



Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

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Course Title: Telecommunication Engineering

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Assignment Name: Question and Answer on Unit 1 & 3.

Assignment No: 01

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1. a) What is telecommunication engineering? 5
What are the key challenges facing telecommunication engineering?

b) Describe a telephone number? 4

+8802 9138 234113

c) Explain switching system? 5.

2. a) Describe touch tone dial telephony with associated figure? 5

b) What are the main design considerations for touch tone signaling system? 3

c) Explain the technologies used for crosspoint design? 6

3. a) Define: (1) Line (2) Trunk (3) Switching System
(4) Tandem exchange (5) Core networks
(6) International Gateway exchange? 6

b) Draw the block diagram of a common control switching system? 5

c) Categorize the control function in a switching system? Write a list of functions that the initial translation determines 4



4. a) What are the fundamental features of a common control switching system? 5

b) How many methods are there to control a time division switch? How Inlets and outlets are scanned and data memory is accessed in which method? 5

c) Draw distributed SPC? 4

5. a) Describe automatic switching system 5

b) Describe common control subsystem? 4

c) Describe multi-exchange network? 6

Q) What is crossbar switching matrix? 5

Draw 2x2 Crossbar switching matrix?

b) How configure crossbar switch? 5

c) What are the challenges for the cross point technology? 4

7. a) Describe with diagram of process in a multiprogramming Environment. 5
- b) Classified Data network according to geographical coverage? 4
- c) Describe switching technology of Data transmission? 5

8. a) What is LAN? Why we use LAN? 5
- b) Briefly explain fiber optic network? 5
- c) Why we need satellite based data network? 4

Answer to the Ques. No-1(a)

Telecommunication Engineering:

Telecommunication engineering is an engineering discipline centered on electrical and computer engineering which seeks to support and enhance telecommunication systems.

The work ranges from basic circuit design to strategic system developments.

Key Challenges Facing Telecommunication Engineering:

1. Lack of talent in developed countries.
2. Access to top-notch problem-solving capabilities.
3. Access to new technologies like 5G.
4. Pre-design infrastructure, upgradation.
5. Growing competition among service providers.
6. Globalization.

7. Meet seasonal & one-time workforce needs.
8. Internet of Things (IoT), virtual Reality (VR) Augmented Reality (AR)
9. Variety of new products, services.
10. Providing telecommunication services in the rural areas.

Answer to the Question No.-1(b)

A telephone number define many internal notation such as country, trunk Line Extension.

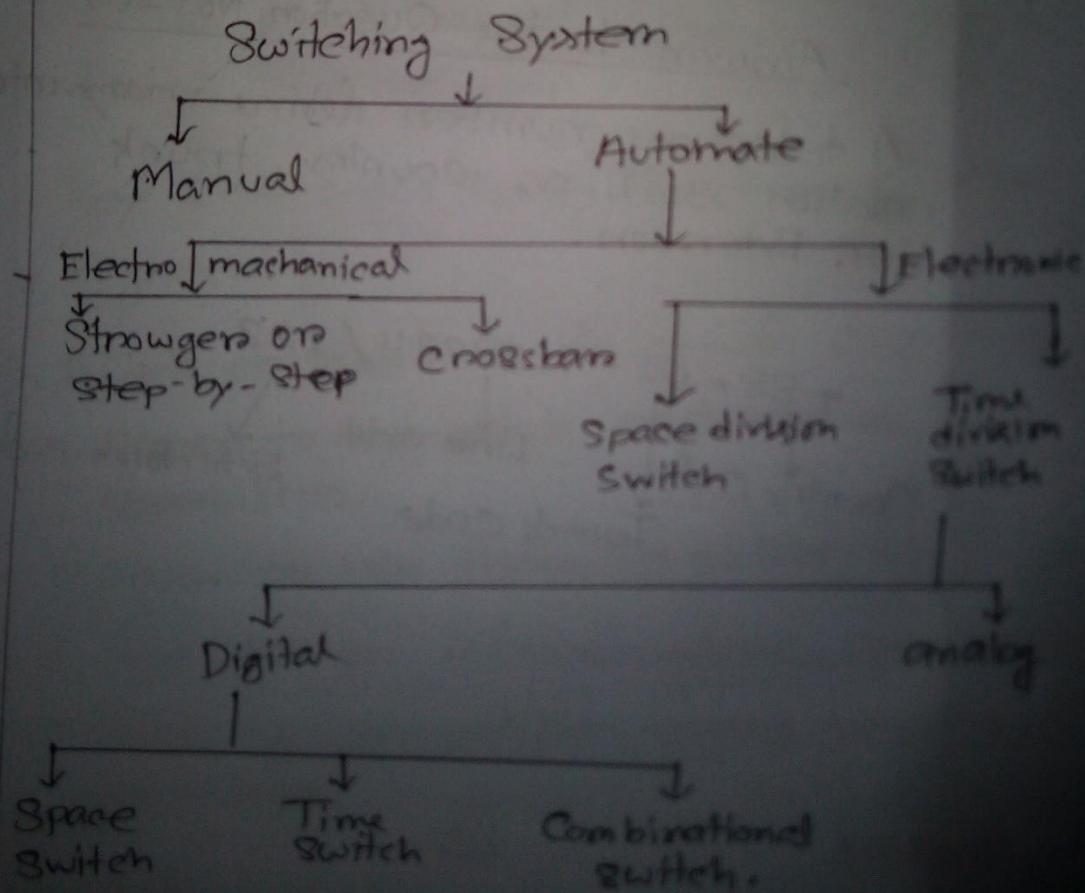
+88 - 02 - 9138234 / 113

↓ ↓ ↓
Country Code Trunk Code Line Code Extension code.

Answer to the Question No 1(c)

Q1a Switching System: The 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.

Categorization of Switching System



Answers to the Question No-2 (a)

Touch Tone Dial Telephone:

The touch tone dial telephone is a communication device that makes use of a form of telephone.

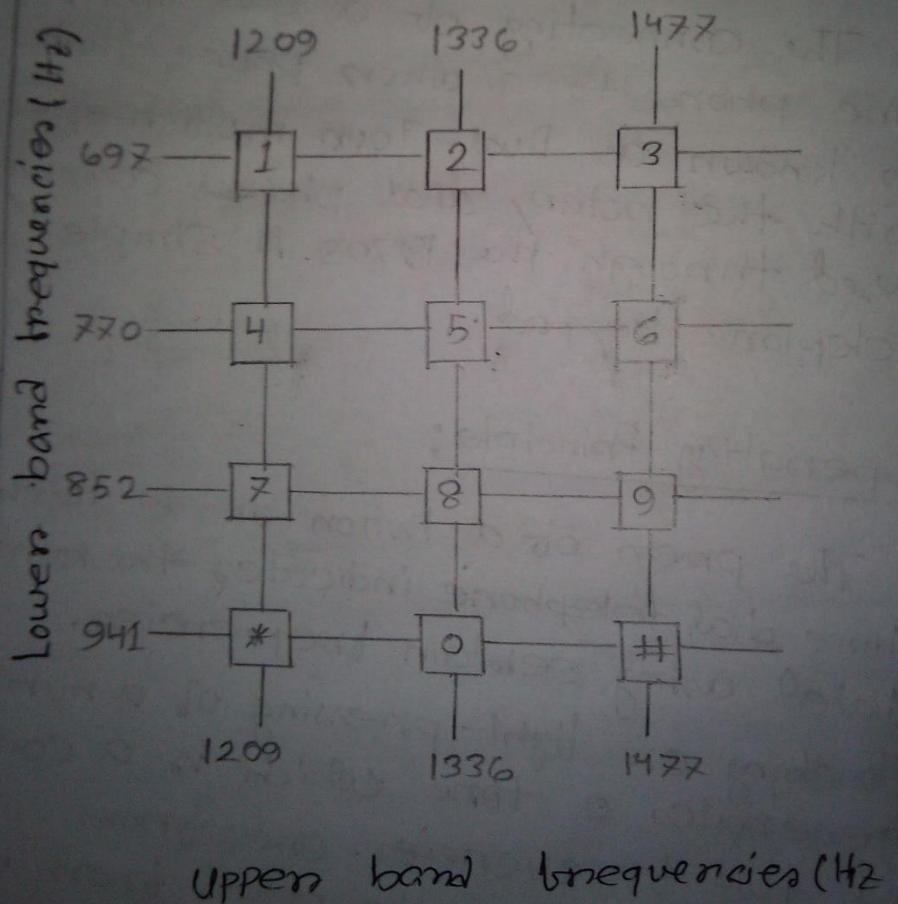
The connecting of a call from one phone to another phone that is known as Dual-Tone multi-frequency, with the rotary dial phones commonly used through the 1970s. A simple telephone keypad.

Operating Principle:

The press of a button on the touch tone dial telephone indicates the numbers dialed using certain frequencies.

Touching or light pressing of a number generates a tone which is a combination of two frequencies. One from lower band and the other from upper band.

Example: By pressing the button 9, two frequencies such as 852 Hz the lower frequency and 1477 Hz the upper frequency are produced. The design of touch-tone dialing producing two frequencies is as shown below.



Answer to the Question No-2(b)

Design considerations of touch tone signaling system. Ans:

1. Choice of code.
2. Band separation.
3. Choice of frequencies.
4. Choice of power levels.
5. Signaling duration.

Answer to the Question No- 2(c)

Crosspoint technology: Crosspoint technology is an amalgamation of two related technologies.

- * Electromechanical
- * Electronic.

Electromechanical Campoint Technology

The electromechanical switches which are capable of making and breaking contacts in 1-10ms of time duration for several million times without any wear and tear. are being extensively used even today.

There are two types of switches.

1. Mini-Switches
2. Reed relay switch.

Mini-Switches: These switches are made up of a precious metal like palladium, which makes the contacts work quieter, with their bulbous design and high resistance to corrosion for long lasting design. These mechanically latched switches use notches for this purpose and are highly reliable in crossbar switching system. This switches mounted on endbars move horizontally and vertically to establish and release contacts with a switching time of 8-10ms.

Reed relay switches: In order to reduce the usage of mechanical switches and increase the operating life of the switches further, the Reed relay switches were introduced. These switches are made up of magnetic material contacts sealed in a glass tube. This protects the contacts from getting contaminated. The following figure illustrates the design of a reed relay switch.

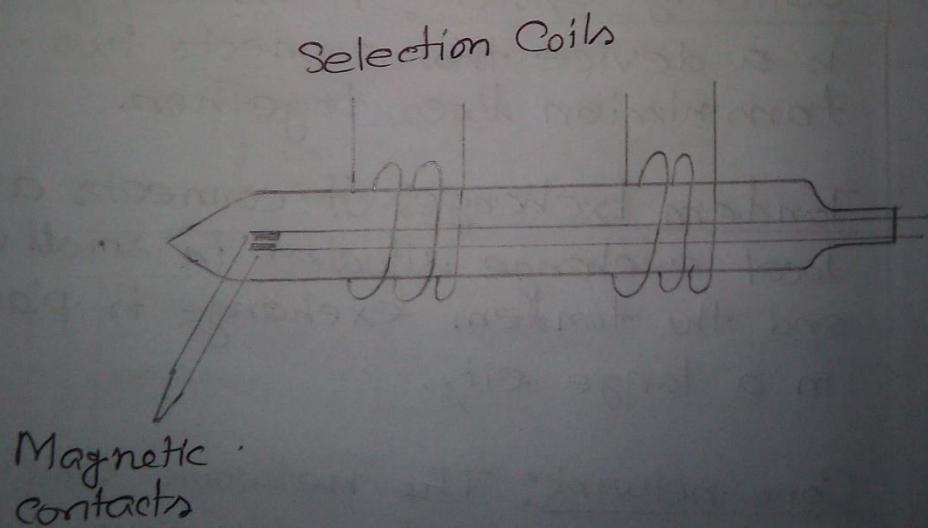


fig: Reed relay switch.

Answers to the Question No- 3(a)

Line: A line is a connection that is configured to support a normal calling load generated by one individual.

Trunk: A trunk is a circuit that is configured to support the calling loads generated by a group of users. It is the transmission facility that ties together switching systems.

Switching System: A switching system is a device that connects two transmission lines together.

Tandem Exchange: It connects a few local exchange situated in small cities and the tandem exchange is placed in a large city.

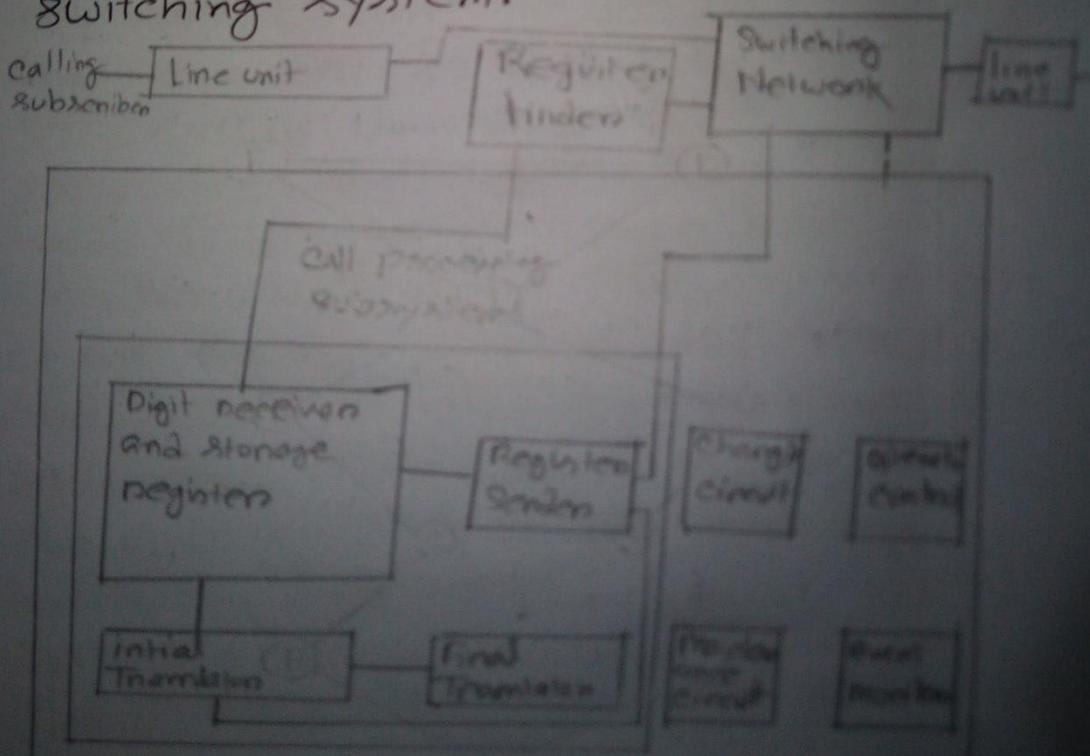
Cone network: The network which has no direct connection with subscribers is called cone network.

International Gateway Exchange:

To make an international call or to receive an international call, the exchange which is used to establish connection is called international gateway exchange or IGIX.

Answer to the Question No- 9(b)

Block diagram of common control switching system.



Answer to the Question No- 3(c)

- The function control function of switching system are following:
 - Event monitoring
 - Call processing
 - Charging
 - Operating and maintenance.
 - Map-in-Memory
 - Map-in-Network

Answer to the Question No. 4 (Q)

Load Sharing Mode: Load sharing mode is where a task is shared between two processors. The exclusion device is used instead of the comparators in this mode.

Operating Principle: The processors call for ED (Exclusion Device) to share the resources, so that both the processors do not seek the same resource at the same time. In this mode both the processors are simultaneously active. These processors share the resources of the exchange and load. In case of the processor fails, the other one takes over the entire load of the exchange with the help of ED. Under normal operation, each processor handles one-half of the calls on a statistical basis.

Answer To the Question No-4(b)

There are three methods to control time division time switch.

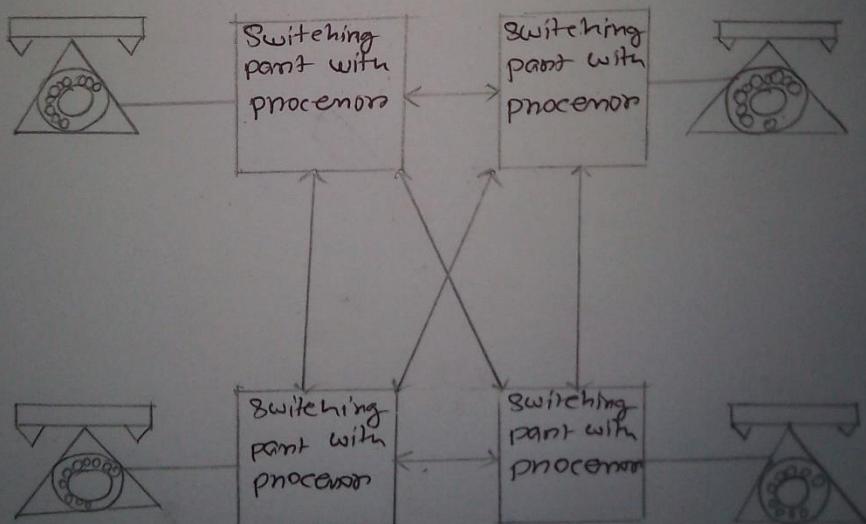
Inlets and Outlets: The set of input circuit of an exchange are called Inlets and the set of output circuits are called the Outlets.

The primary function of a switching system is to establish an electrical path between a given inlet and outlets pair.

Map-in-network is connected with inlet and outlet to be connected and the actual path is determined by the switching network. This map-in-Network technique is common in common exchanges using markers for control.

Answer to the Question No- 4(c)

Distributed SPC The distributed SPC has more availability and reliability than centralized SPC, because entire exchange control function may be decomposed either horizontally or vertically for distributed processing.



Such distributed control where switching equipment is divided into parts, each of which have its own processor, is indicated in the figure above.

The exchange environment in vertical decomposition is divided into several blocks and each block is assigned to a processor that performs all the control functions that are related to a specific block of equipment. Whereas each processor in horizontal decomposition performs one or some of the exchange control functions.

Answers to the Question No-5 (a)

Automatic Switching System: Automatic switching system in telecommunication is a mechanism that connects callers with called numbers without operators.

Advantages of automatic switching system

- 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 on the system on the time of the day.

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

Automatic switching classified two types

- Electromechanical Switching

- Electronic Switching.

Electromechanical switching: The electromechanical switching are combination of mechanical and electrical switching.

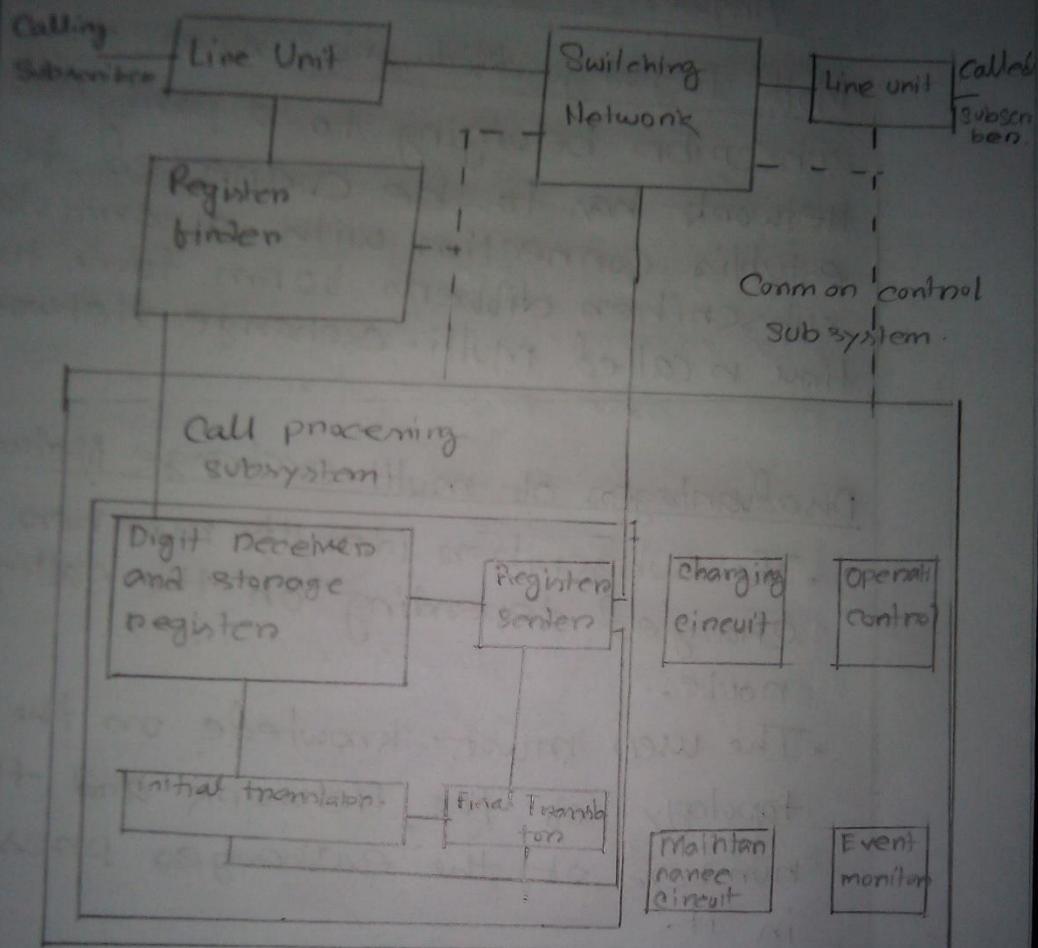
Electronic switching: The electronic system are operated with the help of a processor on a computer, which control the switching time.

Answers to the Question No. 5(b)

Common control subsystem: Two main ideas were implemented by the common control subsystem.

- The routing of the call should be done by the exchange, but not by the numbers dialed.
- A unique Identification Number should be allotted to the subscriber. The VIN contains the number of the exchange of the subscriber and the number indicating the line of the subscriber.

This is a combination of Subscribers Trunk Dialing Code and the subscriber numbers consider this as the physical line address. Every user is assigned a logical number irrespective of the physical line number. An address translation mechanism translates the logical address to actual physical address for connection establishment.



big Common control Sub system,

Answer to the Question No-5(c)

Multi-Exchange Network: When a subscriber belonging to a particular network has to be connected to establish connection with a particular subscriber differs from time to time is called multi-exchange Network.

Disadvantages of multi-exchange Network

- The subscriber identity numbers is changed depending on the calling route.
- The user must knowledge on the topology of the Network and the numbers of the exchanges present in it.
- The number and size of the called subscriber varies depending upon the exchange from where the call originates.

Following figure is an example of the topology of a Multi-exchange Network.

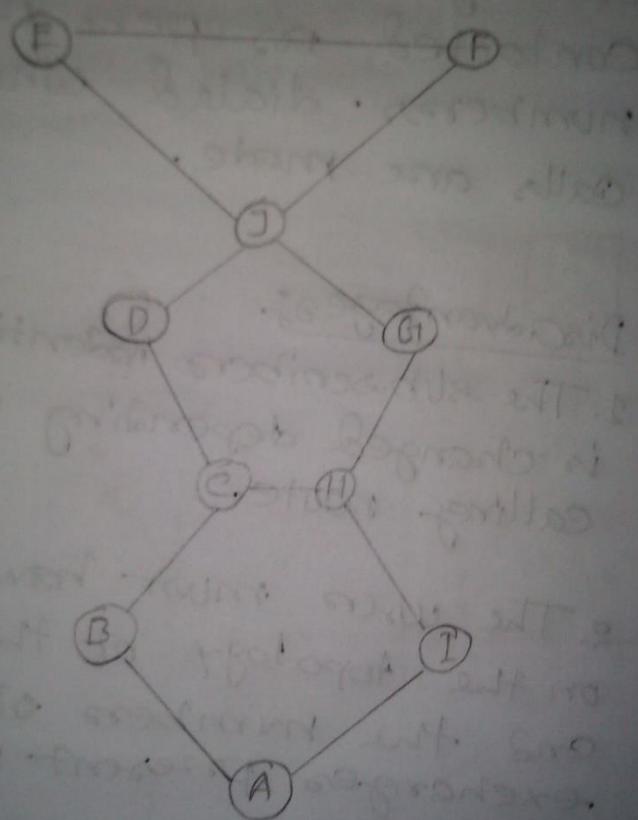


Fig: Multi-exchange Network.

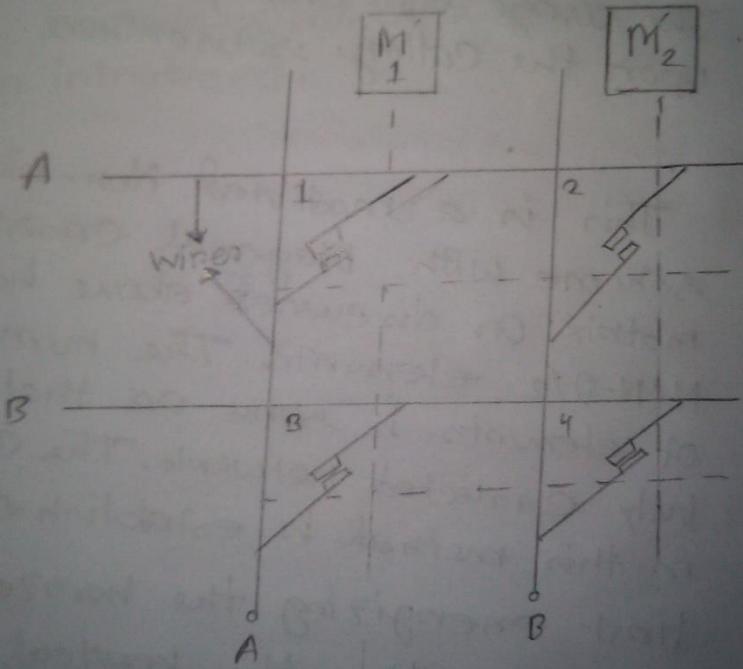
The level is reserved in each exchanges, where the output calls are connected to neighboring exchanges. These exchanges are contacted as per the exchange numbers dialed when the calls are made.

Disadvantages:

1. The subscribers identity number is changed depending on the calling route.
2. The users must have knowledge on the topology of the network and the numbers of the exchanges present in it.
3. The numbers and size of the called subscribers varies depending upon the exchange from whom the call originates.

Answer to the Question No-6 (Q)

Crombars Matrix: Crombars matrix is an arrangement of Crombars which is formed by the $M \times N$ set of contacts arranged as vertical and horizontal bars with contact point where they meet.



2x2 Crombars Switching.

Answer to the Question No- 6(b)

Croombas Switch Configurations

The Croombas switch configurations are Non-blocking configurations which have N^2 switching elements for N subscribers and can make $N/2$ simultaneous conversations. The usage of crosspoint depends upon the calling subscribers.

This is a modified Non-blocking scheme with Diagonal crosspoint matrix as discussed above having $N(N-1)/2$ elements. The number of elements is same as that of a fully connected network. The connection in this method is established by first energizing the horizontal bars and then the vertical bars. However this Non-blocking scheme has few disadvantages -

- Large numbers of switching elements are required.
- This is neither a cost-effective process.
- This is neither a cost effective process.

To overcome these disadvantages the blocking crossbar switching was introduced.

Answers to the Question No- 6(c)

Challengers for the Crosspoint technology.

- Reduction in the size of a Crosspoint
- Reduction in the cost of a Crosspoint
- Improvisation of the switching time.

In this process of binding solution to the existing challenges, the Crosspoint technology evolved. Crosspoint technology is an amalgamation of two related technologies. That are,

- Electromechanical
- Electronic.

Electromechanical Crosspoint Technology

The electromechanical crosspoint switches which are capable of making and breaking contact in 1-10ms of time during for several million times without any wear and tear.

Two types of switches widely used.

Mini Switch: These switches are made up of a precious metal like palladium, which makes the contacts work quieter. These switches mounted on Crombarane move horizontally and vertically to establish and release contacts with a switching time of 8-10ms.

Reed Relay Switches: These switches are made up of magnetic material contacts sealed in a glass tube. It protects the contacts from getting contaminated.

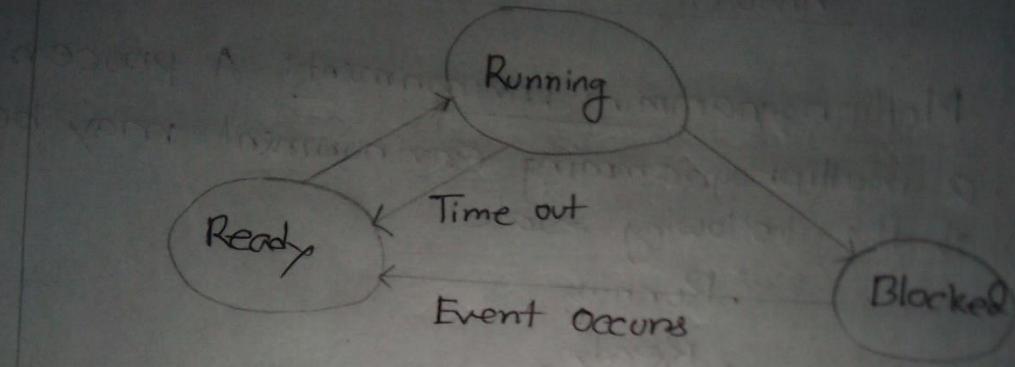
Answers to the Question No-2 (a)

Multiprogramming Environment: A process in a multiprogramming environment may be one of the following states:

- Running
- Ready
- Blocked

The state of a process is defined by its current activity and the process it executes and the transitions that its state undergoes.

- A process is said to be running if an instruction is currently being executed by the process.
- A process is said to be ready if the next instruction of running a process is waiting or has an instruction that is timed out.
- A process is said to be blocked if it is waiting for some event to occur before it can proceed.



While some processes are in the running state, some will be in the ready state while others are blocked up. The processes in the ready list will be according to the priorities. The blocked processes are unordered and they unblocked in the orders in which the events are waiting to occur. If a process is not executed and waits for some others instruction or resource, the process time is saved by pushing such process to the ready list and will be unblocked when its priority is high.

Answers to the Question No-7(b)

Classification of data networks according to their geographical coverage.

- Wide area network
- Metropolitan area network
- Local area network.

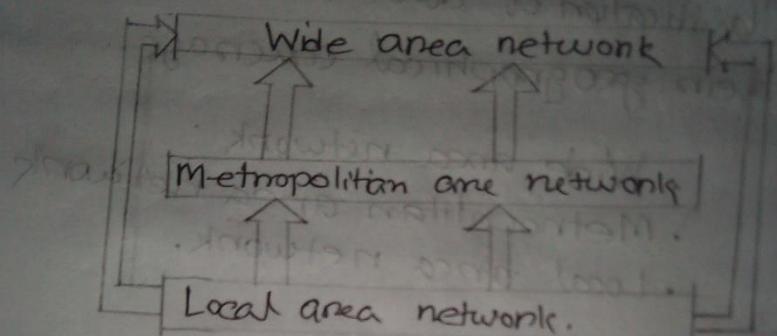
Wide area network: Intercity inter country and intercontinental network are known as wide area network.

Metropolitan area network: A metropolitan area network interconnects computers with a metropolitan city.

Local area network: Local area network networks are confined to a single building or a group of buildings generally belonging to the same organization.

(1) Explain hierarchy of networks

Q1. Explain hierarchy of networks



Data network hierarchy

Answer to the Question No- 8(c)

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 bursty in nature. When a user sits at a terminal and works with a

Computer interactivity. he/she spends time thinking, keying in the query or command to the computer, and waiting for a response from the computer's database proceeding further.

In constraint, 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 similar period in the case of a telephone conversation.

While voice traffic is half-duplex, data traffic may be half or full-duplex. Another important difference lies in acceptable errors and loss rates. No errors or losses are acceptable in data transmission whereas a small amount of speech loss is often not noticeable.

Answers to the Question No. 8 (a)

LAN: A local area network (LAN) typifies a distributed environment and finds application in a number of areas.

- Office automation.
- Factory automation
- Distributed computing.
- Fire and security systems.
- Process control.
- Document distribution.

Advantages

1. It may be put into operation with a small investment and more systems may be added as the need arises.
2. The systems are generally so chosen as to meet most of the users.

3. A LAN adhering to a certain standard permits multivendor systems to be connected to it.

4. LAN provides a resource sharing environment.

Answers to the Question No- 8(b)

Fibre Optic Networks:

1. High speed operation (100 Mbps or more)

2. Ability to span large distance (100-200km)

3. Ability to support a moderate number of stations are supported with a maximum limit around 1000.

These characteristics make the fibre optic networks suitable for high speed LANs and MANs with a limited number of stations.

Fibre optic network may be configured around a star, ring, or bus structure. The number of stations that can be supported in a star or bus structure is relatively low compared to that in a ring configuration.

(d) 2 - 4
Optical fibers are inherently unidirectional and this influences the way in which the network structure are realized and the consideration for medium access. Some of medium access consideration, discussed.

Answers to the Question No- 8(c)

Satellite Based Data Networks

There are some important aspects of satellite communication.

- Satellite network topology and contention modulation schemes and bandwidth utilisation. These are aspects related to the physical layer function of the reference model.
- Being a common communication medium accessible by all or a group of earth stations simultaneously. Media access becomes a non-trivial function in the data link layer.
- Satellite communication being broadcast in nature, routing becomes a trivia function however organising point-to-point or point-to-multipoint connections in a broadcast environment.

• Since a geostationary communication satellite is placed at an altitude of about 36,000 km above the equator, the signal will have to travel a distance of 72,000 km or more between the source and the destination resulting in a significant propagation delay of 250-300 ms. So it can any point in side the area.

• Propagation loss is given by the formula $L = k \log_{10}(d)$ where k is a constant and d is the distance between the transmitter and receiver. The value of k depends on the frequency of the signal. At higher frequencies, the value of k is smaller than at lower frequencies. This is because at higher frequencies, the wavelength is shorter, and the signal is more easily scattered by atmospheric particles. The value of k is also affected by the presence of obstacles in the path of the signal. If there are many obstacles, the value of k will be larger than if there are fewer obstacles.