NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCE
CL3001 - Computer Networks Lab - Spring 2023
Lab Session 01

To get started with the lab activities, some basic terms to be familiarized with:

**Network:** a group or system of interconnected people or things.

Computer Network: A computer network or data network is a telecommunications network which allows nodes to share resources. In computer networks, networked computing devices exchange data with each other using a data link. The connections between nodes are established using either cable media or wireless media.

**Types of Network:** Some of the different networks based on size are LAN, MAN, WAN.
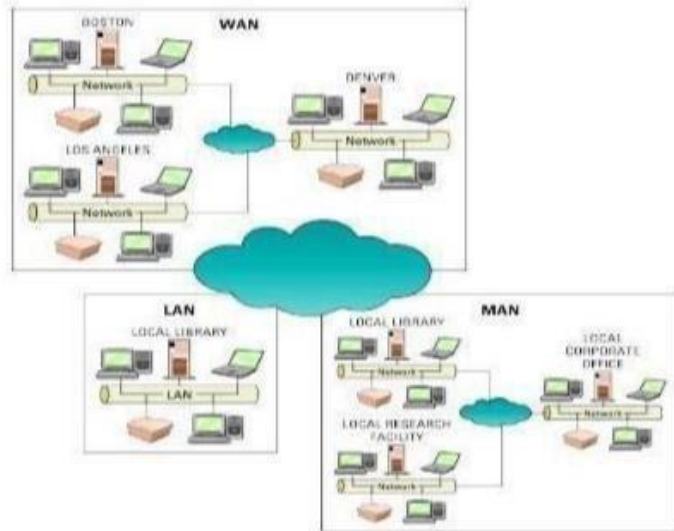
Host: computer to be connected to a network.

Topology: Network topology is the arrangement of the various elements (links, nodes, etc.) of a computer network. Essentially, it is the topological structure of a network and may be depicted physically or logically. The basic examples of network topologies used in local area networks include bus, ring, star, and tree and mesh topologies as shown below.
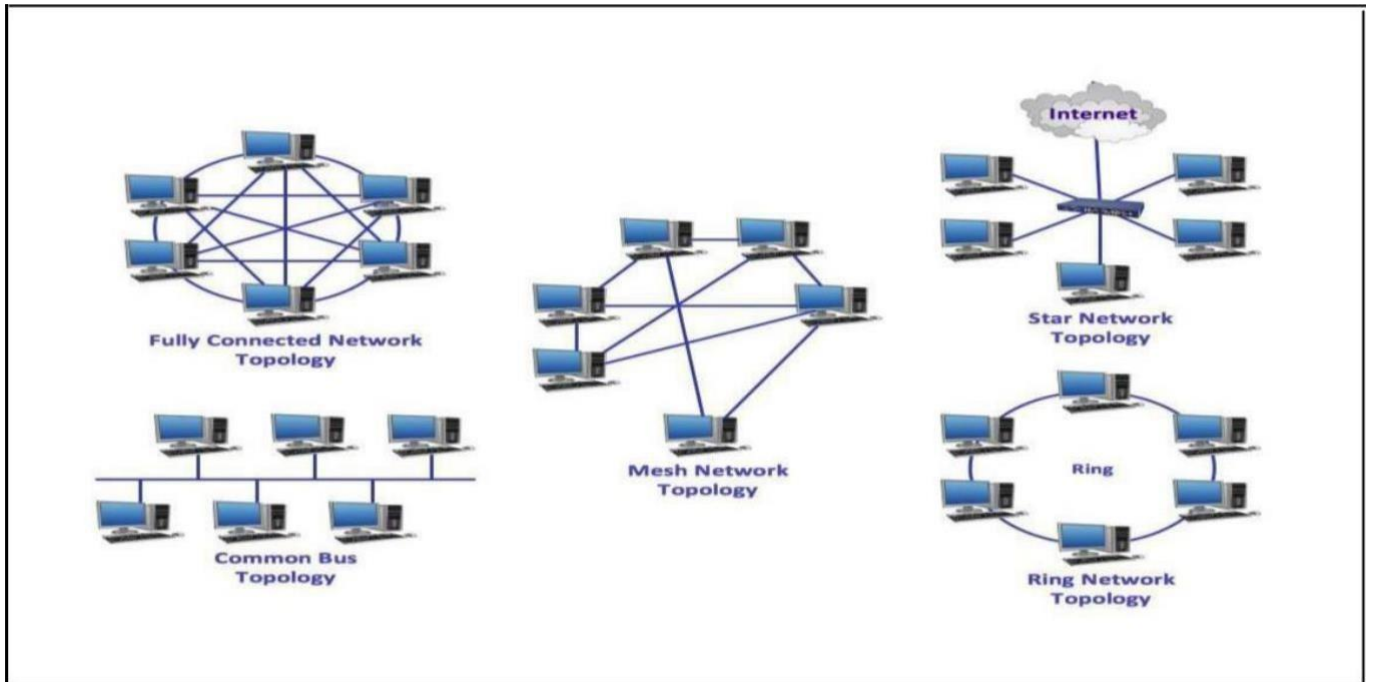
RJ45 Connector: An 8-pin/8-position plug or jack is commonly used to connect computers onto Ethernet-based local area networks (LAN). Two wiring schemes–T568A and T568B–are used to terminate the twisted-pair cable onto the connector interface as shown below.
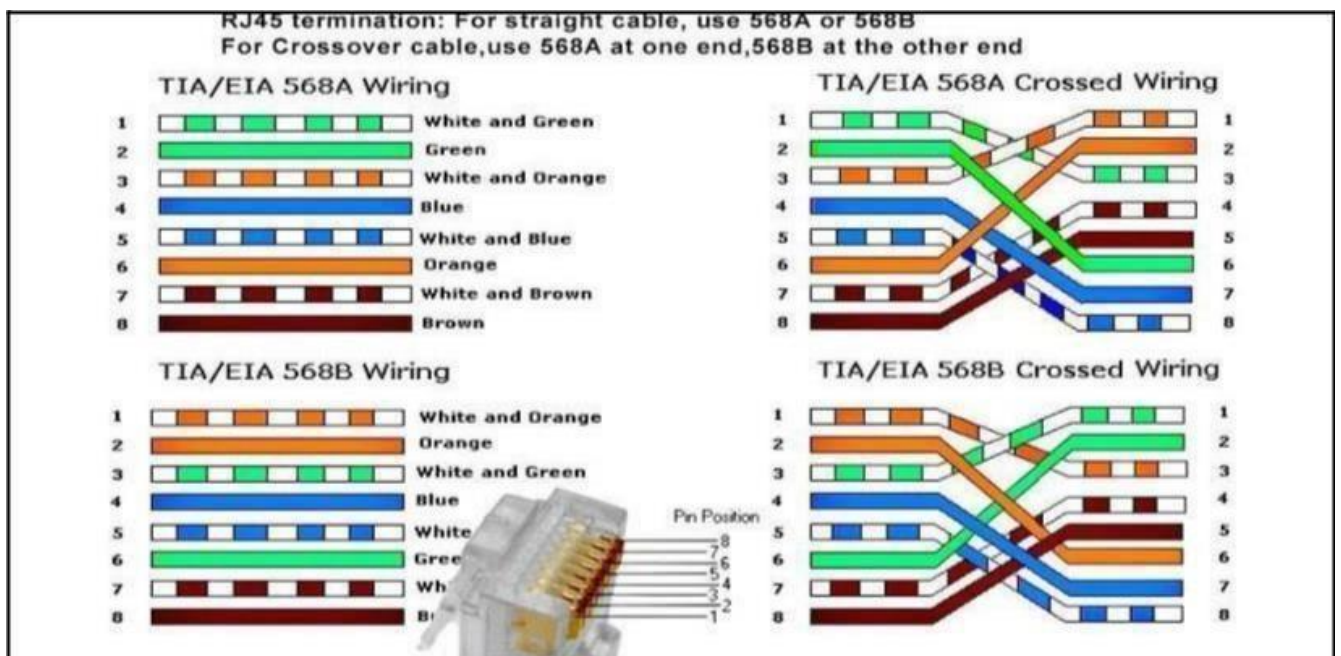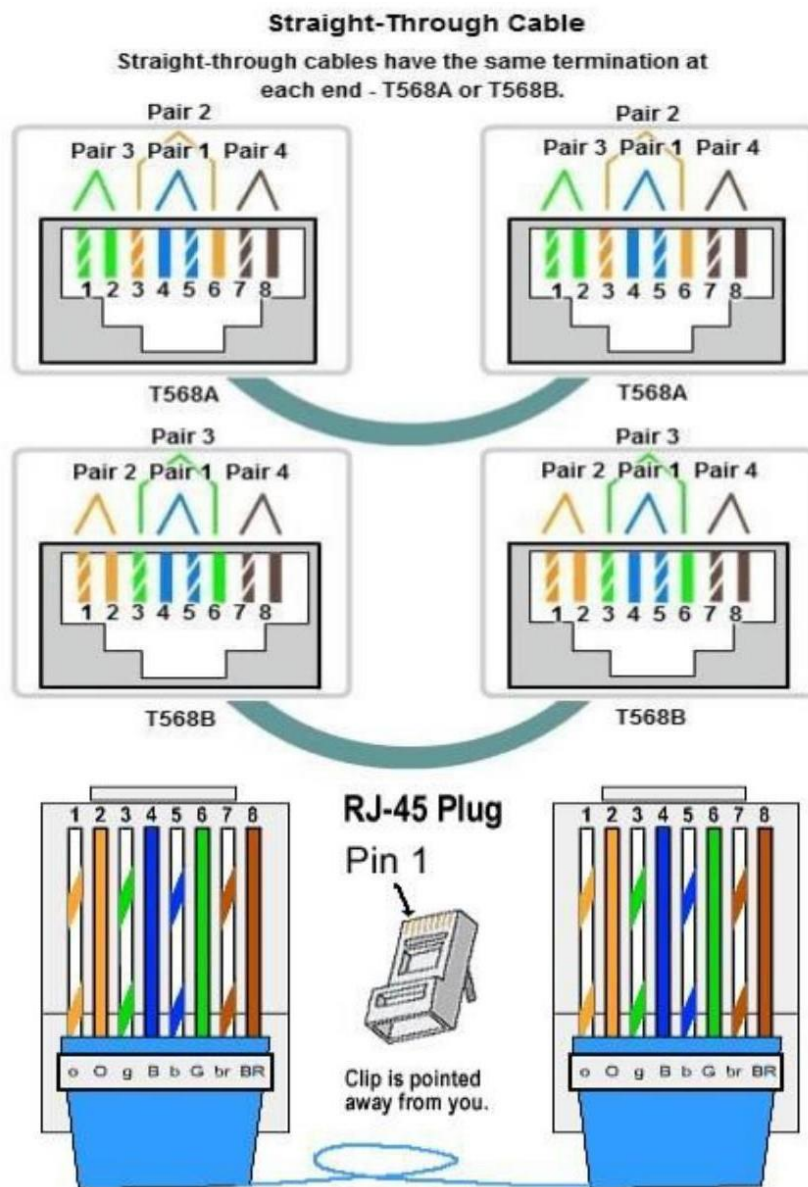
Straight cable:

You usually use straight cable to <u>connect different type of devices</u>. This type of cable will be used most of the time and can be used to:

1) Connect a computer to a switch/hub's normal port.

2) Connect a computer to a cable/DSL modem's LAN port.

3) Connect a router's WAN port to a cable/DSL modem's LAN port.

4) Connect a router's LAN port to a switch/hub's uplink port (normally used for expanding network).

5) Connect 2 switches/hubs with one of the switch/hubs using an uplink port and the otherone using normal port.

If you need to check how straight cable looks like, it's easy. Both sides (side A and side B) of cable have wire arrangement with same color

Straight-Through Cable

Straight-through cables have the same termination at each end - T568A or T568B.

Pair 2		
Pair 3	Pair 1	Pair 4

1 2 3 4 5 6 7 8

T568A

Pair 2		
Pair 3	Pair 1	Pair 4

1 2 3 4 5 6 7 8

T568A

Pair 3		
Pair 2	Pair 1	Pair 4

1 2 3 4 5 6 7 8

T568B

Pair 3		
Pair 2	Pair 1	Pair 4

1 2 3 4 5 6 7 8

T568B

1 2 3 4 5 6 7 8

o O g B b G br BR

RJ-45 Plug

Pin 1

Clip is pointed away from you.
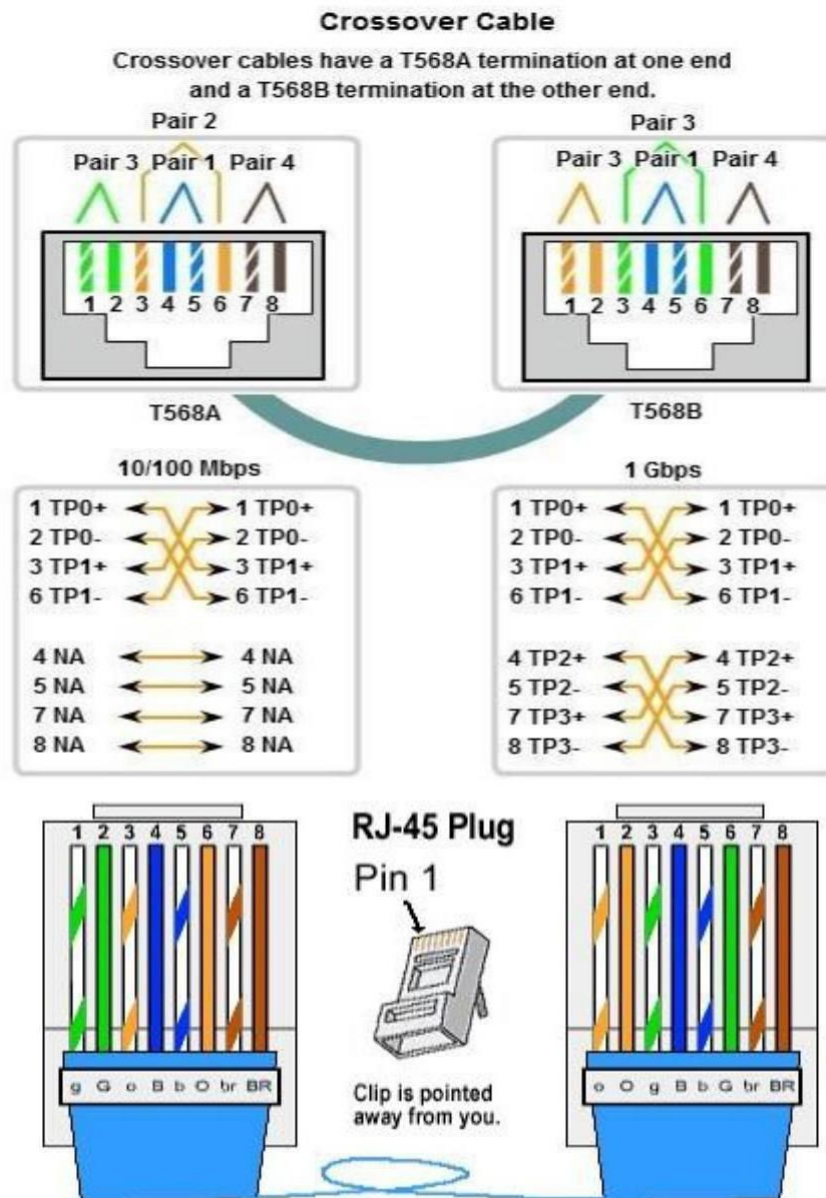
1 2 3 4 5 6 7 8

o O g B b G br BR
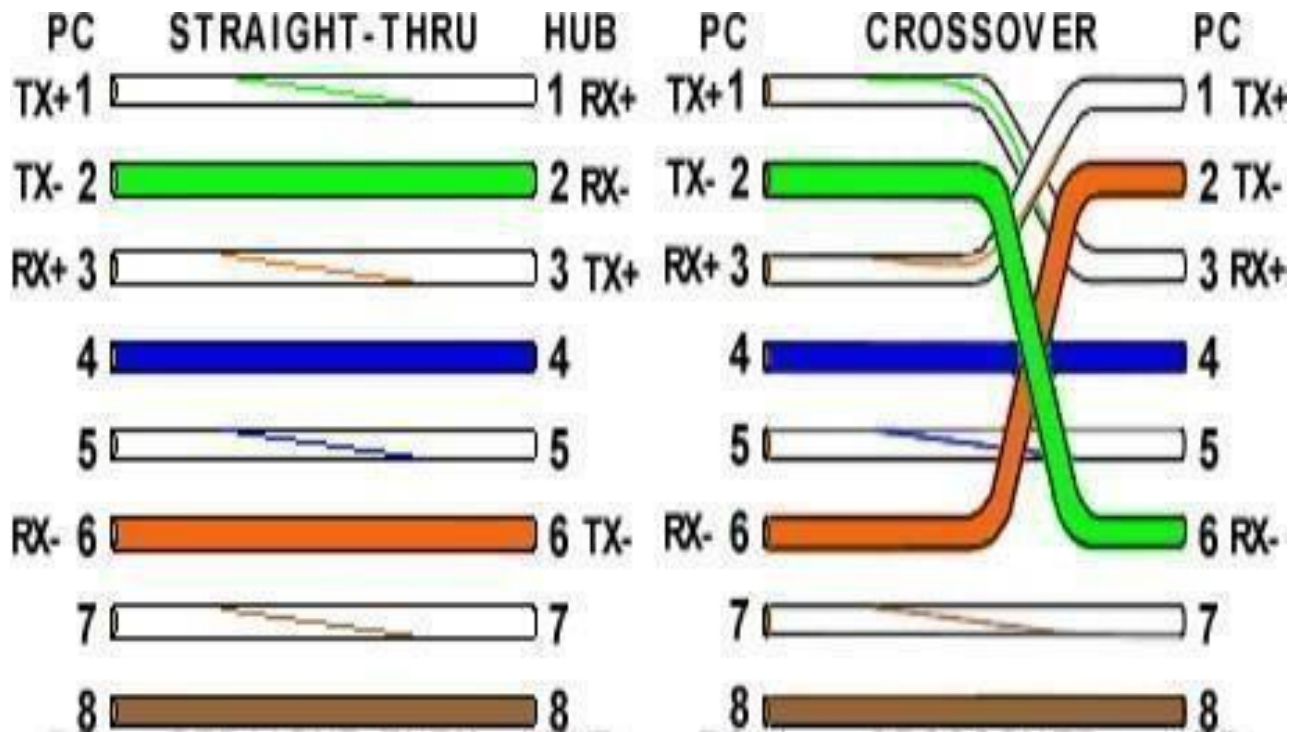
Crossover Cable:

Sometimes you will use crossover cable, it's usually used to **connect same type of devices**. A crossover cable can be used to:

1) **Connect 2 computers directly.**

2) **Connect a router's LAN port to a switch/hub's normal port. (normally used for expanding network)**

3) **Connect 2 switches/hubs by using normal port in both switches/hubs.**

In you need to check how crossover cable looks like; both sides (side A and side B) of cable have wire arrangement with following different color.

Crossover Cable

Crossover cables have a T568A termination at one end
and a T568B termination at the other end.

Pair 2	Pair 3
Pair 3 Pair 1 Pair 4	Pair 3 Pair 1 Pair 4

1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8

T568A   T568B

10/100 Mbps

1 TP0+	← →	1 TP0+
2 TP0-	← →	2 TP0-
3 TP1+	← →	3 TP1+
6 TP1-	← →	6 TP1-
4 NA	← →	4 NA
5 NA	← →	5 NA
7 NA	← →	7 NA
8 NA	← →	8 NA

1 Gbps

1 TP0+	← →	1 TP0+
2 TP0-	← →	2 TP0-
3 TP1+	← →	3 TP1+
6 TP1-	← →	6 TP1-
4 TP2+	← →	4 TP2+
5 TP2-	← →	5 TP2-
7 TP3+	← →	7 TP3+
8 TP3-	← →	8 TP3-

1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8

RJ-45 Plug

Pin 1

Clip is pointed
away from you.

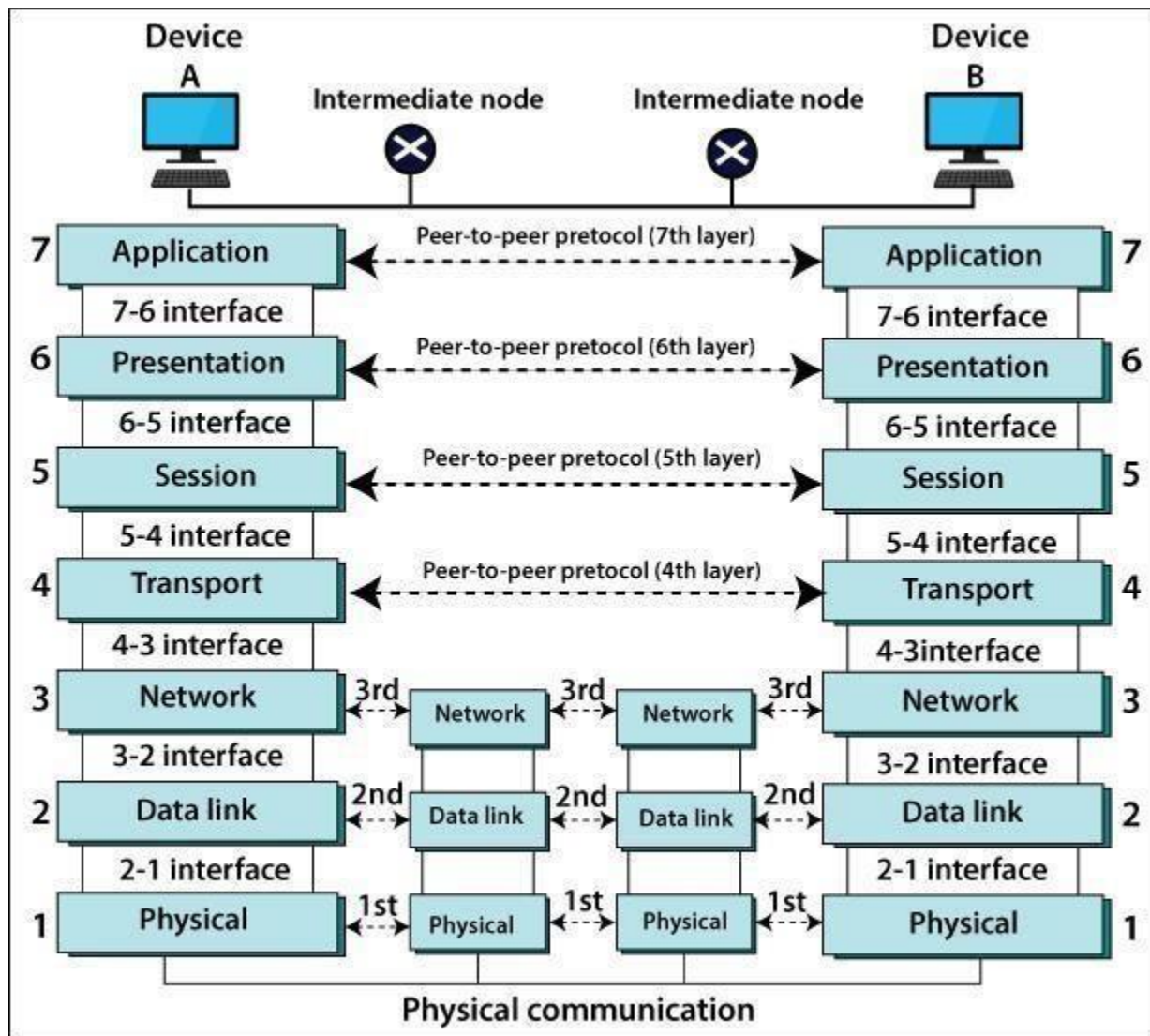g G o B b O br BR   o O g B b G br BR

Note: If there is auto MDI/MDI-X feature support on the switch, hub, network card or other network devices, you don't have to use crossover cable in the situation which is mentioned above. This is because crossover function would be enabled automatically when it's needed.

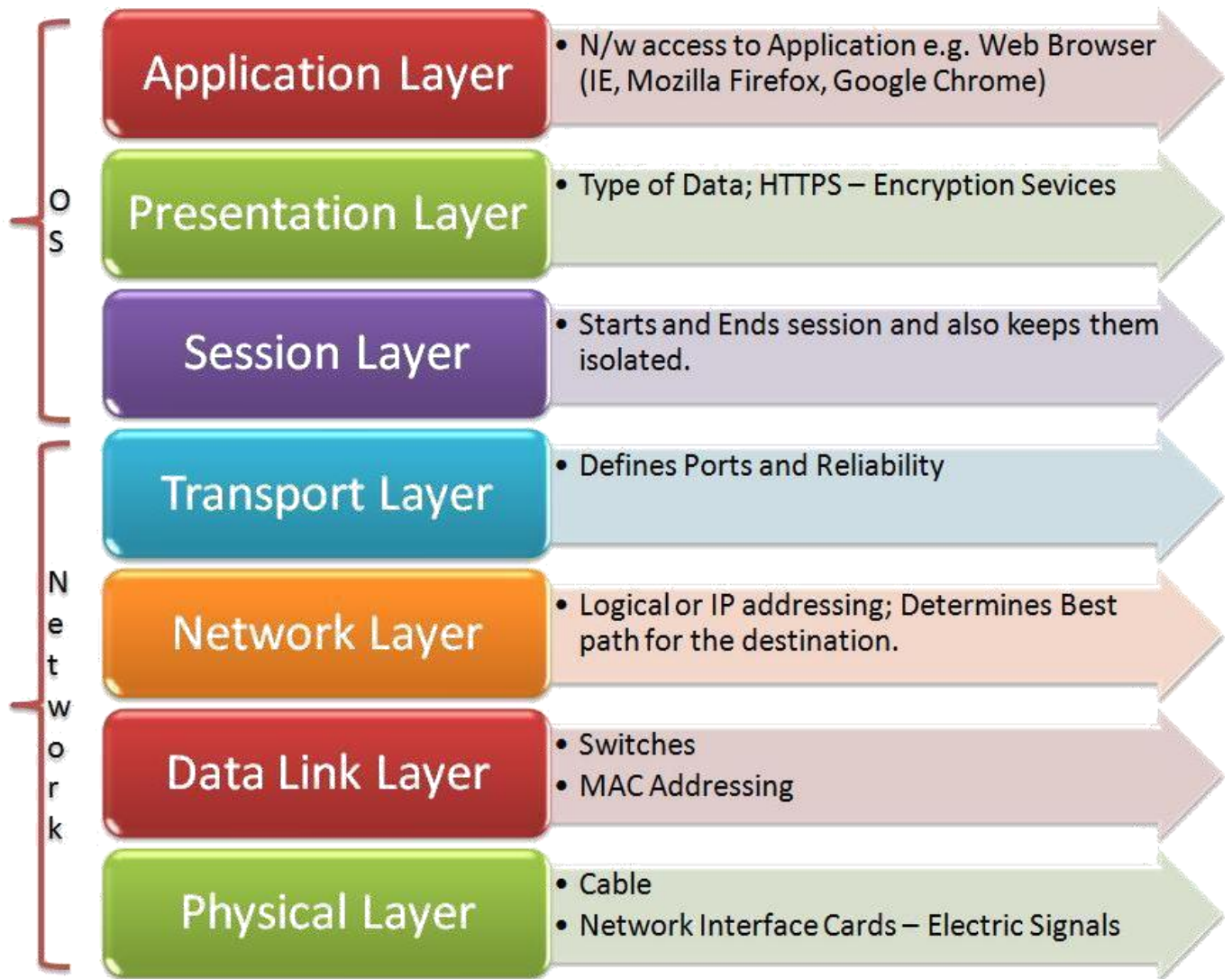| PC	STRAIGHT-THRU	HUB	PC	CROSSOVER	PC
TX+1		1 RX+	TX+1		1 TX+
TX- 2		2 RX-	TX- 2		2 TX-
RX+ 3		3 TX+	RX+ 3		3 RX+
4		4	4		4
5		5	5		5
RX- 6		6 TX-	RX- 6		6 RX-
7		7	7		7
8		8	8		8

NIC:	Network Interface Card. The hardware interface from a host to the network.
MAC:	Medium Access Control is a six hexit number that uniquely defines the NIC in the entire world. For example: 00:C0:9F:9B:D5:46
Hub:	a hub is the most basic networking device that connects multiple computers or other network devices together. Unlike a network switch or router, a network hub has no routing tables or intelligence on where to send information and broadcasts all network data across each connection.
Switch:	is a computer networking device that connects devices together on a computer network, by using packet switching to receive, process and forward data to the destination device.
Router:	A device that decides where a packet should be sent in order to get to a destination outside a network. Routers range from simple gateways between your home PC and backbone routers of the Internet proper.
IP address:	All hosts and routers have an IP address consisting of four decimal numbers. For example: 192.168.0.1 and 131.170.40.33
Port address:	every host has 65,535 ports each of which can be connected to a specific application that sends and receives data packets from the network.
Gateway address:	every host needs to know the address of the router which connects a network to other networks and the Internet.
Domain name:	hosts may have a domain name which maps onto an IP address. For example, www.google.com is mapped to IP address 66.102.7.104.
DNS Server:	Domain Name System Server. Every host needs access to a DNS server so it can convert between IP address and domain name.
DHCP:	Dynamic Host Configuration Protocol. A DHCP can give a host a unique IP address whenever the host restarts thus saving IP addresses. A DNS address is also provided.

OSI model:

To define the OSI model in one sentence: the OSI model is a concept-based model that defines, and sets standards for, the way in which a computing or telecommunication system functions. The goal of the OSI model is to achieve interoperability, through the use of standards, amongst a diverse set of communications. A Layer-Based System. There are seven distinct layers in the OSI model. They are:

OSI

Application Layer
- N/w access to Application e.g. Web Browser (IE, Mozilla Firefox, Google Chrome)

Presentation Layer
- Type of Data; HTTPS – Encryption Sevices

Session Layer
- Starts and Ends session and also keeps them isolated.

Network

Transport Layer
- Defines Ports and Reliability

Network Layer
- Logical or IP addressing; Determines Best path for the destination.

Data Link Layer
- Switches
- MAC Addressing

Physical Layer
- Cable
- Network Interface Cards – Electric Signals

Network Command

OBJECTIVES

1. To learn how to use Windows/Linux networking commands.
2. To test networking commands.
3. To solve networking problems using networking commands.

INTRODUCTION

Most computers will be running Linux or MS Windows operating systems (OS).

LINUX is an excellent vehicle to understand and play with networks for several reasons:

Free and open source. Open source lessens the likelihood of
deliberate security weaknesses.
Dominates the web server market and it is the basis of many
networking boxes such as routers.
More powerful command line than Windows thus making script
file operations more powerful and flexible.

WINDOWS:

   Dominates the desktop market.
   More users are familiar with Windows. (95% of desktop PCs run on Windows)
   Has GUI which provides easier usage. However, recent KDE and GNOME
      desktops under Linux have been shown to be equivalently easy to use.

Notes – Every engineer with networking knowledge should be familiar with both OS.

In LINUX:

There are a number of simple commands that can be used to examine, debug and play with a network. To see all, use the manual pages (eg man ping) of the info pages (info ping).

ROOT PRIVILEGES – many commands require root privileges, or the programs reside in paths that root knows about but not users. It may be easier to log onto Linux as a user and open a root terminal.

In Windows:

Windows has a number of command line programs and GUI programs that can be used to view and alter network configuration. To see all, type hh ntcmds.chm in your terminal window, and to see all options for a command line, type –h, /?, -help, or?

Some common commands used in Linux and Windows:

Linux Command	Windows Command	Usage / Effect
ifconfig	ipconfig	to find ip address of the computer
hostname	hostname	to display host name
nmap	nmap	To scan what hosts are available on a network and what ports they have open.
nslookup	nslookup	to list variety of info about DNS and the computers that have joined the domain
ping	ping	to check if a host can be accessed (by IP or name)
traceroute	tracert	to trace route from a host through internet router to a destination. Useful to discover why a network cannot get access to internet, and internet routing problems.
netstat	netstat	to print status of network ports, routing tables and more