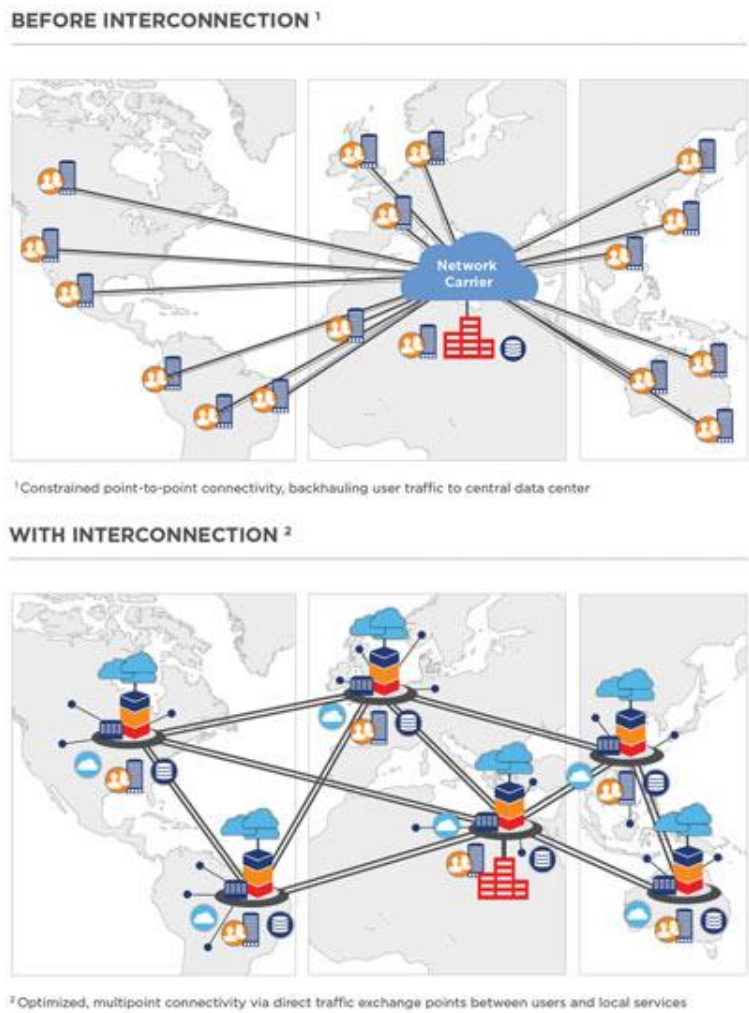


Computer Networking Technologies

A system of interconnected computers and computerized peripherals such as printers is called a computer network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by either wired or wireless media.

Interconnection is private data exchange between businesses. It is the deployment of IT traffic exchange points that integrate direct, private connections between counterparties.



Classification of Computer Networks

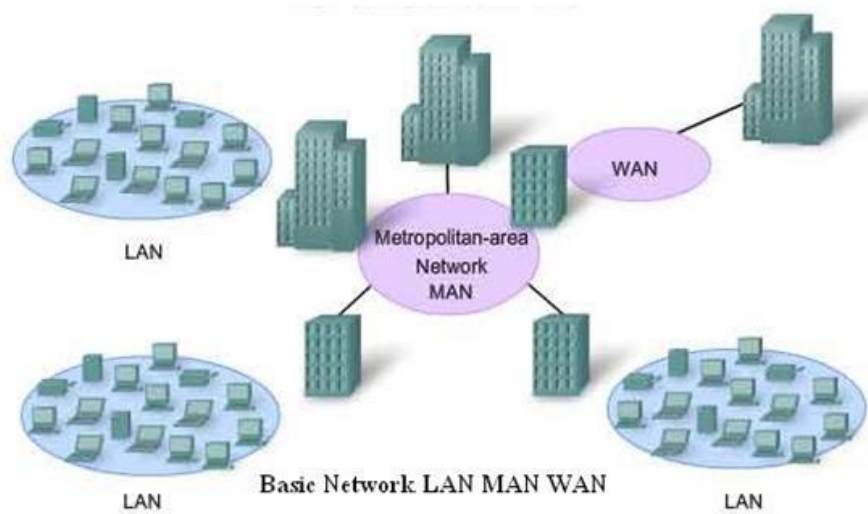
Computer networks are classified based on various factors. They include:

- Geographical span
- Inter-connectivity
- Administration
- Architecture

Geographical Span

Geographically a network can be seen in one of the following categories:

- It may be spanned across your table, among Bluetooth enabled devices, Ranging not more than a few meters.
- It may be spanned across a whole building, including intermediate devices to connect all floors.
- It may be spanned across a whole city.
- It may be spanned across multiple cities or provinces.
- It may be one network covering the whole world.

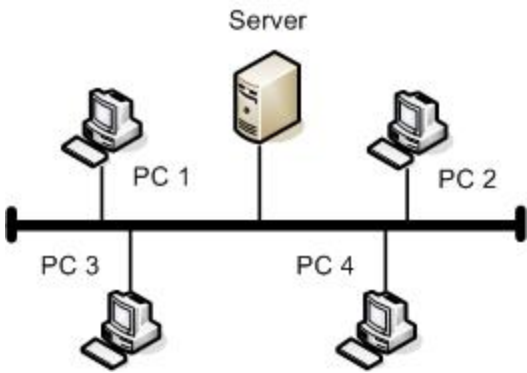


Inter-Connectivity

Components of a network can be connected to each other differently in some fashion.

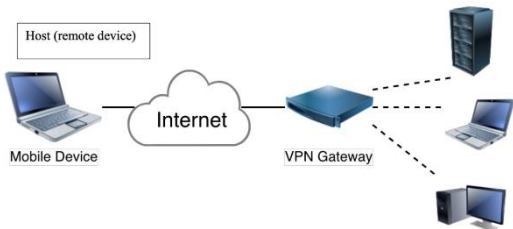
By connectedness, we mean either logically, physically, or both ways

- Every single device can be connected to every other device on the network, making the network mesh.
- All devices can be connected to a single medium but geographically disconnected, created a bus-like structure.
- Each device is connected to its left and right peers only, creating linear structure.



Administration

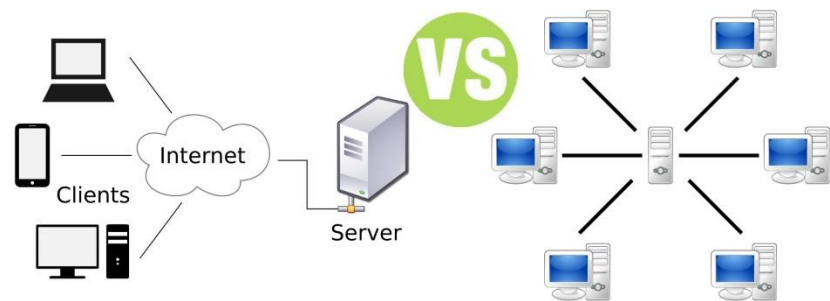
From an administrator’s point of view, a network can be a private network which belongs a single autonomous system and cannot be accessed outside its physical or logical domain. A network can be public, which is accessed by all.



Network Architecture

Computer networks can be discriminated into various types such as Client-Server, peer-to-peer or hybrid, depending upon its architecture.

1. There can be one or more systems acting as servers. Other being **Client**, requests the Server to serve requests. The **server** takes and processes requests on behalf of Clients.
2. Two systems can be connected Point-to-Point, or in back-to-back fashion. They both reside at the same level and called peers.
3. There can be a hybrid network which involves network architecture of both the above types.



Types of Computer Networks

Generally, networks are distinguished based on their geographical span. A network can be as small as distance between your mobile phone and its Bluetooth headphone and as large as the internet itself, covering the whole geographical world.

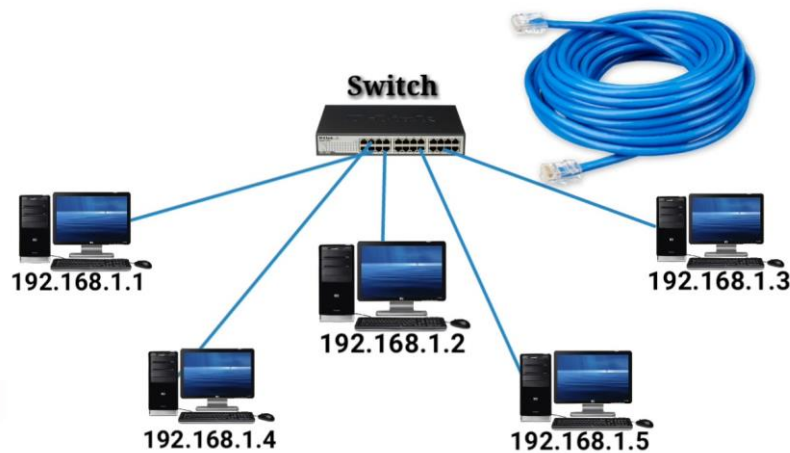
Personal Area Network

A **Personal Area Network (PAN)** is smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to **10 meters**. PAN may include wireless computer keyboard and mouse, Bluetooth enabled headphones, wireless printers, and TV remotes.



Local Area Network (LAN)

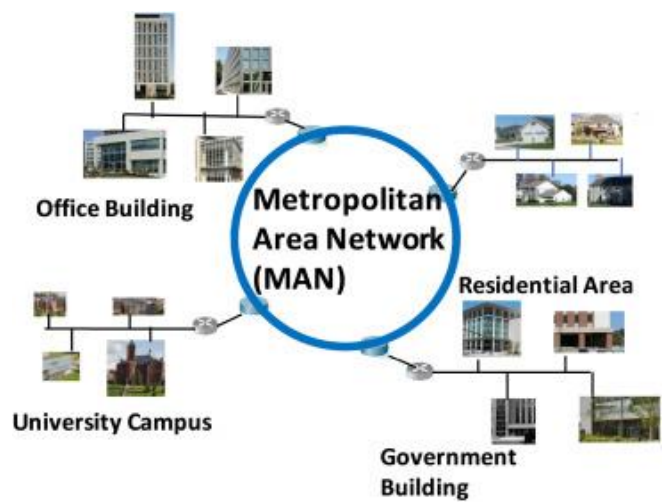
A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network (LAN). Usually, LAN covers an organization office, schools, colleges or universities.



LAN provides a useful way of sharing the resources between end users. The resources such as printers, file servers, scanners, and internet are easily shareable among computers.

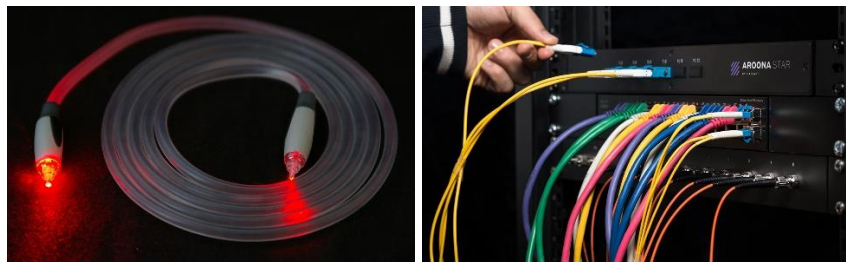
Metropolitan Area Network

The Metropolitan Area Network (MAN) generally expands throughout a city such as cable TV network. It can be in the form of Ethernet, Token-ring, ATM, or Fiber Distributed Data Interface (FDDI). Metro Ethernet is a service which is provided by ISPs.



This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a city.

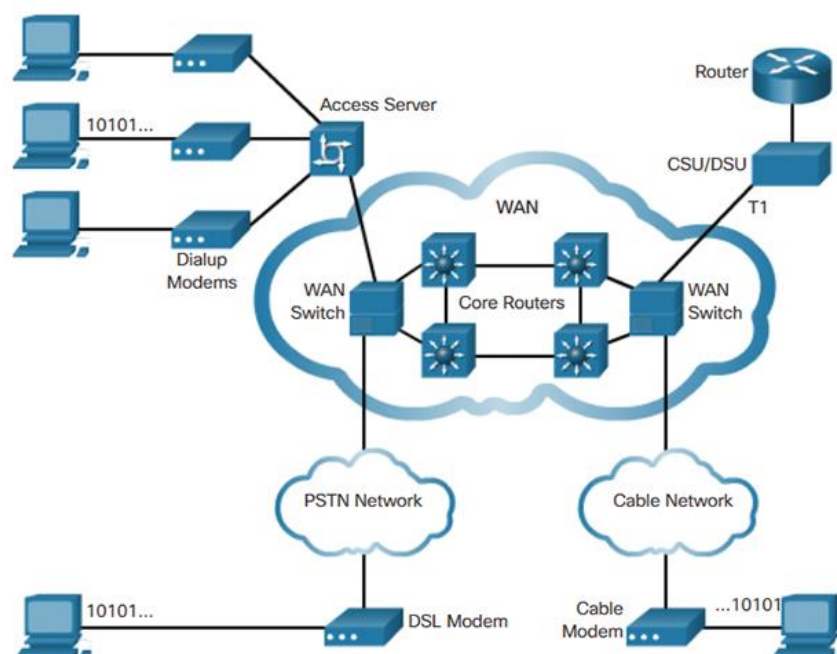
The backbone of MAN is high-capacity and high-speed **fiber optics**. MAN works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or the internet.



Week 2 Module – Networking 1 - September 21-28, 2020

Wide Area Network (WAN)

As the name suggests, the Wide Area Network (WAN) covers a wide area which may span across provinces and even a whole country. Generally, **telecommunication networks are Wide Area Network**. These networks provide connectivity to MANs and LANs. Since they are equipped with very high speed backbone, WANs use very expensive network equipment.



Internetwork

A network of networks is called an **internetwork**, or simply the internet. It is the largest network in existence on this planet. The **internet** hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol.



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Present-day, the Internet is widely implemented using IPv4. Because of the shortage of address spaces, it is gradually migrating from IPv4 to IPv6.



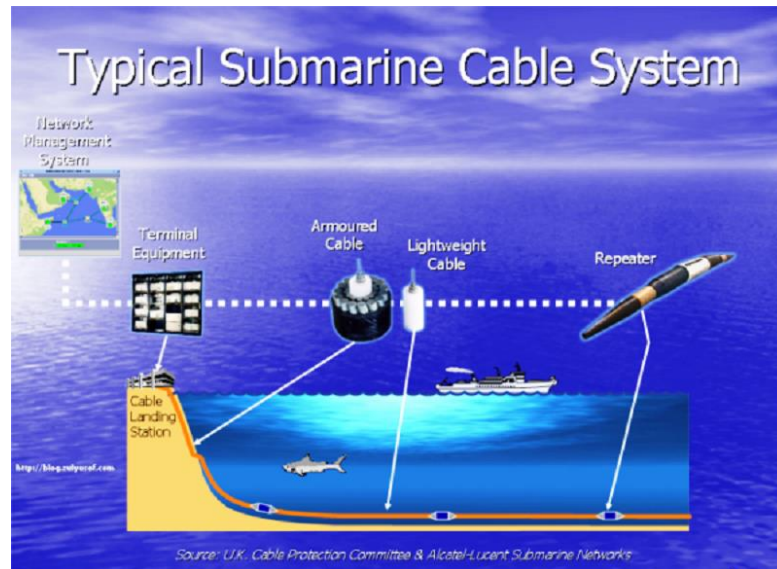
The **Internet** enables its users to share and access enormous amounts of information worldwide. It uses WWW, FTP, email services, audio, and video streaming, etc.

A huge level, the internet works on the **Client-Server** model.

Also, the Internet uses a very high-speed backbone of fiber optics. To inter-connect various continents, fibers are laid undersea known to us as **submarine communication cable**.



Submarine cables are laid down by using specially-modified ships that carry the submarine cable on board and slowly lay it out on the seabed as per the plans given by the cable operator.



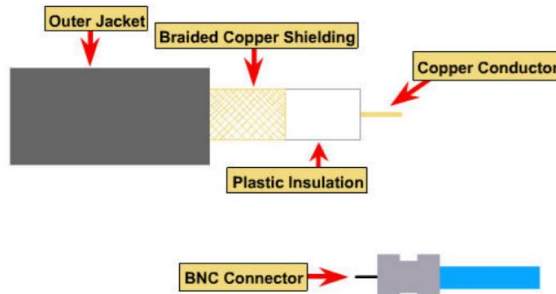
Major Types of Network Cables Used in Communication Systems

Coaxial Cable

Coaxial cable is braided-grounded strands of wire that can provide some shielding and noise immunity; however, the installation and the termination of the cable itself can be costly.

Coaxial cabling, which uses connectors called BNC (Bayonet Nut Connector).

Coaxial Cable



- ◆ Speed and throughput: 10 - 100 Mbps
- ◆ Average \$ per node: Inexpensive
- ◆ Media and connector size: Medium
- ◆ Maximum cable length: 500m (medium)

10BASE2 50 Ohm Coax Cable



Cat 3 UTP and STP

- Category 3 UTP and STP (Cat 3) include applications as voice (telephony) or data (up to 10 Mbps).
- More commonly Cat 3 is used on a networks for cable segments to workstations or printers.
- Cat 3 is not recommended for data installations since its maximum bandwidth of 10Mbps is rapidly being exceeded by many LAN technologies.

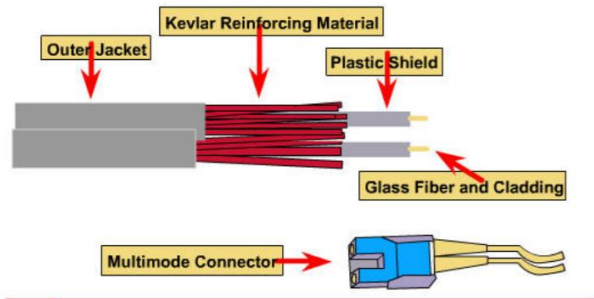
Category 5 UTP and STP

- Applications for Category 5 UTP and STP include voice (telephony) or data (up to 100 Mbps, or with certain technologies, 1000 Mbps).
- Cat 5 is sometimes used as a backbone; however, it is restricted to 100 meters in length. It is currently the most popular cabling for connecting workstations and horizontal cable runs due to its low cost, high bandwidth, relative ease of installation, and ease of termination with RJ-45 connectors.

Fiber Optic

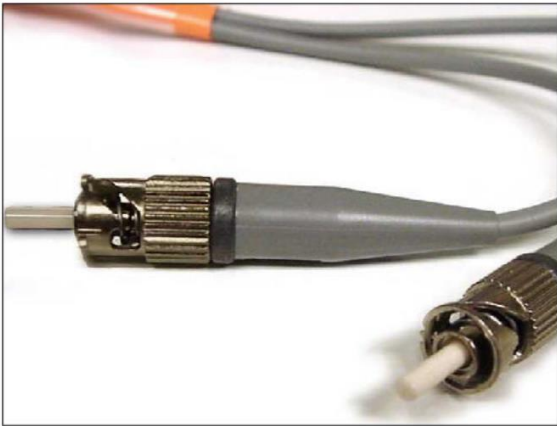
- Fiber optic cabling carries signals, which have been converted from electrical to optical (pulses of light) form.
- It consists of the core, either an extremely thin cylinder of glass or optical quality plastic, which is surrounded by a second glass or plastic layer called the cladding.
- Fiber optic cables are not susceptible to interference, such as radio waves, fluorescent lighting, or any other source of electrical noise.
- It is the common cable used for network backbones and can support up to 1000 stations, carrying signals beyond 25 km.

Fiber Optic Cable



- Speed and throughput: 100+ Mbps
- Average \$ per node: Most Expensive
- Media and connector size: Small
- Single mode, maximum cable length: Up to 3000m
- Multimode mode, maximum cable length: Up to 2000m
- Single mode: One stream of laser-generated light
- Multimode: Multiple streams of LED-generated light

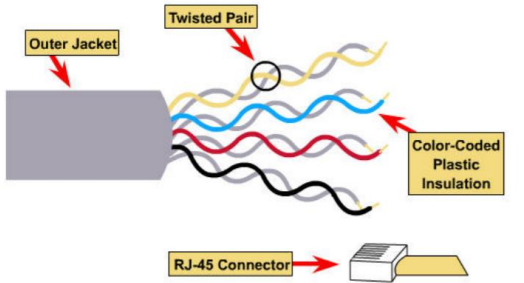
Fiber Optic Cable Connectors



Unshielded Twisted Pair (UTP)

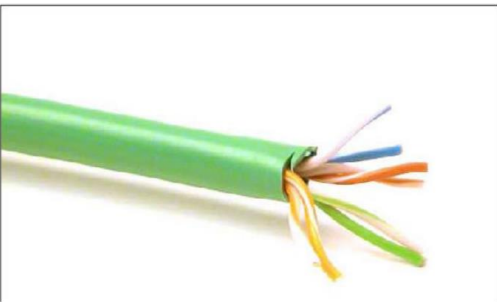
- Unshielded Twisted Pair (UTP) is a set of three or four pairs of wires with each wire in each pair twisted around the other to prevent electromagnetic interference.
- UTP cabling uses RJ-45, RJ-11, RS232, and RS-449 connectors. RJ stands for Registered Jack.
- An example of UTP application is telephone networks, which use RJ-11 connectors, and 10BASE-T networks, which use RJ-45 connectors.
- The maximum length is 100 meters, without using any kind of signal regeneration device like repeater, and a maximum data transfer rate of 1000 Mbps for Gigabit Ethernet.

Unshielded Twisted Pair (UTP)



- Speed and throughput: 10 - 100 Mbps
- Average \$ per node: Least Expensive
- Media and connector size: Small
- Maximum cable length: 100m (short)

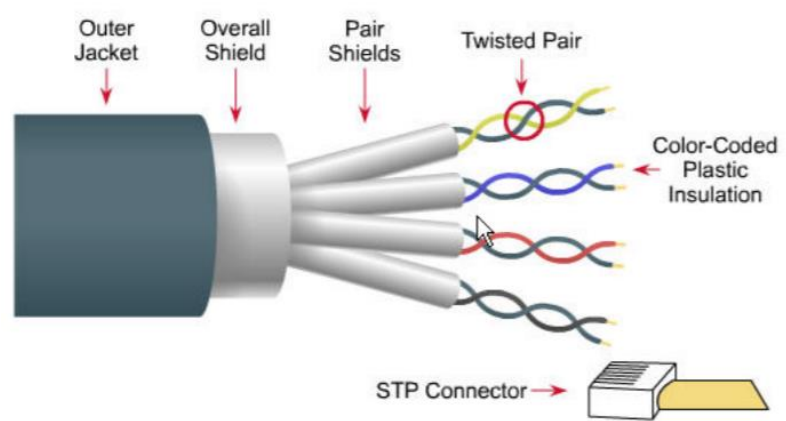
UTP



Shielded Twisted Pair (STP)

- Shielded Twisted Pair (STP), like UTP, also has four pairs of wires with each wire in each pair twisted together.
- STP is surrounded with a foil shield and copper braided around the wires that allows more protection from any external electromagnetic interference.
- The maximum cable length with no signal regenerating device is 100 meters, with a maximum data transfer rate is 500 Mbps.
-

STP (Shielded Twisted Pair)



- ◆ Speed and throughput: 10 - 100 Mbps
- ◆ Average \$ per node: Moderately Expensive
- ◆ Media and connector size: Medium to Large
- ◆ Maximum cable length: 100m (short)

RJ-45

