Week #1

Study and understand the basic networking tools - Wireshark, Tcpdump, Ping, Traceroute and Netcat.

Learn and Understand Network Tools

1. Wireshark

- Perform and analyze Ping PDU capture
- Examine HTTP packet capture
- Analyze HTTP packet capture using filter

2. Netcat

- Establish communication between client and server
- Transfer files

3. Tcpdump

- Capture packets

4. Ping

- Test the connectivity between 2 systems

5. Traceroute

- Perform traceroute checks

6. Nmap

- Explore an entire network

IMPORTANT INSTRUCTIONS:

- This manual is written for Ubuntu Linux OS only. You can also execute these experiments on VirtualBox or VMWare platform.
- For few tasks, you may need to create 2 VMs for experimental setup.
- Perform **sudo apt-get update** before installing any tool or utility.
- Install any tool or utility using the command **sudo apt-get install name_of_the_tool**
- Take screenshots wherever necessary and upload it to Edmodo as a single PDF file. (Refer general instructions for submission requirements).
- Instructors will give information, to define an IP address for your machine (e.g., Section – 'a' & Serial number is 1, then your IP address should be 10.0.1.1. Section – 'h' & & Serial number is 23, then your IP address should be 10.0.8.23)

Task 1: Linux Interface Configuration (ifconfig / IP command)

Step 1: To display status of all active network interfaces.

ifconfig (or) **ip addr show**

Analyze and fill the following table:

ip address table:

Interface name	**IP address (IPv4 / IPv6)**	**MAC address**	

Step 2: To assign an IP address to an interface, use the following command.

sudo ifconfig interface_name 10.0.your_section.your_sno netmask 255.255.255.0 (or)

sudo ip addr add 10.0.your_section.your_sno /24 dev interface_name

Step 3: To activate / deactivate a network interface, type.

sudo ifconfig interface_name down

sudo ifconfig interface_name up

Step 4: To show the current neighbor table in kernel, type

ip neigh

Task 2: Ping PDU (Packet Data Units or Packets) Capture

Step 1: Assign an IP address to the system (Host).

Note: IP address of your system should be 10.0.your_section.your_sno.

Step 2: Launch Wireshark and select 'any' interface

Step 3: In terminal, type **ping 10.0.your_section.your_sno**

Observations to be made

Step 4: Analyze the following in Terminal

- TTL
- Protocol used by ping
- Time

Step 5: Analyze the following in Wireshark

On Packet List Pane, select the first echo packet on the list. On Packet Details Pane, click on each of the four "+" to expand the information. Analyze the frames with the first echo request and echo reply and complete the table below.

Details	First Echo Request	First Echo Reply
Frame Number		
Source IP address		
Destination IP address		
ICMP Type Value		
ICMP Code Value		
Source Ethernet Address		
Destination Ethernet Address		
Internet Protocol Version		
Time To Live (TTL) Value		

Task 3: HTTP PDU Capture

Using Wireshark's Filter feature

Step 1: Launch Wireshark and select 'any' interface. On the Filter toolbar, type-in 'http' and press enter

Step 2: Open Firefox browser, and browse www.flipkart.com

Observations to be made

Step 3: Analyze the first (interaction of host to the web server) and second frame (response of server to the client). By analyzing the filtered frames, complete the table below:

Details	First Echo Request	First Echo Reply
Frame Number		
Source Port		
Destination Port		
Source IP address		
Destination IP address		
Source Ethernet Address		
Destination Ethernet Address		

Step 4: Analyze the HTTP request and response and complete the table below.

HTTP Request		HTTP Response	
Get		Server	
Host		Content-Type	
User-Agent		Date	
Accept-Language		Location	
Accept-Encoding		Content-Length	
Connection		Connection	

Using Wireshark's Follow TCP Stream

Step 1: Make sure the filter is blank. Right-click any packet inside the Packet List Pane, then select 'Follow TCP Stream'. For demo purpose, a packet containing the HTTP GET request "GET / HTTP / 1.1" can be selected.

Step 2: Upon following a TCP stream, screenshot the whole window.

Task 4: Capturing packets with tcpdump

Step 1: Use the command **tcpdump -D** to see which interfaces are available for capture.

sudo tcpdump -D

Step 2: Capture all packets in any interface by running this command:

sudo tcpdump -i any

Note: Perform some pinging operation while giving above command. Also type www.google.com in browser.

Observation

Step 3: Understand the output format.

Step 4: To filter packets based on protocol, specifying the protocol in the command line. For example, capture ICMP packets only by using this command:

sudo tcpdump -i any -c5 icmp

Step 5: Check the packet content. For example, inspect the HTTP content of a web request like this:

sudo tcpdump -i any -c10 -nn -A port 80

Step 6: To save packets to a file instead of displaying them on screen, use the option -w:

sudo tcpdump -i any -c10 -nn -w webserver.pcap port 80

Task 5: Perform Traceroute checks

Step 1: Run the traceroute using the following command.

sudo traceroute www.google.com

Step 2: Analyze destination address of google.com and no. of hops

Step 3: To speed up the process, you can disable the mapping of IP addresses with hostnames by using the *-n* option

sudo traceroute -n www.google.com

Step 4: The -I option is necessary so that the traceroute uses ICMP.

sudo traceroute -I www.google.com

Step 5: By default, traceroute uses icmp (ping) packets. If you'd rather test a TCP connection to gather data more relevant to web server, you can use the -T flag.

sudo traceroute -T www.google.com

Task 6: Explore an entire network for information (Nmap)

Step 1: You can scan a host using its host name or IP address, for instance.

nmap www.pes.edu

Step 2: Alternatively, use an IP address to scan.

nmap 163.53.78.128

Step 3: Scan multiple IP address or subnet (IPv4)

nmap 192.168.1.1 192.168.1.2 192.168.1.3

Task 7 a): Netcat as Chat tool

a) Intra system communication (Using 2 terminals in the same system)

Step 1: Open a terminal (Ctrl+Alt+T). This will act as a Server.

Step 2: Type **nc -l any_portnum** (For eg., nc -l 1234)

Note: It will goto listening mode

Step 3: Open another terminal and this will act as a client.

Step 4: Type nc <your-system-ip-address> portnum

Note: portnum should be common in both the terminals (for eg., nc 10.0.2.8 1234)

Step 5: Type anything in client will appear in server

Note: For the below tasks, create 2 virtual machines. Use VMware Workstation or VirtualBox.

b) Inter system communication

Setup a simple switched network of 2 PCs with one acting as Web server. Assign IP addresses for both PCs. Set the capture option as described above.

Step 1: Open terminal on Server machine (Machine 1).

Step 2: Type **nc -l any_portnum**

Step 3: Open terminal on the Client machine (Machine 2)

Step 4: Type nc <server-ip-address> portnum

Step 5: Type anything in client will appear in the server terminal

Task 7 b): Use Netcat to Transfer Files

The netcat utility can also be used to transfer files.

Step 1: At the server side, create an empty file named 'test.txt'

sudo nc -l 555 > test.txt

Step 2: At the client side, we have a file 'testfile.txt'. Add some contents to it.

Step 3: Run the client as:

sudo nc 10.0.2.8 555 < testfile.txt

here, 10.0.2.8 is the IP address of server and 555 is the port number.

Step 4: At server side, verify the file transfer using the command

cat test.txt

Task 7 c): Other Commands

1) To test if a particular TCP port of a remote host is open.

nc -vn 10.0.2.8 555

2) Run a web server with a static web page.
   Step 1: Run the command below on local host (e.g. 10.0.2.8) to start a web server that serves test.html on port 80.
   while true; do sudo nc -lp 80 < test.html; done

   Step 2: Now open **http://10.0.2.8/test.html** from another host to access it.

   Step 3: Observe the details on the terminal

Questions on above observations:

1) Is your browser running HTTP version 1.0 or 1.1? What version of HTTP is the server?
2) When was the HTML file that you are retrieving last modified at the server?
3) How to tell ping to exit after a specified number of ECHO_REQUEST packets?
4) How will you identify remote host apps and OS?

Exercises:

1) Capture and Analyze IPv4 / IPv6 packets

IPv4 / IPv6 packet header

GET	
HOST	
USER-AGENT	
ACCEPT-LANGUAGE	
CACHE-CONTROL	
PRAGMA	
CONNECTION	

2) Explore various other network configuration, troubleshooting and debugging tools such as Route, Netstat, etc.