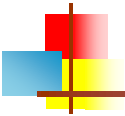# IT WORKSHOP I

Computer Networks and Types

2-Dec-22

Computer Networks

- A collection of computing devices that are connected in various ways in order to communicate and share resources

- In other words, a collection of computers and other devices that communicate to share data, hardware, and software.

- Usually, the connections between computers in a network are made using physical wires or cables

- However, some connections are wireless, using radio waves or infrared signals

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Classification

- Depending on one's perspective, we can classify networks in different ways
- Based on Transmission Media
  - Wired (UTP, coaxial cables, fiber-optic cables) and Wireless
- Based on Network Size
  - PAN, LAN, MAN, WAN
- Based on Network Architecture
  - Peer-to-peer and Client/Server
- Based on Topology (connectivity)
  - Bus, Star, Ring, Mesh

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Transmission Media

- Two main categories:
  - Guided — wires, cables
  - Unguided — wireless transmission, e.g. radio, microwave, infrared, sound, sonar
- Guided Media
  - Twisted-Pair cables:
    - Unshielded Twisted-Pair (UTP) cables
    - Shielded Twisted-Pair (STP) cables
  - Coaxial cables
  - Fiber-optic cables
- Unguided Media
  - Radio waves - FM radio.
  - Microwaves - Satellite
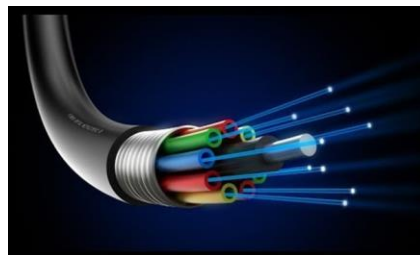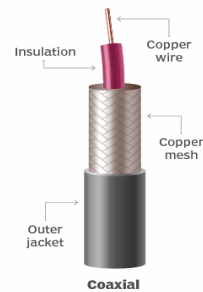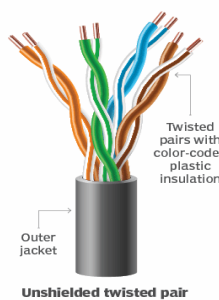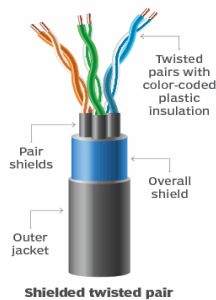 - IR

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Transmission Media

Electromagnetic Spectrum

Transmission Media

Shielded twisted pair

Unshielded twisted pair

Coaxial

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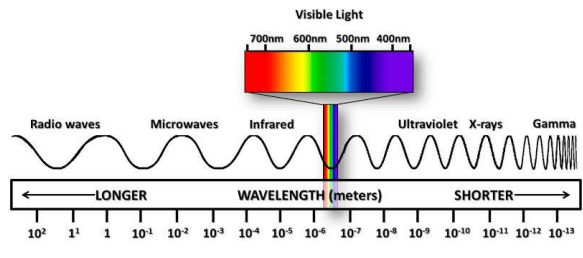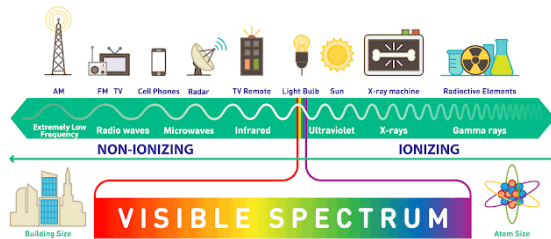
Networks Types

- Classification by scale/size.

| Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	Local area network
1 km	Campus	Local area network
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	Wide area network
10,000 km	Planet	The Internet

Personal Area Networks (PANs)

- A personal area network (PAN) is a computer network used for communication among computer and different information technological devices close to one person.
- Is a small network established for communication between different devices, such as laptops, computers, mobiles, and PDAs.
- A PAN may include wired and wireless devices.
- The reach of a pan typically extends to 10 meters.

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Local Area Network (LANs)

- A local area network (LAN) is a network that connects computers and devices in a limited geographical area such as a home, school, office building, or closely positioned group of buildings.
- Wired LANs are most likely based on Ethernet technology
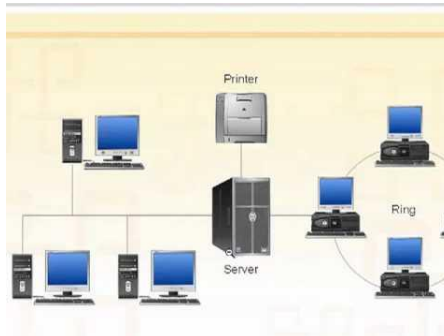

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Metropolitan Area Network (MANs)

- It is relatively larger than LAN and extends across a city or a metropolitan.
- It is created by connecting two or more LANs located at different locations in a city.
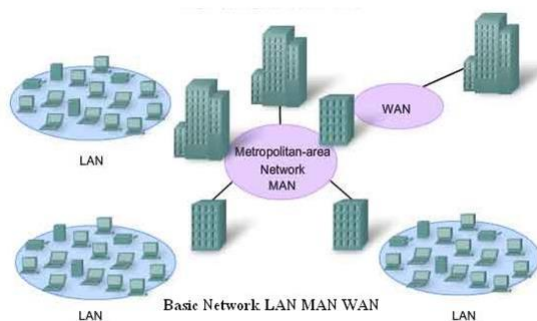
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Wide Area Network (WANs)

- A wide area network (WAN) is a computer network that covers a large geographic area such as a city, country, or spans even intercontinental distances.

- A WAN uses a communications channel that combines many types of media such as telephone lines, cables, and air waves.

- A WAN often makes use of transmission facilities provided by common carriers, such as telephone companies.

- One of the most prominent examples of the existing WANs is the Internet.
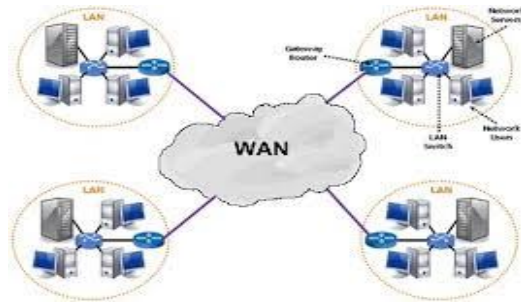
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By Network Architecture

- The architecture of a network is a logical design that determines how the devices in the network communicate.

- The commonly used architectures for computer networks are:
  - Client-server architecture
  - Peer-to-peer architecture
  - Hybrid architecture

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Client-server Architecture

- On a network built using the client-server architecture, the devices communicate to other devices through a central computer referred to as a server.
- The server is a terminal with high processing power, which provides services for the other computers on the network.

- The client is a terminal that accesses the resources available on a server.
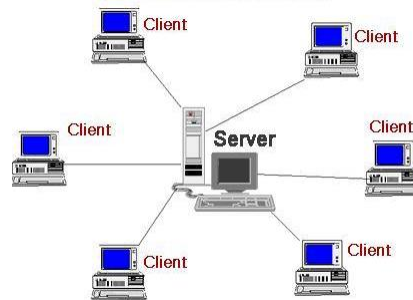
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Peer-to-Peer Architecture

- On a network built using the peer-to-peer architecture, no specific distinction exists between a client and a server.
- Any node can provide a service as well as send a request for a service from another node on the network.
- The peer-to-peer network architecture allows sharing of resources, data, and users.

- Each node on the network has full control over the network resources
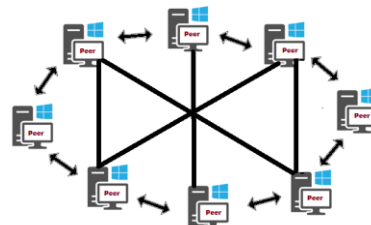
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Hybrid Architecture

- A hybrid, in general, is a composition of two different types of elements.
- A hybrid network architecture is created to get the benefits of both, the peer-to-peer and the client-server architectures, in a network.

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Topology

- Network structure/topology refers to the way/fashion the computers are get connected.
- Topology is the physical layout of computers, cables, and other components on a network.
  - Bus
  - Star
  - Ring
  - Mesh
  - Hybrid

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Bus Structure

- In a bus topology, all computers are connected on one linear cable.
- Terminators at both end of BUS absorb signal, removing it from BUS.
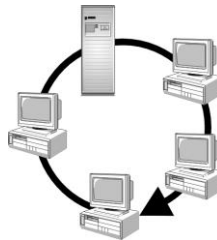

- Advantage: Cost is less, easy to install.
- Disadvantages: difficulty of troubleshooting, a cable break between computers on a bus topology, which would take the entire network down.

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Ring Structure

- In a ring topology, all computers are connected with a cable that loops around.
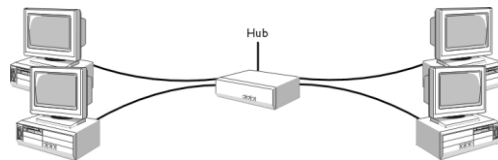

- Advantage: each computer has equal access to communicate on the network.
- Disadvantages: if one computer fails or the cable link is broken the entire network could go down

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Star Structure

- In a star topology, all computers are connected through one central hub or switch.
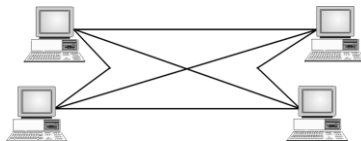- You can easily add nodes to a star-based network by attaching the required nodes to the hub

- Advantage: centralization of cabling, Centralized management and monitoring of network .
- Disadvantages: if the hub fails, the entire network comes down.

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Mesh Structure

- With the mesh topology, every workstation has a connection to every other component of the network.

- Advantage: The biggest advantage of a mesh topology is fault tolerance
- Disadvantages: hard to administer and manage , cost of installation is high

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Advantages and Disadvantages of Network Topologies

Topology	Advantages	Disadvantages
Bus	Cheap. Easy to install.	Difficult to reconfigure. Break in bus disables entire network.
Star	Cheap. Easy to install. Easy to reconfigure. Fault tolerant.	More expensive than bus.
Ring	Efficient. Easy to install.	Reconfiguration difficult. Very expensive.
Mesh	Simplest. Most fault tolerant.	Reconfiguration extremely difficult. Extremely expensive. Very complex.

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Hop Delay Analysis

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End

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