भारतीय ज्ञान परंपरा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक :
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मुद्रक - श्रीनिवास प्रिन्टोग्राफिक्स, अजमेर

Computer Networking

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What is a Computer Network?

* Computer Network is a collection of computers linked with one another via wires, optical fibres or optical links such that different devices can communicate with one another through a network.

* The objective of the computer network is the sharing of resources between different devices.

* In the context of computer network technology, there are a number of networks which differ from simple to complex level.

Features Of Computer network

1. Speed of communication

Network offers us to communicate on the network in an efficient and quick way. For instance, we can perform video conferencing, email messaging, etc. on the internet. Thus, the computer network is an excellent means to share our ideas and knowledge.

2. Sharing of files

Sharing of files is one of the biggest plus point of the computer network. Computer network offers us to share the files with others.

3. Back up and Roll back is simple

As the files are saved in the main server that is centrally located. Hence, it is simple to extract the back up from the main server.

4. Software and Hardware sharing

We can put the applications on the main server, thus, the user will get access to the applications centrally. Hence, we do not have to install the software on all machines. In the same way, hardware can be shared.

5. Security

Network enables the security by providing that the user has the authority to use the specific files and programs.

6. Scalability

Scalability refers to the fact that we can insert the new components on the network. Network needs to be scalable such that we can expand the network by inserting new devices. But, it reduces the speed of the connection and data of the transmission speed also gets reduced, this enhances the possibilities of error happening. This issue can be resolved by employing the routing or switching devices.

7. Reliability

Computer network can utilize the alternate source for the data communication when any hardware failure occurs.

Computer Network Architecture

Computer Network Architecture is the physical and logical design of the hardware, software, protocols, and transmission media of data. Simply we can say that the organization of computers and the allocation of tasks to the computer.

Two types of network architectures are employed:

1. Peer-To-Peer network

2. Client/Server network

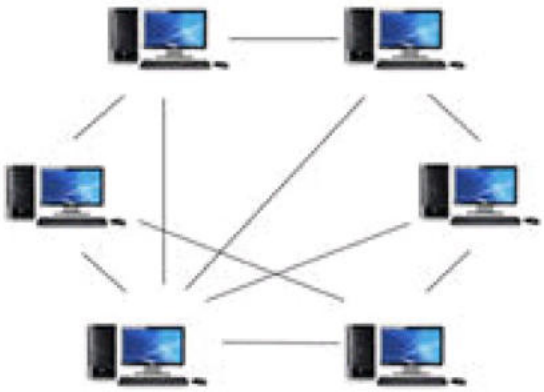
1. Peer-To-Peer network

* Peer-To-Peer network is a network where all the computers are connected with the same privilege and duty of processing the data.

* Peer-To-Peer network is helpful for small environments, typically up to 10 computers.

* Peer-To-Peer network does not have a dedicated server.

* Special permissions are given to every computer for sharing the resources, but this can create a problem if the computer having the resource is off.



Advantages C

1. All computers are less expensive because it doesn't have any dedicated server.

2. If a single computer is not working but, others won't be out of work.

3. It's simple to install and maintain since every computer takes care of itself.

Disadvantages Of Peer-To-Peer Network:

1. In Peer-To-Peer network, it doesn't have the centralized system. Thus, it can't backup the data since the data is varied in varied locations.

2. It has a security problem since the device is controlled by itself.

2. Client/Server Network

* Client/Server network is a model of this network made for the end-users referred to as clients, to use the resources like songs, video, etc. from a main computer referred to as Server.

* The central controller is referred to as a server while all other computers in the network are referred to as clients.

* A server carries out all the main activities like security and networking management.

* A server controls all the resources like files, directories, printer, etc.

* All the clients exchange messages with each other via a server. Suppose client1 needs to send some data to client 2, then it sends the request to the server for the approval first. The server sends the reply

to the client 1 in order to open its communication with the client 2.

Advantages Of Client/Server network

1. A Client/Server network houses the centralized system. Thus we can easily back up the data.

2. A Client/Server network has a separate server which enhances the overall performance of the entire system.

3. Security is enhanced in Client/Server network because a single server manages the shared resources.

4. It also enhances the sharing resources speed.

Disadvantages Of Client/Server network

1. CLIENT/SERVER network is costly as it has the server with huge memory.

2. A server is equipped with a Network Operating System(NOS) to offer the resources to the clients, but it is highly costly.

3. It needs to have a dedicated network administrator to take care of all the resources.

Computer Network Types

A computer network is a set of computers connected to one another which allows the computer to talk to another computer and access their resources, data, and applications.

A computer network can be classified based on their size. A computer network is primarily of four types:

1. LAN(Local Area Network)

2. PAN(Personal Area Network)

3. MAN(Metropolitan Area Network)

4. WAN(Wide Area Network)

1. LAN(Local Area Network)

* Local Area Network is a collection of computers connected to one another in a small area like building, office.

* LAN is employed for connecting two or more personal computers with the help of a communication medium like twisted pair, coaxial cable, etc.

* It is cheaper since it is constructed using cheap hardware like hubs, network adapters, and ethernet cables.

* Data is transmitted at a much faster rate in Local Area Network.

* Local Area Network offers greater security.

2. PAN(Personal Area Network)

* Personal Area Network is a network organized in the space of an individual human being, often between 10 meters.

* Personal Area Network is employed for linking the computer equipment of personal usage is referred to as Personal Area Network.

* Thomas Zimmerman was the initial research scientist who introduced the concept of the Personal Area Network.

* Personal Area Network occupies a space of 30 feet.

* Laptop, mobile phones, media player and play stations are the personal computer devices that are used to create the personal area network.

There are two forms of Personal Area Network:

1. Wired Personal Area Network

2. Wireless Personal Area Network

1.Wireless Personal Area Network : Wireless Personal Area Network is created by simply employing wireless technologies like WiFi, Bluetooth. It is a low range network.

2.Wired Personal Area Network : Wired Personal Area Network is established using the USB.

Examples Of Personal Area Network:

* Body Area Network : Body Area Network is that network which travels with a person. For instance, a mobile network travels with a person. Assume a person sets up a network connection and then sets up a connection with some other device to exchange the information.

* Offline Network : A network can be made offline within the house, hence it is also referred to as a home network. A home network is intended to combine the devices like printers, computer, television but they are not internet connected.

* Small Home Office : It is utilized to link different devices to the internet and to a company network through a VPN

MAN(Metropolitan Area Network)

* A metropolitan area network is a network that spans a wide geographical area by connecting a different LAN to create a bigger network.

* Government agencies utilize MAN to link to the citizens and private industries.

* In MAN, multiple LANs are linked to one another via a telephone exchange line.

* The protocols most commonly used in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.

* It has a wider range compared to Local Area Network(LAN).

Uses Of Metropolitan Area Network:

1.MAN is applied in communication between the banks within a city.

2.It may be applied in an Airline Reservation.

3.It may be applied in a college within a city.

4.It may be applied for use in communication in the military.

WAN(Wide Area Network)

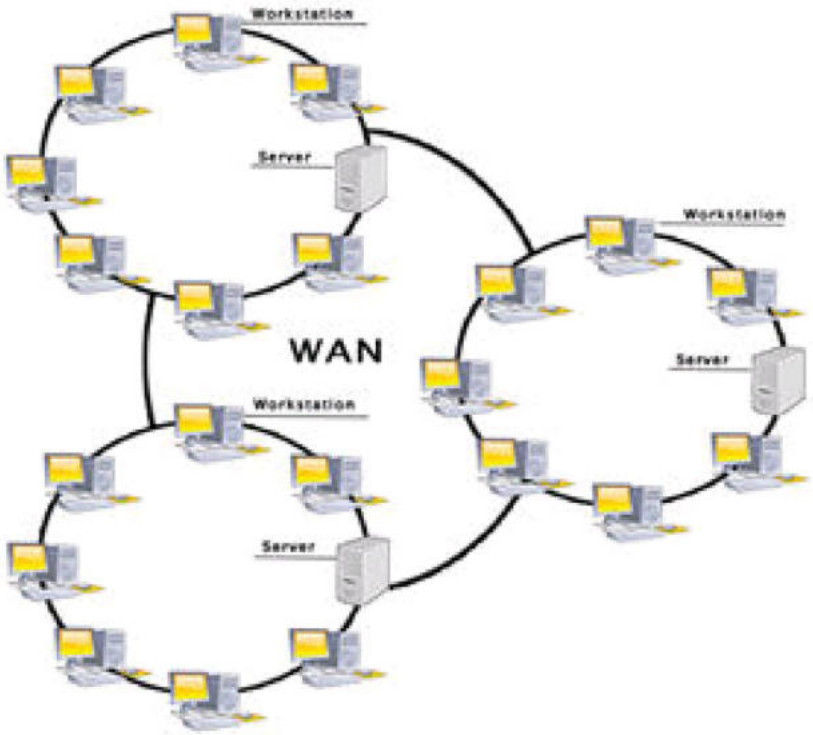
* A Wide Area Network is a network that covers a wide geographical region like states or countries.

* A Wide Area Network is much larger network than the LAN.

* A Wide Area Network is not confined to one place, but it covers a vast geographical area by means of a telephone line, fibre optic cable or satellite links.

* The internet is one of the largest WAN in the world.

* A Wide Area Network is being extensively used in the domain of Business, government, and education.



Examples Of Wide Area Network:

1. Mobile Broadband : A 4G network is extensively used throughout a country or region.

2. Last mile : A telecom company is utilized to deliver the internet services to the customers in hundreds of cities by linking their home with fiber.

3. Private network : A bank offers a private network that links the 44 offices. It is constructed by utilizing the telephone leased line offered by the telecom company.

Advantages Of Wide Area Network:

1. Geographical Area : A Wide Area Network offers a broad geographical area. Let's assume if our office branch is located in another city then we can access them through WAN. The internet offers a leased line via which we can reach another branch.

2. Centralized Data : Data is centralized in case of WAN network. Hence, we do not have to purchase the emails, files or back up servers.

3. Get updated Files : Software companies operate on the live server. Hence, the programmers receive the updated files in seconds.

4. Exchange Messages : In WAN network, messages are exchanged quickly. The web application such as Facebook, Whatsapp,

Skype provides you with the ability to communicate with friends.

5.Software and resource sharing : In WAN network, we are able to share the software and other resources such as a hard drive, RAM.

6.Worldwide business : We are able to do the business over the internet all over the world.

7.High bandwidth : If we utilized the leased lines in our company then this provides the high bandwidth. The high bandwidth provides the increased data transfer rate which further provides the increased productivity of our company.

Disadvantages of Wide Area Network:

1. Security Issue : A WAN network involves more security issues compared to LAN and MAN network because all the technologies are amalgamated together that causes the security problem.

2. Needs Firewall & Antivirus Software : The information is transferred on the net which may be modified or hacked by the hackers, hence the firewall must be employed. People may inject the virus in our system so antivirus is required to save from such a virus.

3. High Setup Cost : Installation cost of the WAN network is costly as it includes purchasing routers, switches.

4. Troubleshooting Issues : It has a big area so it is hard to fix the issue.

Computer Network Hardware :-

Computer network hardware are the main components which are required to install the software. Some key network hardware are NIC, switch, cable, hub, router, and modem. Based on the nature of the network which we have to install, some of the network hardware can also be uninstalled. For instance, the wireless network does not need a cable.

Below are the key elements needed to install a network:

NIC :-

* NIC is an acronym for network interface card.

* NIC is a hardware element utilized to link a computer with another computer onto a network

* It is able to support a transfer rate of 10,100 to 1000 Mb/s.

* The physical address or MAC address is embedded in the chip of the network card which is issued by the IEEE to uniquely identify a network card. The MAC address is held in the PROM (Programmable read-only memory).

There are two forms of NIC:

1.Wired NIC

2.Wireless NIC

1. Wired NIC :- The Wired NIC is within the motherboard. Cables and connectors are employed with wired NIC to move data.

2. Wireless NIC :- The wireless NIC has the antenna to receive the link over the wireless network. For instance, laptop computer has the wireless NIC.

Hub :- Hub is a piece of hardware which splits the network connection between different devices. Whenever computer makes a request for some data from a network, it sends the request to Hub via cable first. Hub will forward this request to the entire network. Every device will analyze if the request is meant for it or not. If not, the request will be discarded.

The mechanism employed by the Hub is bandwidth-consuming and restricts the level of communication. Today, the employment of hub is outdated, and it is substituted with more sophisticated components of a computer network like Switches, Routers.

Switch :- Switch is a piece of hardware that interconnects several devices on a computer network. A Switch incorporates more sophisticated features compared to Hub. The Switch holds the new table which determines where the data is sent or not. Switch sends the message to the right destination as per the physical address contained in the incoming message. A Switch does not send the message to the whole network like the Hub. It determines the device to whom the message has to be sent. So, we can say that switch offers a straight connection from source to destination. It makes the network faster.

Router :-

* A router is a device which is hardware based and used to interconnect a LAN with an internet connection. It is utilized to get, examine and pass on the incoming packets to another network.

* A router operates in a Layer 3 (Network layer) of the OSI Reference model.

* A router sends the packet depending on the available information in the routing table.

* It finds the best route from the available routes for the delivery of the packet.

Advantages Of Router:

1. Security :- The data that will be sent to the network will travel the whole cable, but only the device that has been specified can read the data.

2. Reliability :- If the server has ceased to function, the network crashes, but no other networks are impacted which are being served by the router.

3. Performance :- Router improves the overall performance of the network. Assume there are 24 workstations in a network produces a same level of traffic. This doubles the traffic load of the network. Router divides the single network into two networks of 12 workstations each, halves the traffic load.

Modem

* A modem is a hardware device to enable the computer to access the internet via the existing telephone line.

* A modem is not part of the motherboard but instead is mounted on the PCI slot on the motherboard.

* It is an abbreviation for Modulator/Demodulator. It translates the digital data into an analog signal via telephone lines.

According to differences in transmission rate and speed, a modem can be divided under the following types:

1. Standard PC modem or Dial-up modem

2. Cellular Modem

3. Cable modem

Cables and Connectors

Cable is a medium of transmission to transmit a signal.

There are three types of cable employed in transmission:

1. Twisted pair cable

2. Coaxial cable

3. Fibre-optic cable

1. Twisted Pair Cable :- Twisted pair cables are made up of pairs of copper wires that are insulated and twisted around each other in order to minimize electromagnetic interference from external and neighboring cables or pairs within the same cable. They are typically employed in telephone wires and Ethernet networking (like Cat 5e, Cat 6 cables) because they offer a cost and performance balance for short- to medium-distance communication. The two most common types are Unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP), with STP providing greater protection from interference.

2. Coaxial Cable :- Coaxial cable includes a central copper conductor, a dielectric insulator surrounding it, a metallic shield (often braided or layered), and an outer insulating sheath. The design enables it to transmit high-frequency electrical signals with low loss and great immunity from external electromagnetic interference. Common applications are cable TV distribution, broadband internet connections, radio transmitters and receivers, and computer data buses. Common variants are RG-6, RG-59, and RG-11 cables. Coaxial cable is prized for its stable impedance, low attenuation, broad frequency range, good environmental stability, and high degree of shielding.

3. Fibre-Optic Cable :- Fibre-optic cable sends data as light flashes along thin strands of glass or plastic fibers. The cable consists of a core (for transmitting light), cladding (to bend light back into the core), and outer protective layers. Fibre-optic cables have very high data transmission rates, low loss of signal over long distances, total immunity to electromagnetic interference, and added security. They are used for long-distance telecommunication, high-speed internet connections, and backbone network infrastructure because of their excellent performance than metal cables.

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