

1.(a) What is Telecommunications? write the brief history of telecommunications.

Ans: The word tele is a greek word which means distance. Hence Telecommunication means the exchange of information between two distant places. So we can say the exchange of information between two or many individuals is called Telecommunication.

In march 1876, Alexander Graham Bell invented and demonstrated his telephone set and the possibility of long distance voice communication. He demonstrated the point-to-point communication, in which a calling subscriber chooses the

appropriate link to establish connection with the called subscriber. This system also requires some mode of signalling to alert the called subscriber about the incoming call and a signal to indicate the calling subscriber, when the called subscriber is busy on another call.

(b) Describe the types of connections. Show a point-to-point connection for 86 subscribers (telephone sets).

Ans: There are 4 types of connections that can be established in a telecommunication network. The connections are as follows:

- ① Local Call Connection between two subscribers in the system.
- ② Outgoing Call Connection between a subscriber and an outgoing trunk.
- ③ Incoming Call Connection between an incoming trunk and a local subscriber.
- ④ Transit Call Connection between an incoming trunk and an outgoing trunk.

The illustration Shows a point-to-point connection for 6 subscribers (telephone sets):

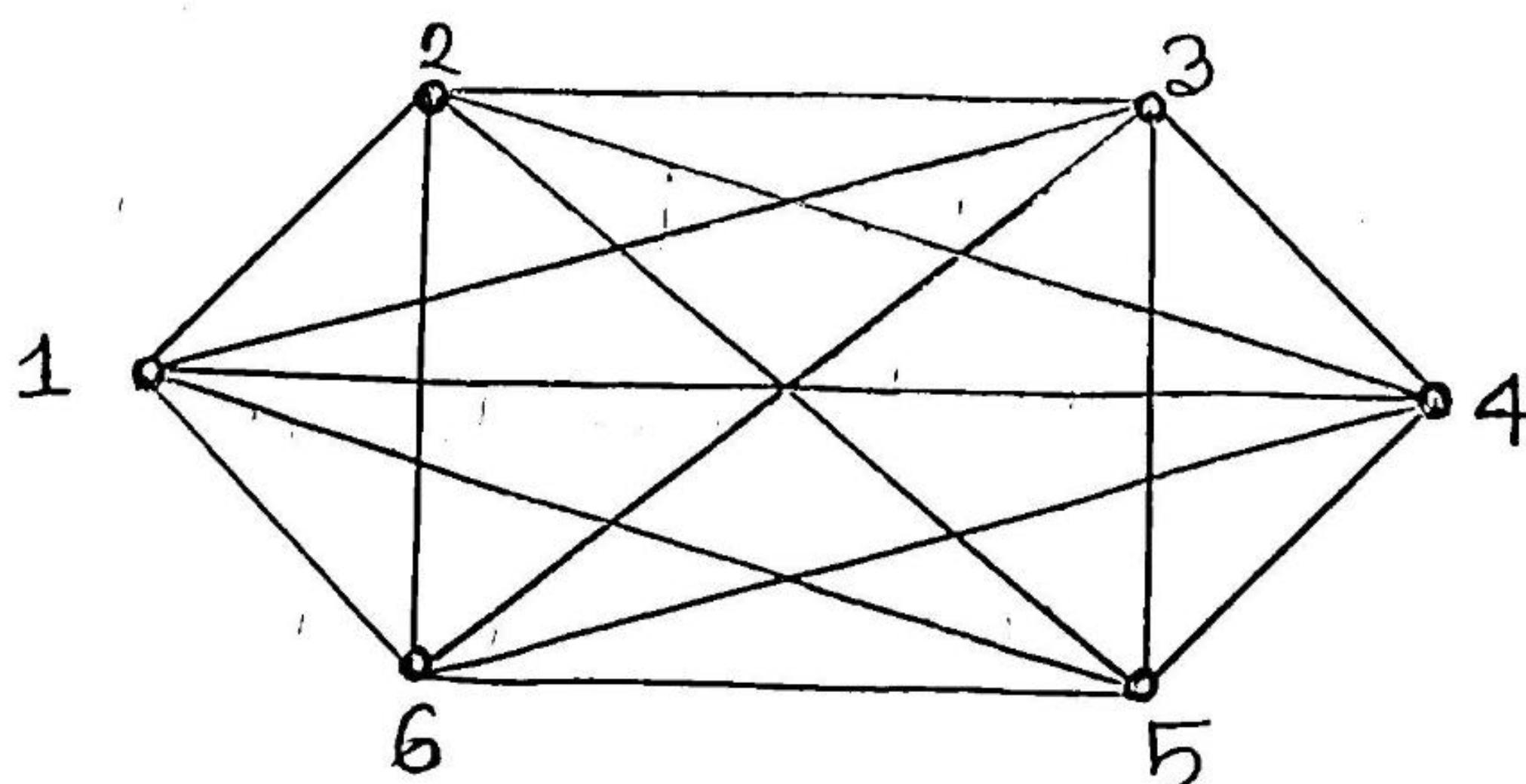


Fig: Point-to-point Connection for 6 subscribers.

In the point to point connection, for n entities, we need $n(n-1)/2$ links. All these links form a network. Networks with point-to-point links among all the entities are known as Fully Connected Networks. The number of links required in a fully connected network becomes very large even with moderate values of n .

(c) What is switching system? Explain the switching system with diagram.

Ans: 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.

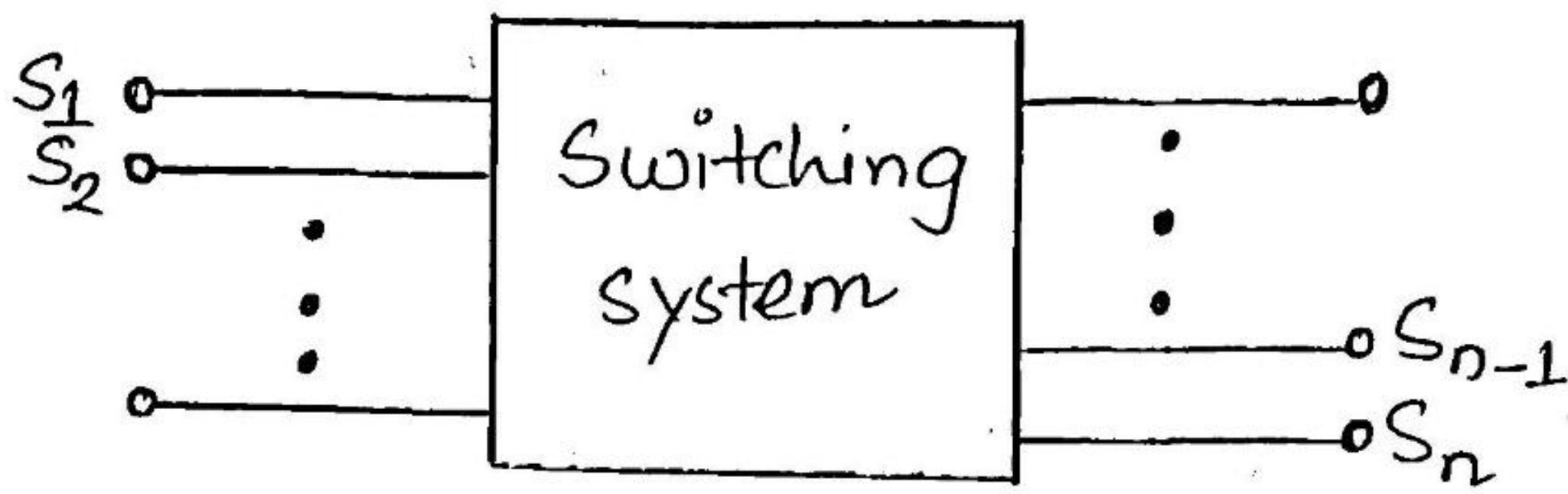


Fig: switching system.

With the introduction of switching systems, the need for traditional connections between the subscribers reduced. All the subscribers need to have a connection with the switching system, which makes or breaks any connection, requested by the calling subscriber. The switching system, which is also called the telephone exchange, takes care of establishing the calls. Hence, the total number of such links is equal to the number of subscribers connected to the system.

2.(a) What is crossbar switching system?
Explain ~telecommunication~ network
with diagram.

Ans: The Crossbar switching systems have hard-wired control ~~system~~ subsystems which use relays and latches. These subsystems have limited capability and it is virtually impossible to modify them to provide additional functionalities.

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 the trunks. The lines that run to the subscriber premises are called the subscriber lines.

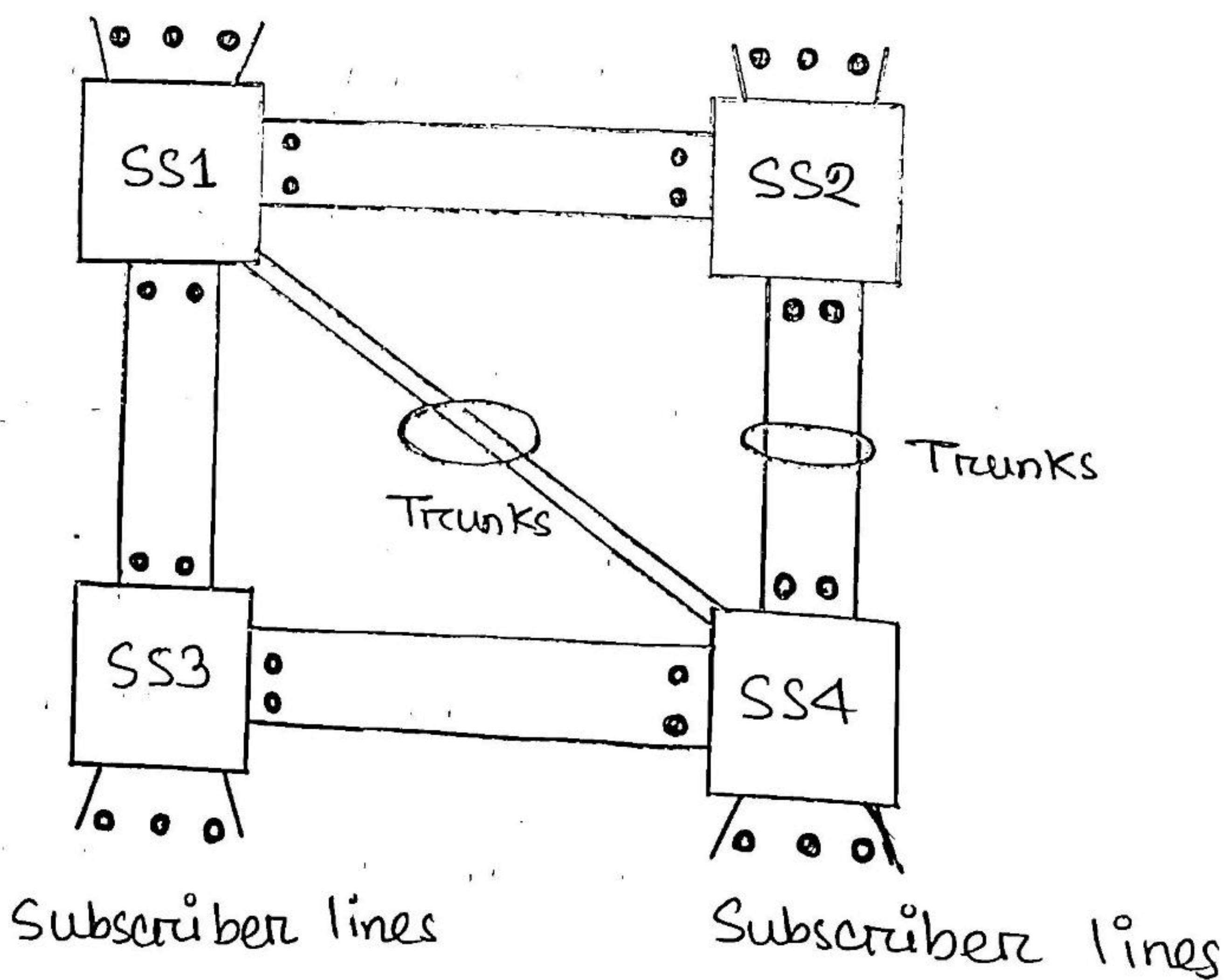


Fig: Telecommunication network.

(b) Explain a simple telephone circuit briefly with diagram.

Ans: In the simplest form of a telephone circuit, there is one way communication involving two entities. One receiving and the other is transmitting. This form of one way communication 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. Most commonly used microphone is a carbon microphone. Carbon

microphones do not produce high fidelity signals but give out strong electrical signals at acceptable quality levels for telephone conversation.

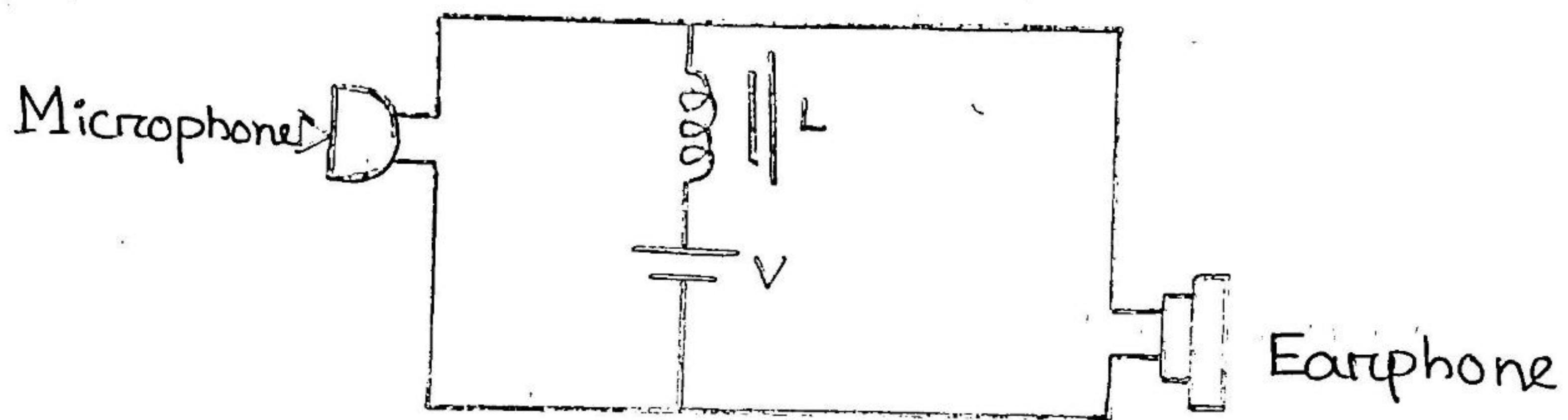


Fig: A simplex telephone circuit.

(c) What is folded network? How only $N/2$ connections are established for N inlets of a folded network?

Ans: 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 the folded Network.

In a folded network, the N number of inlets which come as outlets are again folded back to the inlets.

Nevertheless, the switching network provides connections to the inlets and outlets as per the requirement. As one connection can be given to one line per time, only $N/2$ connections are established for N inlets of a folded network. Such a network can be called as Non-blocking network.

3.(a) What is space division switching? Explain Block network.

Ans: The switching scheme used by the electronic switching systems may be ~~other~~ space division switching. In space division switching, a dedicated path is established between the calling and the called subscribers for the entire duration of the call.

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 switching paths is less than the maximum number of simultaneous conversations that can take place. The probability that a user may get blocked is called the blocking probability. A good design should ensure low blocking probability.

(b) what is junctures? write some advantages of automatic switching system.

Ans: The junctures is a junction that provides a folded connection for the local subscribers and the service circuits. If the ~~called~~ called subscriber

and the calling subscriber both are local, then the folded Connection helps in making the connection to a local call.

Overcoming the disadvantages of manual

switching systems, the automatic switching systems come with the following advantages:

→ Language barriers will not affect the request for Connection.

→ Higher degree of privacy is maintained.

→ Faster establishment and release of calls is done.

→ Number of calls made in a given period can be increased.

→ Calls can be made irrespective of the load on the system or the time of the day.

(c) what is Erlang? Explain the stronger switching system.

Ans: The traffic in a telecommunication network is measured by an internationally accepted unit of traffic intensity known as Erlang.

A switching resource is said to

carry one erlang of traffic

if it is continuously occupied through
a given period of observation.

Strawger switching system: The first
ever automatic telephone switching
was developed by Almon B Strawger.

As the operator at the manual
telephone exchange was the wife
of his competitor and was
diverting all the business, Strawger
thought of developing a switching
system, which does not require
an operator. This led to the
invention of the automatic

switching system developed by Stromger. The Stromger switching system is also called the step-by-step switching system as the connections are established in a step-by-step manner.

4. (a) What is dial tone? Write some important features of Crossbar switches.

Ans: The dial tone is the signaling tone, which indicates that the exchange is ready to accept the dialed digits from the subscriber. The number should be dialed only when this signal is heard.

Some features of crossbar switches:

- While processing a call, the common control system helps in the sharing of resources.
- The specific route functions of call processing are hardwired because of the wire logic computers.
- The flexible system design helps in the appropriate ratio selection is allowed for a specific switch.
- Fewer moving parts ease the maintenance of crossbar switches systems.

(b) What is busy tone? Explain multi exchange network with diagram.

Ans: Busy tone: After dialing the required number, if the called subscriber on the lines at the exchange are not free to place a call, the calling subscriber is sent a busy tone indicating that the lines or the subscriber is busy, this is called a busy tone.

In a multi exchange network, the routes used to establish connection with a particular subscriber differs from time to time. In the stronger exchange following the multi exchange network,

-the subscriber has to be more concerned with the routing. A subscriber should have the details of all the numbers of exchanges present in the route.

-There may arise situations where a subscriber may be required to establish a connection on other routes.

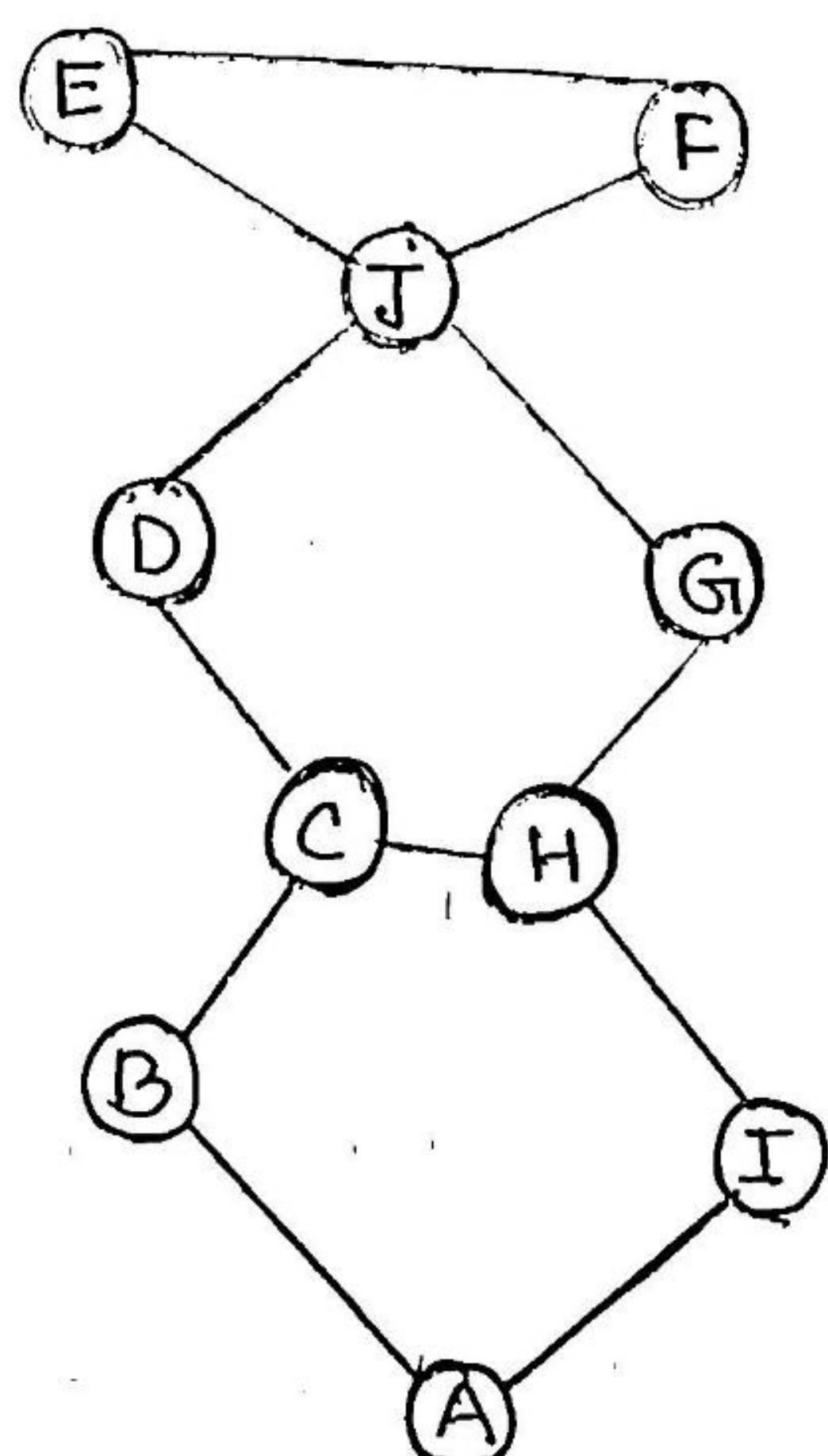


Fig: Multi exchange network

5. (a) Classify the Data networks and explain them briefly.

Ans: - There are 3 kinds of data networks.

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

LAN: LAN stands for local area network.

is usually privately owned and links the device in a single office, building or campus. LAN are designed to allow resources to shared between personal computers or workstation. optical fibre, twisted pair and coaxial cables are used as the communication

media for LANS.

MAN: A metropolitan area network is a network with a size between a LAN and a WAN. It is normally covers the area inside a town or city. Community antenna television cables, twisted pair wire, optical fibres and radio links are used for the medium of MAN.

WAN: A wide area network provides long distance transmission of data, image, audio, video, information over large geographic areas that may comprise a country a continent or even the whole world.

(b) Write the advantages of Local Area Network.

Ans: Advantages of local area network:

→ 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 as the need arises.

→ 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.

This, in turn, enhances the reliability and availability of the systems to users.

- LAN provides a resource-sharing environment. Expensive peripherals, hosts and databases may be shared by all the LAN users.
- A LAN adhering to a certain standard permits multivendor systems to be connected to it. Thus, a user is not committed to a single vendor.
- In LAN, the systems are generally so chosen as to meet most of the user.

(c) What is modem? Explain the data transmission in PSTNS.

Ans: Modem: Combined modulator demodulator unit is called a modem.

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, the 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 and modulator translates the data pulses into voice band analog signals at the transmitting end.

6. (a) Briefly explain circuit switching.

Ans: 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. It remains dedicated to the communicating pair for the entire duration of the transmission irrespective of either data is actually transferred or not. No other potential user can use the path even it is idle. The connection is realised only when specially signalled so by either of the communicating entities. Data transmission using a PSTN connection is a typical example of a circuit switched data transfer.

(b) what is system ? Mention the function of message switching.

Ans: System: A system is one or more autonomous computers and their associated software, peripherals and users, which are capable of information processing and/or transfer.

In message switching, once the transmission is initiated, a message is transmitted in its entirety without a break from one node to another. The node processor performs the following functions:

→ Receive the full user message and store the same.

- Check the message for data transmission errors and perform error recovery if required.
- Determine the destination address from the user message.
- Choose an appropriate link towards destination based on certain routing criterion.
- Forward the message to the next node on the chosen link.

(c) Write the difference between voice traffic and data traffic.

Ans:

Voice traffic	Data traffic
① Voice traffic is continuous.	① Data traffic is bursty.
② Low bandwidth for long duration	② High bandwidth for short duration.
③ Typical line utilization 85-95%	③ Typical line utilization 5-15%.
④ Voice traffic is half duplex.	④ Data traffic is either half or full duplex.
⑤ Loss acceptable	⑤ Loss unacceptable.
⑥ In voice traffic error tolerable..	⑥ In data traffic error not tolerable.

7. (a) Explain the data rates in PSTNs.

Ans: For a 3kHz channel, and a binary signal, the maximum data rate works out to be 6000 bps, if the channel is 'ideal'. In a practical channel, the maximum rate would come down.

A 'first-cut' estimate of this can be obtained from Nyquist's theorem which applies to noiseless channels and

states, $R = 2H \log_2 V$ bps

Where, R = maximum data rate

H = bandwidth of the channel

V = number of discrete levels in the signal.

By increasing the ~~no~~ number of levels used to represent the signal the bit rate may be increased arbitrarily in a noiseless channel.

It is important to recognise that the actual number of signal transitions is still limited to the binary level limit.

(b) Explain link to link layers briefly.

Ans: The first three layers, physical, network layers from the link to link layers of OSI

reference model entities in an OSI layer perform certain functions to fulfil the stated purpose of the layer. They obtain services from the immediate lower layer and provide services to the immediate upper layer. In Connection oriented services, a connection is first established between the sender and the receiver before data transfer can commence. The connection may be virtual or physical, depending upon the network capabilities and facilities.

(c) Describe network layer briefly.

Ans: The highest link to link layer in the OSI model is the network layer. Although this layer functions on a link to link basis, it is concerned with transmission of packets from the source node to the destination node. It deals with routing and switching considerations that are required in establishing a network connection which may involve the use of several transmission resources in tandem. Including a number of intermediate switching nodes of

different sub networks. The network layer makes invisible to the transport layer, the details of the underlying communication media and the different characteristics of the transmission and network technologies. It only assures a certain quality of service to the upper layers.

8. (a) What is entity? Mention the performance of a routing algorithm.

Ans: Entity: The functions in a layer are performed by hardware subsystems and/or software packages. These are known as entities.

The performance of a routing algorithm:

- Minimum delay.
- Minimum number of intermediate nodes or hops.
- Processing Complexity.
- Signalling capacity required on the network.
- The rate of adaption in the case of adaptive algorithms.
- Fairness to all types of traffic.
- A reasonable response time over a range of traffic intensities.
- Robustness: The ability to reach the destination even when parts of the network fail.

(b) What is layer? Application layer provides which services?

Ans: A layer is composed of subsystems of the same rank of all the interconnected systems.

The application layer provides all services that are directly comprehensible by the users, which are

- Electronic mail or message handling services.
- Directory services.
- Cost allocation.
- Determination of quality of service.

- File transfer and management.
- Editors and terminal support services.
- Telematic services like videotex.

(c) Describe ~~the~~ some important aspects of satellite communication.

Ans: There are some important aspects of satellite communication are given below:

→ Satellite network topology and configurations modulation schemes and bandwidth utilization. These are aspects related to the physical layer functions of the reference model.

- Being a Common Communication resource accessible by all or a group of earth stations simultaneously. media access becomes a nontrivial function in the data link layer.
- Satellite Communication being broadcast in nature, routing becomes a trivial function, however organising point to point or point to multipoint connections in a broadcast.
- Since a geostationary Communication satellite is placed at an altitude of about 36000 Km above the equator, the signal will have to travel a distance of 72000 km.