

Introduction to Computer Security

Project II: Phishing Attacks in Wi-Fi Networks

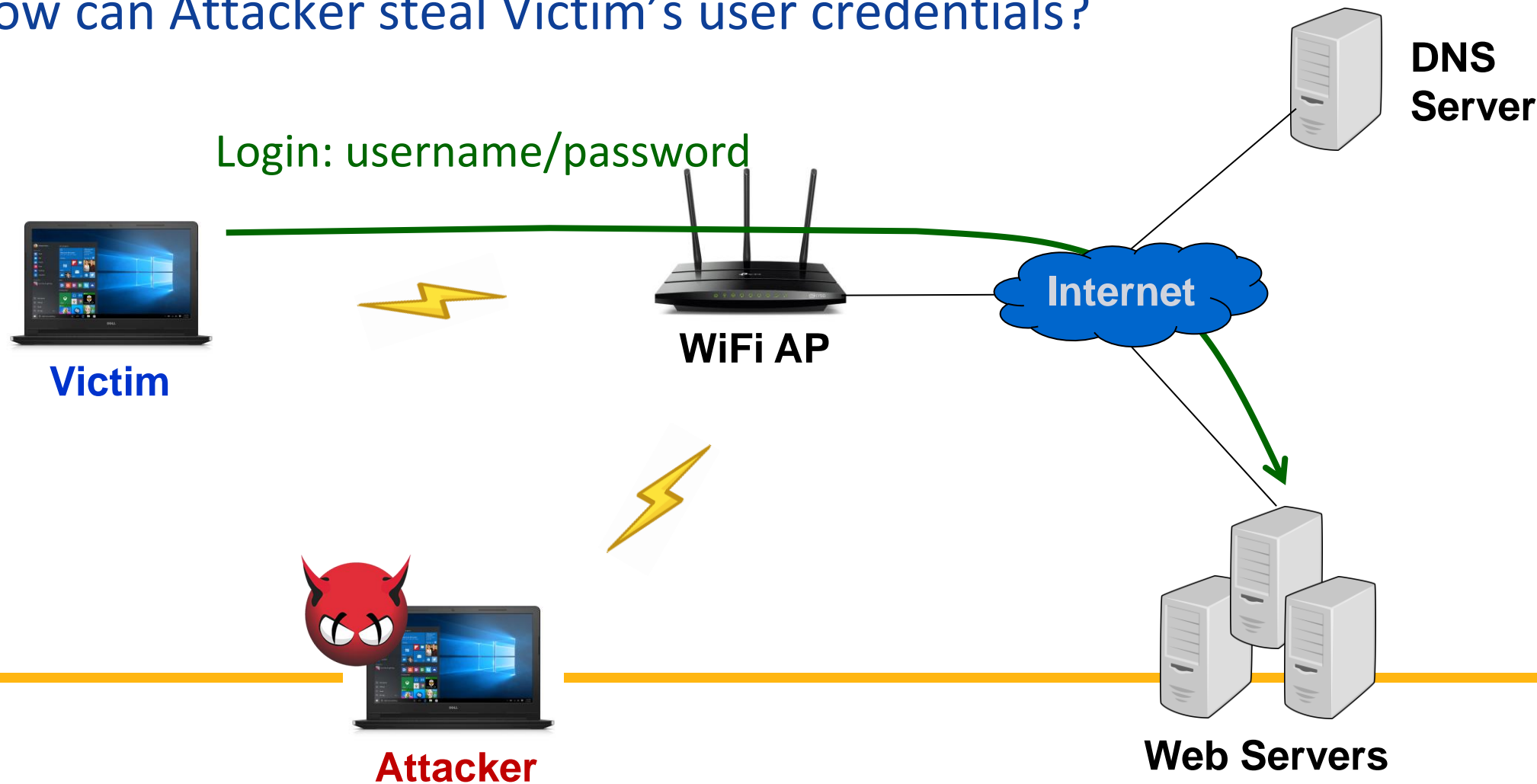
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Goal

- Understand how user credentials can be leaked by a man-in-the-middle attack over Wi-Fi networks
- You will learn how to
 - scan IP/MAC addresses of the devices in a Wi-Fi network
 - launch an ARP spoofing attack
 - launch a pharming attack
 - launch a man-in-the-middle attack

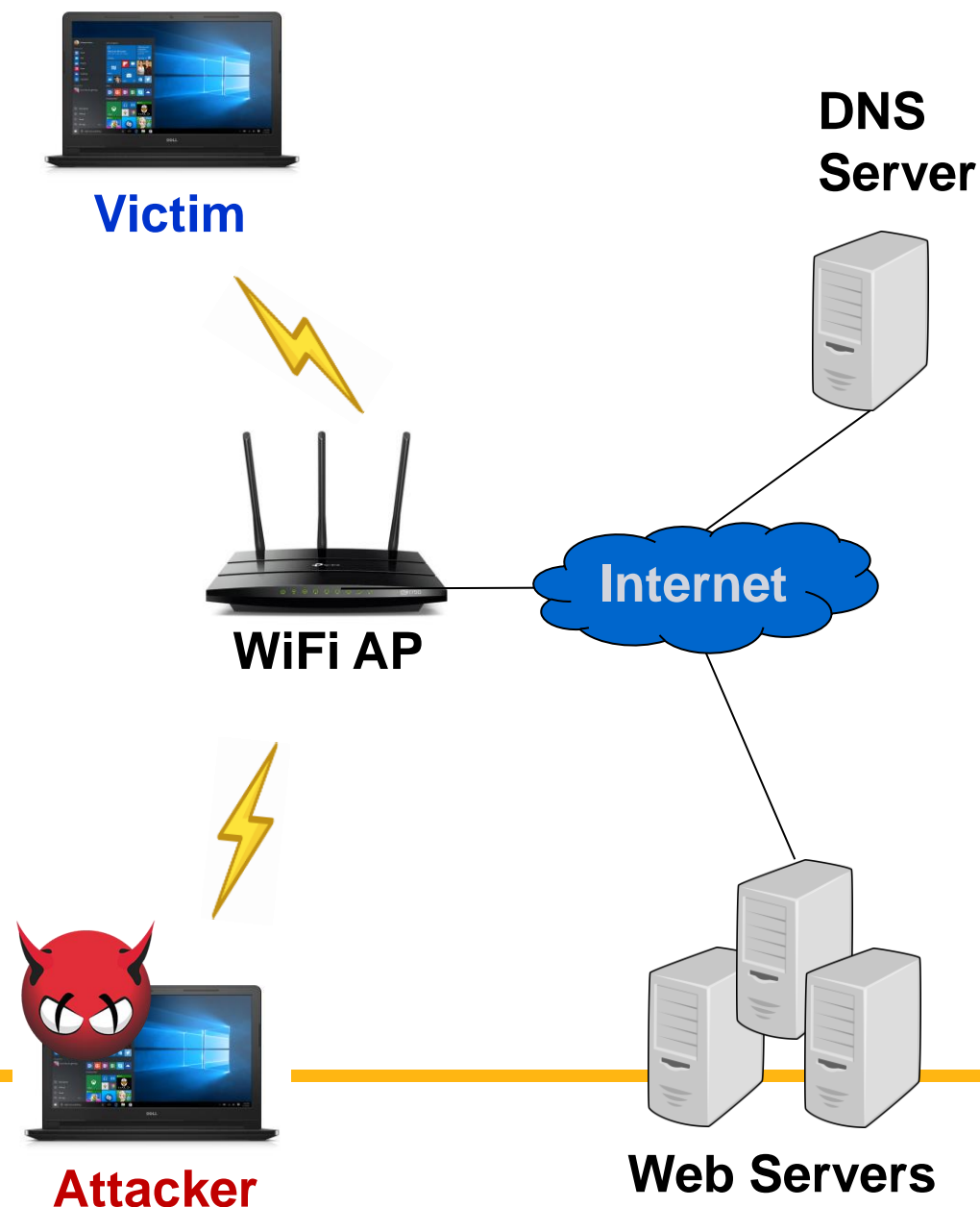
Attack Scenario

- How can Attacker steal Victim's user credentials?



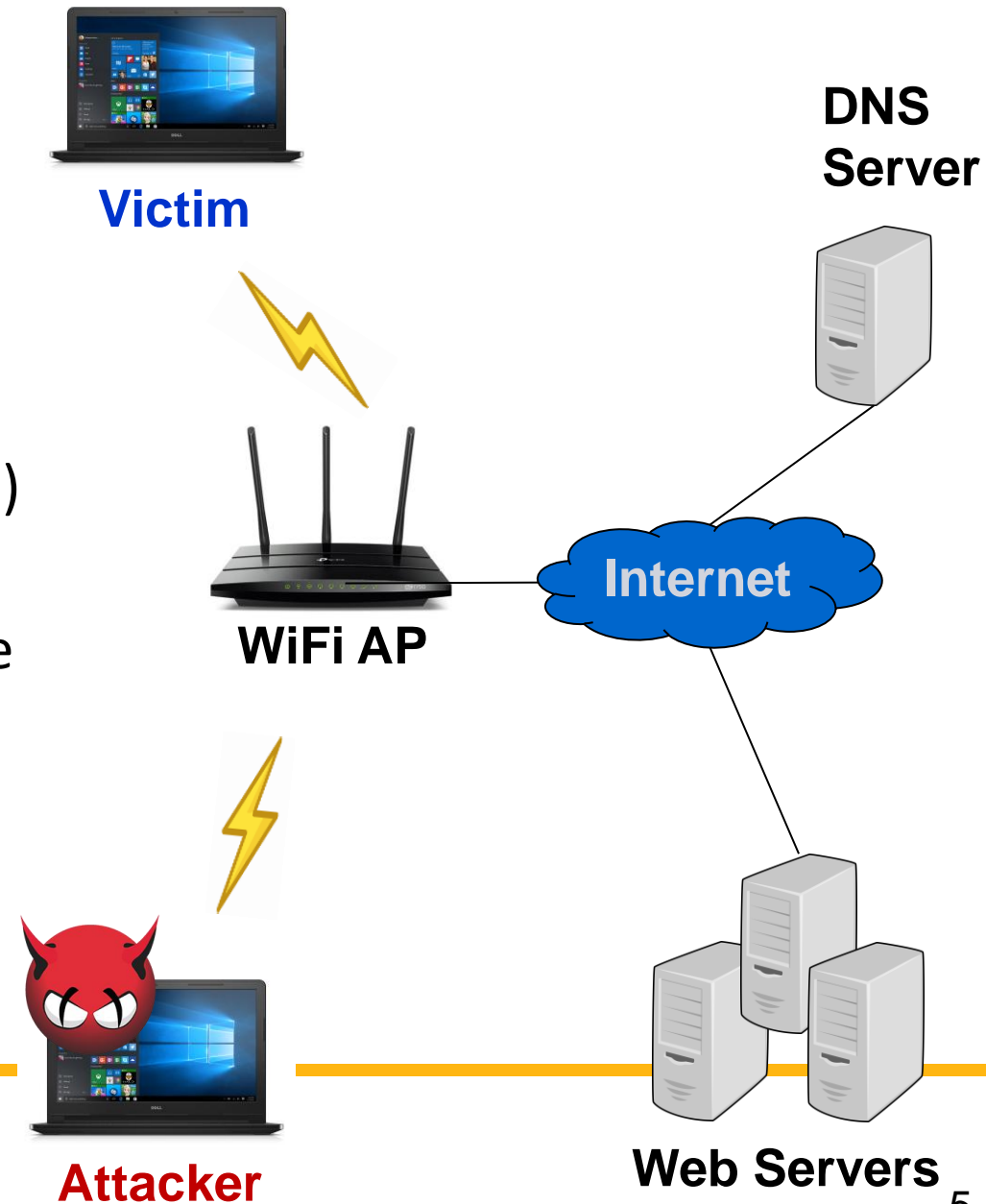
Major Ideas

- Redirect Victim's traffic to Attacker
 - ❑ Man-in-the-middle based on ARP spoofing
 - ❑ How to know Victim's IP/MAC address?
- Unencrypted sessions
 - ❑ Parse HTTP messages
- How about encrypted sessions?
 - ❑ Pharming attack: redirect an HTTP request to a phishing web page



Tasks: Two Attacks and One Report

- **Man-in-the-middle Attack (40%)**
 - ❑ Obtain all other client devices' IP/MAC addresses in a connected Wi-Fi network (Task I)
 - ❑ ARP spoofing for all other client devices in the Wi-Fi network (Task II)
 - ❑ Fetch all the inputted username/password strings on a specified web page

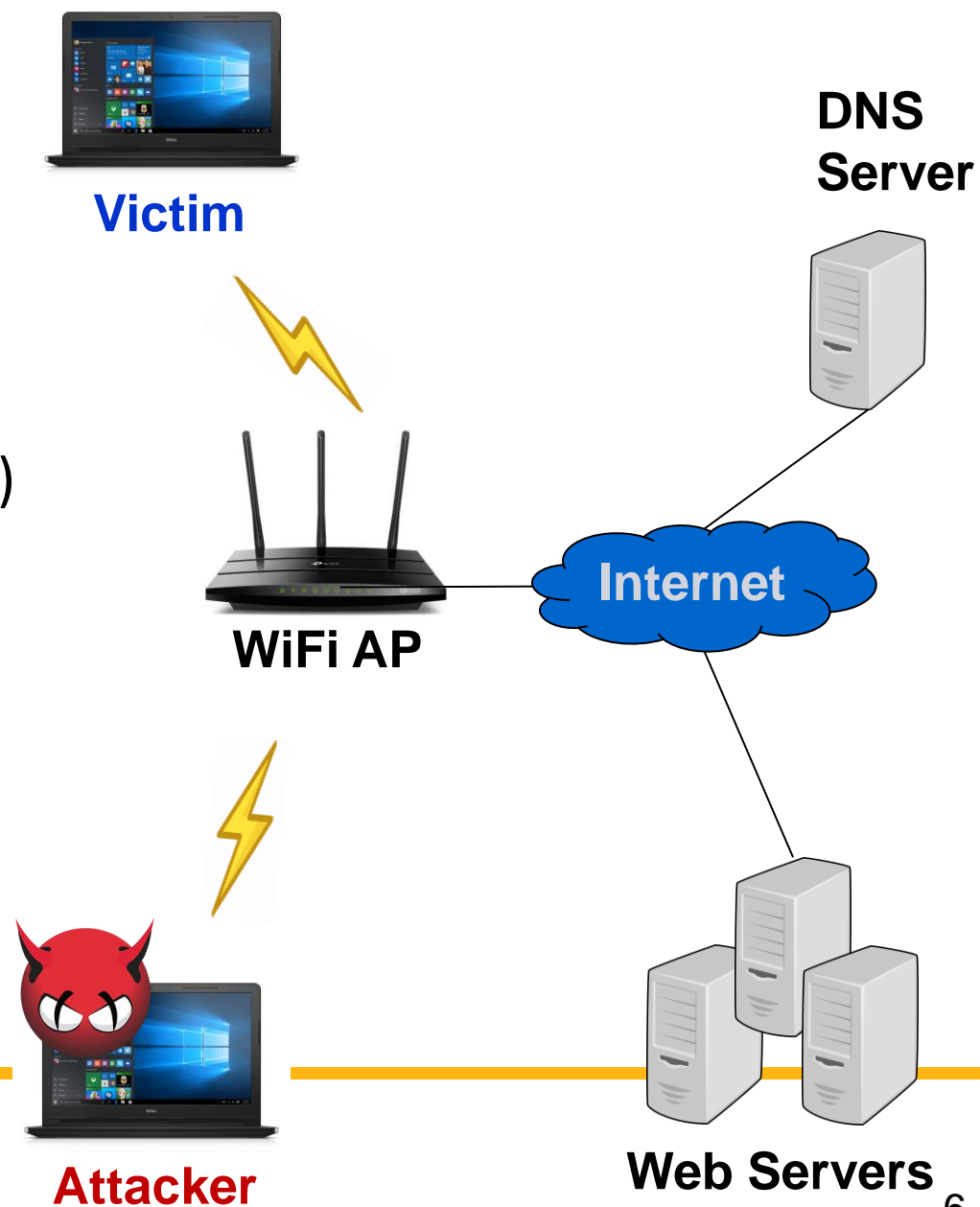


Tasks: Two Attacks and One Report

- **Pharming Attack (30%)**

- ❑ Obtain all other client devices' IP/MAC addresses in a connected Wi-Fi network (Task I)
- ❑ DNS spoofing attack on a specified web page (Task III)

- **Report (30%)**



Task 1: Obtain Other Client Devices' IP/MAC Addresses in a Wi-Fi Network

- Scan all the devices' IP/MAC addresses in the Wi-Fi network

- You can use 'Scapy' library in Python or commands 'nmap', 'arp', and 'route'

```
→ project 2 cat scan_result
Available devices
-----
IP                               MAC Address
-----
192.168.1.1                      fc:f5:28:67:dd:db
192.168.1.101                    cc:2f:71:fe:45:7f
192.168.1.104                    54:35:30:73:c1:87
```

- Fetch the IP/MAC addresses of all the other client devices

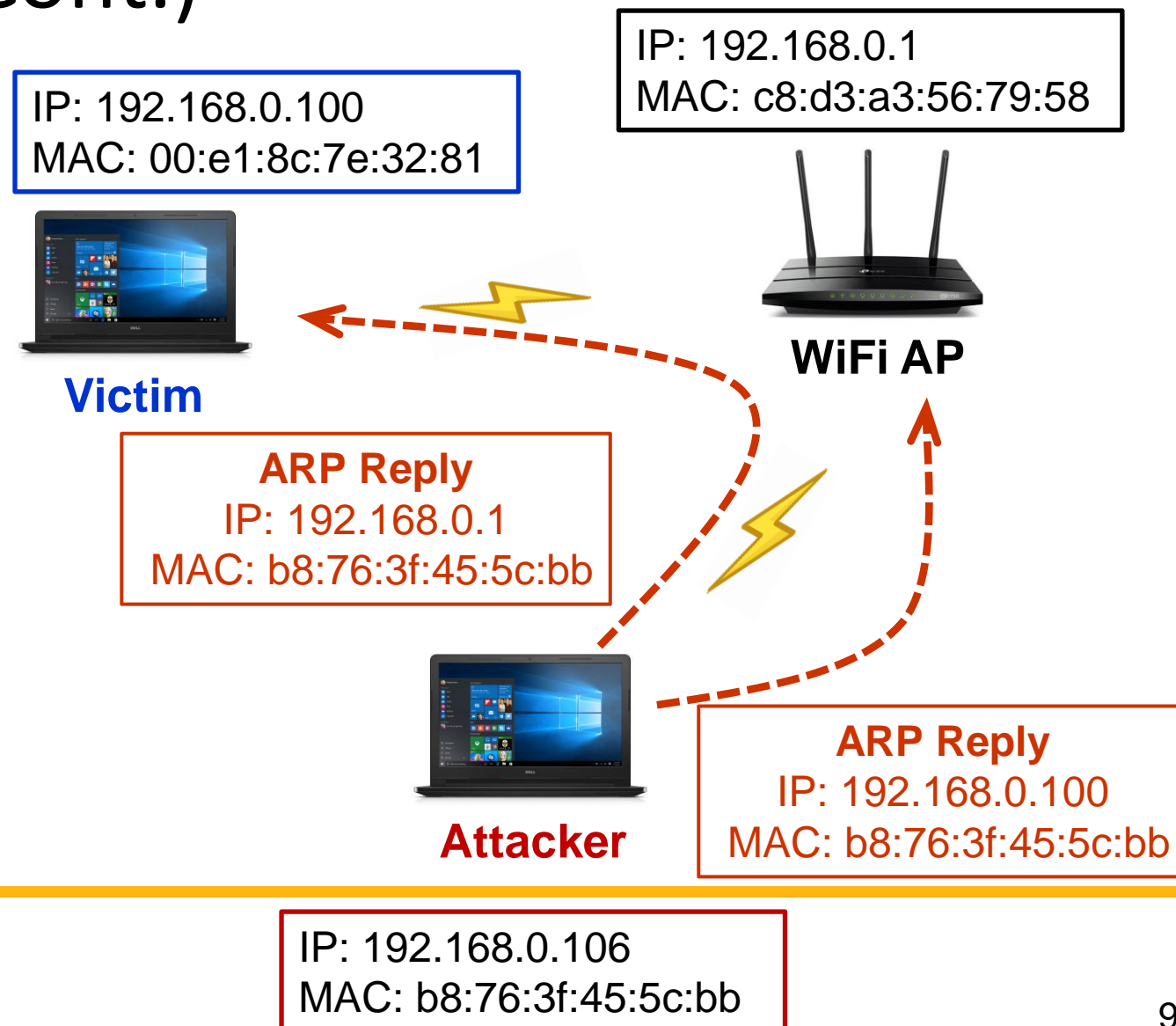
Task II: ARP Spoofing

- What is ARP (Address Translation Protocol)?

- ❑ A communication protocol: discovering the link layer (or MAC) address associated with a given IP
- ❑ A request-response protocol: messages are encapsulated by a link-layer protocol
 - ARP request: broadcast
 - ARP response: unicast
- ❑ Never routed across internetworking nodes

Task II: ARP Spoofing (Cont.)

- Generate spoofed ARP replies for all other client devices
 - ❑ You can use 'Scapy' library in Python
- Both uplink and downlink should be considered
 - ❑ Other client devices' network services can work normally



Task II: ARP Spoofing (Cont.)

- An example trace of the successful ARP spoofing at Attacker

The image displays a Wireshark packet capture of an ICMP ping sequence. The interface shows a list of packets and their details. Red boxes highlight the source and destination MAC addresses in the Ethernet II layer of specific frames, with red arrows indicating the direction of traffic.

Packet 2743: ICMP Echo (ping) request from 192.168.0.100 to 8.8.8.8. Details: Ethernet II, Src: IntelCor_7e:32:81 (00:e1:8c:7e:32:81), Dst: HonHaiPr_45:5c:bb (b8:76:3f:45:5c:bb). Internet Protocol Version 4, Src: 192.168.0.100, Dst: 8.8.8.8. Internet Control Message Protocol.

Packet 2744: ICMP Echo (ping) request from 192.168.0.100 to 8.8.8.8. Details: Ethernet II, Src: HonHaiPr_45:5c:bb (b8:76:3f:45:5c:bb), Dst: D-LinkIn_56:79:58 (c8:d3:a3:56:79:58). Internet Protocol Version 4, Src: 192.168.0.100, Dst: 8.8.8.8. Internet Control Message Protocol.

Packet 2745: ICMP Echo (ping) reply from 8.8.8.8 to 192.168.0.100. Details: Ethernet II, Src: D-LinkIn_56:79:58 (c8:d3:a3:56:79:58), Dst: HonHaiPr_45:5c:bb (b8:76:3f:45:5c:bb). Internet Protocol Version 4, Src: 8.8.8.8, Dst: 192.168.0.100. Internet Control Message Protocol.

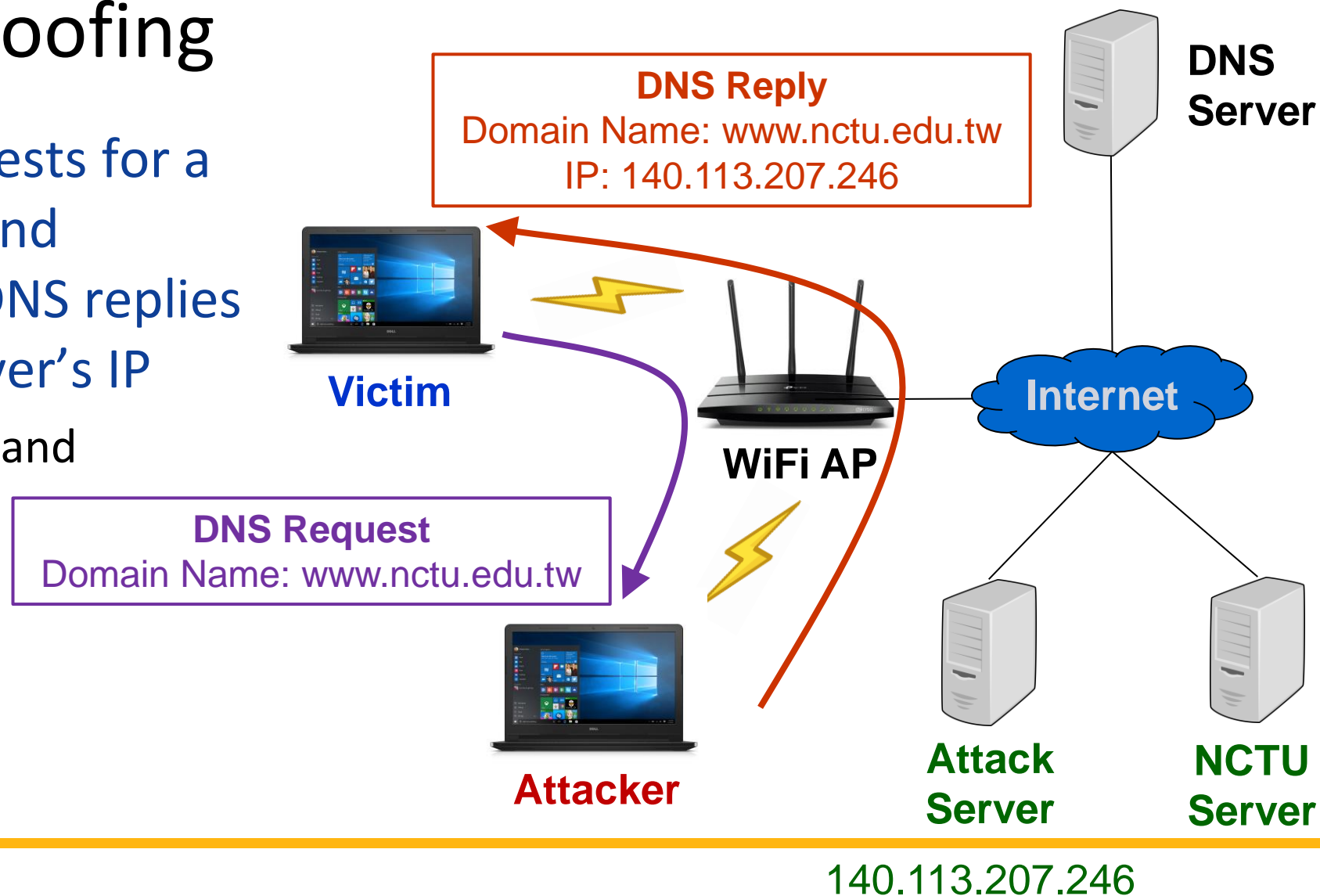
Packet 2746: ICMP Echo (ping) reply from 8.8.8.8 to 192.168.0.100. Details: Ethernet II, Src: HonHaiPr_45:5c:bb (b8:76:3f:45:5c:bb), Dst: IntelCor_7e:32:81 (00:e1:8c:7e:32:81). Internet Protocol Version 4, Src: 8.8.8.8, Dst: 192.168.0.100. Internet Control Message Protocol.

Arrows indicating traffic flow:

- Victim → Attacker (Packet 2743)
- Attacker → AP (Packet 2744)
- AP → Attacker (Packet 2745)
- Attacker → Victim (Packet 2746)

Task III: DNS Spoofing

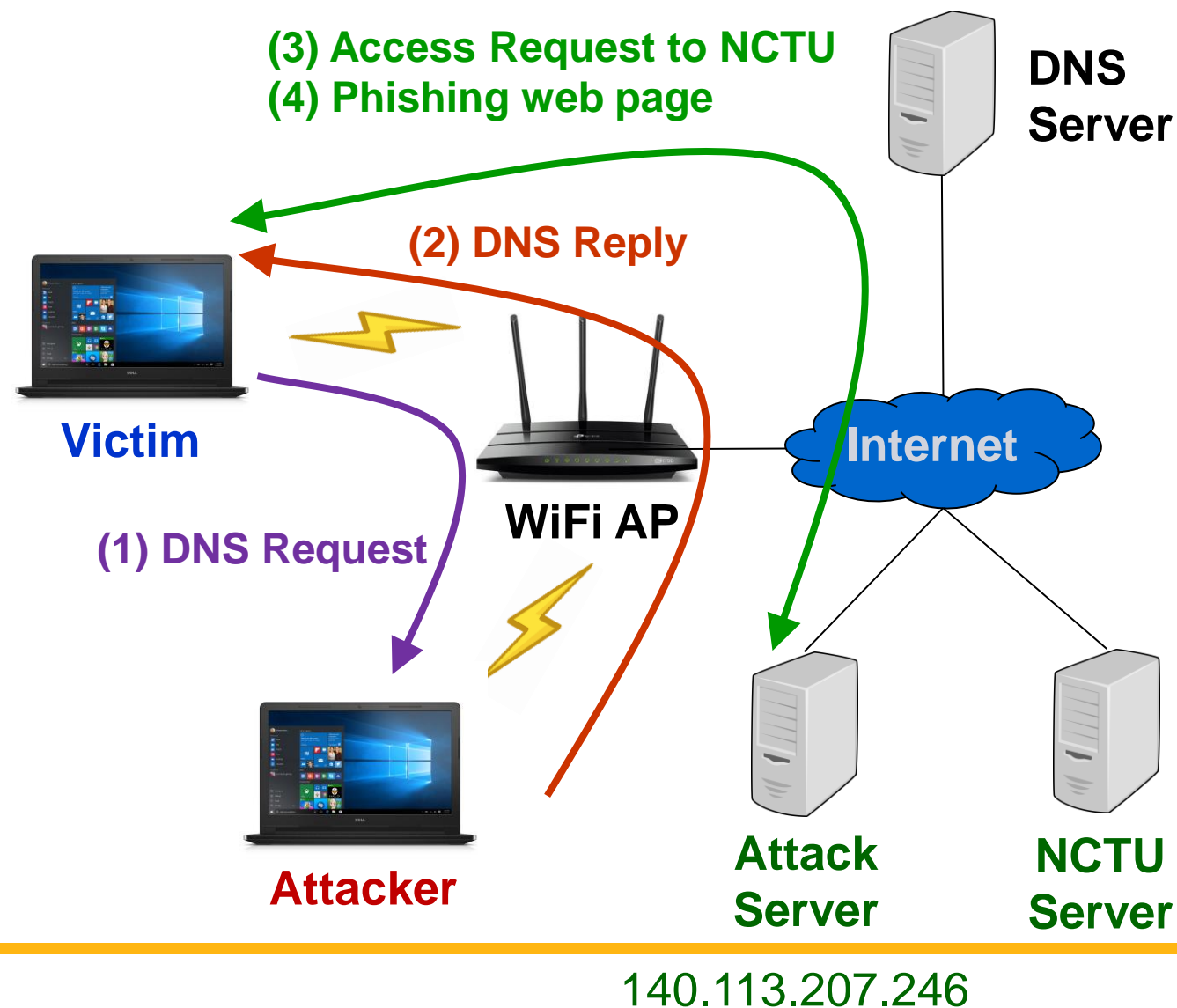
- Intercept DNS requests for a specific web page and generate spoofed DNS replies with the attack server's IP
 - You can use 'Scapy' and 'NetfilterQueue' library in Python



Task III: DNS Spoofing

● Successful attack

- ❑ An access request to NCTU home page will be redirected to the attack server (140.113.207.246)
- ❑ A phishing web page will be shown to Victim

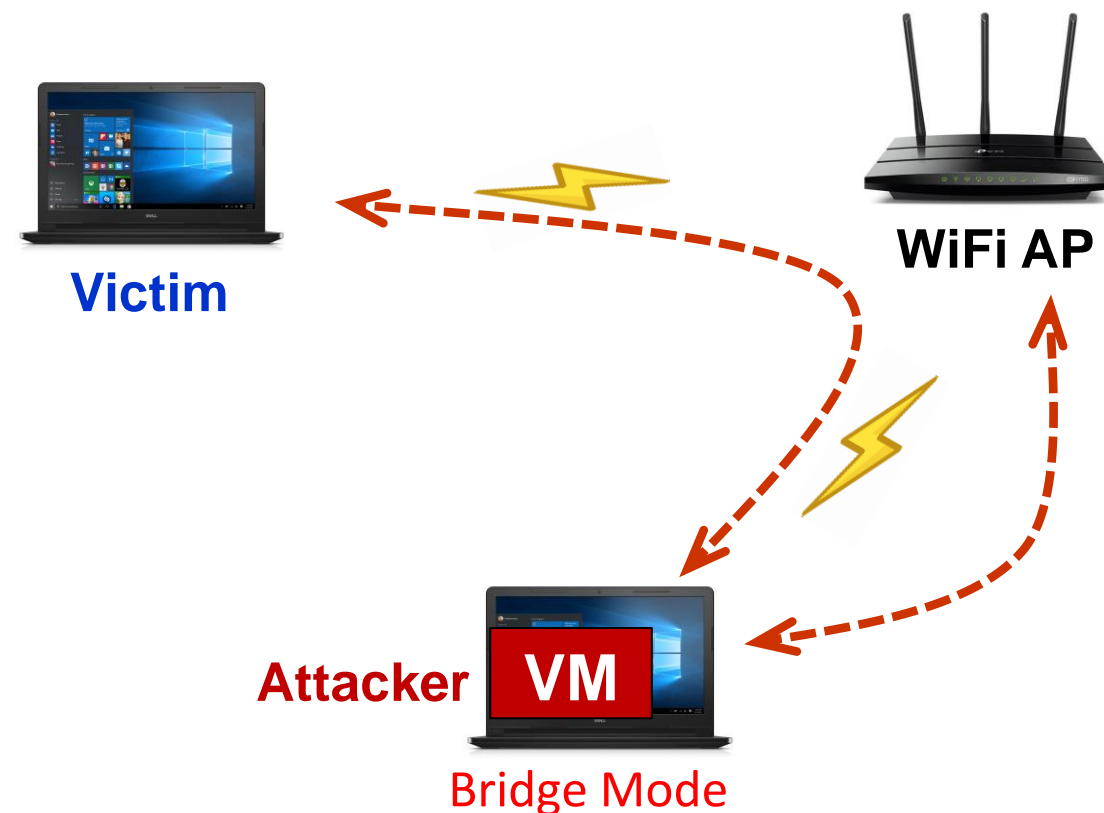


Requirements

- You need to develop/run your program in a given virtual machine
 - VM image: Please download it from [Link](#)
 - Username/password: cs2020/cs2020
- You are allowed to use C/C++ and Python
- You are allowed to team up. Each team has at most 2 students
 - Teams: discussions are allowed, but no collaboration
- Please submit your source codes and report to E3

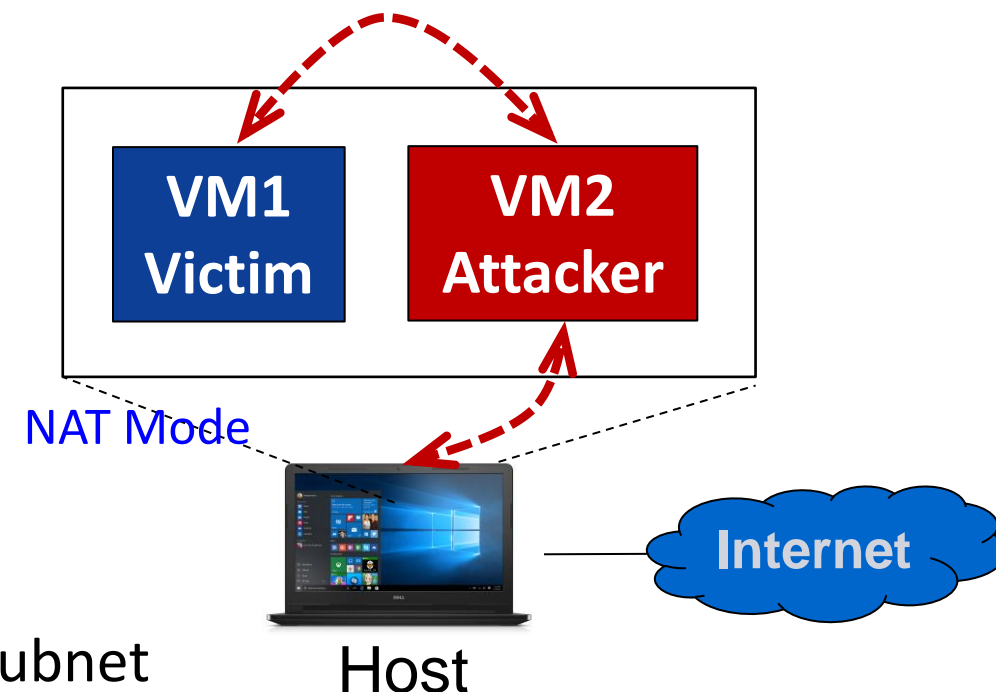
Test Scenario I: Target Scenario

- However, this scenario does not work for all the combinations of OS and VM software
 - ❑ Working: Linux + VirtualBox/VMware
 - ❑ Not working properly
 - Windows + VirtualBox/Vmware
 - MacOS + VirtualBox
- You can choose Test Scenario II



Test Scenario II: Alternative Scenario

- VM2 (Attacker) launches attacks on VM1 (Victim)
 - ❑ NAT mode shall be used for VMs
- Host is similar to the role of the AP in Test Scenario I
 - ❑ Scenario I: The Wi-Fi devices are in the same subnet
 - ❑ Scenario II: The VMs are in the same subnet



- Host can be connected to the Internet via Wi-Fi or wired Ethernet

Important: How to Prepare Your Attack Programs?

- Must provide a **Makefile** which compiles your source codes into two executable files, named **mitm_attack** and **pharm_attack** (Missing: -20%)
- Test requirements for the programs
 - ❑ Must be run in the given VM without any additional tools or libraries
 - ❑ Must use the following parameters
 - Test web page in the man-in-the-middle attack: <http://140.113.207.246/login.php>
 - DNS spoofing for the NCTU home page: <http://www.nctu.edu.tw>
 - Attacker server IP in the DNS spoofing: 140.113.207.246
 - ❑ Must work for the test commands: `./mitm_attack` and `./pharm_attack`

Important: How to Prepare Your Attack Programs?

- Results from the MitM attack (./mitm_attack)

- ❑ Print out the IP/MAC addresses of **all the Wi-Fi devices or VMs** except for **Attacker and AP/Host**
- ❑ Print out the username and password which a user submits to the website <http://140.113.207.246/login.php> using any of **the Wi-Fi devices or VMs**

- Results from the pharming attack (./pharm_attack)

- ❑ Print out the IP/MAC addresses of **all the Wi-Fi devices or VMs** except for **Attacker and AP/Host**
- ❑ Redirect the NCTU home page (www.nctu.edu.tw) to the phishing page (140.113.207.246)

- Notes

- ❑ TA will verify the MitM attack by giving inputs on the website using **one Wi-Fi device or VM**
- ❑ TA will verify the pharming attack by accessing the NCTU page on **one Wi-Fi device or VM**

Important: How to Prepare Your Report?

- Item 1 (10%): please give evidence that you have finished the MitM attack
 - Specify your scenario (I or II) and Illustrate your results based on some snapshots
- Item 2 (10%): please give evidence that you have finished the pharming attack
 - Specify your scenario (I or II) and Illustrate your results based on some snapshots
- Item 3 (10%): please propose a solution that can defend against the ARP spoofing attack
 - No more than 200 English words
- Note: the report must be written in English with font size 11 or 12 in Times New Roman. It must be submitted in one PDF file with a name “report.pdf.”

Project Submission

- Due date: 5/7 11:55pm

- Makeup submission: 5/21 11:55pm (75 points at most)

- Submission rules

- Put all your files into a directory and name it using your student ID(s)

- If your team has two members, please concatenate your IDs separated by “-”

- Zip the directory and upload the zip file to New E3

- A sample of the zip file: 01212112-02121221.zip

- Makefile

- mitm_attack.cpp

- report.pdf

- mitm_attack.h

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