JEREMY'S IT LAB

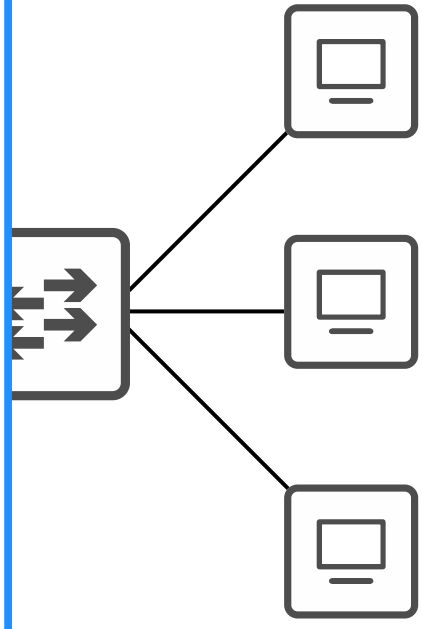
CCNA Day 44

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%

4.1 Configure and verify inside source NAT using static and pools
4.2 Configure and verify NTP operating in a client and server mode
4.3 Explain the role of DHCP and DNS within the network
4.4 Explain the function of SNMP in network operations
4.5 Describe the use of syslog features including facilities and levels
4.6 Configure and verify DHCP client and relay
4.7 Explain the forwarding per-hop behavior (PHB) for QoS such as classification, marking, queuing, congestion, policing, shaping
4.8 Configure network devices for remote access using SSH
4.9 Describe the capabilities and function of TFTP/FTP in the network

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

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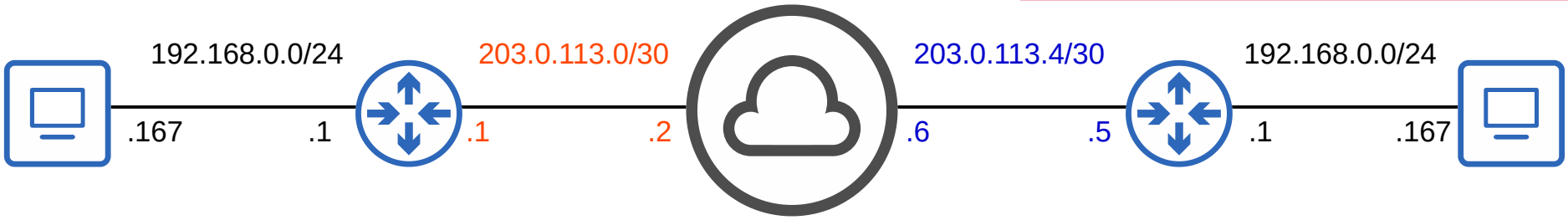
  172.16.0.0/12 (172.16.0.0 to 172.31.255.255)
  192.168.0.0/16 (192.168.0.0 to 192.168.255.255)

- 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
```

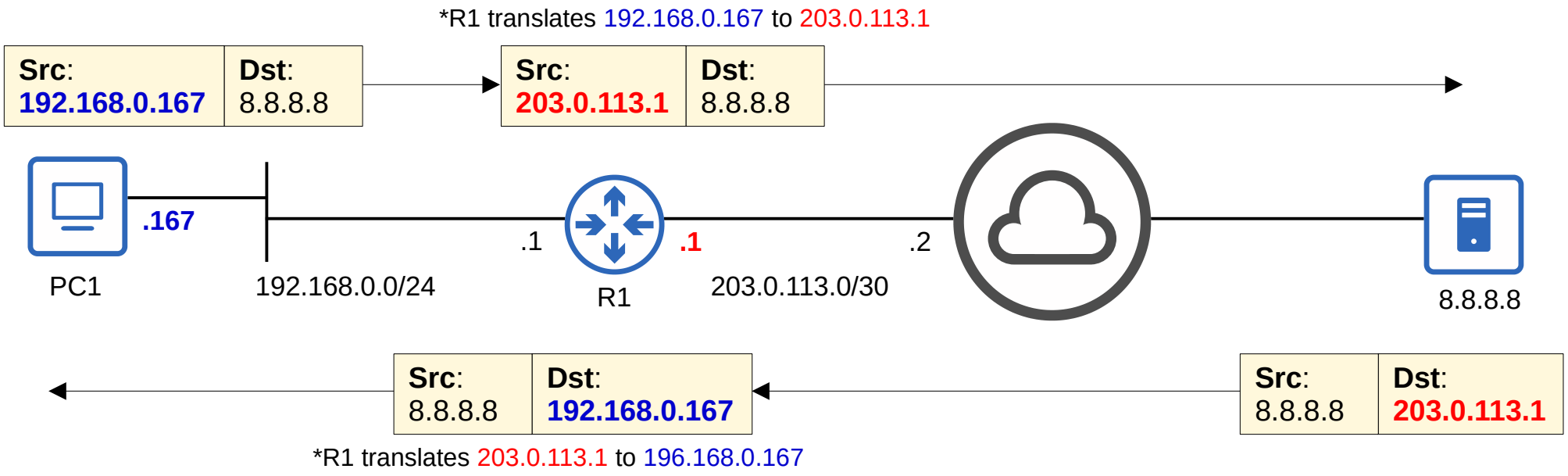
*Private IP addresses cannot be used over the Internet!

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



Network Address Translation (NAT)

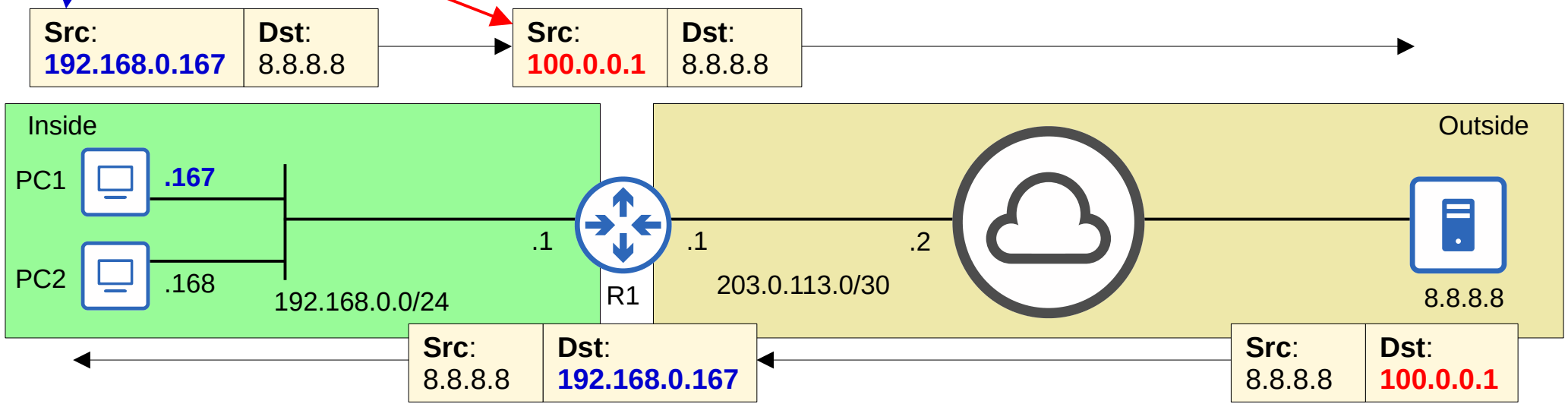
- Network Address Translation (NAT) is used to modify the source and/or destination IP addresses of packets.
- There are various reasons to use NAT , but the most common reason is to allow hosts with private IP addresses to communicate with other hosts over the Internet.
- For the CCNA you have to understand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



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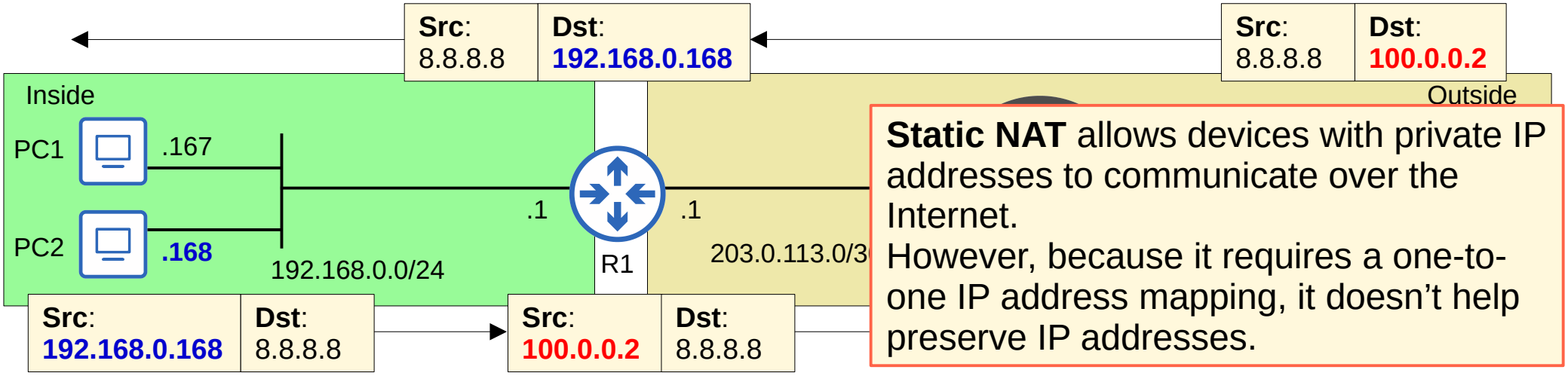


Static NAT Configuration

```
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
```

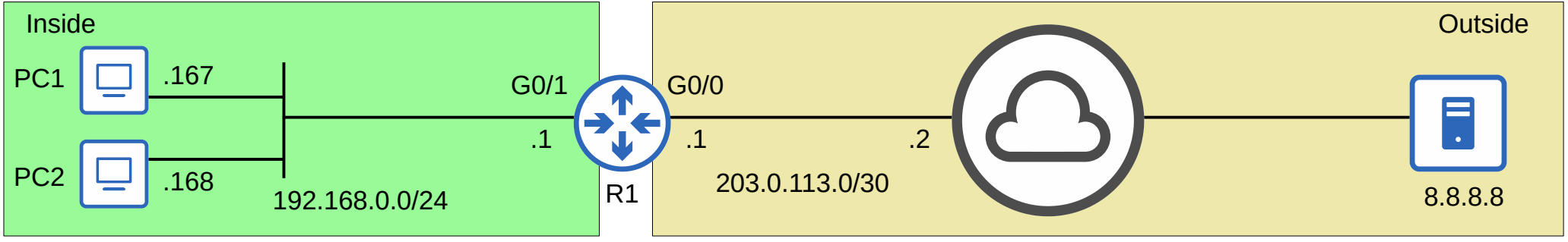
Define the ‘outside’ interface(s) connected to the external network.

```
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.

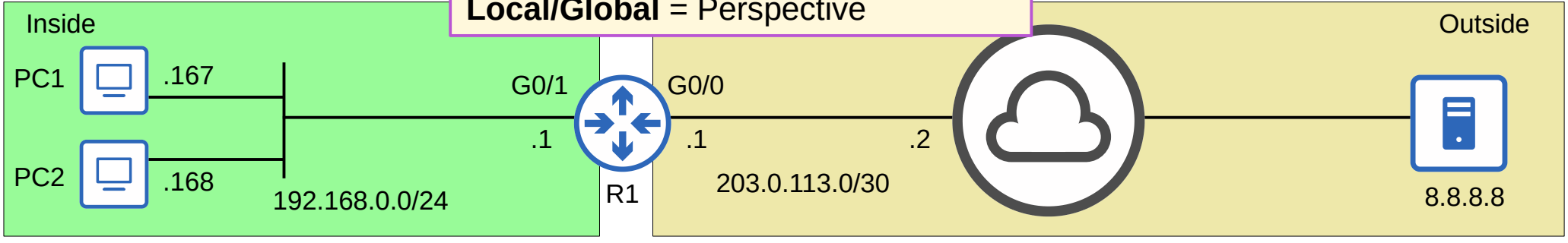
→ **Inside Local** = The IP address of the *inside* host, from the perspective of the local network
*the IP address actually configured on the inside host, usually a private address

→ **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 *

```
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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      ---                 ---
```
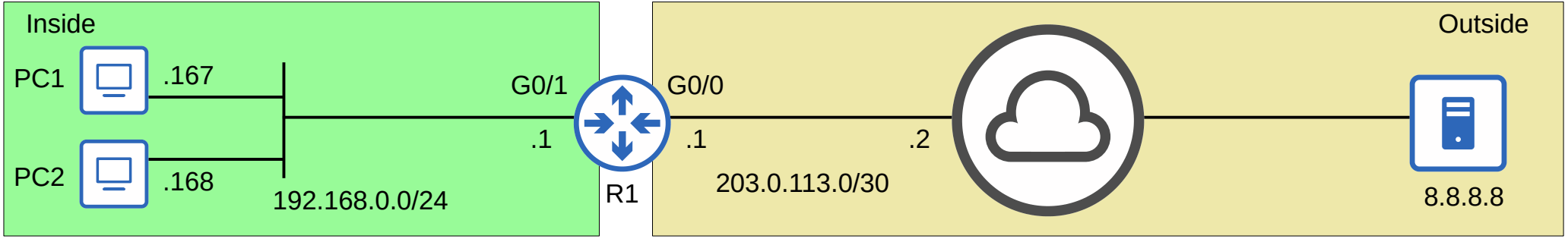
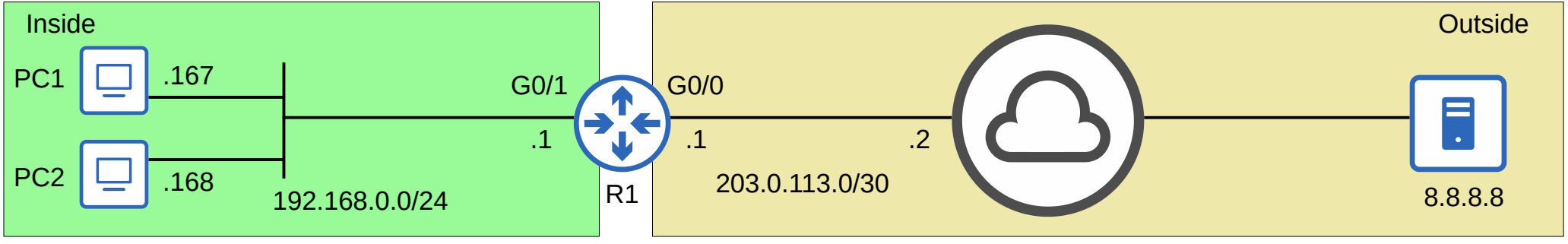



show ip nat statistics

```
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
```



Command Review

```
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

Quiz 1

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

Quiz 4

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

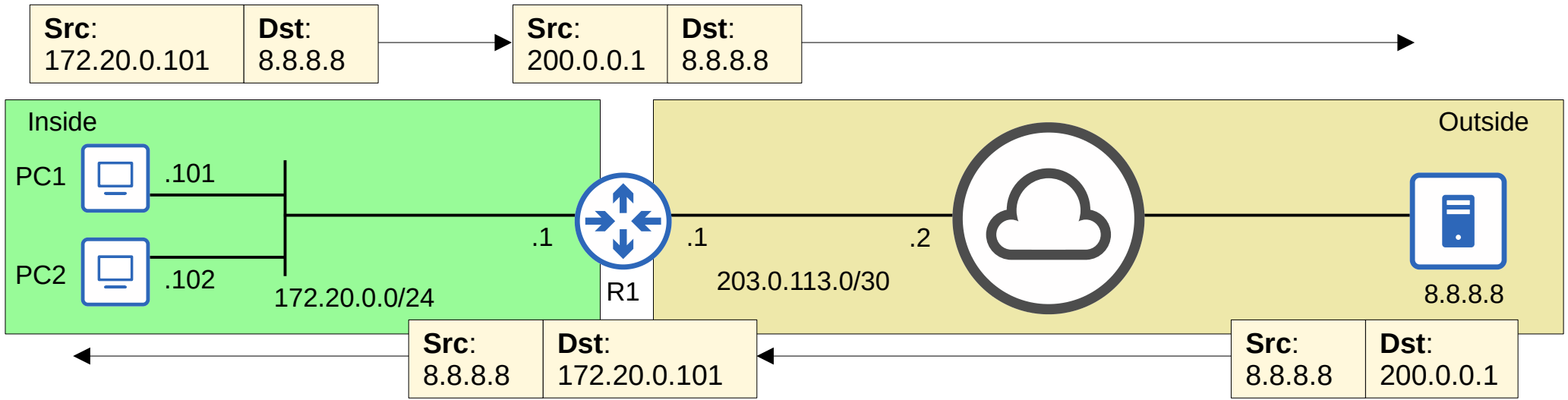
Examine the packet flow below as PC1 pings 8.8.8.8 and receives a reply.
Identify each of the following addresses in this situation, from R1's perspective:

Outside Global: 8.8.8.8

Outside Local: 8.8.8.8

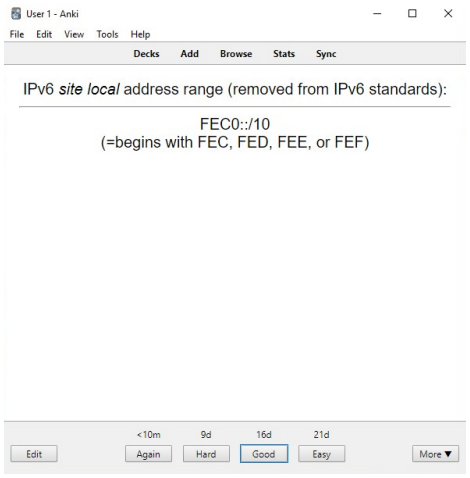
Inside Local: 172.20.0.101

Inside Global: 200.0.0.1

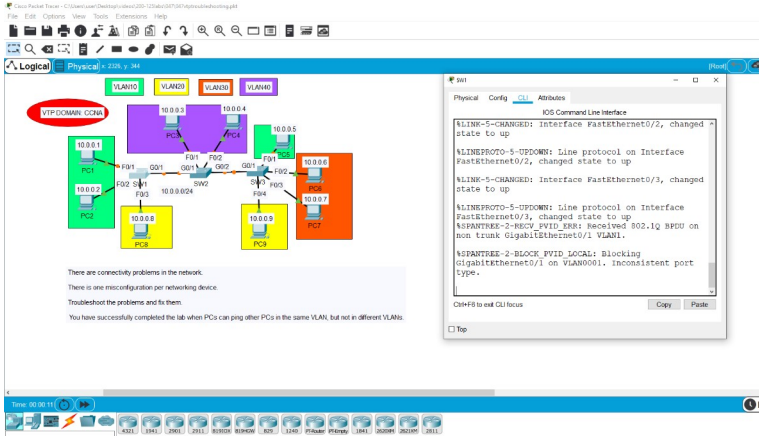


Supplementary Materials

- Review flash cards
  (link in the description)



- Packet Tracer lab



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- Daming Li
- Ed Velez
- #VALUE?
- john goff
- funnydart
- velvijaykum
- Channel has been deleted
- Mark von kanel
- M Yousif
- Boson Software
- Devin Sukhu
- Lito Castillejo
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- Vance Simmons

*as of March 18th, 2021