

What is a Computer Network Class 12 Notes | Computer Science

Interconnection between two or more computers is known as a [computer](#) network. Computer networks can share [hardware](#) and software resources within the network system.

Advantages of Computer Network

1. **Resource Sharing:** Users can share resources within the network; users can share three types of resources.
 - **Hardware resources:** User can share printer or scanner to the other computers.
 - **Software resources:** The user can share the software file, like open-source software.
 - **Information sharing:** Users can share documents, reports, etc.
2. **Reliability:** Reliability means keeping the copy of files on multiple computers using a network. It helps to retrieve the file when the computer has crashed.
3. **Cost Factor:** Computer networks reduce the cost of resource sharing between computers. For example, suppose you have 10 computers on the network but only one printer; in that condition, you can share the printer resources with the other computers.
4. **Exchange of information** – Users in a network can quickly communicate using text, video, audio, data, and information with other users.

Evolution of Computer Network

1. **ARPANET (1969)** – The US government formed ARPANET (Advanced Research Project Agency Network) to connect various universities and defence agencies to share information. ARPANET was the first operational computer network, which became the foundation of the modern internet.
2. **NSFNET (1985)** – A more powerful network than ARPANET, NSFNET stands for the National Science Foundation Network, established by the National Science Foundation (NSF) to promote advanced research and education in networks.
3. **INTERNET (1990)** – Internet is a worldwide system of interconnected computer networks.

What is data communication?

Data communication refers to the process of sending and receiving data from one device to another device. The data can be in any form, like text, image, audio or video. This data can be shared using any medium, like wires, optical fibres or wireless channels.

Components of Data communication

- **Sender & Receiver:** The sender and receiver are both electronic devices. The sender can send data through the network system, and the receiver receives data from the network. For example, laptops and smartphones can send and receive the data through a network, also known as a node in a network system.
- **Node:** Any device connected to a network and can send, receive or process data is known as a node.
- **Message:** It is information which can be shared between the sender and receivers.
- **Communication Media** – It is a methods used to transport messages from the sender to the receiver are referred to as communication medium. Communication Media can be send message throug wired or wireless.
- **Protocols** – A protocol is a set of rules for exchanging data. Each step and process of communication between two or more computers has a set of rules that apply to it. For networks to transport data successfully, they must abide by certain guidelines.

Measuring Capacity of Communication Media

In data communication, the capacity of communication media can be measured by bandwidth; the communication media is also known as a channel. Which means that what amount of data is transmitted in the channel in a given amount of time. It is measured in terms of bandwidth and data transfer rate.

- **Bandwidth** – Bandwidth refers to how much data a computer network can send in one second. Higher bandwidth refers to a large amount of data that can be transferred over the network. Bandwidth is measured in bits per second (bps), megabits per second (Mbps), and gigabits per second (Gbps).
- **Data Transfer Rate (DTR)** – The amount of digital data transferred from one location to another in a predetermined amount of time is known as the data transfer rate (DTR). The speed at which a certain amount of data moves from one location to another is referred to as the data transfer rate.
 - The higher units for data transfer rates are:
 - 1 Kbps=1024 bps
 - 1 Mbps=1024 Kbps
 - 1 Gbps=1024 Mbps

What is an IP address?

A device on the internet or a local network has a special identification name known as an IP address. An IP address is a unique address that identifies a device on the internet or a local

network. The rules define how the data delivered over the internet, or a local network are known as Internet Protocol.

What is switching techniques?

In large network systems there may be multiple paths for transmitting data between sender and receiver. The best path for data transfer will be selected by the switching technique. Switching can be classified into two main categories.

- **Circuit Switching** – Circuit switching is a type of network where a single connection is used between two network nodes for communication. This connection remains reserved during the communication. An example of circuit switching is a telephone call.
- **Packet Switching** – Packet switching is a method of sending data across the network by breaking it into small pieces called packets. These packets are sent separately over the network using the most optimum route. For example, sending an email to your friend.

Transmission media

Transmission media refers to the physical or wireless path between sender and receiver. Each [computer](#) in the network is connected with transmission media. There are two types of transmission media: guided media and unguided media.

1. Guided Media

Guided media is also referred to as wired or bounded media. Guided media is a physical path of the network system, like twisted pair cables, coaxial cables and fibre optic cables.

a) Twisted pair cable – Twisted pair cable is the most common type of wire used in networks; twisted pair cable is also known as Ethernet cable. twisted pair cable having two insulated copper wires twisted together. Twisted pair cable helps to improve signal quality and reduce external disturbances. Twisted pair cable can transfer data up to 1 Gbps speed covering a 100-metre distance. It uses an RJ-45 connector for connecting computers and network devices.

Advantages of Ethernet Cable

- Cost – Effective
- Easy to install and Maintain

Disadvantages of Ethernet Cable

- Very difficult to manage for long distance

b) Co-axial cable – Coaxial cable is generally used in cable internet or in cable TV transmission. It is used for transmitting high-frequency signals and basically used in cable TV,

internet connection and security cameras. Coaxial cables have a central wire that is surrounded by an insulating layer and then an outer conductive shield. Coaxial cable uses a BNC (Bayonet Neil-Concelman) connector.

Advantages of Co-axial cable

- Easy to install and very durable

Disadvantages of Co-axial cable

- If a single cable fails, then all the network will not work.

c) Fiber – optical cable – A fibre optic cable is a type of communication cable that transmits data using light. This cable is made of thin glass or plastic, which can carry light pulses. Optical fibre can transmit data over long distances using high-speed methods. These cables are used in internet, phone and TV connections.

Advantages of Fiber – optical cable

- High speed data transmission
- Data are more secure in fiber optical cable

Disadvantages of Fiber – optical cable

- The cost of fiber optical cable is higher than the copper wire
- Installation is also more expensive as compare to other wire

2. Unguided Media

Unguided media refers to communication channels that transmit signals through air or using wireless mediums. Examples of unguided media are radio waves, microwaves and infrared.

a) Radio waves – Radio waves can carry information wirelessly; radio waves have the longest wavelengths. the frequency of radio waves between 300 GHz and 3 kHz. Radio waves transmit the data in omnidirection (surrounding) and can travel through walls and buildings.

Advantages of Radio waves

- Radio waves are transmitted easily through air.
- Radio waves can be reflect and change their direction but data will not destroy

Disadvantage of Radio waves

- Rain, thunderstorms, and other meteorological factors can affect these signals.

b) Microwaves – Microwave is a wireless technology that transmits the data in the form of electromagnetic waves. Microwave signals are used in satellite communication. This signal can transmit the data for long distances. Approximately, microwaves can cover distances up

to 100 km. A high-frequency radio signal can be sent over the air in a straight line using a microwave.

Advantages of Microwaves

- Microwaves signal can receive any where
- Higher data transfer rates and bandwidth are more as compared to other medium

Disadvantages of Microwaves

- Rain, thunderstorms, and other meteorological factors can affect these signals.
- It is not a secure method of communication

c) Infrared waves – Infrared communication uses infrared light waves for transmitting data. Infrared waves are used for short-distance communication using wireless, approximately 5 meters. Infrared waves are mostly used in TV remotes, cordless phones, toys, etc.

Network devices

- **Modem:** A modem is used to enable your computer to connect to the internet. A modem is also known as a “modulator-demodulator.” A modem is used to convert a digital signal to an analog signal (modulator) and an analog signal to a digital signal (demodulator). These signals can be transmitted over telephone lines or cable networks.
- **Ethernet card:** An Ethernet card is also known as a network interface card. An Ethernet card is a physical device that allows a [computer](#) to connect to a computer network using an Ethernet cable.
- **RJ45:** RJ45 is a connector that is basically used in Ethernet cable. This RJ45 connector is a small plastic connector plug for an Ethernet card.
- **Repeater:** A repeater is an electronic device that amplifies the weak signal and helps to transmit the signal over long distances.
- **Hub:** A hub is a basic network device that connects multiple computers to a single network. A hub works as a central connection device that connects multiple computers using Ethernet cables and RJ45 connectors. It receives data from one port and broadcasts to the multiple ports.
- **Switch:** A switch is a device that can connect multiple computers in the network. A switch shares data in the network using packet switching. It can also combine multiple small network segments to form a big network.
- **Router:** A router can connect multiple devices, like computers, phones, and tablets, to the internet. Routers allow all the devices to communicate with each other. A

router can manage data traffic between networks and keeps track of paths connected to the router.

- **Gateway:** A gateway is used to connect two or more different or dissimilar networks, especially those having different protocols or different communication methods. A gateway is also known as a protocol converter, which can convert data packets from one protocol to another. A LAN connects to the internet using a gateway.
- **WIFI card:** A WiFi card is a wireless network card that enables a device to connect to the network using WiFi. A WiFi card connects to the network using radio waves within the coverage area.

Type of Computer Network

On the basis of geographical span, the network can be broadly categorized as PAN, LAN, MAN, and WAN.

- **Personal Area Network** – It is a small network that connects personal devices within a limited physical area. For example, a connection between a computer and a printer or scanner.
- **Local Area Network** – A local network is one that has been built inside a specific geographic region. Usually, they are located in a building or on a campus. LANs operate at rates of 10 Mbps to 1 Gbps.
- **Metropolitan Area Network** – A metropolitan area network is a computer network that connects computers in a large geographical area, like a connection within a city. These networks, which have a 50 km radius.
- **Wide Area Network** – A wide area network, or WAN, has a radius of around 1000 km. They help connect remote areas and facilitate long-distance communication. Within a country or continent, they forge ties.

Network Topologies

Network topology is a physical and logical arrangement of devices. It is responsible for how the data is flowing within a network. The layout of interconnection of devices in a network is called topology. Example, Bus, Ring, mesh and tree topology.

Bus Topology

Bus topology, often called line topology, is a type of network topology in which each device is connected to the network by a single coaxial or RJ-45 network wire.

Advantages

- Easy to use.
- Low cost of installation.
- Can be easily extended.

Disadvantages

- If the cable fails, then the entire network will not work.
- At the same time, only one message can travel.
- Difficult to troubleshoot an error.

Star Topology

All of the devices in a star topology are linked to a central controller called a hub since communication between any two devices occurs through the hub. Installation and configuration of the Star network are simple. Furthermore, fault isolation and detection are simple.

Advantages

- Easy to troubleshoot
- If any wire has a fault, then it will not affect the entire network.
- Fault detection and removal is easy.
- If a workstation fails, the network is not affected.

Disadvantages

- Difficult to expand.
- A longer cable is required.
- More expensive.
- All nodes are dependent on the central node. If the central node is not working, then the entire network will go down.

Tree Topology

A hybrid topology that combines bus and star topologies is called tree topology. In a bus topology, backbone cable functions as the tree's stem, while star networks (and even individual nodes) are connected to the primary tree by star cables.

Advantages

- if one node fails, it does not affect entire network

- The network can be easily extended.

Disadvantages

- Uses large cable.
- Requires a large amount of [hardware](#) components.
- Difficult for installation and reconfiguration.

Network Protocols

HTTP (Hypertext Transfer Protocol) – HTTP stands for Hypertext Transfer Protocol, which is basically designed for communication between web browsers and web servers. A http is an application-layer protocol with some set of rules for transmitting hypermedia documents between network devices. Now we have a more secure version of http that is https. https can send information in encrypted form to provide a more secure method.

FTP (File Transfer Protocol): A File Transfer Protocol is used for downloading, uploading, and transferring files between the client and server computers.

PPP (Point to Point Protocol): Point-to-Point Protocol is used to make a connection between two devices using dial-up modems. This protocol is used when we want to connect two computers using a telephone network and both computers have the same state.

SMTP (Simple mail transport Protocol): Simple Mail Transfer Protocol is used for sending email messages over a network where the sender server sends the message to the recipient server.

TCP/IP (Transmission Control Protocol): TCP/IP stands for Transmission Control Protocol/Internet Protocol, used for communication on a network, including the internet. TCP/IP handles a two-layer protocol where TCP is used for end-to-end communication and IP handles routing data packets between devices.

POP3 (Post Office Protocol 3): POP3 is a method for receiving incoming emails. Post Office Protocol 3 is an email protocol used to receive emails from the client server.

HTTPS (Hypertext Transfer Protocol Secure): HTTPS stands for Hypertext Transfer Protocol Secure. This protocol is used for sending and receiving data between a browser and a website using an encryption method.

TELNET: Telnet is a text-based communication between a client and a server; the Telnet can connect to remote machines.

VoIP: It enables voice to be transported over a packet switched network as opposed to a public switched telephone network. VOIP [software](#) enables making phone calls over a standard internet connection. Today, ATA, IP phones, and computer-to-computer VoIP services are the three main categories that are regularly used.

Introduction to web services

WWW: The WWW stands for World Wide Web. WWW is also known as W3 or “the Web.” The World Wide Web is an interconnected web of pages and documents accessible through the internet.

Hyper Text Markup Language (HTML): HTML stands for Hyper Text Markup Language. HTML is a text-based method for describing how the text, images, and other content will display or be structured on the HTML file. HTML is a foundation of every webpage on the internet.

Extensible Markup Language (XML): Extensible Markup Language is a markup language that defines rules for how the data will be structured, which will be helpful for readability by both humans and machines. It is a universal file format for storing and transmitting data in a structured way.

Domain names: A domain name is a human-readable web address, a unique and easy-to-remember address that helps to access websites such as [google.com](https://www.google.com) and [youtube.com](https://www.youtube.com), etc. A domain name is

URL (Uniform Resource Locator): A URL is the unique address used to access a webpage, file, image, etc. The URL of the web tells the information about where the resources are located on the web. A URL is sometimes called a web address. A URL contains a protocol, domain, subdomain, and name of the webpage along with the directory. For example, <https://www.ncert.nic.in/textbook/textbook.html>. Here, https is the protocol, www is a subdomain, [ncert.nic.in](https://www.ncert.nic.in) is a domain name, textbook is a directory, and textbook.html is a webpage.

Website: A website is a group of interconnected web pages that may contain text, images, audio, and video. A website’s home page is its first page. To access a website, you must type its unique internet address (URL) into your browser.

Web browser: A web page can be viewed on a web browser. A web browser is a simple software application used to access internet information. When the user requests some information, the web browser fetches the data from the web server and displays it on the webpage. The popular web browsers are Chrome, Firefox, Safari, Edge, etc.

Web servers: A web server is used to store the web-related files, and these files are accessible on the internet. All the websites on the internet are hosted on the web server.

Web hosting: Web hosting is an online service that allows the users to publish the website on the internet; web servers work as hosting servers.