CCNA Day 38

Domain Name System
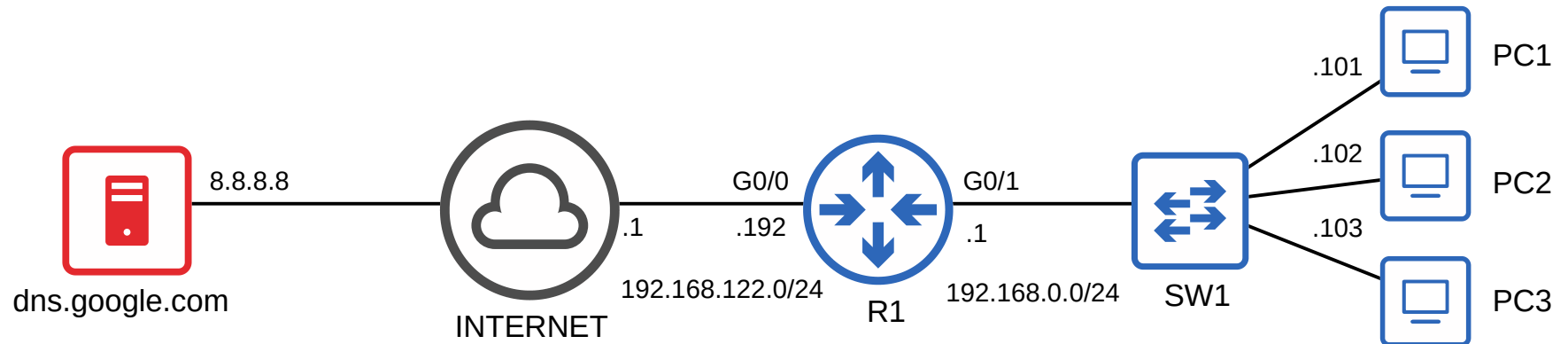
JEREMY'S IT LAB

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% ∨
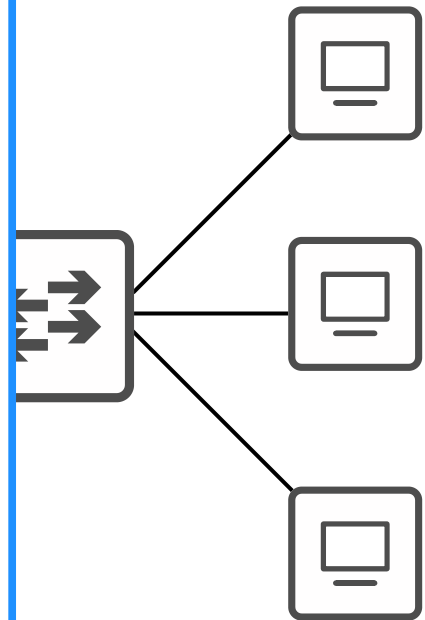
- The purpose of DNS

- Basic functions of DNS

- Configuring DNS in Cisco IOS

- DNS is used to *resolve* human-readable names (google.com) to IP addresses.

- Machines such as PCs don't use names, they use addresses (ie. IPv4/IPv6).

- Names are much easier for us to use and remember than IP addresses.
  → What's the IP address of youtube.com?

- When you type 'youtube.com' into a web browser, your device will ask a DNS server for the IP address of youtube.com.

- The DNS server(s) your device uses can be manually configured or learned via DHCP.

ipconfig /all

```
C:\Users\user>ipconfig /all

[output omitted]

Ethernet adapter ローカル エリア接続 :

    Connection-specific DNS Suffix   . :
    Description . . . . . . . . . . . : Intel(R) 82579LM Gigabit Network Connection
    Physical Address. . . . . . . . . : 78-2B-CB-AC-08-67
    DHCP Enabled. . . . . . . . . . . : No
    Autoconfiguration Enabled . . . . : Yes
    IPv4 Address. . . . . . . . . . . : 192.168.0.101(Preferred)
    Subnet Mask . . . . . . . . . . . : 255.255.255.0
    Default Gateway . . . . . . . . . : 192.168.0.1
    DNS Servers . . . . . . . . . . . : 8.8.8.8
    NetBIOS over Tcpip. . . . . . . . : Enabled

[output omitted]
```
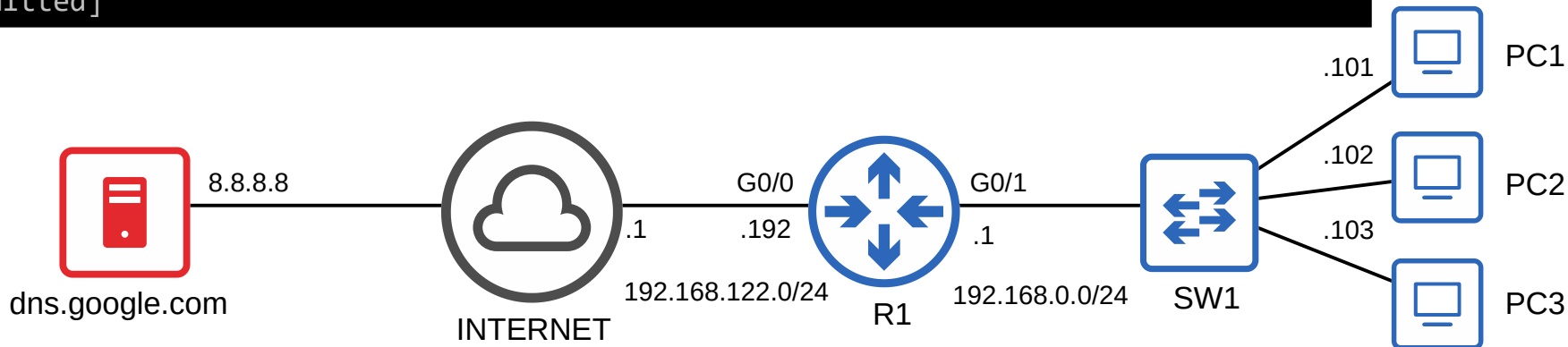
1.10   Verify IP parameters for Client OS (Windows, Mac OS, Linux)

nslookup

```
C:\Users\user>nslookup youtube.com
Server:  dns.google
Address:  8.8.8.8

Non-authoritative answer:
Name:    youtube.com
Addresses:  2404:6800:4004:819::200e
          172.217.25.110

C:\Users\user>ping youtube.com

Pinging youtube.com [172.217.25.110] with 32 bytes of data:
Reply from 172.217.25.110: bytes=32 time=10ms TTL=117
Reply from 172.217.25.110: bytes=32 time=7ms TTL=117
Reply from 172.217.25.110: bytes=32 time=7ms TTL=117
Reply from 172.217.25.110: bytes=32 time=7ms TTL=117

Ping statistics for 172.217.25.110:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 7ms, Maximum = 10ms, Average = 7ms
```
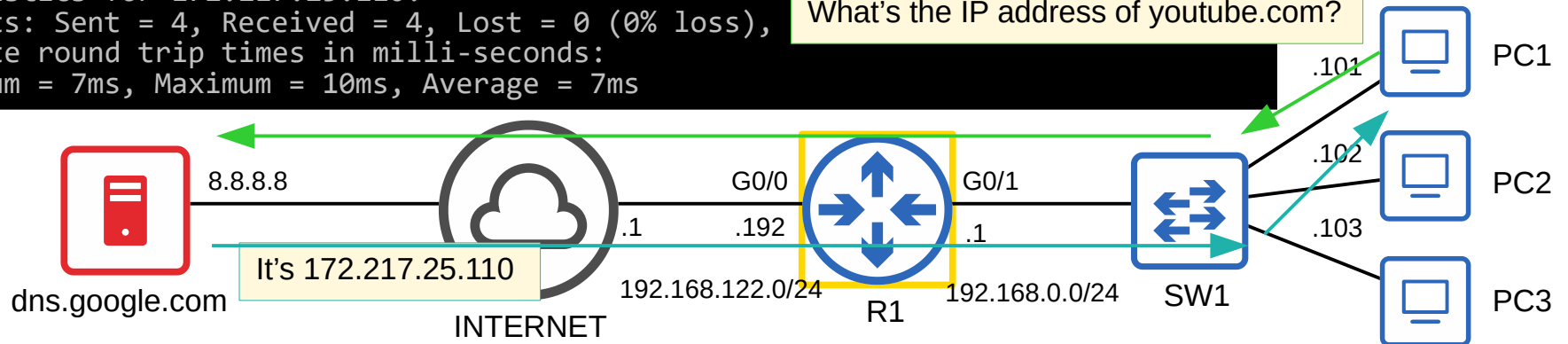
*you don't have to use the **nslookup** command before sending the ping. If your device doesn't know the correct IP address it will automatically ask the server.

In this case, R1 isn't acting as a DNS server or client. It is simply forwarding packets.
No DNS configuration is required on R1.

What's the IP address of youtube.com?

It's 172.217.25.110

.101 PC1
.102 PC2
.103 PC3

8.8.8.8

dns.google.com

INTERNET

G0/0
.192
192.168.122.0/24

.1

R1

G0/1
.1
192.168.0.0/24

SW1

No.	Time	Source	Destination	Protocol	Length	Info
1087	08:55:44.458619	192.168.0.101	8.8.8.8	DNS	71	Standard query 0x0002 A youtube.com
1088	08:55:44.500043	8.8.8.8	192.168.0.101	DNS	87	Standard query response 0x0002 A youtube.com A 172.217.25.110
1089	08:55:44.508888	192.168.0.101	8.8.8.8	DNS	71	Standard query 0x0003 AAAA youtube.com
1115	08:55:44.641775	8.8.8.8	192.168.0.101	DNS	99	Standard query response 0x0003 AAAA youtube.com AAAA 2404:6800:4004:819::200e

> Frame 1087: 71 bytes on wire (568 bits), 71 bytes captured (568 bits) on interface \Device\NPF_{9956EC07-3774-4B11-970D-C8233E7CD172}, id 0
> Ethernet II, Src: Dell_ac:08:67 (78:2b:cb:ac:08:67), Dst: Tp-LinkT_dd:a8:e4 (98:da:c4:dd:a8:e4)
> Internet Protocol Version 4, Src: 192.168.0.101, Dst: 8.8.8.8
> User Datagram Protocol, Src Port: 49286, Dst Port: 53
∨ Domain Name System (query)
    Transaction ID: 0x0002
   ∨ Flags: 0x0100 Standard query
       0... .... = Response: Message is a query
       .000 0... .... = Opcode: Standard query (0)
       .... ..0. .... = Truncated: Message is not truncated
       ....1 .... = Recursion desired: Do query recursively
       .... .0.. .... = Z: reserved (0)
       ....0 .... = Non-authenticated data: Unacceptable
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
   ∨ Queries
     ∨ youtube.com: type A, class IN
       Name: youtube.com
       [Name Length: 11]
       [Label Count: 2]
       Type: A (Host Address) (1)
       Class: IN (0x0001)
    [Response In: 1088]

DNS 'A' record = Used to map names to IPv4 addresses.

DNS 'AAAA' record = Used to map names to IPv6 addresses.

Standard DNS queries/responses typically use **UDP**. **TCP** is used for DNS messages greater than 512 bytes. In either case, port 53 is used.

DNS Cache

```
C:\Users\user>ipconfig /displaydns

[output omitted]

www.youtube.com
    ----------------------------------------
    Record Name . . . . . : www.youtube.com
    Record Type . . . . . : 5
    Time To Live  . . . . : 98
    Data Length . . . . . : 8
    Section . . . . . . . : Answer
    CNAME Record  . . . . : youtube-ui.l.google.com

[output omitted]

Record Name . . . . . : youtube-ui.l.google.com
    Record Type . . . . . : 1
    Time To Live  . . . . : 98
    Data Length . . . . . : 4
    Section . . . . . . . : Answer
    A (Host) Record . . . : 172.217.25.110

[output omitted]
```
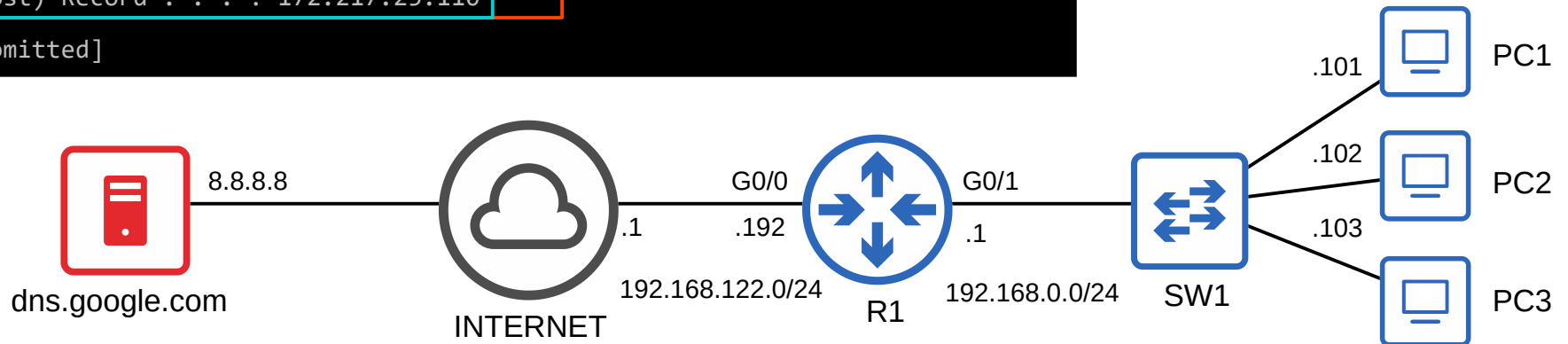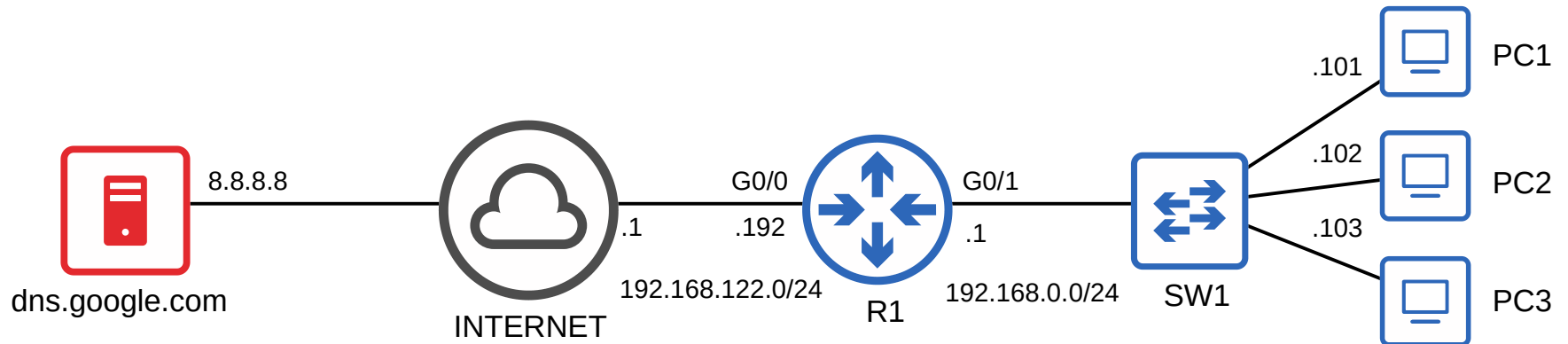
Devices will save the DNS server's responses to a local DNS cache.
This means they don't have to query the server every single time they want to access a particular destination.
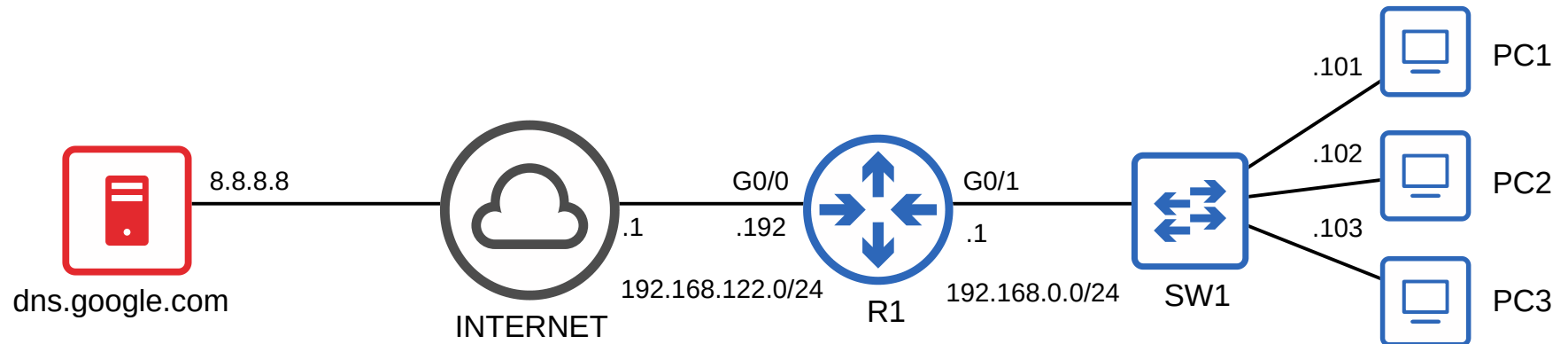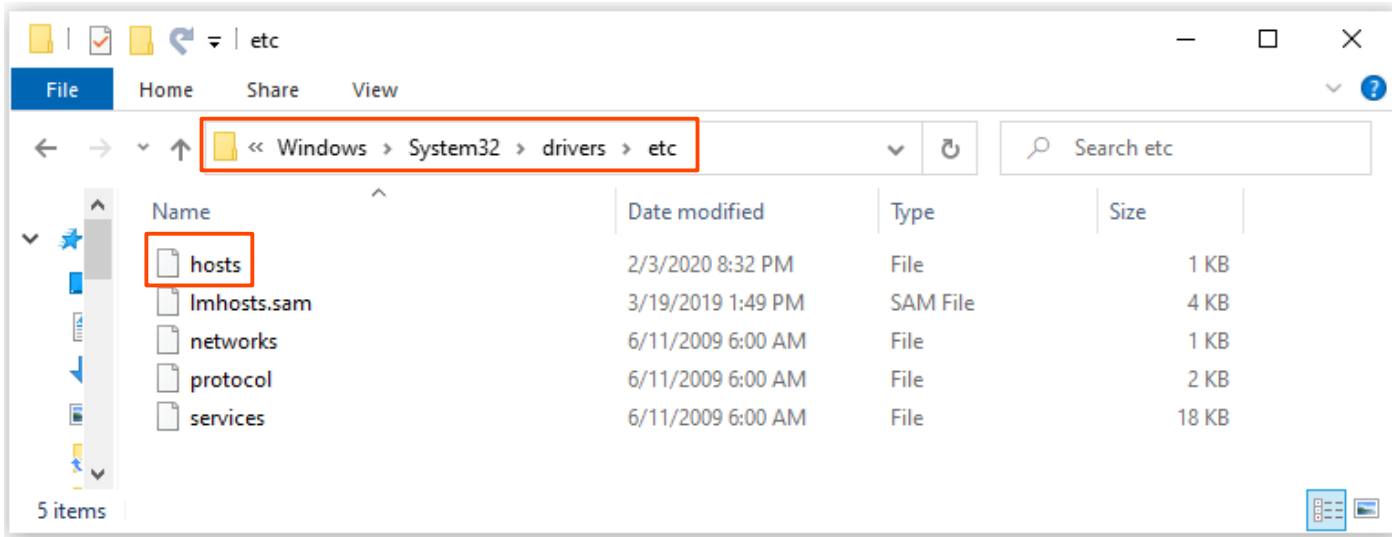
DNS Cache

```
C:\Users\user>ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

C:\Users\user>ipconfig /displaydns

Windows IP Configuration


C:\Users\user>
```


dns.google.com

8.8.8.8

INTERNET

G0/0
.1   .192

192.168.122.0/24

R1

G0/1
.1

192.168.0.0/24

SW1

.101   PC1

.102   PC2

.103   PC3

Host file

Hosts file

hosts - Notepad

```
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97     rhino.acme.com          # source server
#       38.25.63.10     x.acme.com              # x client host

192.168.0.1 R1

# localhost name resolution is handled within DNS itself.
#      127.0.0.1       localhost
#       ::1            localhost
```
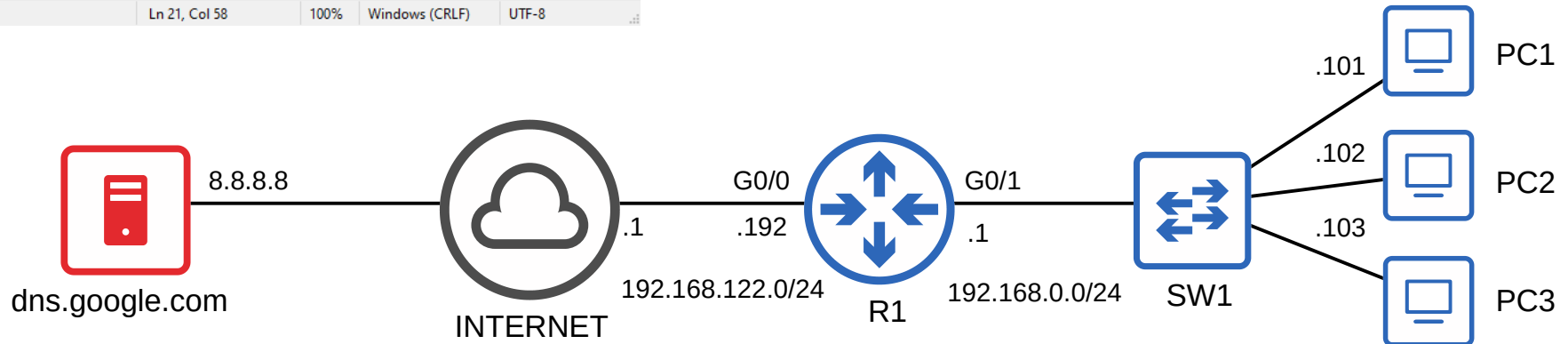
Ln 21, Col 58   100%   Windows (CRLF)   UTF-8

```
C:\Users\user>ping R1

Pinging R1 [192.168.0.1] with 32 bytes of data:
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```
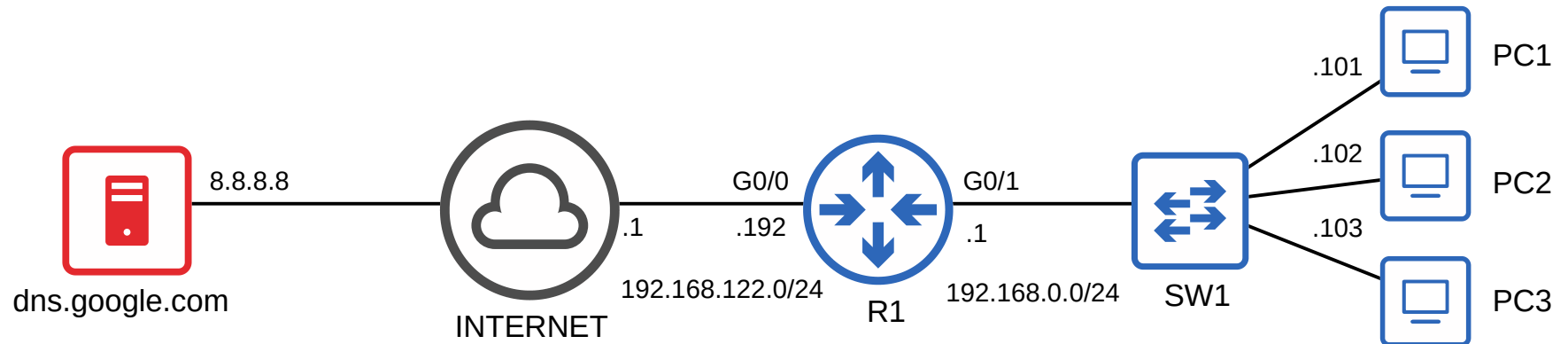
dns.google.com   8.8.8.8   INTERNET   G0/0   .1   .192   R1   G0/1   .1   SW1   .101 PC1   .102 PC2   .103 PC3

192.168.122.0/24   192.168.0.0/24

- For hosts in a network to use DNS, you don't need to configure DNS on the routers. They will simply forward the DNS messages like any other packets.

- However, a Cisco router can be configured as a DNS server, although it's rare.
  → If an internal DNS server is used, usually it's a Windows or Linux server.

- A Cisco router can also be configured as a DNS client.

8.8.8.8

dns.google.com

INTERNET

G0/0
.1   .192

192.168.122.0/24

R1

G0/1
.1

192.168.0.0/24   SW1

.101   PC1

.102   PC2

.103

PC3

DNS in Cisco IOS

```
R1(config)#ip dns server
```
Configure R1 to act as a DNS server.

```
R1(config)#ip host R1 192.168.0.1
R1(config)#ip host PC1 192.168.0.101
R1(config)#ip host PC2 192.168.0.102
R1(config)#ip host PC3 192.168.0.103
```
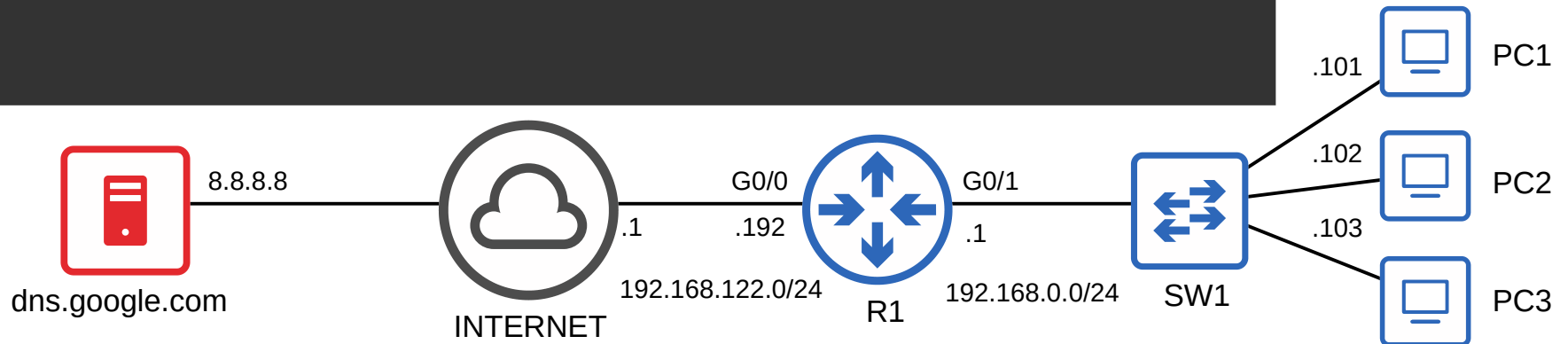Configure a list of hostname/IP address mappings.

```
R1(config)#ip name-server 8.8.8.8
```
Configure a DNS server that R1 will query if the requested record isn't in its host table.

```
R1(config)#ip domain lookup
```
Enable R1 to perform DNS queries.
(enabled by default)
(old version of the command is `ip domain-lookup`)

8.8.8.8

.1

G0/0

.192

192.168.122.0/24

dns.google.com

INTERNET

R1

G0/1

.1

192.168.0.0/24
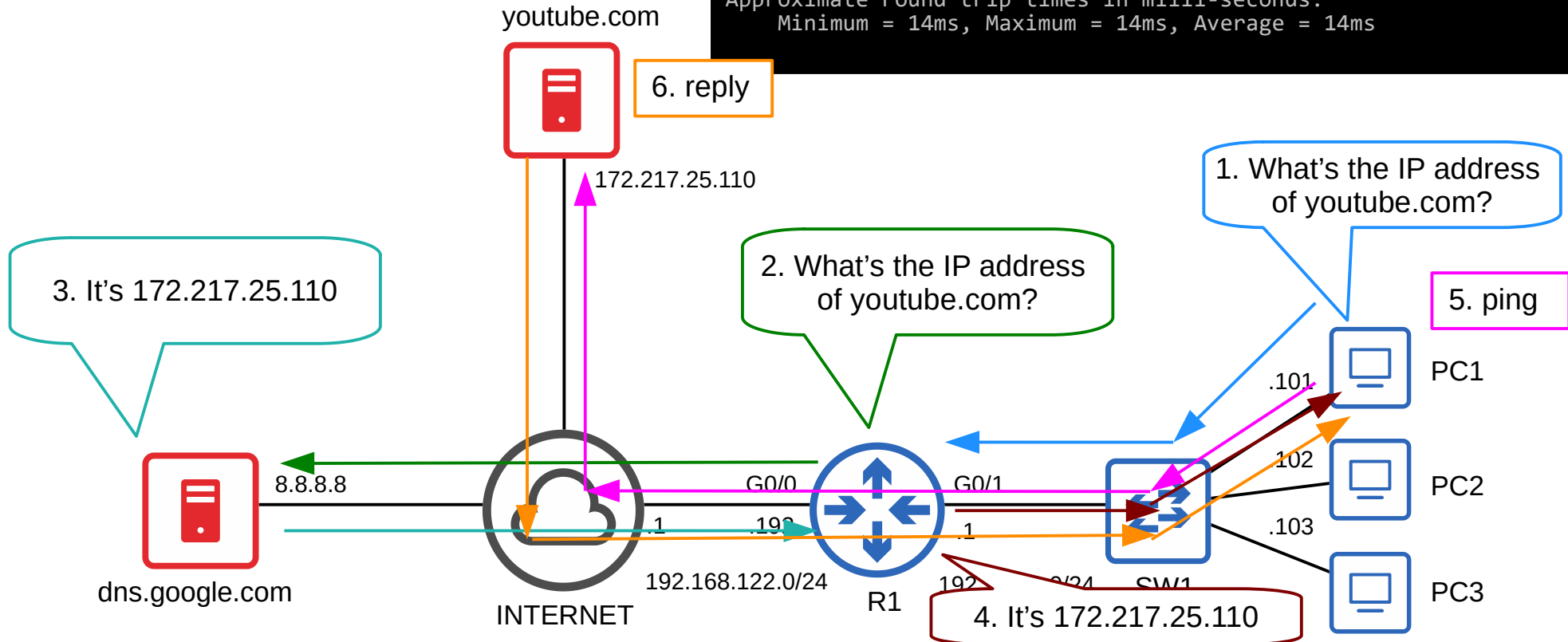
SW1

.101 — PC1

.102 — PC2

.103 — PC3

DNS in Cisco IOS

DNS in Cisco IOS

```
C:\Users\user>ping youtube.com -n 1

Pinging youtube.com [172.217.25.110] with 32 bytes of data:
Reply from 172.217.25.110: bytes=32 time=14ms TTL=117

Ping statistics for 192.168.0.102:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 14ms, Maximum = 14ms, Average = 14ms
```

youtube.com

6. reply

172.217.25.110

1. What's the IP address of youtube.com?

3. It's 172.217.25.110

2. What's the IP address of youtube.com?

5. ping

8.8.8.8

G0/0

G0/1

.101

PC1

.102

PC2

dns.google.com

INTERNET

.1

192

192.168.122.0/24

R1

.1

SW1

.103

4. It's 172.217.25.110

PC3

```
R1#show hosts
Default domain is not set
Name/address lookup uses domain service
Name servers are 8.8.8.8

Codes: UN - unknown, EX - expired, OK - OK, ?? - revalidate
       temp - temporary, perm - permanent
       NA - Not Applicable None - Not defined


Host                    Port  Flags     Age Type   Address(es)
youtube.com             None  (temp, OK) 0   IP     172.217.25.110
R1                      None  (perm, OK) 4   IP     192.168.0.1
PC1                     None  (perm, OK) 1   IP     192.168.0.101
PC2                     None  (perm, OK) 4   IP     192.168.0.102
PC3                     None  (perm, OK) 4   IP     192.168.0.103
```
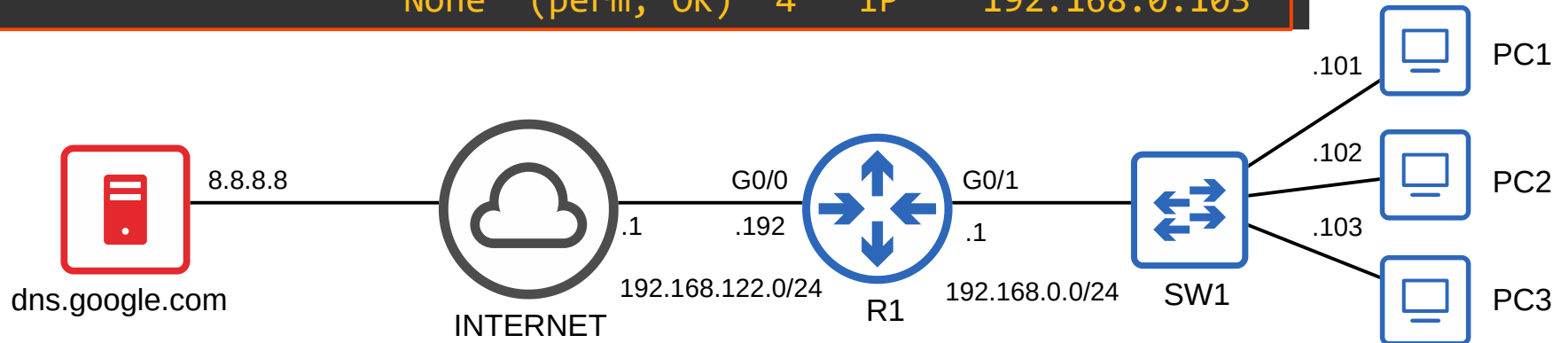
```
R1(config)#do ping youtube.com
Translating "youtube.com"
% Unrecognized host or address, or protocol not running.
```

```
R1(config)#ip name-server 8.8.8.8
```
Configure R1 to use the specified DNS server.

```
R1(config)#ip domain lookup
```
Enable R1 to perform DNS queries. (default)

```
R1(config)#do ping youtube.com
Translating "youtube.com"...domain server (8.8.8.8) [OK]

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.217.25.110, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/13 ms
```

```
R1(config)#ip domain name jeremysitlab.com
```

(optional)
- Configure the default *domain* name.
- This will be automatically appended to any hostnames without a specified *domain*.
- ie. `ping pc1` will become `ping pc1.jeremysitlab.com`

- (old version of the command: `ip domain-name`)

- I will cover this command again in a later video (about SSH).

8.8.8.8

dns.google.com

INTERNET

.1

192

Command Review
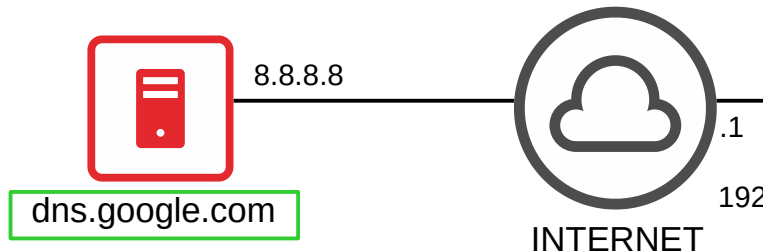
Windows:

```
C:\Users\user>ipconfig /all

C:\Users\user>nslookup name

C:\Users\user>ipconfig /displaydns

C:\Users\user>ipconfig /flushdns

C:\Users\user>ping ip-address -n number
```

Cisco IOS:

```
R1(config)#ip dns server

R1(config)#ip host hostname ip-address

R1(config)#ip name-server ip-address

R1(config)#ip domain lookup

R1(config)#ip domain name domain-name

R1#show hosts
```

- The purpose of DNS

- Basic functions of DNS

- Configuring DNS in Cisco IOS

Which of the following Windows command prompt commands will display the PC's DNS server? (select two)

a) `ipconfig`

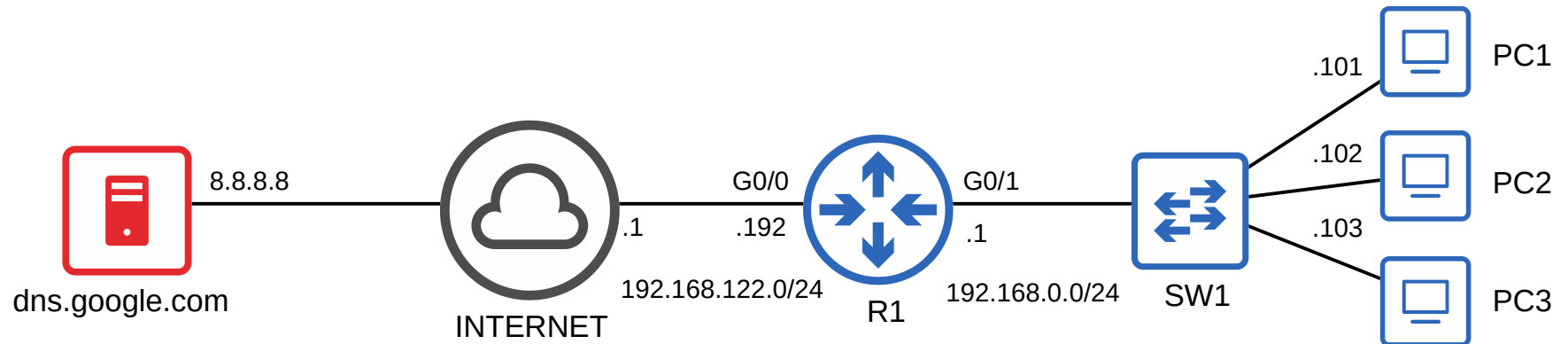b) `ipconfig /all`

c) `ipconfig /displaydns`

d) `nslookup`

Which of the following statements about DNS are true? (select two)

a) Messages greater than 512 bytes in size are sent using UDP.

b) 'A' records map hostnames to IPv4 addresses.

c) 'AAA' records map hostnames to IPv6 addresses.

d) A Cisco router can be configured as a DNS server and DNS client at the same time.

PC1 is configured to use an external server, 8.8.8.8, as its DNS server. What DNS command is necessary on R1 to enable this?

a) `R1(config)#ip domain lookup`

b) `R1(config)#ip name-server 8.8.8.8`

c) `R1(config)#ip dns server`

d) No DNS configurations are needed on R1.

8.8.8.8

dns.google.com

INTERNET

G0/0
.1   .192

192.168.122.0/24

R1

G0/1
.1

192.168.0.0/24

SW1

.101   PC1

.102   PC2

.103

PC3

Which of the following Cisco IOS commands shows the cached name/IP address mappings learned via DNS?

a) R1#show hosts

b) R1#show dns cache

c) R1#ipconfig /displaydns

d) R1#show dns hosts

Which of the following protocols can hosts use to automatically learn the address of their DNS server?

a) DNS

b) SSH

c) DHCP

d) IP