

## Lab - Explore DNS Traffic

### Objectives

Part 1: Capture DNS Traffic

Part 2: Explore DNS Query Traffic

Part 3: Explore DNS Response Traffic

### Background / Scenario

Wireshark is an open source packet capture and analysis tool. Wireshark gives a detailed breakdown of the network protocol stack. Wireshark allows you to filter traffic for network troubleshooting, investigate security issues, and analyze network protocols. Because Wireshark allows you to view the packet details, it can be used as a reconnaissance tool for an attacker.

In this lab, you will install Wireshark on a Windows system and use Wireshark to filter for DNS packets and view the details of both DNS query and response packets.

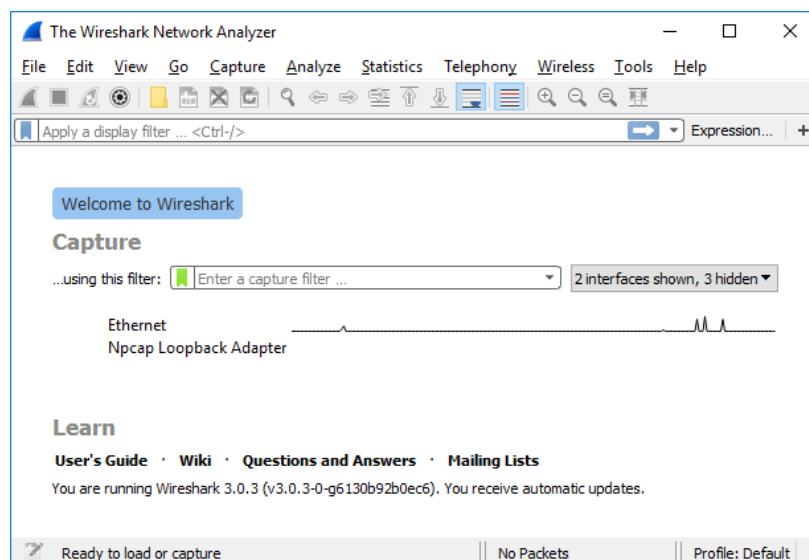
### Required Resources

- 1 Windows PC with internet access and Wireshark installed

### Instructions

#### Part 1: Capture DNS traffic.

- Open **Wireshark** and start a Wireshark capture by double clicking a network interface with traffic.



- At the Command Prompt, enter **ipconfig /flushdns** clear the DNS cache.

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

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

- c. Enter **nslookup** at the prompt to enter the nslookup interactive mode.
- d. Enter the domain name of a website. The domain name **www.cisco.com** is used in this example. Enter **www.cisco.com** at the > prompt.

```
C:\Users\Student> nslookup
```

```
Default Server: UnKnown
```

```
Address: 68.105.28.16
```

```
> www.cisco.com
```

```
Server: UnKnown
```

```
Address: 68.105.28.16
```

```
Non-authoritative answer:
```

```
Name: e2867.dsca.akamaiedge.net
```

```
Addresses: 2001:578:28:68d::b33
```

```
2001:578:28:685::b33
```

```
96.7.79.147
```

```
Aliases: www.cisco.com
```

```
www.cisco.com.akadns.net
```

```
wwwds.cisco.com.edgekey.net
```

```
wwwds.cisco.com.edgekey.net.globalredir.akadns.net
```

- e. Enter **exit** when finished to exit the nslookup interactive mode. Close the command prompt.
- f. Click **Stop capturing packets** to stop the Wireshark capture.

## Part 2: Explore DNS Query Traffic

- a. Observe the traffic captured in the Wireshark Packet List pane. Enter **udp.port == 53** in the filter box and click the arrow (or press enter) to display only DNS packets.
- b. Select the DNS packet labeled **Standard query 0x0002 A www.cisco.com**.

## Lab - Explore DNS Traffic

In the Packet Details pane, notice this packet has Ethernet II, Internet Protocol Version 4, User Datagram Protocol and Domain Name System (query).

The screenshot shows the Wireshark interface with the file 'Ethernet.pcapng' open. The filter bar shows 'udp.port==53'. The packet list displays six packets, with packet 11 (time 8.038415) selected. The packet details pane for packet 11 shows the following structure:

- Frame 11: 73 bytes on wire (584 bits), 73 bytes captured (584 bits) on interface 0
- Ethernet II, Src: PcsCompu\_80:91:db (08:00:27:80:91:db), Dst: Netgear\_18:a6:81 (cc:40:d0:18:a6:81)
- Internet Protocol Version 4, Src: 192.168.1.10, Dst: 68.105.28.16
- User Datagram Protocol, Src Port: 58461, Dst Port: 53
- Domain Name System (query)

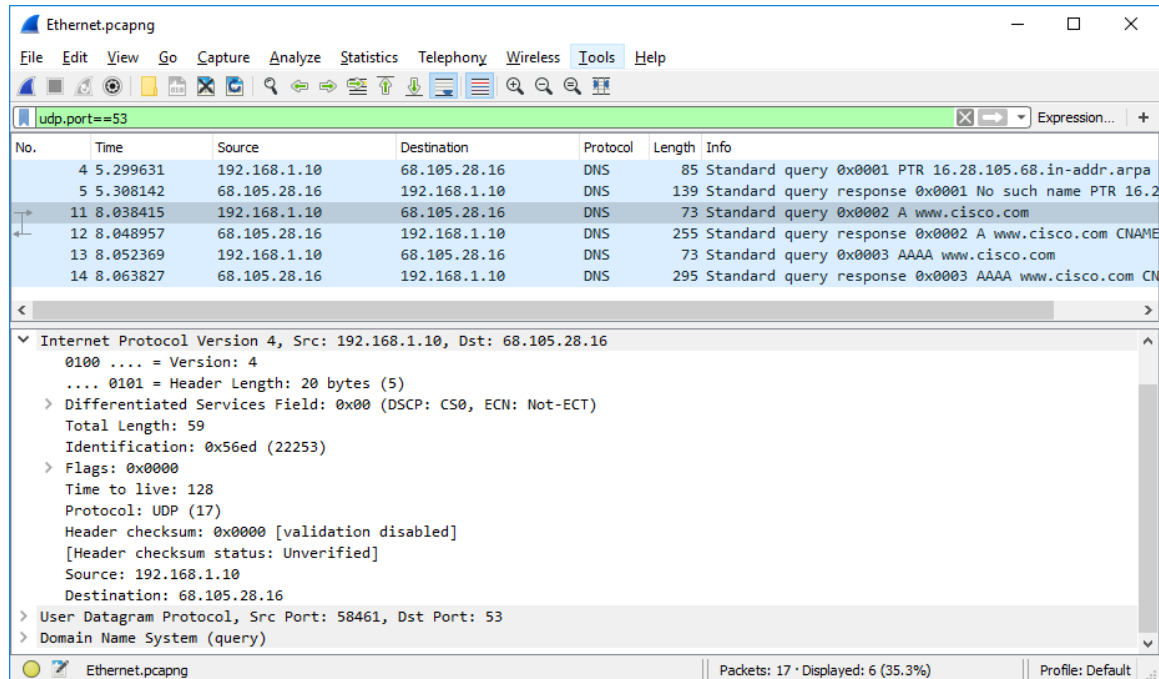
- c. Expand **Ethernet II** to view the details. Observe the source and destination fields.

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  - ▼ Destination: Netgear\_18:a6:81 (cc:40:d0:18:a6:81)
    - Address: Netgear\_18:a6:81 (cc:40:d0:18:a6:81)
    - ... .. = LG bit: Globally unique address (factory default)
    - ... .. = IG bit: Individual address (unicast)
  - ▼ Source: PcsCompu\_80:91:db (08:00:27:80:91:db)
    - Address: PcsCompu\_80:91:db (08:00:27:80:91:db)
    - ... .. = LG bit: Globally unique address (factory default)
    - ... .. = IG bit: Individual address (unicast)
  - Type: IPv4 (0x0800)
- Internet Protocol Version 4, Src: 192.168.1.10, Dst: 68.105.28.16
- User Datagram Protocol, Src Port: 58461, Dst Port: 53
- Domain Name System (query)

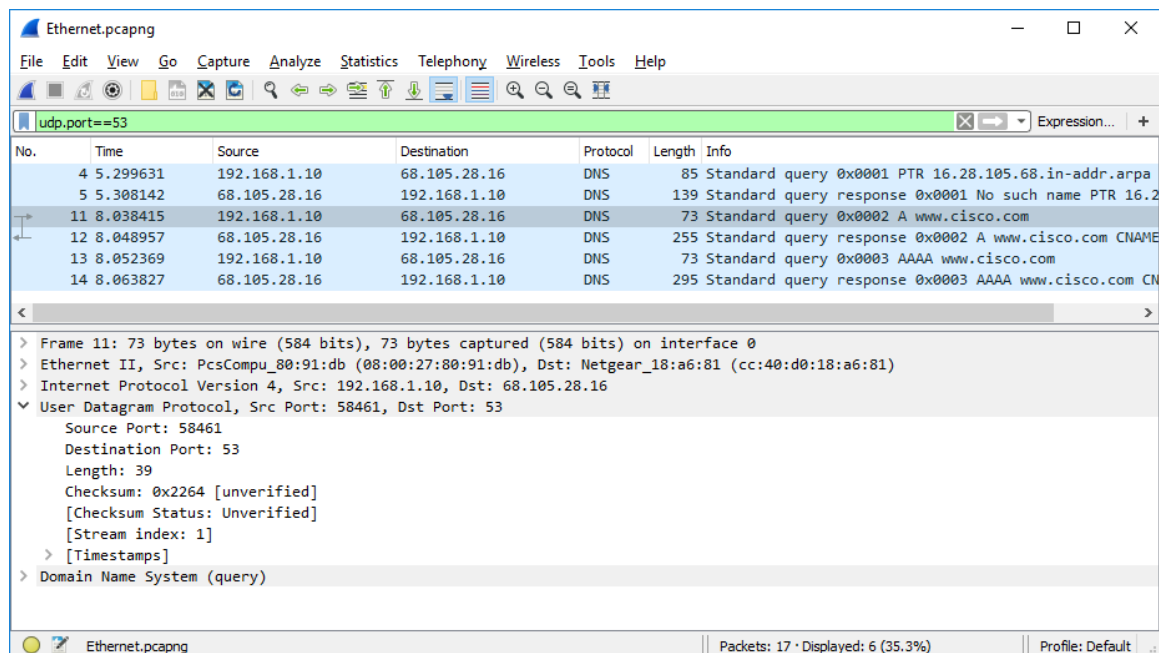
What are the source and destination MAC addresses? Which network interfaces are these MAC addresses associated with?

- d. Expand **Internet Protocol Version 4**. Observe the source and destination IPv4 addresses.



What are the source and destination IP addresses? Which network interfaces are these IP addresses associated with?

- 1) Expand the **User Datagram Protocol**. Observe the source and destination ports.



What are the source and destination ports? What is the default DNS port number?

- 2) Open a Command Prompt and enter **arp -a** and **ipconfig /all** to record the MAC and IP addresses of the PC.

```
C:\Users\Student> arp -a
```

```
Interface: 192.168.1.10 --- 0x4

 Internet Address      Physical Address      Type
192.168.1.1           cc-40-d0-18-a6-81     dynamic
192.168.1.122         b0-a7-37-46-70-bb     dynamic
192.168.1.255         ff-ff-ff-ff-ff-ff     static
224.0.0.22            01-00-5e-00-00-16     static
224.0.0.252           01-00-5e-00-00-fc     static
239.255.255.250       01-00-5e-7f-ff-fa     static
255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

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

Windows IP Configuration

```
Host Name . . . . . : DESKTOP
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
```

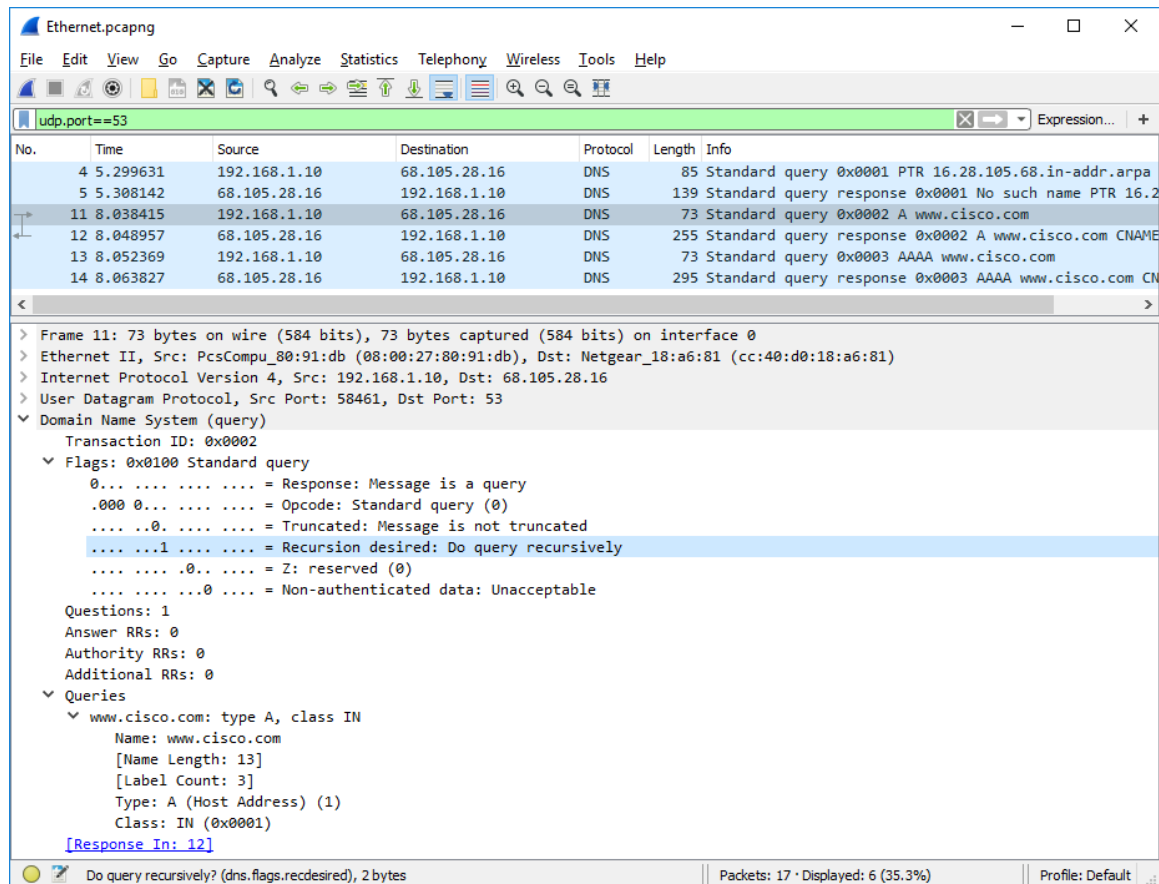
Ethernet adapter Ethernet:

```
Connection-specific DNS Suffix . :
Description . . . . . : Intel(R) PRO/1000 MT Desktop Adapter
Physical Address. . . . . : 08-00-27-80-91-DB
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::d829:6d18:e229:a705%4(Preferred)
IPv4 Address. . . . . : 192.168.1.10(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : Tuesday, August 20, 2019 5:39:51 PM
Lease Expires . . . . . : Wednesday, August 21, 2019 5:39:50 PM
Default Gateway . . . . . : 192.168.1.1
DHCP Server . . . . . : 192.168.1.1
DHCPv6 IAID . . . . . : 50855975
DHCPv6 Client DUID. . . . . : 00-01-00-01-24-21-BA-64-08-00-27-80-91-DB
DNS Servers . . . . . : 68.105.28.16
                       68.105.29.16
NetBIOS over Tcpip. . . . . : Enabled
```

Compare the MAC and IP addresses in the Wireshark results to the results from the **ipconfig /all** results. What is your observation?

- 3) Expand **Domain Name System (query)** in the Packet Details pane. Then expand the **Flags** and **Queries**.

Observe the results. The flag is set to do the query recursively to query for the IP address to **www.cisco.com**.



## Part 3: Explore DNS Response Traffic

- Select the corresponding response DNS packet labeled **Standard query response 0x0002 A www.cisco.com**.

The screenshot shows the Wireshark interface with a packet capture filter of 'udp.port==53'. The packet list shows several DNS packets. Packet 12 is selected, which is a 'Standard query response 0x0002 A www.cisco.com' from 68.105.28.16 to 192.168.1.10. The packet details pane shows the following structure:

- Frame 12: 255 bytes on wire (2040 bits), 255 bytes captured (2040 bits) on interface 0
- Ethernet II, Src: Netgear\_18:a6:81 (cc:40:d0:18:a6:81), Dst: PcsCompu\_80:91:db (08:00:27:80:91:db)
- Internet Protocol Version 4, Src: 68.105.28.16, Dst: 192.168.1.10
- User Datagram Protocol, Src Port: 53, Dst Port: 58461
- Domain Name System (response)

The status bar at the bottom indicates 'Number of answers in packet (dns.count.answers), 2 bytes', 'Packets: 17 · Displayed: 6 (35.3%)', and 'Profile: Default'.

What are the source and destination MAC and IP addresses and port numbers? How do they compare to the addresses in the DNS query packets?

## Lab - Explore DNS Traffic

- b. Expand **Domain Name System (response)**. Then expand the **Flags**, **Queries**, and **Answers**. Observe the results.

Ethernet.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

udp.port==53

No.	Time	Source	Destination	Protocol	Length	Info
4	5.299631	192.168.1.10	68.105.28.16	DNS	85	Standard query 0x0001 PTR 16.28.105.68.in-addr.arpa
5	5.308142	68.105.28.16	192.168.1.10	DNS	139	Standard query response 0x0001 No such name PTR 16.2
11	8.038415	192.168.1.10	68.105.28.16	DNS	73	Standard query 0x0002 A www.cisco.com
12	8.048957	68.105.28.16	192.168.1.10	DNS	255	Standard query response 0x0002 A www.cisco.com CNAME
13	8.052369	192.168.1.10	68.105.28.16	DNS	73	Standard query 0x0003 AAAA www.cisco.com
14	8.063827	68.105.28.16	192.168.1.10	DNS	295	Standard query response 0x0003 AAAA www.cisco.com CN

Domain Name System (response)

Transaction ID: 0x0002

Flags: 0x8180 Standard query response, No error

- 1... .. = Response: Message is a response
- .000 0... .. = Opcode: Standard query (0)
- ... 0... .. = Authoritative: Server is not an authority for domain
- ... ..0. .... = Truncated: Message is not truncated
- ... ..1 .... = Recursion desired: Do query recursively
- ... ..1... .. = Recursion available: Server can do recursive queries
- ... .. .0.. .... = Z: reserved (0)
- ... .. .0. .... = Answer authenticated: Answer/authority portion was not authenticated by the server
- ... .. .0 .... = Non-authenticated data: Unacceptable
- ... .. .0000 = Reply code: No error (0)

Questions: 1

Answer RRs: 5

Authority RRs: 0

Additional RRs: 0

Queries

- www.cisco.com: type A, class IN
  - Name: www.cisco.com
  - [Name Length: 13]
  - [Label Count: 3]
  - Type: A (Host Address) (1)
  - Class: IN (0x0001)

Answers

- www.cisco.com: type CNAME, class IN, cname www.cisco.com.akadns.net
- www.cisco.com.akadns.net: type CNAME, class IN, cname wwds.cisco.com.edgekey.net
- wwds.cisco.com.edgekey.net: type CNAME, class IN, cname wwds.cisco.com.edgekey.net.globalredir.akadns.net
- wwds.cisco.com.edgekey.net.globalredir.akadns.net: type CNAME, class IN, cname e2867.dsca.akamaiedge.net
- e2867.dsca.akamaiedge.net: type A, class IN, addr 96.7.79.147

[Request In: 11]

[Time: 0.010542000 seconds]

Ethernet (eth), 14 bytes

Packets: 17 · Displayed: 6 (35.3%)

Profile: Default

Can the DNS server do recursive queries?

- c. Observe the CNAME and A records in the answers details.

How do the results compare to nslookup results?



### Reflection Question

1. From the Wireshark results, what else can you learn about the network when you remove the filter?
2. How can an attacker use Wireshark to compromise your network security?