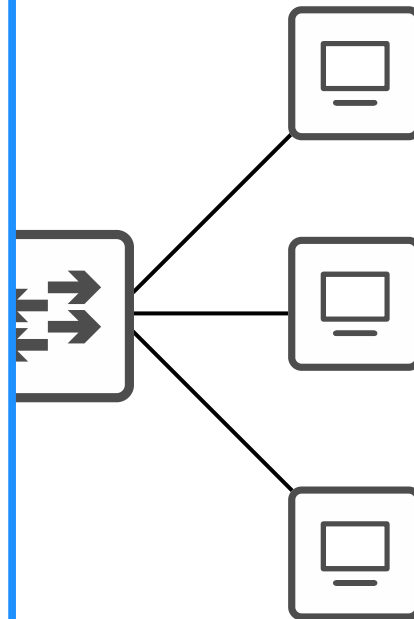


CCNA Day 44

Network Address Translation (Part 1)



1.0 Network Fundamentals	20%	▼
2.0 Network Access	20%	▼
3.0 IP Connectivity	25%	▼
4.0 IP Services	10%	▲
<div>4.1 Configure and verify inside source NAT using static and pools</div> <div>4.2 Configure and verify NTP operating in a client and server mode</div> <div>4.3 Explain the role of DHCP and DNS within the network</div> <div>4.4 Explain the function of SNMP in network operations</div> <div>4.5 Describe the use of syslog features including facilities and levels</div> <div>4.6 Configure and verify DHCP client and relay</div> <div>4.7 Explain the forwarding per-hop behavior (PHB) for QoS such as classification, marking, queuing, congestion, policing, shaping</div> <div>4.8 Configure network devices for remote access using SSH</div> <div>4.9 Describe the capabilities and function of TFTP/FTP in the network</div>		
5.0 Security Fundamentals	15%	▼
6.0 Automation and Programmability	10%	▼





Things we'll cover


- Private IPv4 Addresses
- Intro to NAT
- Static NAT
- Static NAT Configuration

Private IPv4 Addresses (RFC 1918)

- IPv4 doesn't provide enough addresses for all devices that need an IP address in the modern world.
- The long-term solution is to switch to IPv6.
- There are three main short-term solutions:
 - 1) CIDR
 - 2) Private IPv4 addresses
 - 3) NAT
- RFC 1918 specifies the following IPv4 address ranges as private:

10.0.0.0/8 (10.0.0.0 to 10.255.255.255)  Class A

172.16.0.0/12 (172.16.0.0 to 172.31.255.255)  Class B

192.168.0.0/16 (192.168.0.0 to 192.168.255.255)  Class C

Private IPv4 Addresses (RFC 1918)

- RFC 1918 specifies the following IPv4 address ranges as private:
 10.0.0.0/8 (10.0.0.0 to 10.255.255.255)
 172.16.0.0/12 (172.16.0.0 to 172.31.255.255)
 192.168.0.0/16 (192.168.0.0 to 192.168.255.255)
- You are free to use these addresses in your networks. They don't have to be globally unique.

```
C:\Users\user>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet0:

    Connection-specific DNS Suffix  . : 
    IPv4 Address. . . . . : 192.168.0.167
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.0.1
```

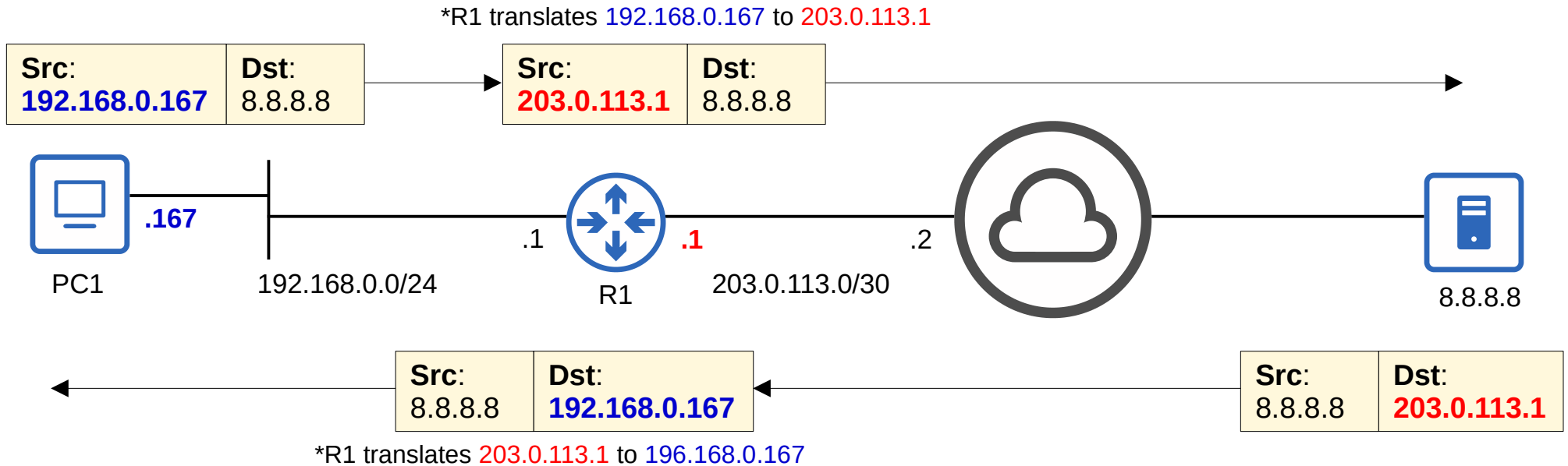
- Two problems:
 - 1) Duplicate addresses
 - 2) Private IP addresses can't be used over the Internet, so the PCs can't access the Internet.

*Private IP addresses cannot be used over the Internet!



Network Address Translation (NAT)

- Network Address Translation (NAT) is used to modify the source and/or destination IP addresses of packets.
- There are various reasons to use NAT, but the most common reason is to allow hosts with private IP addresses to communicate with other hosts over the Internet.
- For the CCNA you have to understand **source NAT** and how to configure it on Cisco routers.

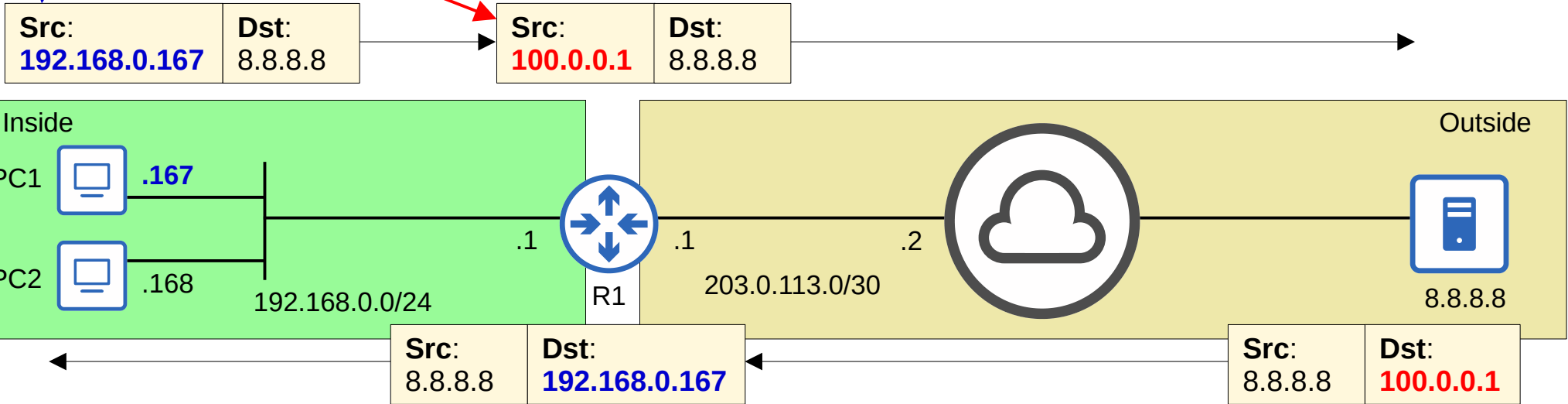


Static NAT

- **Static NAT** involves statically configuring one-to-one mappings of private IP addresses to public IP addresses.
- An *inside local* IP address is mapped to an *inside global* IP address.

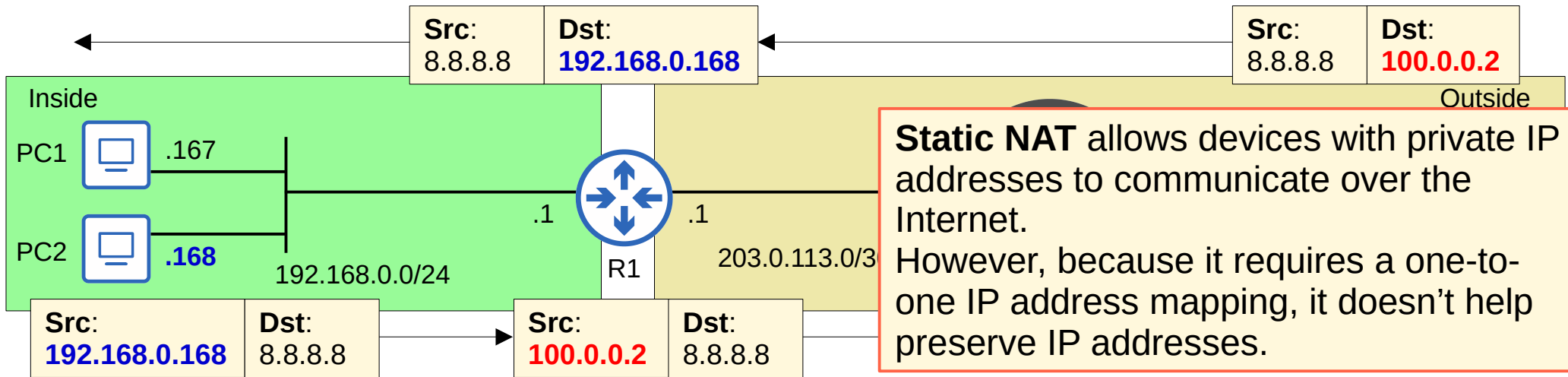
→ **Inside Local** = The IP address of the *inside* host, from the perspective of the local network
 *the IP address actually configured on the inside host, usually a private address

→ **Inside Global** = The IP address of the *inside* host, from the perspective of *outside* hosts
 *the IP address of the inside host after NAT, usually a public address



Static NAT

- **Static NAT** involves statically configuring one-to-one mappings of private IP addresses to public IP addresses.
- An *inside local* IP address is mapped to an *inside global* IP address.
 - **Inside Local** = The IP address of the *inside* host, from the perspective of the local network
*the IP address actually configured on the inside host, usually a private address
 - **Inside Global** = The IP address of the *inside* host, from the perspective of *outside* hosts
*the IP address of the inside host after NAT, usually a public address



Static NAT Configuration

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

Define the 'inside' interface(s) connected to the internal network.

```
R1(config-if)#int g0/0
R1(config-if)#ip nat outside
R1(config-if)#exit
```

Define the 'outside' interface(s) connected to the external network.

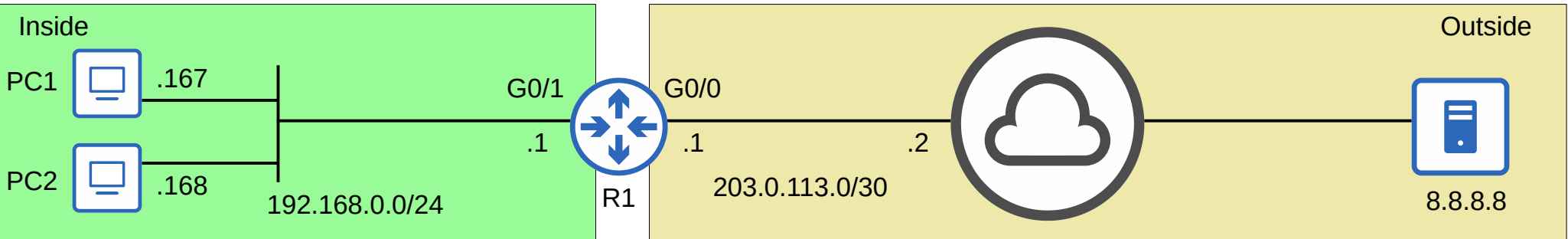
```
R1(config)#ip nat inside source static 192.168.0.167 100.0.0.1
R1(config)#ip nat inside source static 192.168.0.168 100.0.0.2
R1(config)#exit
```

Configure the one-to-one IP address mappings.

ip nat inside source static inside-local-ip inside-global-ip

```
R1#show ip nat translations
```

Pro	Inside global	Inside local	Outside local	Outside global
udp	100.0.0.1:56310	192.168.0.167:56310	8.8.8.8:53	8.8.8.8:53
---	100.0.0.1	192.168.0.167	---	---
udp	100.0.0.2:62321	192.168.0.168:62321	8.8.8.8:53	8.8.8.8:53
---	100.0.0.2	192.168.0.168	---	---



show ip nat translations

```
R1#show ip nat translations
```

Pro	Inside global	Inside local	Outside local	Outside global
udp	100.0.0.1:56310	192.168.0.167:56310	8.8.8.8:53	8.8.8.8:53
---	100.0.0.1	192.168.0.167	---	---
udp	100.0.0.2:62321	192.168.0.168:62321	8.8.8.8:53	8.8.8.8:53
---	100.0.0.2	192.168.0.168	---	---

Unless **destination NAT** is used, these two addresses will be the same.

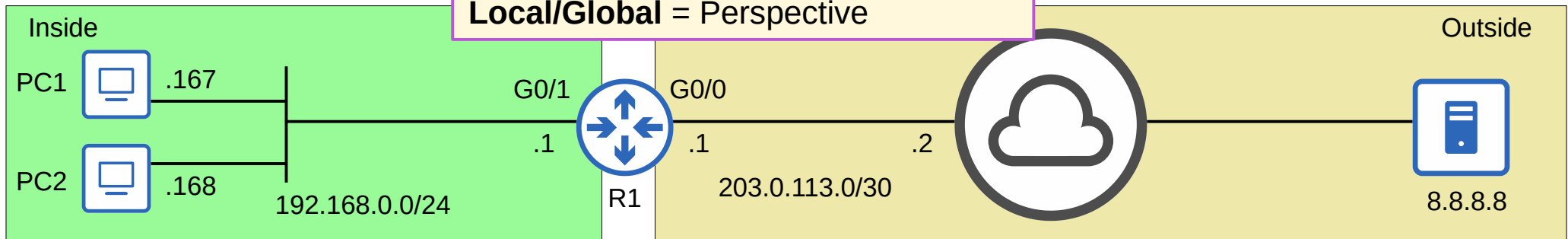
→ **Inside Local** = The IP address of the *inside* host, from the perspective of the local network
 *the IP address actually configured on the inside host, usually a private address

→ **Inside Global** = The IP address of the *inside* host, from the perspective of *outside* hosts
 *the IP address of the inside host after NAT, usually a public address

→ **Outside Local** = The IP address of the *outside* host, from the perspective of the local network

→ **Outside Global** = The IP address of the *outside* host, from the perspective of the outside network

Inside/Outside = Location of the host
Local/Global = Perspective

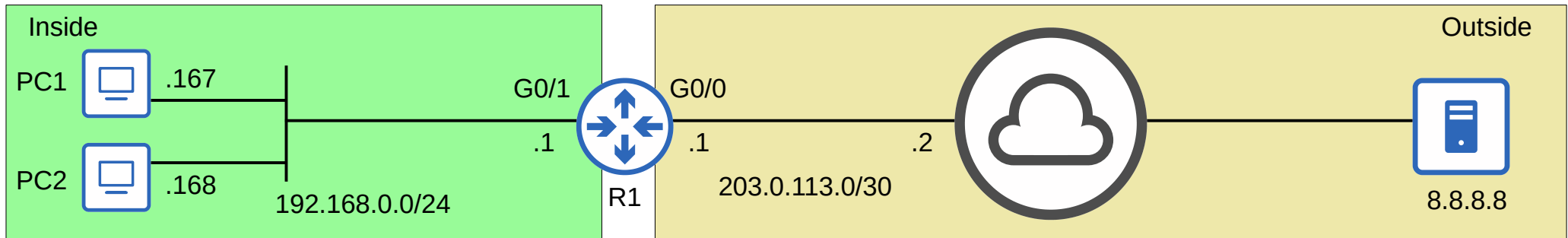


clear ip nat translation *

```
R1#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
udp 100.0.0.1:56310    192.168.0.167:56310 8.8.8.8:53        8.8.8.8:53
--- 100.0.0.1          192.168.0.167      ---                ---
udp 100.0.0.2:62321    192.168.0.168:62321 8.8.8.8:53        8.8.8.8:53
--- 100.0.0.2          192.168.0.168      ---                ---
```

```
R1#clear ip nat translation *
```

```
R1#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
--- 100.0.0.1          192.168.0.167      ---                ---
--- 100.0.0.2          192.168.0.168      ---                ---
```



show ip nat statistics

```
R1#show ip nat statistics
```

```
Total active translations: 2 (2 static, 0 dynamic; 0 extended)
```

```
Peak translations: 4, occurred 02:29:00 ago
```

```
Outside interfaces:
```

```
GigabitEthernet0/0
```

```
Inside interfaces:
```

```
GigabitEthernet0/1
```

```
Hits: 34 Misses: 0
```

```
CEF Translated packets: 30, CEF Punted packets: 4
```

```
Expired translations: 4
```

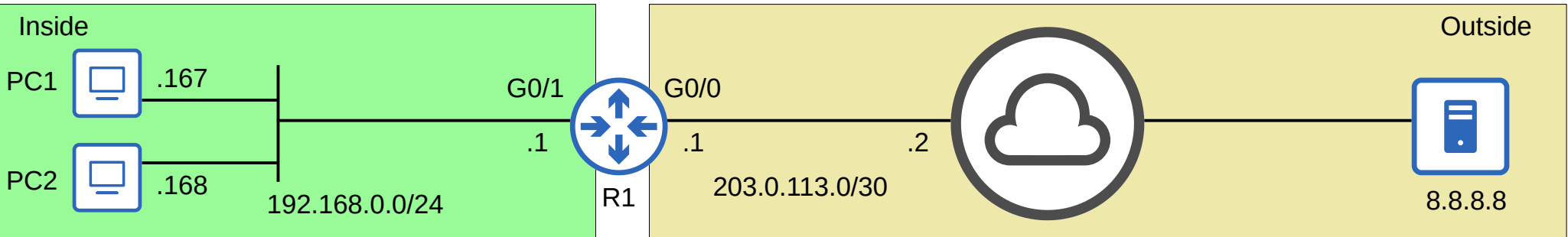
```
Dynamic mappings:
```

```
Total doors: 0
```

```
Appl doors: 0
```

```
Normal doors: 0
```

```
Queued Packets: 0
```



```
R1(config-if)# ip nat inside
```

```
R1(config-if)# ip nat outside
```

```
R1(config)# ip nat inside source static inside-local-ip inside-global-ip
```

```
R1# show ip nat translations
```

```
R1# show ip nat statistics
```

```
R1# clear ip nat translation *
```

Things we covered

- Private IPv4 Addresses
- Intro to NAT
- Static NAT
- Static NAT Configuration

Which of the following commands will configure a static source NAT mapping of 192.168.10.10 to 203.0.113.10?

a) R1(config)# **ip nat inside source static 203.0.113.10 192.168.10.10**

b) R1(config)# **ip nat inside static source 192.168.10.10 203.0.113.10**

c) R1(config)# **ip nat source inside static 203.0.113.10 192.168.10.10**

d) R1(config)# **ip nat inside source static 192.168.10.10 203.0.113.10**

Quiz 2

You have configured the following command on R1:

```
R1(config)# ip nat inside source static 10.0.0.1 20.0.0.1
```

What will happen when you issue the following command on R1?

```
R1(config)# ip nat inside source static 10.0.0.2 20.0.0.1
```

- a) 10.0.0.1 and 10.0.0.2 will both be translated to 20.0.0.1.
- b) Only 10.0.0.1 will be translated to 20.0.0.1.
- c) Only 10.0.0.2 will be translated to 20.0.0.1.
- d) 20.0.0.1 will be translated to 10.0.0.1 or 10.0.0.2.

```
R1(config)#ip nat inside source static 10.0.0.1 20.0.0.1
R1(config)#ip nat inside source static 10.0.0.2 20.0.0.1
% similar static entry (10.0.0.1 -> 20.0.0.1) already exists
```

Quiz 3

Examine the following partial 'show' command output on R1.

```
R1#show ip nat statistics  
Total active translations: 7 (3 static, 4 dynamic; 0 extended)
```

How many active translations will there be if you issue the **clear ip nat translation *** command on R1?

- a) 0
- b) 3
- c) 4
- d) 7

Which of the following are private IPv4 addresses? (select all that apply)

a) 10.254.255.0

b) 192.169.0.1

c) 172.32.1.22

d) 192.191.20.2

e) 172.20.2.3

f) 10.11.12.13

10.0.0.0/8 (10.0.0.0 to 10.255.255.255)

172.16.0.0/12 (172.16.0.0 to 172.31.255.255)

192.168.0.0/16 (192.168.0.0 to 192.168.255.255)

Quiz 5

Examine the packet flow below as PC1 pings 8.8.8.8 and receives a reply.
Identify each of the following addresses in this situation, from R1's perspective:

Outside Global: 8.8.8.8

Outside Local: 8.8.8.8

Inside Local: 172.20.0.101

Inside Global: 200.0.0.1

