology-package
                Current         Type                Next reboot
-----
ipbase          ipbasek9              Permanent          ipbasek9
security        None                  None               None
data            None                  None               None

Configuration register is 0x2142 (will be 0x2102 at next reload)

Router#
```



6.4 Configuring a Cisco Router

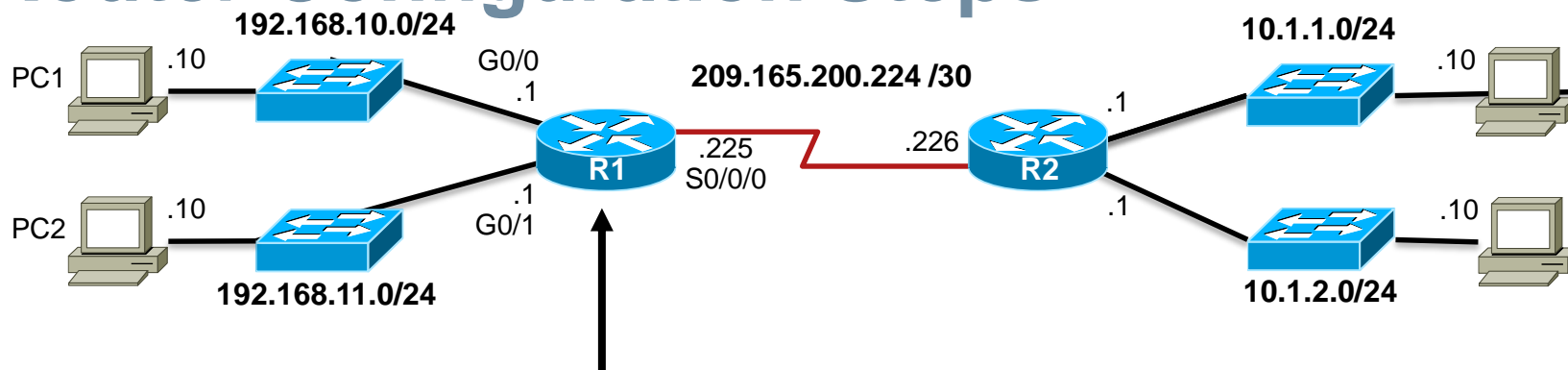


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Configure Initial Settings

Router Configuration Steps



```
Router> enable
Router# configure terminal
Enter configuration commands, one per line.
End with CNTL/Z.
Router(config)# hostname R1
R1(config)#
```

OR

```
Router> en
Router# conf t
Enter configuration commands, one per line.
End with CNTL/Z.
Router(config)# ho R1
R2(config)#
```

```
R1(config)# enable secret class
R1(config)#
R1(config)# line console 0
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# exit
R1(config)#
R1(config)# line vty 0 4
R1(config-line)# password cisco
R1(config-line)# login
R1(config-line)# exit
R1(config)#
R1(config)# service password-encryption
R1(config)#
```

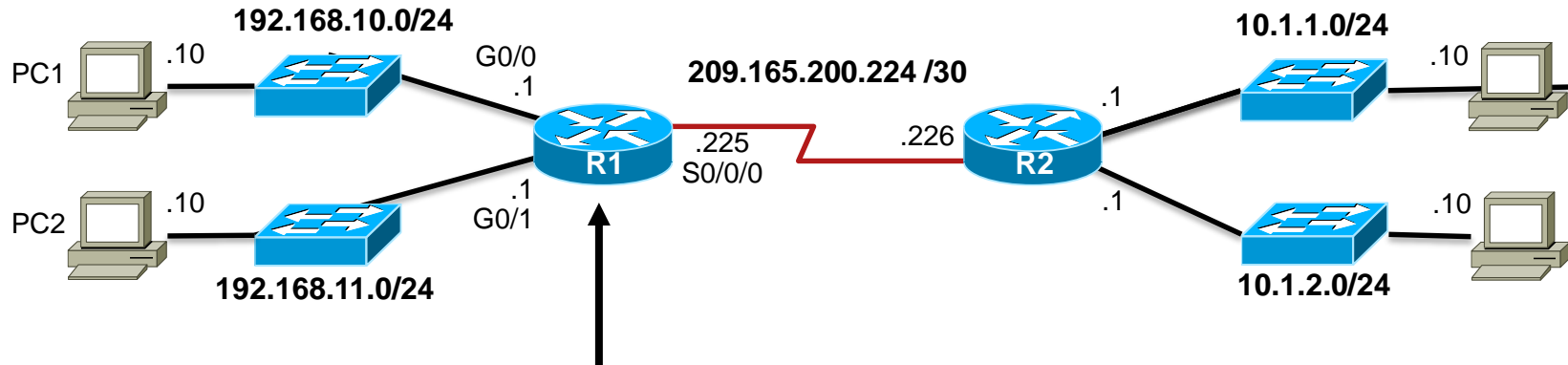
```
R1(config)# banner motd #
Enter TEXT message. End with the character '#'.
*****
WARNING: Unauthorized access is prohibited!
*****
#
R1(config)#
```

```
R1# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#
```



Configure Interfaces

Configure LAN Interfaces

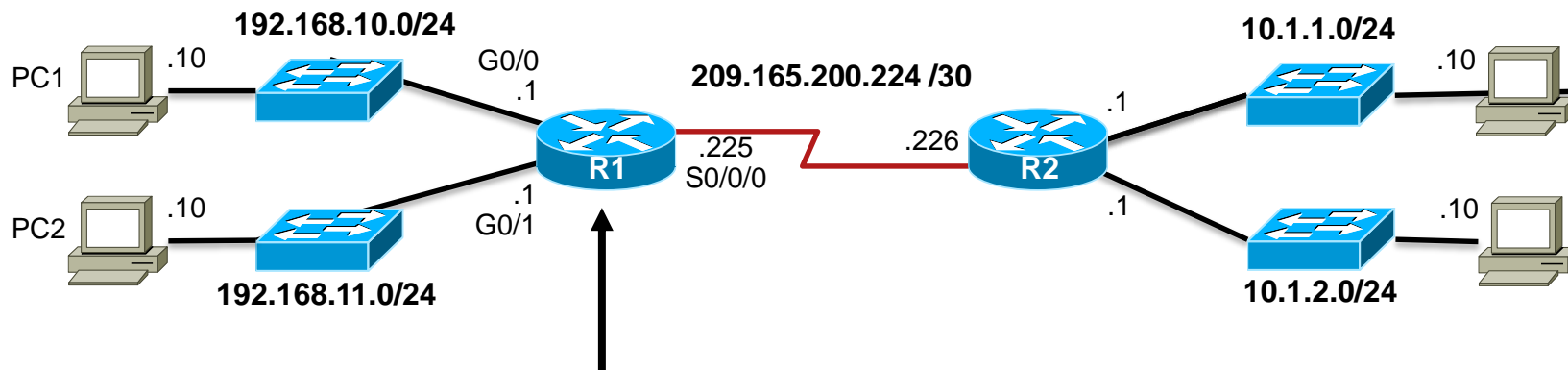


```
R1# conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#
R1(config)# interface gigabitethernet 0/0
R1(config-if)# ip address 192.168.10.1 255.255.255.0
R1(config-if)# description Link to LAN-10
R1(config-if)# no shutdown
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
R1(config-if)# exit
R1(config)#
R1(config)# int g0/1
R1(config-if)# ip add 192.168.11.1 255.255.255.0
R1(config-if)# des Link to LAN-11
R1(config-if)# no shut
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up
R1(config-if)# exit
R1(config)#
```



Configure Interfaces

Verify Interface Configuration



```
R1# show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0       192.168.10.1    YES manual  up          up
GigabitEthernet0/1       192.168.11.1    YES manual  up          up
Serial0/0/0              209.165.200.225 YES manual  up          up
Serial0/0/1              unassigned      YES NVRAM   administratively down down
Vlan1                    unassigned      YES NVRAM   administratively down down
R1#
R1# ping 209.165.200.226

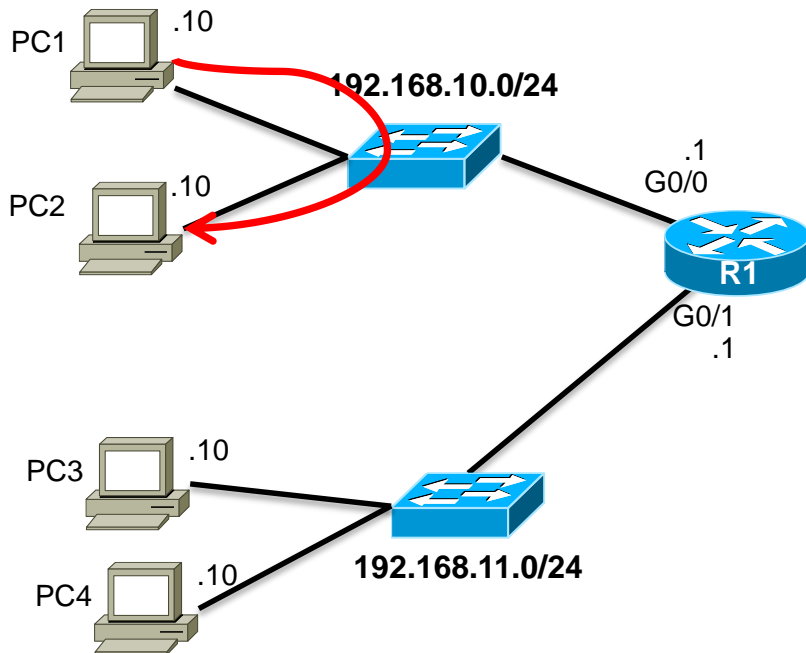
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 209.165.200.226, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/9 ms
R1#
```



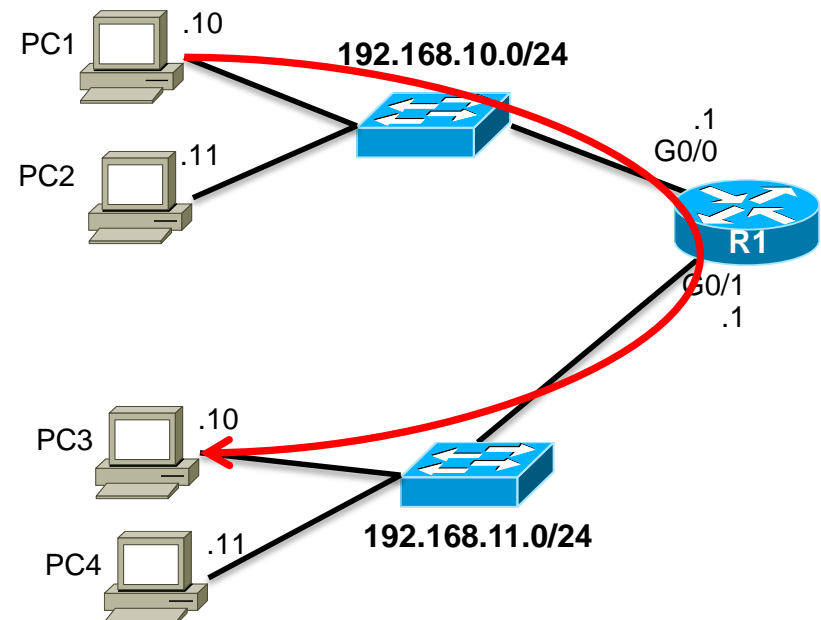
Configuring the Default Gateway

Default Gateway on a Host

Default Gateway
not needed



Default Gateway
needed

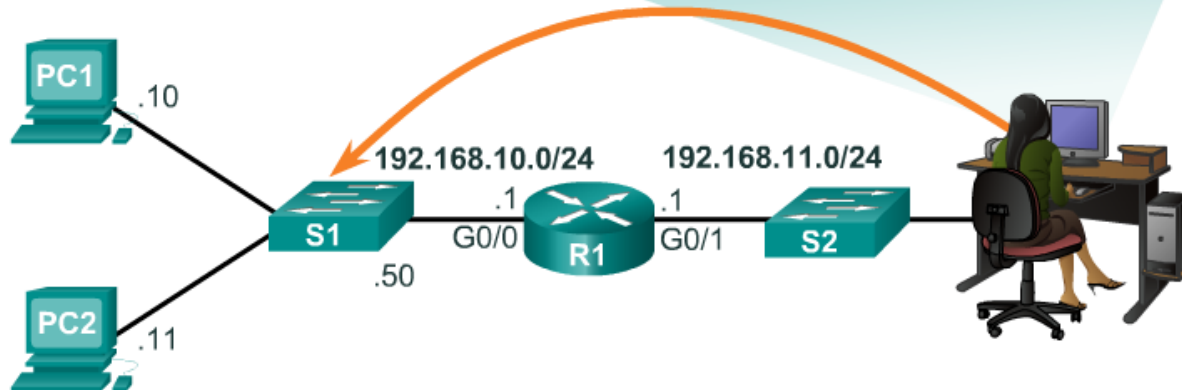




Configuring the Default Gateway

Default Gateway on a Switch

```
S1# show running-config
Building configuration...
!
<output omitted>
service password-encryption
!
hostname S1
!
Interface Vlan1
ip address 192.168.10.50
!
ip default-gateway 192.168.10.1
<output omitted>
```



If the default gateway was not configured on S1, response packets from S1 would not be able to reach the administrator at 192.168.11.10. The administrator would not be able to manage the device remotely.



Network Layer Summary

In this chapter, you learned:

- The network layer, or OSI Layer 3, provides services to allow end devices to exchange data across the network.
- The network layer uses four basic processes: IP addressing for end devices, encapsulation, routing, and de-encapsulation.
- The Internet is largely based on IPv4, which is still the most widely-used network layer protocol.
- An IPv4 packet contains the IP header and the payload.
- The IPv6 simplified header offers several advantages over IPv4, including better routing efficiency, simplified extension headers, and capability for per-flow processing.



Network Layer Summary (cont.)

- In addition to hierarchical addressing, the network layer is also responsible for routing.
- Hosts require a local routing table to ensure that packets are directed to the correct destination network.
- The local default route is the route to the default gateway.
- The default gateway is the IP address of a router interface connected to the local network.
- When a router, such as the default gateway, receives a packet, it examines the destination IP address to determine the destination network.



Network Layer Summary (cont.)

- The routing table of a router stores information about directly-connected routes and remote routes to IP networks. If the router has an entry in its routing table for the destination network, the router forwards the packet. If no routing entry exists, the router may forward the packet to its own default route, if one is configured or it will drop the packet.
- Routing table entries can be configured manually on each router to provide static routing or the routers may communicate route information dynamically between each other using a routing protocol.
- For routers to be reachable, the router interface must be configured.

