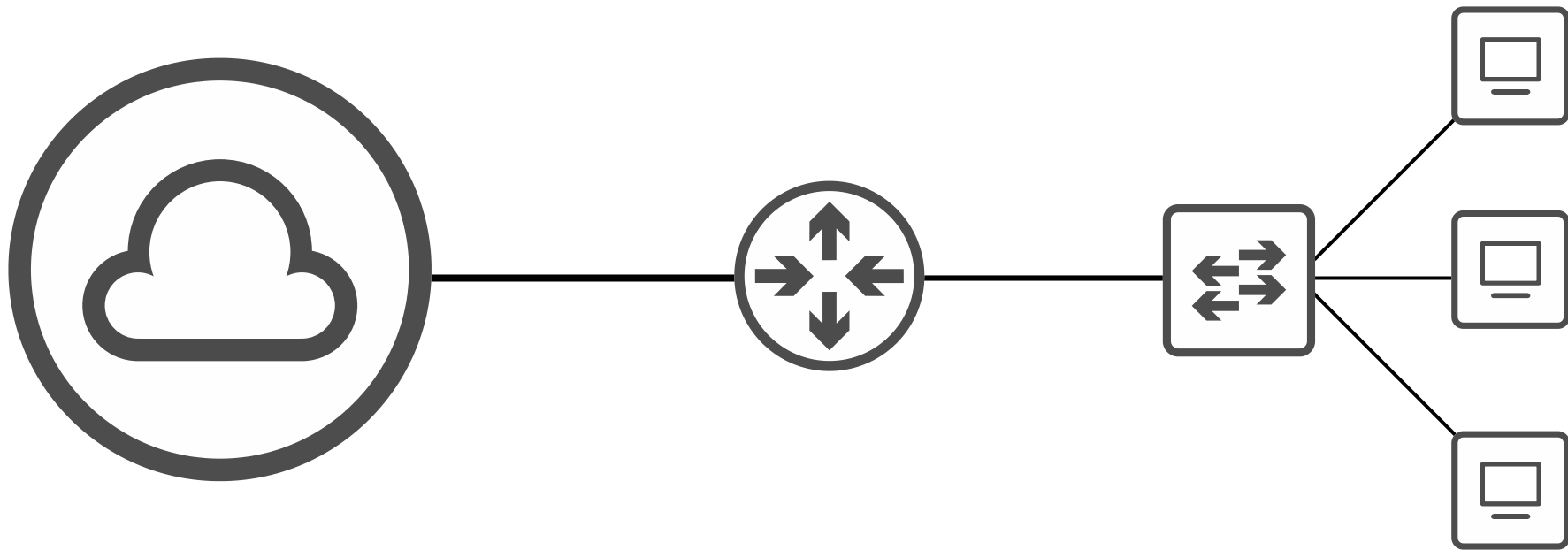




CCNA 200-301 Day 8

IPv4 Addressing (Part 2)





Things we'll cover

- IPv4 address classes (review, clarification)
- Finding the ...
 - maximum number of hosts,
 - network address,
 - broadcast address,
 - first usable address,
 - last usable address of a particular network
- Configuring IP addresses on Cisco devices

IPv4 Address Classes

Class	First octet	First octet numeric range
A	0xxxxxxx	0-127
B	10xxxxxx	128-191
C	110xxxxx	192-223
D	1110xxxx	224-239
E	1111xxxx	240-255



IPv4 Address Classes

Class	Leading bits	Size of <i>network number</i> bit field	Size of <i>rest</i> bit field	Number of networks	Addresses per network
Class A	0	8	24	128 (2^7)	16,777,216 (2^{24})
Class B	10	16	16	16,384 (2^{14})	65,536 (2^{16})
Class C	110	24	8	2,097,152 (2^{21})	256 (2^8)

Maximum Hosts per Network

192.168.1.0/24 → 192.168.1.255/24

Host portion = 8 bits = $2^8 = 256$

Host portion all 0s = **network address**
(network ID)

Host portion all 1s = **broadcast address**

Maximum hosts per network = $2^8 - 2 = 254$

Maximum Hosts per Network

172.16.0.0/16 → 172.16.255.255/16

Host portion = 16 bits = $2^{16} = 65,536$

Host portion all 0s = **network address**
(network ID)

Host portion all 1s = **broadcast address**

Maximum hosts per network = $2^{16} - 2 = 65,534$

Maximum Hosts per Network

10.0.0.0/8



10.255.255.255/8



Host portion = 24 bits = $2^{24} = 16,777,216$



Host portion all 0s = **network address**
(network ID)

Host portion all 1s = **broadcast address**

Maximum hosts per network = $2^{24} - 2 = 16,777,214$

Maximum hosts per network = $2^n - 2$
(n = number of host bits)

First/Last Usable Address

192.168.1.0/24



Host portion all 0s = **network address**
(network ID)

00000000



00000001

192.168.1.1/24

= first usable address

192.168.1.255/24



Host portion all 1s = **broadcast address**

11111111



11111110

192.168.1.254/24

= last usable address

First/Last Usable Address

172.16.0.0/16



Host portion all 0s = **network address**
(network ID)

00000000 00000000



00000000 00000001

172.16.0.1/16

= first usable address

172.16.255.255/16



Host portion all 1s = **broadcast address**

11111111 11111111



11111111 11111110

172.16.255.254/16

= last usable address

First/Last Usable Address

10.0.0.0/8



Host portion all 0s = **network address**
(network ID)

00000000 00000000 00000000



00000000 00000000 00000001

10.0.0.1/8

= first usable address



10.255.255.255/8



Host portion all 1s = **broadcast address**

11111111 11111111 11111111



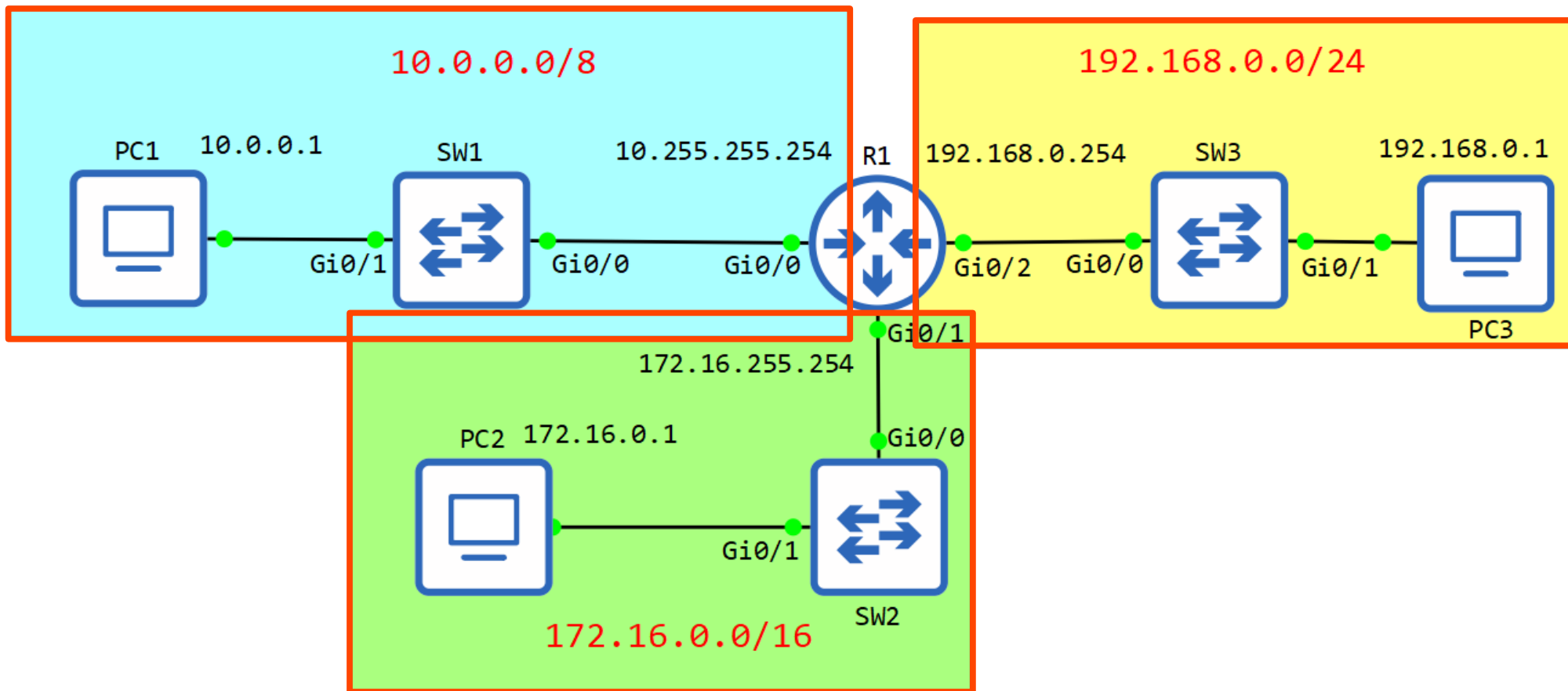
11111111 11111111 11111110

10.255.255.254/8

= last usable address



IPv4 Addressing



IPv4 Addressing

Layer 1 status

Layer 2 status

```
R1>en
```

```
R1#show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	unassigned	YES	unset	administratively down	down
GigabitEthernet0/1	unassigned	YES	unset	administratively down	down
GigabitEthernet0/2	unassigned	YES	unset	administratively down	down
GigabitEthernet0/3	unassigned	YES	unset	administratively down	down

```
R1#
```

- administratively down: Interface has been disabled with the 'shutdown' command.
- This is the default Status of Cisco router interfaces.
- Cisco switch interfaces are NOT administratively down by default.

IPv4 Addressing

```
R1#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
R1(config)#interface gigabitethernet 0/0
```

```
R1(config-if)#
```

```
R1(config)#interface gigabitethernet0/0  
R1(config-if)#
```

```
R1(config)#i?  
id-manager  ida-client  identity      interface  
ip           ipc        iphc-profile  ipv6  
isis        ixi
```

```
R1(config)#in?  
interface
```

```
R1(config)#in g?  
GMPLS  GigabitEthernet  Group-Async
```

```
R1(config)#in g0/0  
R1(config-if)#
```

IPv4 Addressing

```
R1(config-if)#ip address 10.255.255.254 ?  
A.B.C.D  IP subnet mask
```

```
R1(config-if)#ip address 10.255.255.254 255.0.0.0
```

```
R1(config-if)#no shutdown
```

```
R1(config-if)#
```

```
*Dec  7 08:29:08.937: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed state to up
```

```
*Dec  7 08:29:09.938: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/  
0, changed state to up
```

```
R1(config-if)#
```

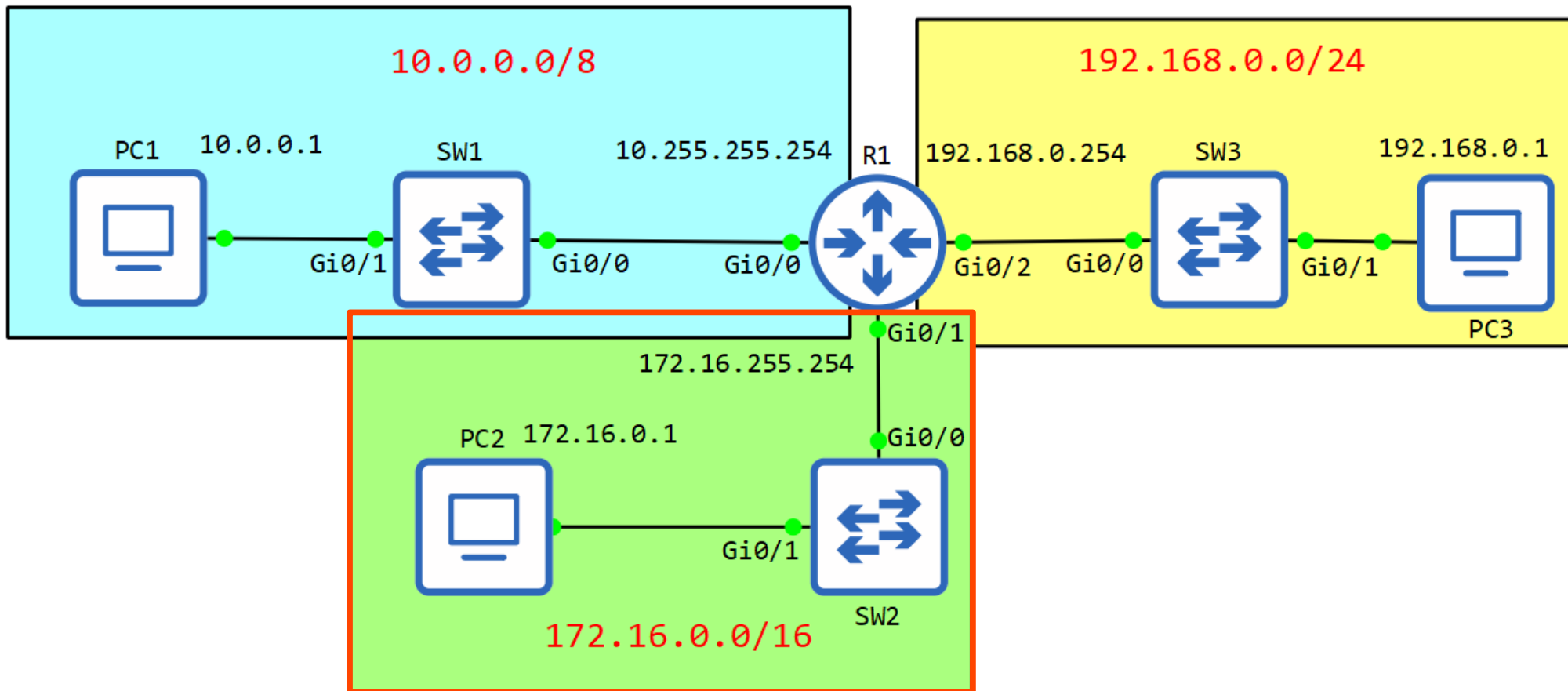
```
R1(config-if)#do sh ip int br
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	10.255.255.254	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	unset	administratively down	down
GigabitEthernet0/2	unassigned	YES	unset	administratively down	down
GigabitEthernet0/3	unassigned	YES	unset	administratively down	down

```
R1(config-if)#
```



IPv4 Addressing



IPv4 Addressing

```
R1(config-if)#int g0/1
```

```
R1(config-if)#ip add 172.16.255.254 255.255.0.0
```

```
R1(config-if)#no shut
```

```
R1(config-if)#
```

```
*Dec  7 08:51:42.648: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to up
```

```
*Dec  7 08:51:43.649: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
```

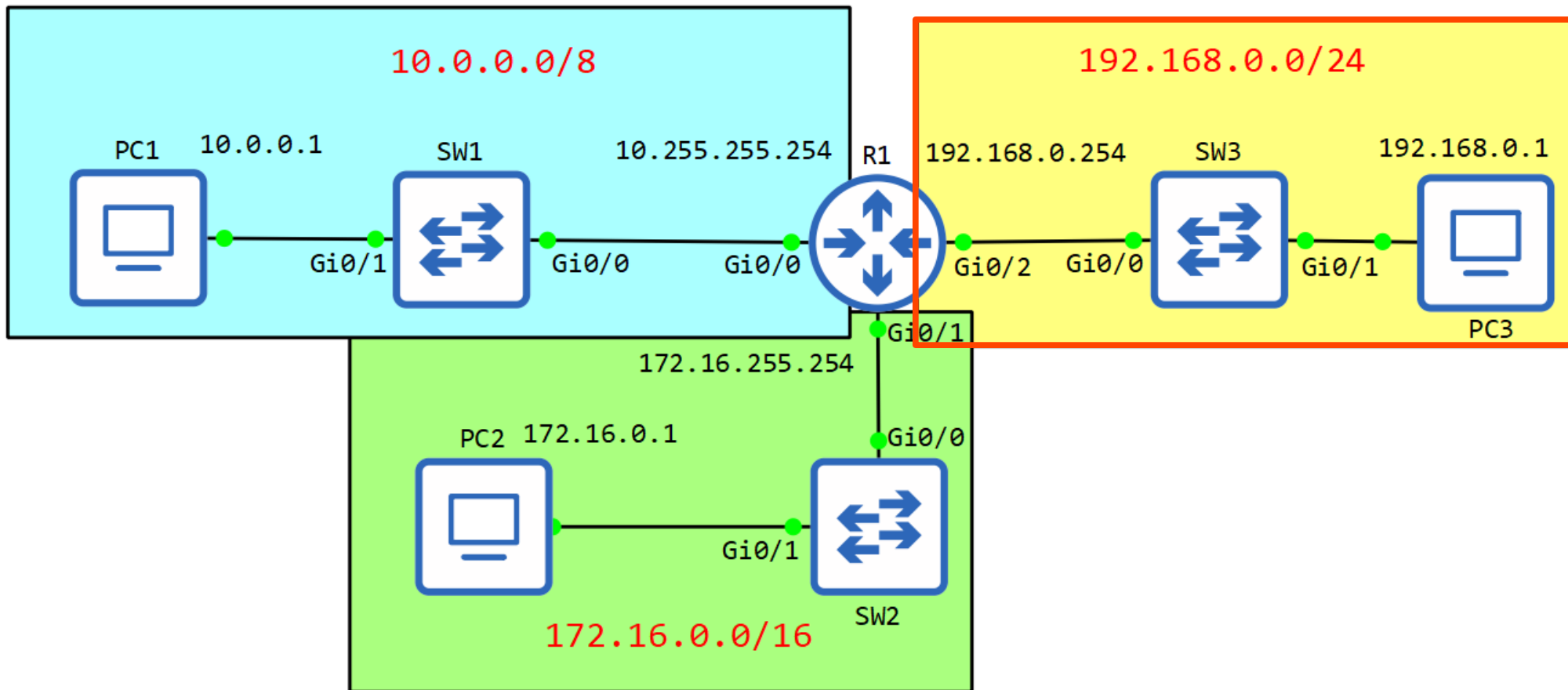
```
R1(config-if)#do sh ip int br
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	10.255.255.254	YES	manual	up	up
GigabitEthernet0/1	172.16.255.254	YES	manual	up	up
GigabitEthernet0/2	unassigned	YES	unset	administratively down	down
GigabitEthernet0/3	unassigned	YES	unset	administratively down	down

```
R1(config-if)#
```




IPv4 Addressing



IPv4 Addressing

```
R1(config-if)#int g0/2
```

```
R1(config-if)#ip add 192.168.0.254 255.255.255.0
```

```
R1(config-if)#no shut
```

```
R1(config-if)#
```

```
*Dec 7 09:05:41.505: %LINK-3-UPDOWN: Interface GigabitEthernet0/2, changed state to up
```

```
R1(config-if)#
```

```
*Dec 7 09:05:42.505: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
```

```
R1(config-if)#do sh ip int br
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	10.255.255.254	YES	manual	up	up
GigabitEthernet0/1	172.16.255.254	YES	manual	up	up
GigabitEthernet0/2	192.168.0.254	YES	manual	up	up
GigabitEthernet0/3	unassigned	YES	unset	administratively down	down

```
R1(config-if)#
```



show interfaces *[interface]*

```
R1#show interfaces g0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is iGbE, address is 0c1b.8444.f000 (bia 0c1b.8444.f000)
  Internet address is 10.255.255.254/8
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Auto Duplex, Auto Speed, link type is auto, media type is RJ45
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:06, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    167 packets input, 30159 bytes, 0 no buffer
    Received 0 broadcasts (0 IP multicasts)
    0 runs, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 0 multicast, 0 pause input
    350 packets output, 39097 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    105 unknown protocol drops
    0 babbles, 0 late collision, 0 deferred
    1 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
```

show interfaces description

```
R1#show interfaces description
```

Interface	Status	Protocol	Description
Gi0/0	up	up	
Gi0/1	up	up	
Gi0/2	up	up	
Gi0/3	admin down	down	

show interfaces description

```
R1(config)#int g0/0
R1(config-if)#description ## to SW1 ##
```

```
R1(config-if)#int g0/1
R1(config-if)#desc ## to SW2 ##
R1(config-if)#int g0/2
R1(config-if)#desc ## to SW3 ##
```

```
R1(config-if)#do sh int desc
```

Interface	Status	Protocol	Description
Gi0/0	up	up	## to SW1 ##
Gi0/1	up	up	## to SW2 ##
Gi0/2	up	up	## to SW3 ##
Gi0/3	admin down	down	

Topics we covered

- IPv4 address classes (review, clarification)
- Finding the ...
 - maximum number of hosts,
 - network address,
 - broadcast address,
 - first usable address,
 - last usable address of a particular network
- Configuring IP addresses on Cisco devices



QUIZ

Quiz Question 1

PC1 has an IP address of 43.109.23.12/8

Find the following:

Network address: 43.0.0.0

Maximum number of hosts in the network: 16,777,214

Network broadcast address: 43.255.255.255

First usable address of the network: 43.0.0.1

Last usable address of the network: 43.255.255.254

Quiz Question 2

PC4 has an IP address of 129.221.23.13/16

Find the following:

Network address: 129.221.0.0

Maximum number of hosts in the network: 65,534

Network broadcast address: 129.221.255.255

First usable address of the network: 129.221.0.1

Last usable address of the network: 129.221.255.254

Quiz Question 3

PC8 has an IP address of 209.211.3.22/24

Find the following:

Network address: 209.211.3.0

Maximum number of hosts in the network: 254

Network broadcast address: 209.211.3.255

First usable address of the network: 209.211.3.1

Last usable address of the network: 209.211.3.254

Quiz Question 4

PC5 has an IP address of 2.71.209.233/8

Find the following:

Network address: 2.0.0.0

Maximum number of hosts in the network: 16,777,214

Network broadcast address: 2.255.255.255

First usable address of the network: 2.0.0.1

Last usable address of the network: 2.255.255.254

Quiz Question 5

PC6 has an IP address of 155.200.201.141/16

Find the following:

Network address: 155.200.0.0

Maximum number of hosts in the network: 65,534

Network broadcast address: 155.200.255.255

First usable address of the network: 155.200.0.1

Last usable address of the network: 155.200.255.254