Computer Networks Lab
Lab Assignment 1

Objective: Study of the different networking devices, cables, connectors, and topologies.

Preliminaries:

Various Types of Devices in CN

Sr. No.	Device Name	OSI Layer
1.	Workstations & Server	All 7
2.	Hub	1 (PL)
3.	Switch	2 (PL, DLL)
4.	Bridge	2 (PL, DLL)
5.	Router	3 (PL, DLL, NL)
6.	Brouter	3 (PL, DLL, NL)
7.	Gateway	All 7

PL: Physical Layer, **DLL:** Data Link Layer, **NL:** Network Layer

1. Hub

- It is used to connect multiple workstations and servers.
- It is a passive device, and no software is associated with it.
- It is a broadcasting device.
- **Limitations:**
    - Network traffic is high.
    - It causes unnecessary disturbances at various systems.
    - Because of above two reasons, the performance is low.
- **Advantages**
    - Cost is comparatively low.
    - Operation is simple

2. Switch

- It is also used to connect multiple workstations and servers.
- It is an active device associated with software.
- It maintains a lookup table to keep track of all the systems.
- **Advantages**
    - Network traffic is comparatively lesser than the hub.
    - No unnecessary disturbances at various locations.
    - Because of above two reasons, the performance is good.
- **Limitations**
    - Cost of switch is 2-3 times higher than that of the hub.

3. Bridge

- It is used to connect multiple LANs and multiple subnets.
- Filtering and forwarding is effectively done.
- Its operational principle is based on physical addressing system like switch.
- It also maintains a lookup table.

4. Router

- It is a sophisticated WAN device.
- Its principle is based on logical addressing system.
- It is used to connect two or more different similar networks.
- Router requires a lot of configurations, whereas the bridge and switch are plug and play devices.
- All routing algorithms are running in a router. Thus, the cost of the router is very high, sometimes in lacs and crores.

5. Brouter

- It is a combination of router and bridge.

6. Gateway

- It is used to connect two or more different dissimilar networks.
- It is also known as a protocol converter.

7. Other network devices: Network Interface Card (NIC), Wireless Access Point (WAP), Modem.

8. Types of Cables: twisted pair cable, coaxial cable, fibre-optic cable.

9. Cabling: Network cables are used to connect and transfer data and information between computers, routers, switches, and storage area networks. These cables are essentially the carrier or media through which data flows.

10. Types of Cabling: standard cabling (straight-through cable), cross cabling (cross wired cable)
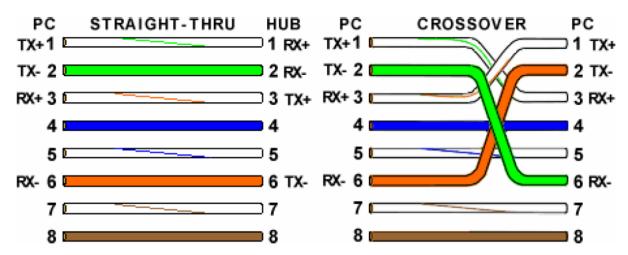
Cable Category Details

Cable Category	Rated Bandwidth (MHz)	Applications
1	None	Telephone Wiring
2	1	Telephone Wiring
3	16	Telephone Wiring, 10BaseT
4	20	Token Ring, 10BaseT

5	100	100BaseTX, 10BaseT
5e	100	1000BaseT, 100BaseTX
6	250	1000BaseT, 100BaseTX
6a	500	10GBaseT
7	600	>10GBaseT
7a	1000	>10GBaseT
8	2000	25GBaseT, 40GBaseT

Note: Category 7 and 7a specification wiring does not use RJ45 connectors.

a) Standard Cabling: It is used to connect a computer to a hub. 10BaseT and 100BaseT are most used modes for LANs. The UTP category-5 cable is used for both the modes.

b) Cross-through Cabling: A cross cable is used to connect two computers directly. It is also used to connect two hubs with a normal port on both hubs.

Note: The colour codes are White/Orange, Orange, White/Green, Blue, White/Blue, Green, White/Brown, Brown. TX corresponds to transmitter and RX corresponds to Receiver.

11. Physical Topology: It refers to the way in which the network is laid out physically. The topology of a network is the geometric representation of the relationship of all the links and linking devices to one another. There are four basic topologies: mesh, star, bus and ring.

11a. Mesh: In a mesh topology, every device has a dedicated point-to-point link to every other device.

11b. Star: In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called hub.

11c. Bus: The bus topology supports the multipoint connection, wherein one long cable acts as a backbone to link all other devices in the network. Nodes are connected to the bus cable using drop

lines and taps. A drop line is a connection running between the device and the main cable. A tap is a connector that either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core.

11d. Ring: In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it. A signal is passed along the ring in one direction, from device to device, until it reaches its destination. Each device in the ring incorporates a repeater. When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.

Task: Assume that an organization has three offices, namely, O1, O2, and O3 situated in north, east and west coasts, respectively. The president of the organization sits at the south coast (L) and wants to control the activities done at the three offices. The established offices in the north, east and west coasts uses a bus, star, and mesh topology LANs, respectively. The offices in north, east and west coasts have 6, 5, and 4 operating personal computers, respectively. For effective monitoring of the offices, the president wants to create a backbone WAN for connecting with all three offices. For this purpose, a switched WAN is leased operated by the BSNL telecom company. The offices at north, east and west coasts are connected via switched WANs using three point-to-point WANs with the router devices installed at all the offices. There are 6 switches connected in the switched WAN. However, the president wants to use a high-speed DSL line (modem) offered by BSNL. The rated bandwidth at the president's location is 1 MHz, north and east coasts are 16 MHz, and west coasts is 250 MHz. The rated bandwidth required for switched WAN is 2000 MHz.

1. Using Cisco Packet Tracer, draw the topology diagram to depict the heterogeneous network and its components. Utilize the standard symbols of the routers, switches, and other networking components.

Submission Instructions:

1. Draw the network diagram for the task on Cisco Packet Tracer and submit the screenshot on Google Classroom in your respective batches.
2. No other form of submission will be accepted for evaluation.
3. Submit it by the deadline, failing which 4 marks will be deducted.