Assignment - 03

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1. a) What is access switch? and traffic switch? 04

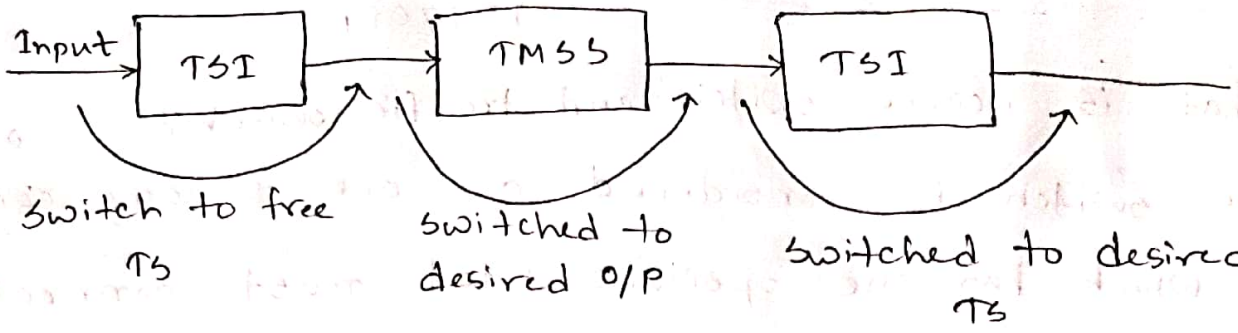
→ Access switch is considered as one to any connection which has one specific inlet must connect to any free outlet. The main theme of this switch is one-to-any connection.

Traffic switch is also known as trunk switch. Traffic switch is defined as one to one connection which has one specific intel that is must connect to one specific outlet.

b) How does a time-space-time switch work? 05

→ Time-space-time switching working process:

- First, find a time slot that is free from the input TSI to the TMSS and from the TMSS to the output TSI to connect to.
- Next, switch the input channels time slot in question to the free time slot.
- Then at the TMSS, connect 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.



c) Explain time slot interchanger (TSI). 05

→ Time slot interchanger:

- In a TSI, one time slot is switched to another.
- Performed through use of two memory stores:
  - Speech store is RAM with to store one full frame of data.
  - For DSI (1.544 Mbps) with 24 channels of 8 bits, the speech store is 24 bytes long.
  - Speech address memory or time switch connection store is RAM with capacity to store a world for each time slot, each word being a number identifying a specific time slot.
  - For DSI, the SAM has capacity to store 24 words of 5 bits per word (need 5 bits to store a number between 1 and 24)

2.a) What is trunk switch? and optical switching? 04

→ Trunk switch also called traffic switch. Trunk switch is defined as one to one comection which has one specific intel that is must connect to one specific outlet.

optical switching is one (or several wavelengths) are switched from one fibre into another. can use splitters and tunable filters. or more recently micro-electro-mechanical switches (MEMS). On the scale of a human hair (100 microns).

b) Explain circuit switching, message switching and packet switching. 05

→ Circuit switching:

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

Message switching:

- Also called store and forward.
- A message is first stored in a buffer and the sent on in its entirely.

- No real time connection. (i.e connectionless)

. Packet switching:

- A message is broken down into parts and each part is sent separately (possibly via different routes).

- Example: Internet UDP protocol.

e) Describe technique of separating circuits. 05

→ Separating circuits:

Four technologies for separating circuits.

i) Space

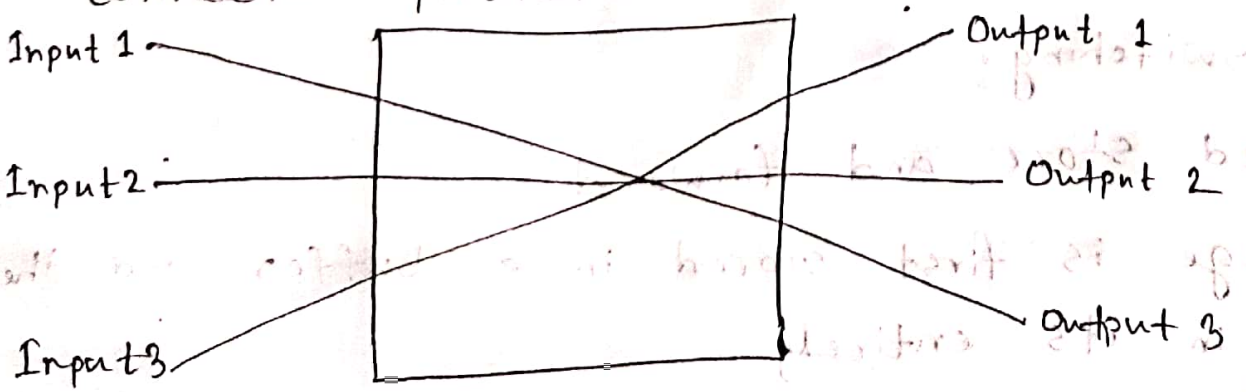
ii) RF frequency.

iii) Time

iv) Optical wavelength

There is logically connect circuits coming into a switch with circuits at the output.

· Example "space division" equivalent inter-connection pattern.



3. a) What is traffic offered? 02

→ Offered traffic (To) equivalent to traffic intensity (A). It takes into account all attempted calls, whether blocked or not and uses their expected holding times.

b) Describe traffic engineering trade offs. 06

→ Traffic engineering trade offs

- Designs number of transmission paths or channels
  - How many required normally.
  - What if there is an overload.
- Design switching and routing mechanisms.
  - How do we route efficiently?
  - E.g.
    - High usage trunk groups.
    - Overflow trunk groups.
    - Where should traffic flows be combined.
- Design network topology.
  - Number and sizing of switching nodes and locations.
  - Number and sizing of transmission systems and

locations.
- Survivability.

c) Explain types of blocking model. 06

→ Three types of blocking models.

· Blocked calls cleared (BCC)
- Blocked calls leave system and do not return.
- Good approximation for calls in first choice trunk group.

· Blocked calls held (BCH)
- Blocked calls remains in the system for the amount of time it would have normally stayed for.
- If a server feeds up, the call picks up in the middle and continues.
- Not a good model of real world behaviour.
- Tries to approximate call attempts 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.

4.a) What is poisson traffic model? 04

→ Poisson approximates binomial with large m and small A/m.

$$P_K = \frac{e^{-x} \lambda^K}{k!}$$

where λ = mean # of busy sources.

and poisson = $\lim_{m \to \infty}$ (Binomial)

This is another simplified traditional traffic generation model for circuit-switched data as well as packet data, is the poisson process, where the number of incoming packets or calls per time unit follows the poisson distribution.

b) Differentiate between time congestions vs. call congestions. 05

→ Time congestions vs call congestions.

' Time congestion

- proportion of time a system is congested (all servers busy).
- probability of blocking from point of views of servers.
- Call congestion

- probability that an arriving call is blocked.
- probability of blocking from point of view of calls.

for call, $P(B) = P(k > N)$
↳ Probability that there are more sources wanting service than there are servers.

for time,
$P(B) = P(k \geq N)$
↑
probability that all servers are busy.

c) Calculate probability of blocking. 05

→ Probability of blocking:

$$P(B) = P(k \geq N) = P(N) + P(N+1) + \dots + P(\infty)$$

$$= \sum_{k=N}^{\infty} \frac{e^{-A} A^k}{k!} = \sum_{k=N}^{\infty} \frac{A^k}{k!} e^{-A}$$

[where $P(k) = \frac{e^{-A} A^k}{k!}$]

$$= 1 - \sum_{k=0}^{N-1} \frac{A^k}{k!} e^{-A}$$

$P(B) = P(N, A)$

Poisson — N = Servers — offered traffic

Example, $P(7,10)$
↑
Poisson P(B) with 10E offered to 7 servers

5. a) What are the failure of the poisson model as valid for situations with high blocking? 03

→ Failure of poisson model,

i) Poisson only good approximation when low blocking.

ii) Use erlang B if high blocking.

Above are the failure of poisson model as valid for situations with high blocking.

b) Explain erlang B model. 05

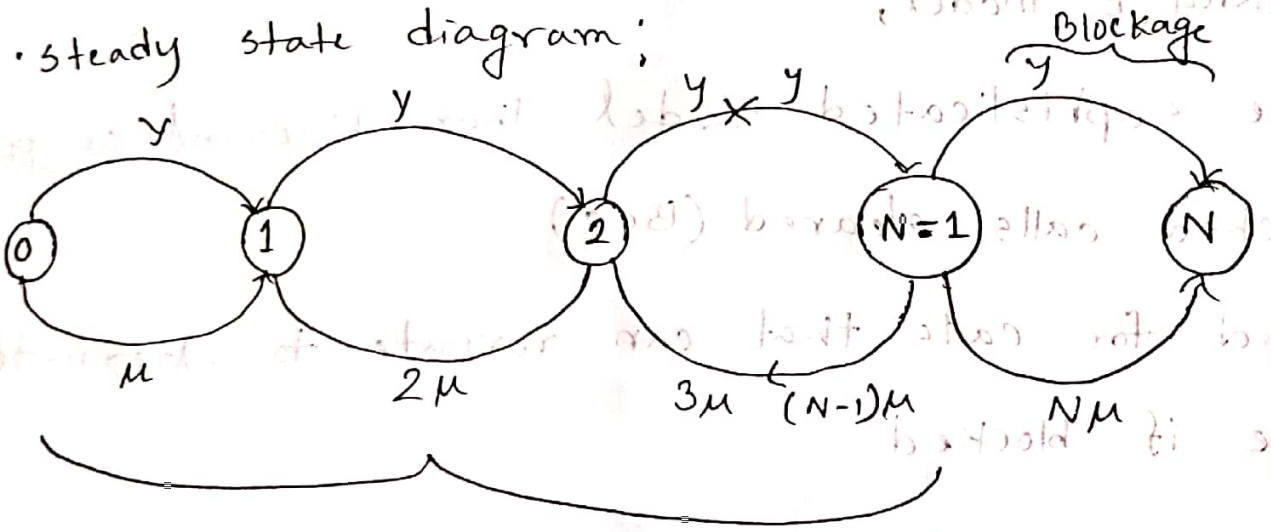
→ Erlang B model,

- More sophisticated model than binomial or poisson.
- Blocked calls cleared (BCC).
- Good for calls that can reroute to alternate route if blocked.
- No approximation for reattempts if alternate route blocked too.
- Derived using birth-death process
- It consider infinitesimally small time it during which only one arrival..

e) Explain Erlang B Birth-Death Process. 06

→ Erlang B Birth-Death Process:

- Consider infinitesimally small time during which only one arrival or departure (or none) may occur.
- Let γ be the arrival rate from an infinite pool or sources.
- Let $\mu = 1/h$ be the departure rate per call.
- if k calls in system, departure rate is $k\mu$.
- steady state diagram:



6. a) Define receiver. ~~09~~ 02

→ Receiver:

Varifying electrical current passing through windings on magnet, moves a diagram. Same as in a music loudspeaker.

6. b) What is transmitter? Differentiate between early telephone system and todays telephone system. 07

→ Transmitter: (carbon granule microphone)

- Air pressure of sound waves impact on diaphragm, varying pressure on carbon granules.
- Resistance of electrical current passing through carbon granules varies the current (analog).

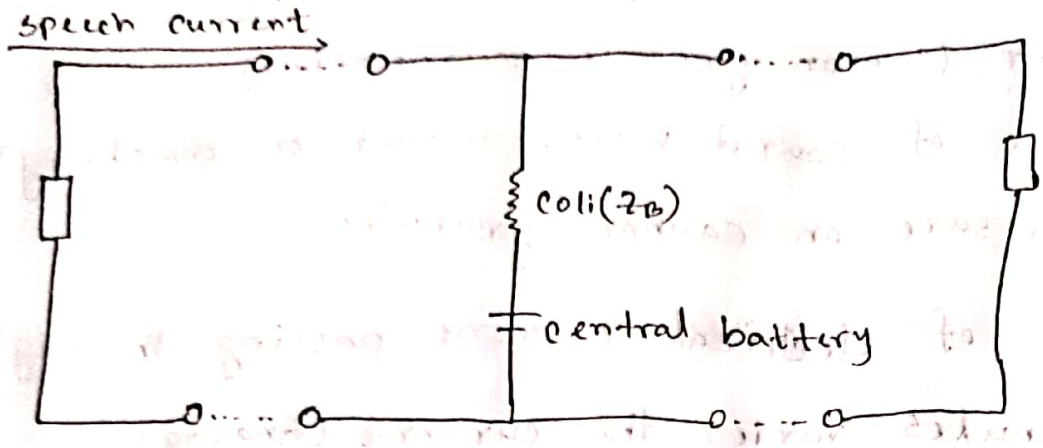
Differentiating between early telephone system and today's telephone system are given below,

- Early telephone system:
- Powered by self-contained local battery.
- Ringing created by cranking generator.

- Today's telephone system:
- Powered through the line by battery at the central office (-48v).
- Circuit is closed when handset is lifted from the cradle.

e) Show PSTN circuit model. 05

→ PSTN or POTS simplified circuit model of any connection:



"The coil is a 'transmission bridge coil' with a high impedence (Z_B) preventing out the speech current from shorting out at the central battery".

7.a) What is DTMF signalling? 04

→ DTMF signalling:

- Faster than pulse dialling (1-2 seconds for ten digit numbers).
- reduces call set up time.
- Each digit produced by combination of 2 pure frequency tones.
- Reduces chances of error or interference. and also the error.

b) What are the procedures of establishing a call? 06

→ Establishing a call:

1) Calling customer takes phone off hook which closes the circuit to the C.O.

2) C.O detects the loop and indicates readiness with dial tone.

3) Calling customers hears dial tone and dials number.

4) The network checks on the called party status and decides on a routing for the connection.

5) If connection possible, the called party is alerted.

6) Ring tone is returned to the caller.

7) The called party picks up the handset and closes his/her loop.

8) Exchange detects second loop and trips or stop ringing then establishes call.

9) One party opens loop by hanging up and exchange

clear connection.

c) Describe pulse dialing. 04

→ Pulse dialing:

- Line is rapidly disconnected and reconnected in sequence with one pulse for digit value "1", two pulses for digit value "2".
- Each pulse lasts 0.1 second.
- Inter-digit pauses (IDP) must be > 0.5 second -If not current digit may combine with previous digit.
- Ten digit phone number typically takes 6-15 seconds total.
- This is the kind of signalling old "rotary dial" phones produced.

8.a) Define SRL. 03

→ SRL defines as singing return loss which has minimum attenuation to reflected power at any frequency coming back from the 2W-4W interface.

b) Describe subscriber loop. .05

→ Subscriber loop:

- Wire network from the central office to the station sets.
- Largest portion of capital capabilities (50% ?) and workforce requirements (30% - 40%).
- Prime candidate for replacement by optical fibre but costs often prohibitive.
- Main goal is to design and work with length limits.

- Limited by resistance and attenuation along the line.

c) How do you determinate target resistance .06

→ Target resistance determination:

- We need a high enough current at the customer premises to operate the station set (20 mA minimum in North America).

- Use $V = IR$, with a known battery voltage of -48 V.

- $48V \geq 20mA \times R \rightarrow R \leq 2400\Omega$ total.
- Budget $\approx 400\Omega$ for the battery feed bridge at the C.O.
- Budget $\approx 300\Omega$ for other miscellaneous wire resistance (e.g. subset wiring, etc).

∴ The subscriber loops wire resistance must not exceed 1700Ω.