# MAWLANA BHASHANI SCIENCE AND TECHNOLOY UNIVERSITY

## Santosh,Tangail – 1902


## Course Title : Introduction to Telecommunication System

**Assignment No : CT - 3**

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1. (a) Describe Circuit switching.

(b) Describe Message switching.

(c) Describe Packet switching.

2. (a) Describe space Division Switching.

(b) what are the problems and advantages of space Division switching?

(c) Define Strowger switching.

3. (a) Describe Crossbar switching.

(b) ~~Define~~ Describe Blocking Crossbar switches

(c) Define Time Division Switching.

4. (a) What is TSI and its role in a time division switching?

(b) Describe optical switching.

(c) Describe Time Slot Interchanger (TSI)

5. (a) Describe Time multiplexed space switch (TMSS)

(b) How does a TSI system work?

(c) How does a TMSS system work?

6. (a) Define Space Switch, Time switch and Time Space - Time switch.

(b) How does a time - space - time switch work?

- First, we find a time slot that is free from the input TSI to the TMss and from the TMss to the output TSI we wish to connect to.

(c) Describe Calling rate.

7. (a) Describe Holding Time.

(b) Define Traffic Volume and Departure Rate.

(c) Define Traffic Intensity.

8. (a) Describe Grade of Service (GOS)

(b) Describe the types of Blocking Model.

(c) Differentiate Time Congestions and Call Congestion.

## Ans. to the Q. No 1 (a)

Circuit Switching:

- A path is established between the caller and destination.
- Real-time connection formed.
- Example : PSTN

## Ans. to the Q. No 1 (b)

Message Switching:

- Also called store and forward.
- A message is first stored in a buffer and then sent on in its entirety step by step as resources become available.
- No real-time connection (i.e. connectionless)
- Example: E-mail.

## Ans. to the Q.NO 1(c)

Packet Switching:

- A message is broken down into parts and each part is sent separately (Possibly via different routes).
- Example: Internet UDP protocol.

## Ans. to the Q.NO 2(a)

- Connecting two channels that are separated in space.
- Can be mechanical and/or electronic.

## ~~Ans. to the~~

The switching system where any channel of one of its incoming PCM highway is connected to any channel of an outgoing PCM highway, where both of them are spatially separated is called the Space Division switching

Space division switch: Any switching mechanism that is based on the through connection of a set of input lines selectively to a set of output lines. they are implemented either by electromechanical or electronic means.

## Ans. to the Q.No 2(b)

The advantages of space Division Switching is -

- It is instantaneous.

Disadvantages are :-

(i) Number of Crosspoints required to make space division switching are acceptable in terms of blocking.

(ii) It is slow.

(iii) It is bulky with lots of interconnect wiring.

(iv) Subject to cross-talk.

## Ans. to the Q.No 2(c)

The strowger switch is the first ~~come~~ commercially successful electromechanical stepping switch telephone exchange system. It was developed by the strowger Automatic Telephone Exchange Company. Because of its operational characteristics it is also known as a step by step switch.

## Ans. to the Q.No 3(a)

The features of Crossbar switches:

(i) While processing a call, the common control system helps in the sharing of resources.

(ii) The specific route functions of call processing are hardwired because of the wire logic computers.

(iii) The flexible system design helps in the appropriate ratio selection is allowed for

a specific switch.

(iv) Fewer moving parts ease the maintenance of crossbar switching system.

## Ans. to the Q.No 3(b)

Blocking Crossbar Switches :

The main aim of blocking Crossbar switches is to reduce the number of Crosspoint switches. There are single stage and multi-stage switches. The number of Crosspoint switches can be reduced with the help of two different methodologies. In the first method, two subscribers share one vertical bar. With this, the number of crosspoint switches remain the same. The second method is where all the subscribers share a number of vertical bars. With this, the number of bars and Crosspoint switches are reduc

## Ans. to the Q.No 3(c)

Time Division Switching : The incoming and outgoing signals when received and re-transmitted in a different time slot, is called Time Division switching. The digitized speech information is sliced into a sequence of time intervals or slots. Additional voice circuit slots, corresponding to other users are inserted into this bit stream of data.

## Ans. to the Q.No 4(a)

A time-slot interchange (TSI) switch is a network switch that stores data in RAM in one sequence and reads it out in a different sequence. It uses RAM, a small routing memory and a counter. Like any switch, it has input and output ports. The RAM stores the packets or other data that arrive via its input terminal.

## Ans. to the Q.NO 4(b)

Optical Switching:

Optical switching refers to a phenomenon in which transmission of an optical field through a device is switched among two or more possible states by optical means.

Applications: Optical switching technology is driven by the need to provide flexibility in optical network connectivity. Prime applications are optical protection, test systems, remotely re-configurable add-drop multiplexers and sensing. Possible future applications include remote optical provisioning and restoration.

Working Process: Traditional switches that connect optical fiber lines are electro-optic. They convert photons from the input side to electrons internally in order to do the switching and then convert back to photons on the output side. These may separate

signals at different wavelength and direct them to different ports.

## Ans. to the Q.NO 4(c)

Time Slot Interchanger (TSI):-

- A TSI is a time switch.
- Switches one time slot channel in a single physical input to another time slot channel on a single physical output.
- Functionally equivalent to an nxn space divided switch where n is the number of time slots per frame.

## Ans. to the Q.NO 5(a)

Time multiplexed space switch:-

- A space switch (multiple physical inputs and outputs) that is potentially reconfigured entirely in every time slot of each frame.
- Data is switched such that for each time slot, specific inlets are connected to specific outlets.

- Data does not switch timeslots.

## Ans. to the Q.NO 5(b)

TSI system:

- Data is written to the speech store cyclically as it comes in (sequentially, one time slot at a time).
- Path set-up control signalling tells the SAM to store the name of the input time slot in the appropriate location corresponding to the output time slot it must be switched to.
- Data is read a-cyclically from the speech store in the order of the output time slots as stored in the SAM.

## Ans. to the Q.NO 5(c)

A TMSS is a space switch (with multiple physical inputs and outputs) that is potentially reconfigured entirely in every slot of each frame.

Working Procedure:

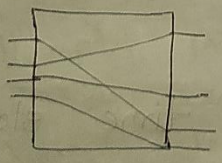
- A memory structure called cross-point address memory (XAM) is used to control switching.

- Control signalling tells the XAM to store the name of the physical input in the appropriate time slot location.

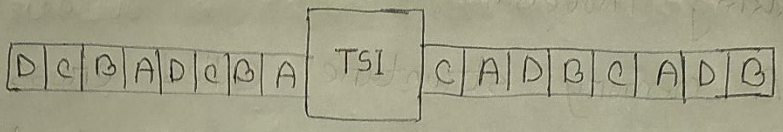
- The space switch is rapidly reconfigured at each time slot to affect the proper connections.

## Ans. to the Q.NO 6(a)

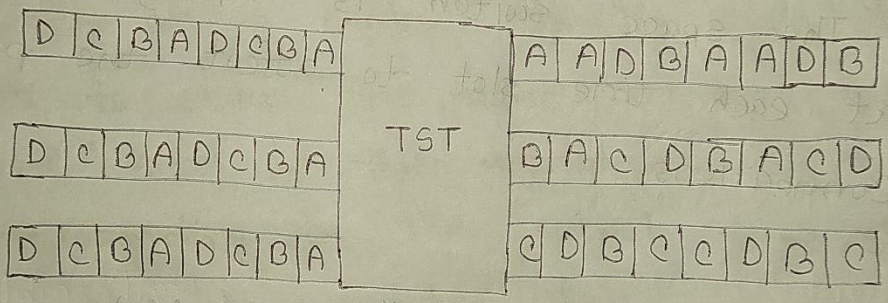
Space Switch: Physical inputs are connected to physical outputs but data does not cross time slot.



Time switch: Data is switched between time slots but remains on the same physical connection.




Time - Space - Time - Switch : Data is switched between time slots and physical connections.




Affected by a combination of TSI and TMSS.

## Ans. to the Q. No 6(b)

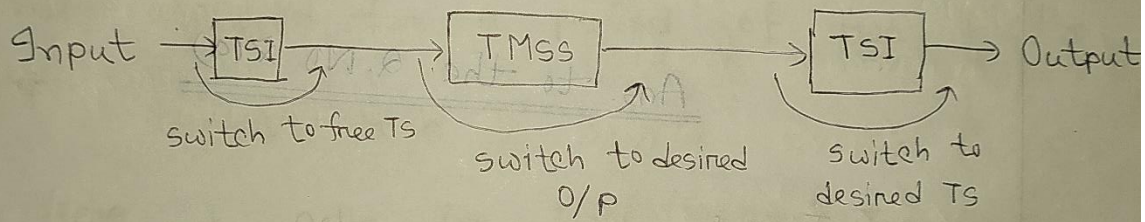
How does a time-space-time switch work?

- First, we find a time slot that is free from the input TSI to the TMSS and from the TMSS to the output TSI we wish to connect to.

- Next, switch the input channel's time slot in question to the free time slot.

- Then at the TMSS, connect the proper input line to the proper output line during free time slot.

- Finally, at the output line's TSI, switch the free time slot to the time slot we wish to switch to.




## Ans. to the Q.NO 6(c)

Calling Rate ($\gamma$) :- It is also called arrival rate, or attempts rate, etc.

- Average number of call initiated per unit time (e.g. attempts per hour)

- Each call arrival is independent of other calls

- Call attempt arrivals are random in time.

- Until otherwise, we assume a "large" calling group or source pool.

If receive $\alpha$ calls from a terminal in time T:

$$r = \frac{\alpha}{T}$$

If receive $\alpha$ calls from m terminals in time T:

$$r_g = \frac{\alpha}{T} \qquad r = \frac{\alpha}{m.T}$$

$r_g$: Group calling rate

$r$: Per terminal calling rate

## Ans. to the Q.NO 7(a)

Holding Time:

- Mean length of time a call lasts
- Probability of lasting time t or more is also -ve exponential in nature:

$$P(T \geq t) = e^{-t/h} \qquad t \geq 0$$

$$P(T \geq t) = 0 \qquad t < 0$$

- Real voice calls fits very closely to the negative exponential form above.
- As non-voice "calls" begin to dominate more and more calls have a constant holding time characteristic.

## Ans. to the Q.No 2(b)

Departure Rate($\mu$): $\mu = \frac{1}{h}$

Traffic Volume(v):

~~$V = \alpha . h$~~

A traffic volume of one erlang-hour can be caused by two circuits being occupied continuously for half an hour or by a circuit being half occupied for a period of two hours.

$$V = \alpha . h$$

Here, $\alpha$ = calls in time period T

h = mean holding time

v = volume of calls in time period T

## Ans. to the Q.No 2(c)

Traffic Intensity: Traffic Intensity is a measure of the average occupancy of a server or resource during a specified period of time, normally a busy hour. It is measured in traffic units (erlangs) and defined as the

ratio of the time during which a facility is cumulatively occupied to the time this facility is available for occupancy. Also called "traffic flow" or simply "traffic".

$$A = \frac{\alpha \cdot h}{T} = \gamma \cdot h = \frac{\gamma}{\mu} = \frac{V}{T}$$

$\alpha$ = calls in time period T

h = mean holding time

T = time period of observations

$\gamma$ = calling rate

$\mu$ = departure rate

V = call Volume

## Ans. to the Q. NO 8(a)

Grade of Service (GOS):

→ In general, the term used for some traffic design objective.

→ Indicative of customer satisfaction.

→ In systems where blocked calls are cleared usually use:

$$gos = \frac{T_L}{T_o} = \frac{T_L}{T_L + T_c} = P(B)$$

→ Typical gos objectives:

- In busy hour, range from 0.2% to 5% for local calls, however.
- generally no more that 1%.
- long distance calls often slightly higher.

→ In systems with queuing, gos often defined as the propability of delay exceeding a specific length of time.

## Ans. to the Q. No 8(b)

There are 3 types of Blocking Model. They are:

- Blocked Calls Cleared (BCC)
  - Blocked calls leave system and do not return.
  - Good approxpximation for calls in 1st choice trunk group.
- Blocked Calls Held (BCH)
  - Blocked calls remain in the system for the amount of time it would have

normally stayed for.

- If a server frees up, the call picks up in the middle and continues

- Not a good model of real world behaviour (mathematical approximation only)

- Tries to approximate call reattempt efforts.

- Blocked Calls Wait (BCW)

- Blocked calls enter a queue until a server is available.

- When a server becomes available, the calls holding time begins.

## Ans. to the Q.No 8(c)

Time Congestion:

- Proportion of time a system is congested (all servers busy)

- probability of blocking from point of view of servers.

- $P(B) = P(k \geq N)$

$P(B)$ = Probability that all servers are busy

Call Congestion:

- Probability that an arriving call is blocked
- Probability of blocking from point of view of calls.
- $P(B) = P(K > N)$

  ↖ Probability that there are more sources wanting service than there are servers.