

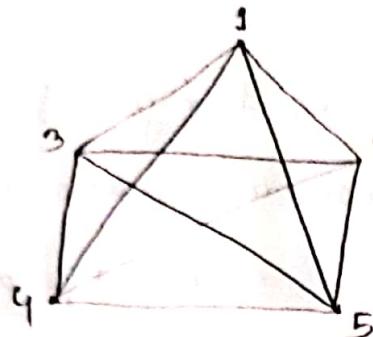
1.a) What is telecommunication?

→ Telecommunication means the exchange of information between two distant places. Telecommunications represent the transfer of information, from an entity at one place to an entity at another place, whereas the information can be in the form of data, voice or symbol. The entities can be human beings, computers, facsimile machines, telegraphy machines, phones or so on. In telephone conversation the one who initiates the call is referred to as the calling subscriber.

b) What is the need of switching exchanges?

→ The point to point connection for establishing communication requires the telephone set to be linked using wires. If the number of telephone sets or the subscribers present is low in number, the type of connection will be a little complex. However, if this number is high or moderate, then the connections will lead to a mess. To understand the complication, let us consider a network of 5 subscribers.

The following illustration shows a point-to-point connection for five subscribers.

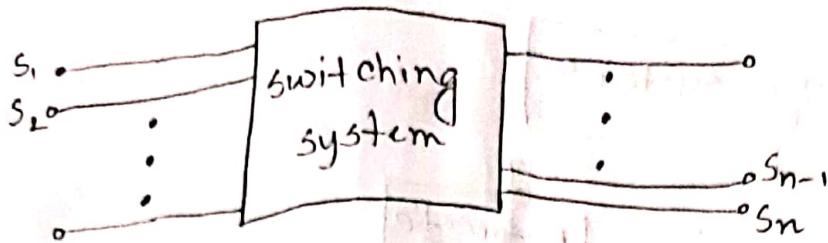


A system of switching the networks is needed in between these subscribers.

c) Describe switching systems.

→ This network connection cannot be simply made with telephone sets and bunch of wires, but a good system is required to make or break a connection. This system is known as the switching system or the switching office or the Exchange. With the introduction of the switching system, the subscribers instead of getting connected directly to one another, are connected to a switching office and then to the required subscriber. The following figure will help to understand.

the switching system.



2. a) Define calling subscriber and called subscriber.

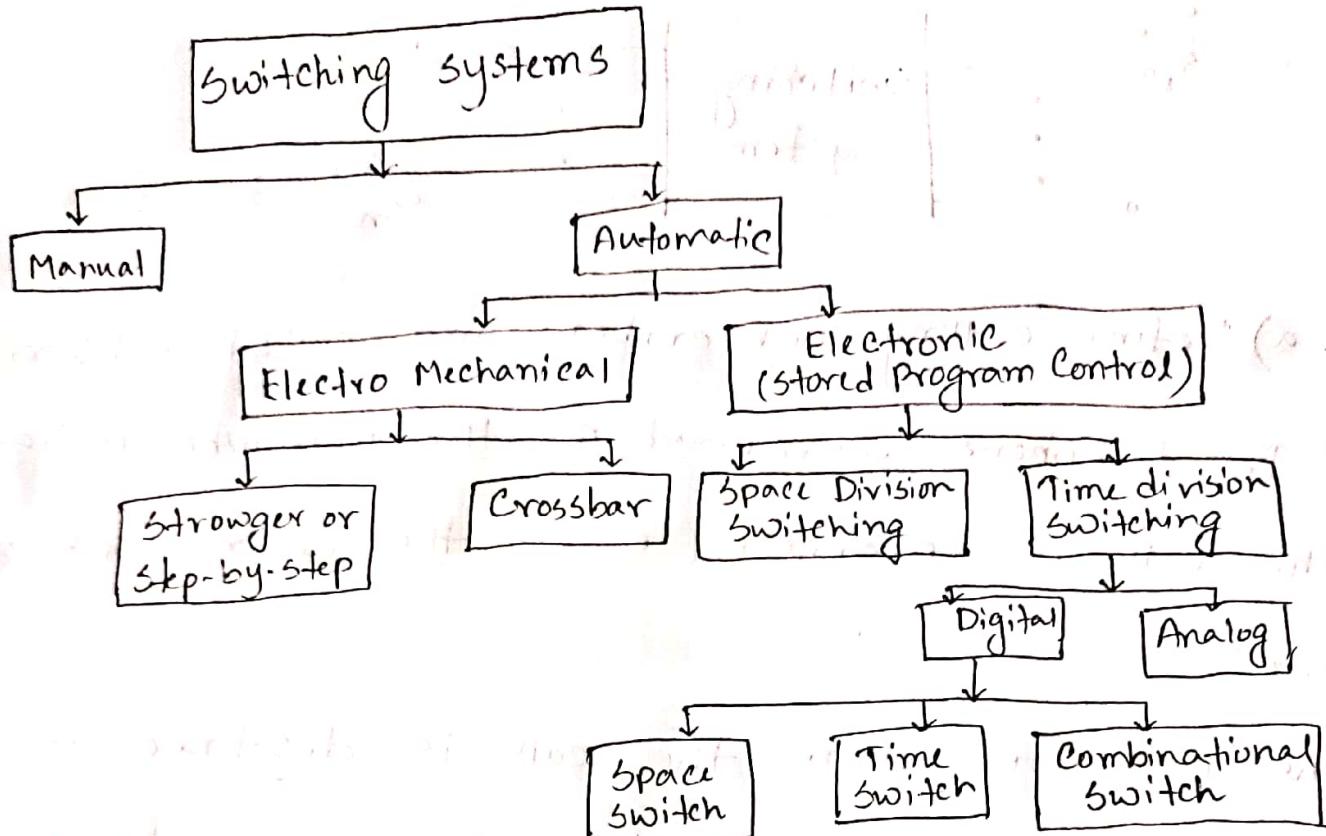
→ In telephone conversation, the one who initiates the call is referred to as the calling subscriber.

The one for whom the call is destined is the called subscriber. In other cases of information transfer, the communicating entities are known as source and destination respectively.

b) What is the classification of switching systems?

→ The process and stages of switching played an important role in making switching systems. At the initial stages, the switching systems were operated manually. These systems were later automated. The following flowchart shows how the switching systems

were classified.



The switching systems in the early stages were operated manually. The connections were made by the operators at the telephone exchanges in order to establish a connection.

c) Describe automatic switching system.

→ The automatic switching systems are classified as the following:

° Electromechanical switching systems - Here, mechanical switches are electrically operated.

° Electronic switching systems - Here, the usage of electronic components such as diodes, transistors and ICs are used for the switching purposes.

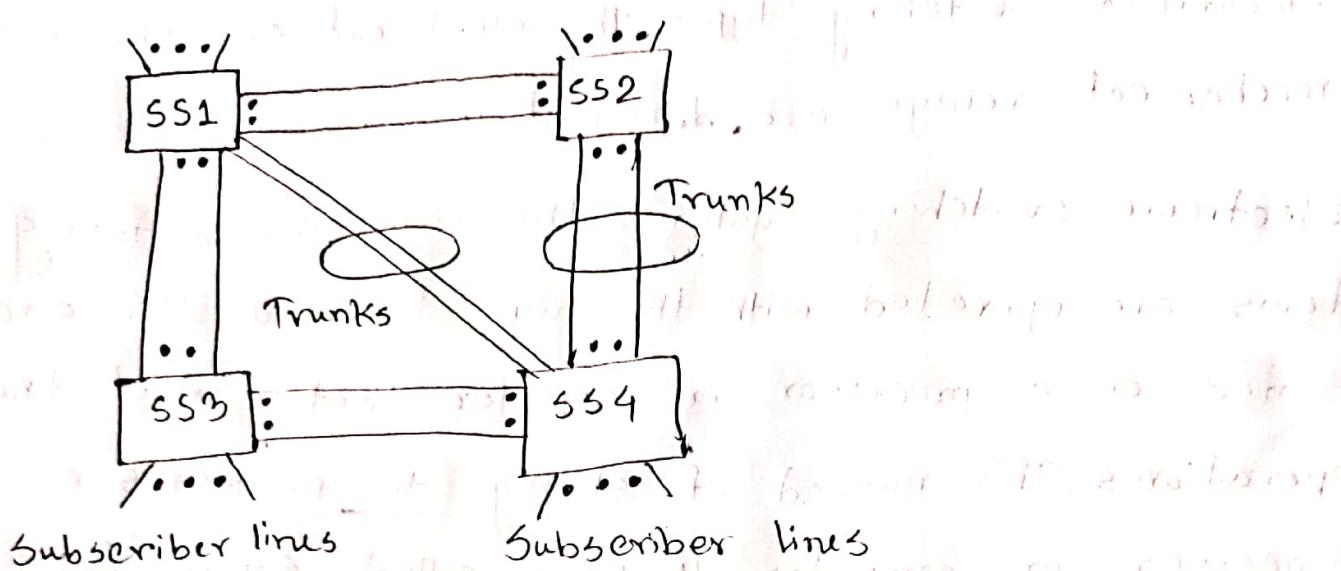
Electromechanical switching systems: The electromechanical switching systems are a combination of mechanical and electrical switching types. The electrical circuits and the mechanical relays are deployed in them.

Electronic switching systems: The electronic switching systems are operated with the help of a processor and stored on a processor or computer that control the operations. This method of storing the programs on a processor or computer that is called stored program control (SPC) technology.

3. a) What is telecommunication network? Define subscriber lines.

→ A telecommunication network is a group of systems that establishes a distant call. The switching systems are part of a telecommunication network. The switching stations provide connection between different subscribers. Such switching systems can be grouped to form a telecommunication network. The switching systems are connected using lines called trunks. The lines that run to the subscriber premises are called subscriber lines.

The following figure shows a telecommunication network.

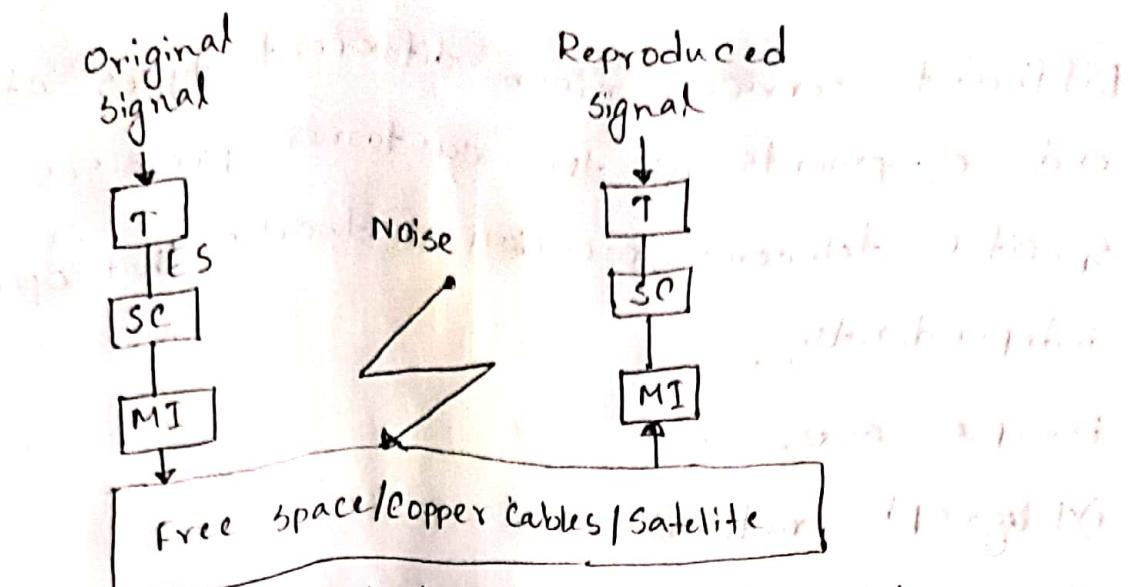


b) Describe communication links. Draw the figure of electrical and optical communication link.

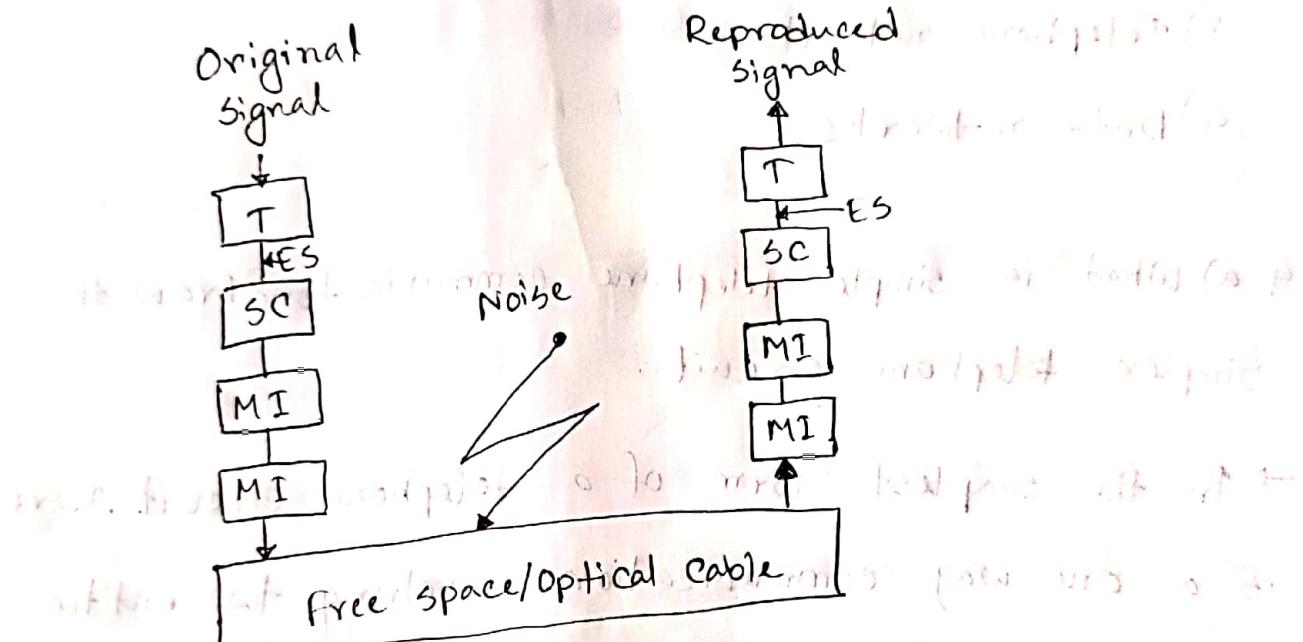
→ A telephone switching network is made tip of switching systems, trunks, subscriber lines and telephone instruments. Trunks and subscriber lines are essentially communication links which carry information signals from one point to another.

There are basically only two forms of communication links electrical and optical.

In the former information is conveyed by means of electrical energy and in the latter by means of light energy.



(a) An electrical communication link.



(b) An optical communication link.

c) Describe service specific networks with example.
 → with the concept of switched connections for telephony taking its firm roots, the idea of offering other non voice services using switches and switched networks caught the attention of telecommunication specialists in the first half of 20th century.

Different services mean different types of end equipments at the customer premises.

Specific telecommunication networks that operate independently.

Examples are:

1) Telegraph networks

2) Telex networks

3) Telephone networks

4) Data networks

4. a) What is simple telephone communication? Draw the Simplex telephone circuit.

→ In the simplest form of a telephone circuit. There is a one-way communication involving two entities. one receiving (listening) and the other transmitting (talking). This form of one-way communication shown in shown as simplex communication.

The microphone and the earphone are the transducer elements of the telephone communication system. Microphone converts speech signals into electrical signals and the earphone

converts electrical signals into audio signals.

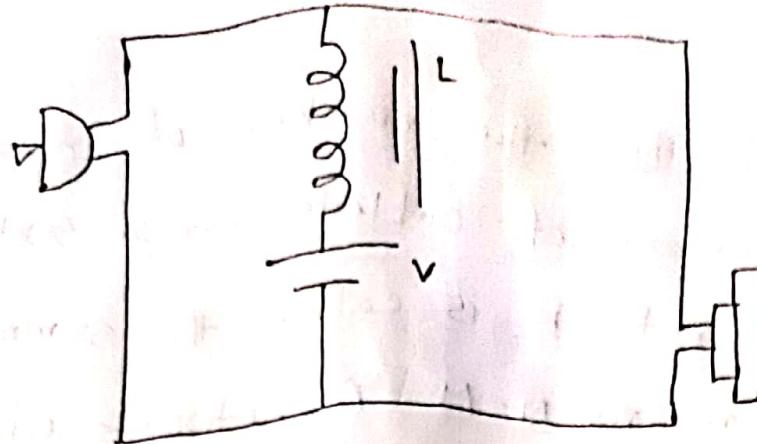


Figure: A Simplex telephone circuit

most commonly used microphone is a carbon microphone.

b) Describe basics of a switching system.

→ Inlets and Outlets: The set of input circuits of an exchange are called Inlets and the set of output circuits are called the outlets. The primary function of a switching system is to establish an electrical path between a given inlet-outlet pair.

Switching matrix: The hardware used to establish connection between inlets and outlets is called the switching matrix or the switching network. This switching network is the group of connections

formed in the process of connecting inlets and outlets.

Folded network: When the number of inlets is equal to the number of outlets for a switching network, such a network is called the symmetric network, which means $N = M$. A network where the outlets are connected to the inlets, is called folded network.

c) What is blocking network? Describe the elements of switching system.

→ If there are no switching paths free in the network, the call requested will be denied, where the subscriber is said to be blocked and the network is called the blocking network. In a blocking network, the number of simultaneous conversations that can take place is less than the maximum number of simultaneous conversations that can take place. The probability that a user may get blocked is called blocking property.

Elements of switching system: There are different kinds of switching systems from manual to automatic, a few basic elements play an essential role for the functioning of a switching system.

Along with switching network, there are different sub systems such as control sub-system, signaling system, trunk and subscriber line interfaces.

5. a) What is signaling? Describe subscriber line interface.

→ The signaling formats and requirements for the subscriber, the trunks and the sub systems differ significantly. Accordingly, a switching system provides for three different forms of signaling.

1) Subscriber loop signaling.

2) Interexchange signaling.

3) Intertech or register signaling.

A switching system is composed of elements that perform switching, control and signaling functions. Subscriber line interface: The subscriber lines used

for connections between the subscribers and the switching systems are terminated at this port. The subscriber line interface is the point where the lines from the subscribers are connected to the system.

b) What are the advantages of automatic switching system? Define line scanning unit.

→ The automatic switching systems come with the following advantages -

- 1) Language barriers will not affect the requests for connection.
- 2) Higher degree of privacy is maintained.
- 3) Faster establishment and release of calls is done.
- 4) Number of calls made in a given period can be increased.
- 5) Calls can be made irrespective of the load on the system or the time of the day.

line scanning unit: The line scanning unit senses

and obtains the signaling information from the respective lines. The information obtained from these lines are given to the control sub system to identify the inlets and outlets.

c) What are the pulse dialing of a rotary dial phone?

- 1) finger plate and spring.
- 2) shaft, gear and pinion wheel.
- 3) Pawl and ratchet mechanism.
- 4) Impulsing cam and suppressor cam or a trigger mechanism.
- 5) Impulsing contact.
- 6) Centrifugal governor and worm gear.
- 7) Transmitter, Receiver and bell's by-pass circuits.

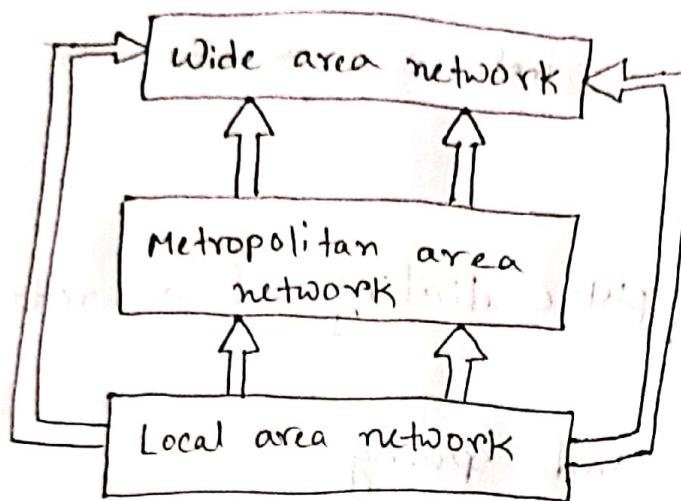
6. a) What are the classification of data networks? Draw the figure of data network hierarchy.

→ Data networks are classified according to their geographical coverage.

- 1) Wide area networks (WANs)
- 2) Metropolitan area networks (LANs)

3) local area networks (LANs)

The figure of data network hierarchy is given below:



b) Describe data transmission in PSTNS

→ Public switched telephone networks and electronic PABXs are designed to carry analog voice signals. They can however, be used for data transmission by employing suitable interfaces. LANs can be designed around PABXs, and MANs around PSTNs.

In these cases, data rates are usually limited to a maximum of 64 Kbps. Terrestrial data networks and the integrated services digital networks however, support data rates of 1.544 or 2.048 Mbps & modulator translates the data pulses into voice band analog signals at the transmitting end. Combined modulator

demodulator unit is called a modem.

c) Define Modem. What are the switching techniques for data transmission?

→ Amplitude, frequency and phase modulation are all used in the design of modems. In amplitude modulation zeros and ones are represented by two different voltage levels. A signal waveform $s(t)$, called baseband signal, is generated from the digital data.

Switching techniques for data transmission: We saw how telephone networks are used to carry data. They are basically designed to carry voice traffic and there are some significant differences in the nature of voice and data traffic.

Voice traffic is generally continuous whereas data traffic is bursty in nature.

In contrast voice traffic needs low bandwidth (3.4 kHz) for long durations. Typically the transmission line is idle for 85-95% of the holding time in the case of data transmission and is busy for a similar period.

7.a) Define circuit switching, store and forward switching.
→ In circuit switching, an electrical path is established between the source and the destination before any data transfer takes place. The electrical path may be realised by physical wires or coaxial cables or radio or satellite links.

A store and forward (S&F) network is the switching nodes that have the ability to store user messages and forward the same towards the destination as and when the links become available. For this purpose, each node is equipped with a processor and some buffer storage. No end-to-end is set up prior to data transmission. The user deposits his/her message to the nearest switching node.

b) What are the functions of node processor?

→ The node processor performs the following functions

1) Receive the full user message and store the same.

2) Check the message for data transmission errors

and perform error recovery if required

- 3) determine the destination address from the user message.
 - 4) choose an appropriate link towards destination based on certain routing criterion.
 - 5) forward the message to the next node on the chosen link.
- c) What are the measures that used to perform routing algorithm?
- A number of measures that used in assessing the performance of a routing algorithm:
 - 1) Minimum delay.
 - 2) Minimum number of intermediate nodes or hops.
 - 3) Processing complexity.
 - 4) Signalling capacity required on the network.
 - 5) The rate of adaption in the case of adaptive algorithms.
 - 6) fairness to all types of traffic.
 - 7) A reasonable response time over a range of traffic intensities.

8.a) Define transport layer. What are QoS parameters?

→ Transport layer is the first end-to-end layer in the OSI architecture. It is responsible for matching user message characteristics and service requirements with that of the network capabilities.

Some QoS parameters that are of direct interest to the users are:

- 1) Transit delay.
- 2) Residual error rate.
- 3) Protection.
- 4) Transfer failure probability.
- 5) Priority.
- 6) Throughput.

b) What are the services that application layer provides?

→ The layer provides all services that are directly comprehensible by the users. Which include -

- 1) Electronic mail or message handling services.

- 2) Directory services.
- 3) Cost allocation.
- 4) Determination of quality of service.
- 5) File transfer and management.
- 6) Editors and terminal support services.
- 7) Telematic services like videotex.

c) What are the advantages of LANs?

→ The advantages offered by the LANs are:

- 1) Unlike a large centralised system, a LAN may evolve with time. It may be put into operation with a small investment and more systems may be added.
- 2) Since LAN is a set of multiple interconnected systems, it offers a good back up capability in the event of one or two systems failing in the network.
- 3) LAN provides a resource-sharing environment. Expensive peripherals, hosts and databases may be shared by LAN users.
- 4) A LAN adhering to a certain standard permits

multivendor systems to be connected to it.

5) In LAN, the systems are generally so chosen as to meet of the user.

• LAN is a local environment. It is probably not interconnected with other networks.

• LAN is to be performed with own topology.

• LAN is to be kept separate from other networks.

• LAN can be used for local network operations.

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