College of Electronic Technology

Spring 2017 **Course: Switching and Networks**

Q-1. What are the major systems of a telecommunication network?

Answer:

The major systems of any telecommunication network may consist of the following major systems:

1. Subscriber end instruments or Equipments
2. Subscriber loop systems
3. Switching Systems
4. Transmission systems
5. Signalling systems

Q2. List the basic functions of a switching system and explain clear down function.

Answer

The switching office performs the following basic functions irrespective of the system whether it is a manual or electromechanical or electronic switching system.

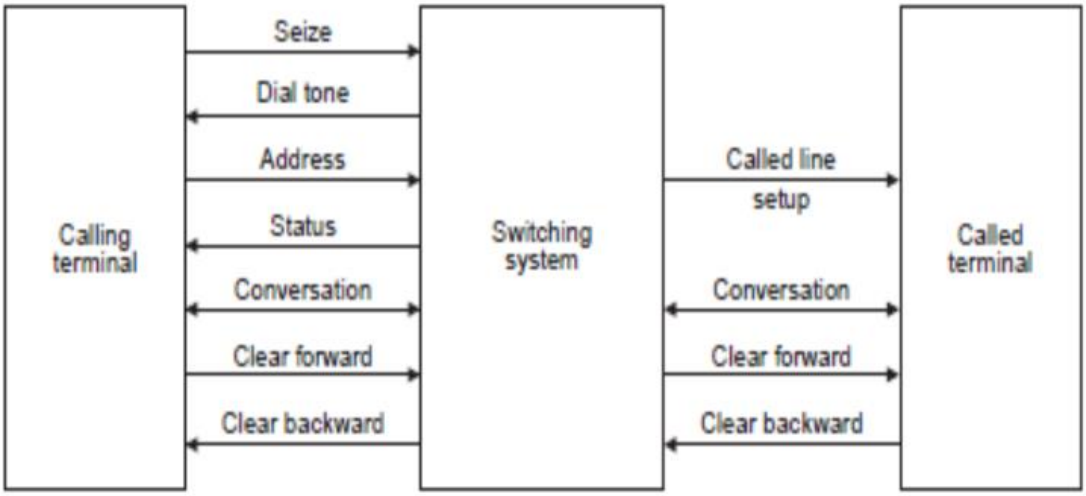
1. **Identity.** The local switching center must react to a calling signal from calling subscriber and must be able to receive information to identify the required destination terminal seize.
2. **Addressing.** The switching system must be able to identify the called subscriber from the input information
3. **Finding and path setup.** Once the calling subscriber destination is identified and the called subscriber is available, an accept signal is passed to the switching system and calling subscriber. Based on the availability, suitable path will be selected.
4. **Busy testing.** If number dialed by the calling subscriber is wrong or the called subscriber is busy (not attending the phone) or the terminal may be free (lifting the phone) but no response (not willing to talk or children handling), a switching system has to pass a corresponding voice message or busy tone after waiting for some time (status).
5. **Supervision.** Once the path is setup between calling and called subscriber, it should be supervised in order to detect answer and clear down conditions and recording billing information.
6. **Clear down.** When the established call is completed, the path setup should be disconnected. If the calling subscriber keeps the phone down first, the signal called clear forward is passed to the switching system. If the called subscriber keeps the phone down first, a signal called clear backward signal is passed to the switching system. By clear

signal, the switching system must disconnect the path setup between calling and called subscriber.

7. **Billing.** A switching system should have a mechanism to meter to count the number of units made during the conversation. The cumulative number of units made for a particular duration by the calling subscriber is calculated. This information and if any should be sent to the called subscriber.

Q-3. Draw the signal exchange diagram for a local call used to represent the sequence of events between the subscriber and exchanges?

Answer



Q-4. What are the three basic steps involved in data communication through circuit switching?

Answer:

The steps are:

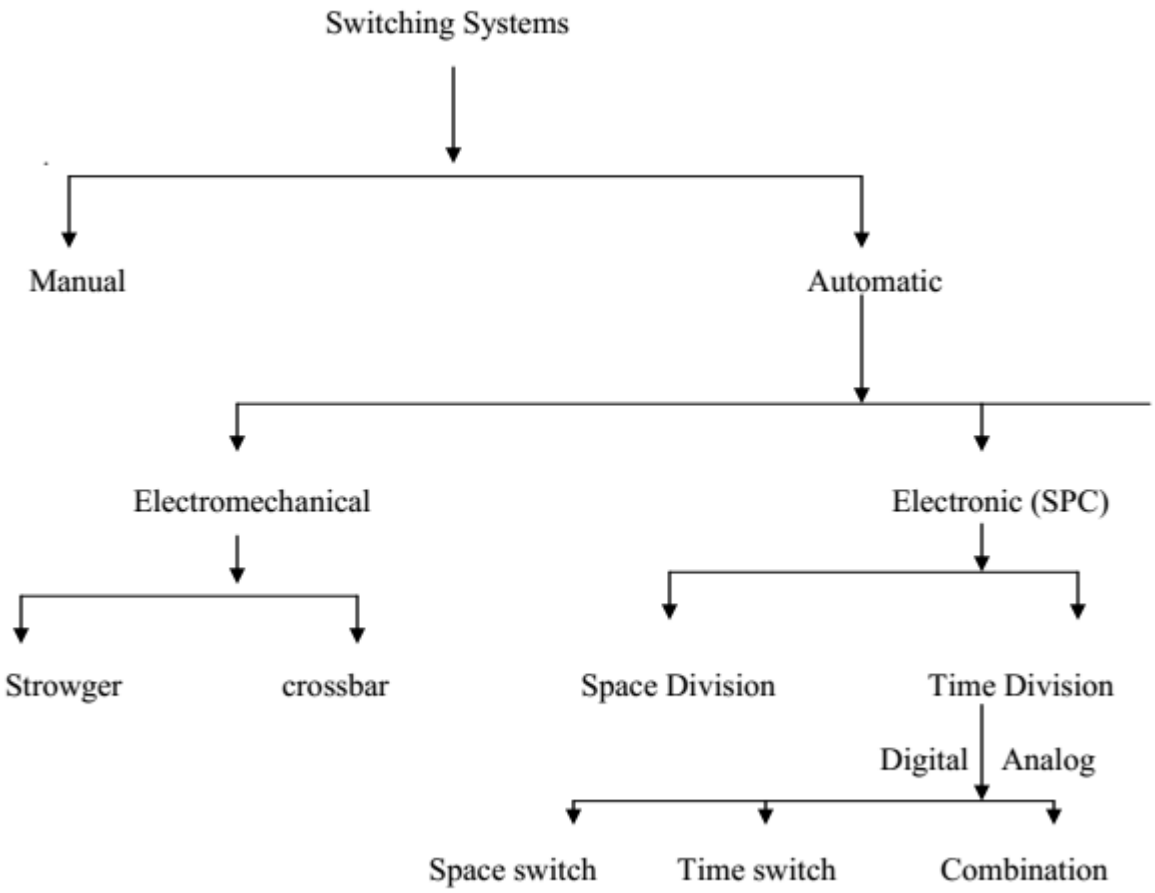
i) Circuit establishment (before data transfer)

ii) Circuit maintenance (When data transfer is going on)

iii) Circuit disconnect (When data transfer is over)

Q-5. Explain briefly various types of switching systems.

Answer:



Q-6. Compare the performance of space-division single-stage switch with multi-stage switch.

Answer

Space-division single-stage switch requires more number of cross points, non-blocking in nature but provides no redundant path. On the other hand multi-stage switches require lesser number of cross points, blocking in nature but provides redundant path

Q-7. Why data communication through circuit switching is not efficient?

Answer

In data communication, traffic between terminal and server are not continuous.

Sometimes more data may come or sometimes there is no data at all.

Circuit switching is not efficient because of its fixed bandwidth.

Q8. What are single stage and multistage networks? Compare the strengths and weaknesses of each.

OR

List the major difference in single stage, two stage and three stage Networks. Also discuss their blocking characteristics.

Answer:

Single Stage Vs. Multistage Network

Sr. No.	Single Stage	Multi Stage
1.	Inlet to outlet connection is through a single cross point.	Inlet to Outlet connection is through multiple cross points
2.	Use of single cross point per connection results in better quality link.	Use of multiple cross points may degrade the quality of a connection.
3.	Each individual cross point can be used for only one inlet/outlet pair connection.	Same cross point can be used establish connection between a number of inlet/outlet pairs.
4.	A specific cross point is needed for each specific connection.	A specific connection may be established by using sets of cross points.
5.	If a cross points fails, associated connection cannot be establish- There is no redundancy.	Alternative cross-points and paths are available.
6.	Cross points are inefficiently used. Only one cross point in each row or column of a square or triangular switch matrix is even in use , even if all the lines are active.	Cross points are used Efficiently
7.	Number of cross points is Prohibitive	Number of cross points is reduced significantly
8.	A large number of cross points in each inlet/outlet leads to capacitive loading.	There is no capacitive loading problem
9.	The network is non blocking in character	The network is blocking in character
10.	Time for establishing a call is less.	Time for establishing a call is more.

Q-9. Mention the key advantages and disadvantages of circuit switching technique.

Answer:

Advantages:

i) After path is established, data communication without delay.

ii) Very suitable for continuous traffic.

iii) It establishes a dedicated path.

iv) No overhead after call setup.

v) It is transparent and data passes in order.

Disadvantages:

i) Provide initial delay for setting up the call.

ii) Inefficient for bursty traffic.

iii) Data rate should be same because of fixed bandwidth.

iv) When load increases, some calls may be blocked.

Q10- Determine the implementation complexity of 2048 channel TST switch with 16 TDM links and 128 channels. Let the time slot of space switch is 25.

Answer

$$IC = N^2 + \frac{NL \log_2 N + 2NT(8) + 2NL \log_2 T}{100}$$

Sol. Given $N = 16$

$T = 128$

$L = 25$

$$IC = 16^2 + \frac{16 \times 25 \times \log_2 16 + 2 \times 16 \times 128 \times 8 + 2 \times 16 \times 25 \times \log_2 128}{100}$$

$IC = 656$ cross points.

Q-11.What are the three functional blocks of a conventional time-slot Interchanger (i.e., a time switch), explain with neat diagram?

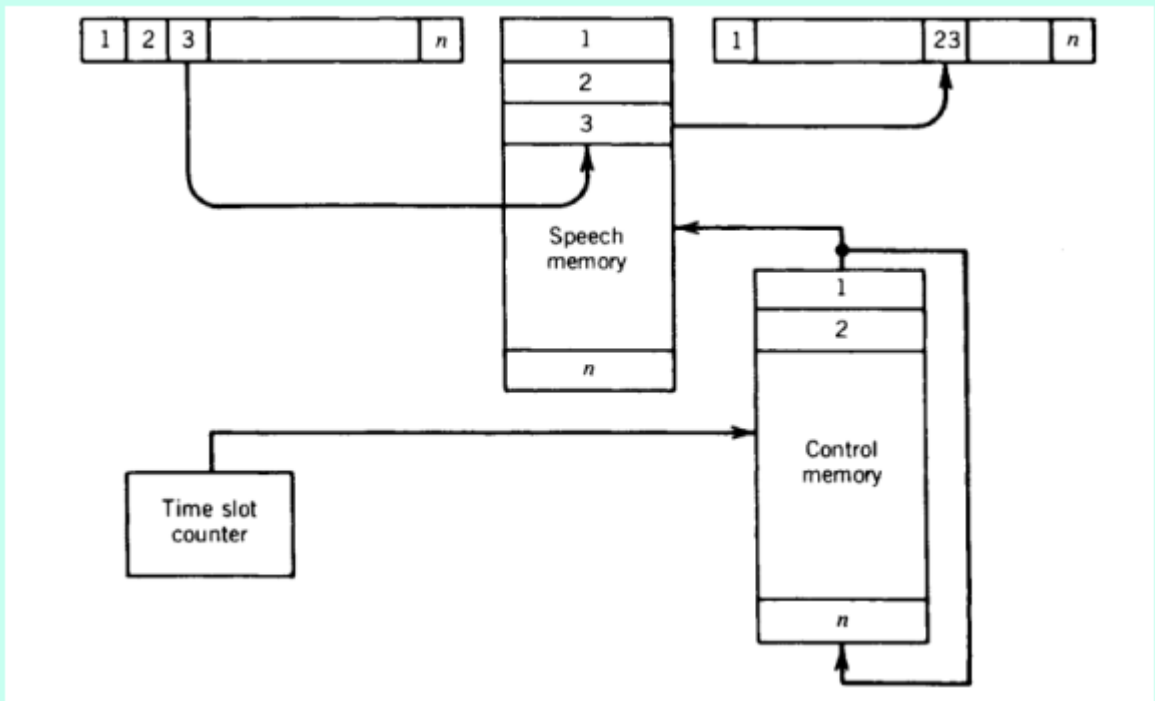
Answer

The three functional blocks are:

(i)- Speech memory

(ii) Control memory

(iii) Time slot counter



Q-12 Draw and explain time division space switching in detail.

Answer:

This switch consists of only two stages. This structure contains a time stage T followed by a space stage S as shown in Figure. Thus this structure is referred to as time-space (TS) switch.

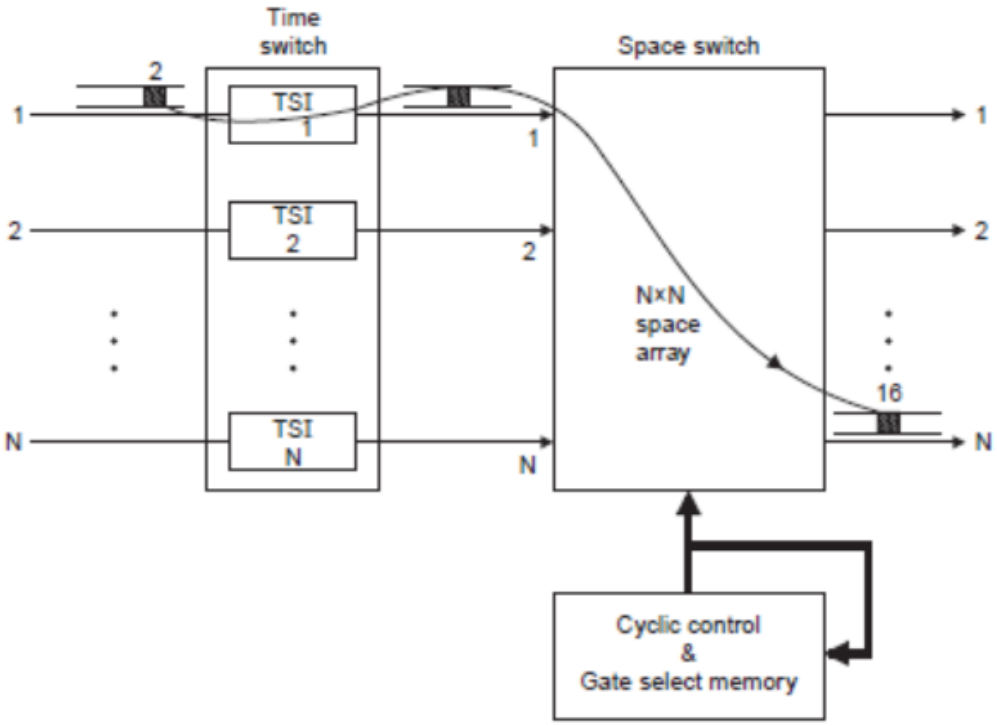
The space arrays have N inlets and N outlets.

For each inlet line, a time slot interchanger with T slots is introduced. Each TSI is provided with a time slot memories. Similarly a gate select memory needs to be provided for the space array.

The transmission of signals carried out from sender to receiver through multiplexer input and de multiplexer output. The reverse communication also similar.

Thus a hybrid arrangement is needed to isolate the transmitted signal from the received signal.

The basic function of the time switch is to delay information in arriving time slots until the desired output time slot occurs.



Q13 List any four important features of T-S-T (time space time) switching.

Answer

Some important features of TST switches are:

(*i*) **Low blocking probability.** An incoming channel time slot may be connected to an outgoing channel time slot using any possible space array time slot. Thus there are many alternative paths between two subscribers.

This concept reduces the blocking probability of a three stage combination switch.

(*ii*) **Stage independency.** The space stage operates in a time-divided fashion, independently of the external TDM links. The number of space stage time slots L does not coincide with the number of external TDM time slots T.

(*iii*) **Implementation advantage.** The factors to be considered for switching design and implementation are traffic loads, modularity, testability, expandability and simple control requirements. For large switches with heavy traffic loads, the TST have good implementation advantage.

(*iv*) **More cost effective.** If the input channel loading is high, the time expansion of TST and space expansion of STS are required.

Time expansion of TST can be achieved at less cost than space expansion of STS

Q14- What are some differences between circuit switching, datagram packet switching and virtual circuit packet switching?

Answer

Circuit Switching	Datagram Packet	Virtual Circuit Packet
Dedicated path	No dedicated path	No dedicated path
Path established for entire conversation	Route established for each packet	Route established for entire conversation
Call set up delay	Packet transmission delay	Call set up delay, Packet transmission delay
Overload may block call set up	Overload increases packet delay	Overload may block call set up and increases packet delay
No speed or code conversion	Speed or code conversion	Speed or code conversio
Fixed bandwidth	Dynamic bandwidth	Dynamic bandwidth
No overhead bits after call set up	Overhead bits in each packet	Overhead bits in each packet

Q15.

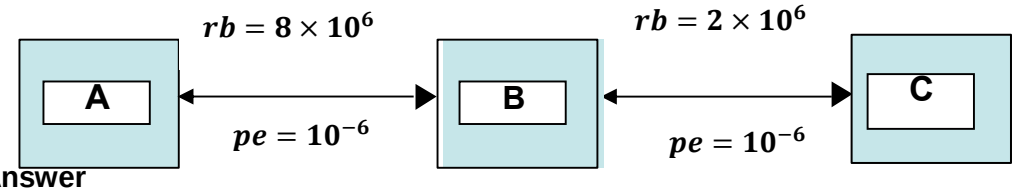
A file of size 2 Mbits is to be transmitted over two links in packet switching network as shown in figure below. If the link speed between A and B is 8Mbps and between B and C is 2Mbps, and the probability of bit errors in both links is 10^{-6}.

(a)- How many bits need to be transmitted to deliver file correctly if the file is sent all at once.

(b)- How many bits need to be transmitted to deliver file correctly if the file is sent as packets of size 500 Kbits.

(c)- Comment on the results of (a) and (b).

(d)- Compare the transmission delay of the above two cases in (a) and (b).



Answer

a)

Packet has 2×10^6 $bits$

$P_{correct} = (1 - P_e)^{2\times10^6}$= 0.135

Number of bits to be transmitted to deliver file correctly = $\frac{1}{0.135} \times 2 \times 2 \times 10^6 = 29.55$ Mbits

b)

$P_{correct} = (1 - P_e)^{500000} = 0.666$

Number of bits to be transmitted to deliver file correctly = $\frac{1}{0.666} \times 2 \times 2 \times 10^6$

$= 6.59$ Mbits

C)

This shows the importance of Packetization, the smaller the packet size, the less number of bits needs to be transmitted to get file send correctly.

c)

$t_{transmission} = \frac{packet\ lenght}{rb} \times number\ of\ bops$

For case (a) $t_{transmission} = \frac{2\times10^6}{\mathbf{8\times10^6}} + \frac{2\times10^6}{\mathbf{2\times10^6}} = 1.25$ sec

For case (b) $t_{transmission} = \frac{500\times10^3}{\mathbf{8\times10^6}} + \frac{500\times10^3}{\mathbf{2\times10^6}} = 0.3125$ sec

Q16. What are the three basic steps involved in data communication through circuit switching?

Answer

The steps are:

i) Circuit establishment (before data transfer)

ii) Circuit maintenance (When data transfer is going on)

iii) Circuit disconnect (When data transfer is over)

What are the advantages and disadvantages of packet switching over circuit switching?

Q17. What are the advantages and disadvantages of packet switching over circuit switching?

Answer

The comparison of packet switching and circuit switching showing advantages and disadvantages of packet switching over circuit switching is given below:

Circuit Switching	**Packet Switching**
Dedicated transmission path.	No dedicated transmission path
Transmission of data.	Transmission of packets.
Operate in real time.	Near real time.
Message not stored.	Message held for short time
Path established for entire message.	Route established for each packet
Call setup delay.	Packet transmission delay.
Busy signal if called party busy.	No busy signal.
Blocking may occur.	Blocking cannot occur
User responsible for message-loss protection.	Network may be responsible for each packet but not for entire message.
No speed or code conversion.	Speed and code conversion.
Fixed bandwidth transmission.	Dynamic use of bandwidth.
No overload bits after initial setup delay.	Overload bits in each packet.

Q18. How ATM technology supports real time communication?

Answer

By considering fixed small packet size and high speed switch, it yields small packet delay and if any packet is lost, it will not affect much the quality of voice.

Q19- What is TSI and what is its role in time-division switching?

Answer :

TSI (time-slot interchange) is the most popular technology in a time-division switch. It used random access memory (RAM) with several memory locations. The RAM fills up with incoming data from time slots in the order received. Slots are then sent out in an order based on the decisions of a control unit.

Q20- What are the two approaches to packet switching?

Answer:

There are two approaches to packet switching: datagram approach and virtual-circuit approach.

Q21- list the Main characteristics of packet switching virtual-circuit approach.

Answer :

The Main characteristics of virtual-circuit approach are:

1- Route between stations is set up prior to data transfer.

2- A packet is buffered at each node, and queued for output over a line.

3- A data packet needs to carry only the virtual circuit identifier for effecting routing decisions.

4- Intermediate nodes take no routing decisions.

5- Often provides sequencing and error control.

Q22- How is an ATM virtual connection identified?

Answer:

An ATM virtual connection is defined by two numbers: a virtual path identifier (VPI) and a virtual circuit identifier (VCI).

Q23- In ATM Switch, how does an NNI differ from a UNI?

Answer:

A UNI defines a connection between the end users and an ATM switch; an NNI defines the connection between two ATM switches.

Q24- How many virtual connections can be defined in a UNI? How many virtual connections can be defined in an NNI?

Answer:

In an UNI, the total length of VPI+VCI is 24 bits. This means that we can define 2^{24} virtual circuits in an UNI.

In an NNI, the total length of VPI+VCI is 28 bits. This means that we can defin 2^{28} virtual circuits in an NNI.