Mawlana Bhashani Science and Technology University

মাওলানা ভাসানী বিজ্ঞান ও প্রযুক্তি বিশ্ববিদ্যালয়

Course code: ICT-4101

Course title: Telecommunication Engineering

Date of Submission: 20/12/2020

Submitted by

Name: MD. Amirul Hasan Shanto

ID: IT17027

4^{th} year 1^{st} semester

Session: 2016-2017

Dept. of ICT

MBSTU.

Submitted To

Nazrul Islam

Assistant Professor

Dept. of ICT

MBSTU.

Sub :

Day

Time : Date : / /

1. a) What is Time Division Switching?

b) Describe Switching Network Design?

c) Define TSI.

2. a) Define Time multiplexed space switch.

b) Differenciate Router & switch.

c) Describe simple network management protocol.

3. a) What is the necessity of CPG message in ISUP protocol

b) Describe both synchronous & asynchronous transmission.

c) What is bridging?

4. a) What is link blocking?

b) Estimate blocking for a pure distribution switch.

c) How to solve the mixing stage?

Sub :
Time : Date : / /

5.a) Describe the Characterization of a Telephone Traffic.

b) How does the Erlang unit correspond to ccs?

6.a) Justify Binomial Distribution Model.

b) Find probability of blocking through poission traffic model.

7.a) How does telecommunication network working?

b) Assume 10^8 number of devices covering total area of $147570\ km^2$. The radius of the wire is 2mm. Find the dept of wiring?

Sub :

Day

Time : Date : / /

8. a) How does a call get established?

b) what is pulse dailling?

c) Determine the cutoff frequency of 26 gauge cable loaded with 22mH inductor at 3000' spacing. $r = 440\,\Omega/\text{mile}$, $c = 83\,\text{nF}$ $l = 1\,\text{mH}$, $g = 0.2\,\mu\text{s}$.

Sub :

Time : Date : / /

Answer to the Question NO: 1(a)

In digital time division switching system are divided by time slot but switching is still possible.

Switching is by a time-slot interchanger & is accomplished by rearranging the order in which data is read out of the buffer. Incoming data enters a speech store while the outgoing channels indicate to the speech address memory which incoming timeslot it is assigned to. During each time-slot, the outgoing circuit reads the speech store slot corresponding to the SAM.

Answer to the Question NO: 1(b)

For switching network design we focus on:

i) Blocking ~~ves~~ versus non-blocking switches.

ii) Number of cross-points.

iii) Reliability

iv) Overload

v) Growth

vi) Cost & technology

For trunk switch:

i) One-to-one connection.

ii) One specefic must connect to one specefic outlet.

Access switch:

i) One-to any connection

ii) One specefic inlet must connect to any free outlet.

Answer to the Question NO: 1(e)

TSI is a time switch. Switches one time slot cannel on a single physical output. Functionally equivalent to an nxn space-divided switches where n is the number of time slot per frame

Sub :

Day

Time : Date : / /

Answer to the Question No: 2 (a)

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

Sub :

Time : Date : / /

Answer to the Question No: 2 (b)

Differences between router & switches are follows:

Router	Switch
1. Appears in Network layer.	1. Appears in Data link layer.
2. PDU is Packet	2. PDU is Frame.
3. Every port has its own Broadcast domain.	3. Switch has only one Broadcast domain.
4. Bandwidth sharing is dynamic.	4. No option for bandwidth sharing.
5. Have memory.	5. Switch has no memory.
6. Store IP address in the routing table.	6. Store MAC address in the lookup table.

Time : Date : / /

Answer to the Question NO: 2(c)

simple network management protocol is one of the UDP-based networks protocols. It's monitoring network-attached devices for various administrative attentions. It has application layer - database schema protocol & a group of data objects.

Answer to the Question NO: 3(a)

CPG message is sent by the switch towards originator. When the switch receives the setup, the call is forwarded. After that the call is progressing. During the setup or active phase of call, a message

Sub : Day Time : Date : / /

is sent. This signifies the relayed to the originating has occurred.

Answer to the Question No: 3(b)

Synchronous transmission:

1. Synchronous transmission does not use start & stop bits, hence data transfer rate is quicker.

2. It uses clock signals that are built at each component.

3. Continual stream of data is sent between two nodes.

4. This method uses check digit instead of parity bits.

Sub :

Asynchronous transmission:

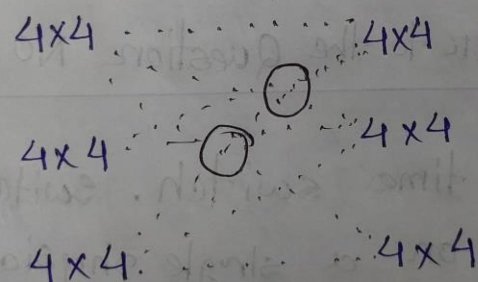
1. It uses the stop & start bits.
2. It used when data need to be sent data intermittently.
3. It recognize the second packet of the information.
4. The starts & stop bits are supposed to be opposite polarity.

Answer to the Question NO: 3(c)

Bridging is one of the forward techniques to use in packet switched networks. Bridge makes no assumption about the address location of the network it's stored in MAC address table.

Answer to the Question No: 4(a)

Because of the single link between each module & the modules in the next stage, there is a possibility of blocking.



2 link block.

Sub :

Day

Time : Date : / /

Answer to the Question NO: 4(b)

Estimate blocking: Distribution stages increase the overall inlet/outlet size of the switch but introduce increasing probability of blocking.

1. There is only a single path between any specific 1st stage inlet & any specific final stage outlet.

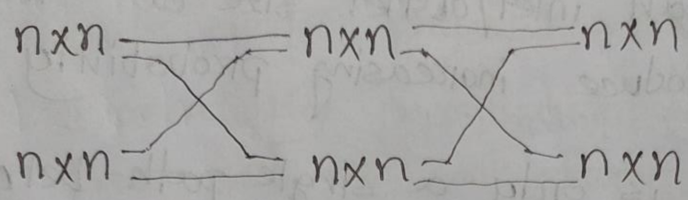
2. Mechanism of blockage is when an inter-stage link on required path is in use.

3. The greater the number of links in the path, the greater the probability that one of them is in use.

4. The more distribution stages we have, the greater the probability that blocking.

Answer to the Question NO: 4(c)

The solution is to add a mixing stage that keeps the overall switch size the same but can reduce blocking by adding mutiple paths through the switch.



Answer to the Question NO: 5(a)

Characterization of telephone traffic:

Calling Rate: It is also called arrival rate, or attempts rate, etc.

1. Average number of calls initiated per unit time.
2. Each call arrival is independent of others call.
3. Call attempt arrivals are random in time.

If receive α calls from a terminal in time T: then $\gamma = \frac{\alpha}{T}$

If receive α calls from m terminals in time T:

$$\gamma_g = \frac{\alpha}{T} \qquad \gamma = \frac{\alpha}{m.T}$$

Group calling rate   Per terminal call rate.

Calling rate assumption:

Number of calls in time T is Poission distributed:

$$P(x) = \frac{e^{-\lambda} . \lambda^x}{x!} \qquad x = 0,1,2$$

$$\lambda = \gamma T$$

$$\therefore f(t) = \lambda . e^{-\lambda t} \quad [0 \leq t \leq \alpha]$$

Answer to the Question NO: 5 (b)

From traffic intensity

$A = \gamma \cdot h$

For dimensionless Erlang unit

$1 \text{ ccs/hour} = \dfrac{100 \text{ call.seconds}}{1\text{hr} \times 60\text{min} \times 60\text{sec}} = 0.027E$

$\therefore 36 \text{ ccs/hour} = \dfrac{3600 \text{ call. seconds}}{1\text{hour} \times 60 \text{ min/hr} \times 60 \text{ sec/min}}$

$= 1E$

Percentage of time a terminal is busy is equivalent to the traffic generated by that terminal in Erlangs, or Average number of circuit in a group busy at any time.

Answer to the Question NO: 6(a)

Let's assumptions:

- m source
- A Erlangs of offered traffic
  - per source $T_0 = A/m$
  - probability that a speaibic source is busy: $P(B) = A/m$

For Binomial distribution to give the probability that a certain number(K) of those m sources is busy:

$$P(K) = \binom{m}{k}\left(\frac{A}{m}\right)^{k}\left(1-\frac{A}{m}\right)^{m-k}$$

$$= \left(\frac{m!}{k!\,(m-k)!}\right)\left(\frac{A}{m}\right)^{k}\left(1-\frac{A}{m}\right)^{m-k}$$

for ~~Net~~ N serves: $(N<m)$

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

Sub :

Day

Time : Date : / /

$$P(B) = \sum_{k=N}^{m} \binom{m}{k} \left(\frac{A}{m}\right)^k \left(1-\frac{A}{m}\right)^{m-k}$$

$$= 1 - \sum_{k=0}^{N-1} \binom{m}{k} \left(\frac{A}{m}\right)^k \left(1-\frac{A}{m}\right)^{m-k}$$

Answer to the Question NO: 6(b)

For probability of blocking:

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

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

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

Sub :

Day

Time : Date : / /

For 1% chance of blocking in a system with N = 10 trunks

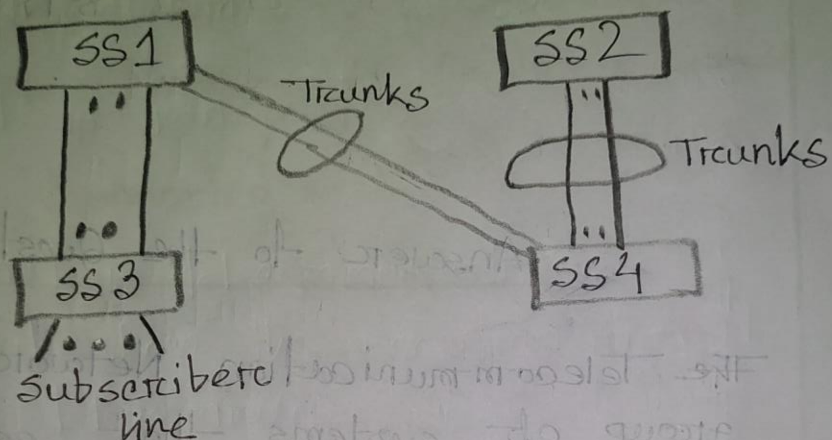
$$1\% = \sum_{K=10}^{\infty} \frac{A^K}{K!} e^{-A} = 1 - \sum_{K=0}^{9} \frac{A^K}{K!} e^{-A}$$

Answer to the Question No: 7 (a)

~~The~~ Telecommunication Network: It is a group of systems that establishes a distant call. The switching systems are part of a telecommunication network

- The switching sections provide connection between different subscribers. The switching systems are connected by using lines called the "Trunks".
The lines that run to the subscriber premises are called the "subscriber line."

The following figure shows a telecommunic-
-ation network:



When a person needed to make a distant call, the call was first routed to the operator at the nearest switching center & then the number & location of called subscriber was noted down. That's how it works.

Answer to the Question No: 7(b)

Here $n = 10^8$ connection area $= 2\times10^3$ km

& $r = 2m.m = 2\times10^{-3}m$ Total area $= 147570$ km^2

Fully connected $= \frac{n(n-1)}{2}$

$\cong \cancel{\frac{n^2}{2}}$

$\cong \frac{n^2}{2} = \frac{(10^8)^2}{2} = \frac{10^{16}}{2}$

$= 5\times10^{15}$ pairs

Avg ~~wat~~wire pair ~~ao~~ cross section

$= \pi r^2$

$= \pi(2\times10^{-3})^2$

$= 12.5\times10^{-12}\ km^2$

Therefore wiring volume $= 5\times10^{15}\times12.5\times10^{-12}\times2\times10^3$

$= 125\times10^6\ km^3$

$\therefore$ Dept of wiring $= \frac{\text{wiring volume}}{\text{Total area}}$

$$\text{Depth of wiring} = \frac{125 \times 10^6}{147570}$$

$$= 847.06\text{km}$$

Ans.

Answer to the Question NO: 8(a)

Establishing a call:

1. Calling customer takes phone off hook.
2. C.O. detects the loop & indicates readiness with dial tone.
3. Calling customer hears dial tone & dials number.
4. The network checks on the called party is alerted.
5. Ring tone is returned to the caller.

7. The called party picks up the handset & closer his/ her loop.

8. Exchange detects second loop and trips or stop ringing.

9. Connected.

Answer to the Question No: 8(b)

Pulse dailing is rapidly disconnected and reconnected in sequence with one pulse for digit value "1", two pulse for digit value "2". Each pulse lasts 0.1 seconds.

Sub :

Day

Time : Date : / /

Answer to the Question NO: 8(c)

We know

$$L' = l\Delta x + L_c$$

$$= 1\,mH(3000/5280) + 22\,mH = 22.57\,mH$$

$$C'' = c\Delta x = 83\,nF\,(3000/5280) = 42.2\,nF$$

$$\omega_c = \frac{2}{\sqrt{L'C''}} = 61.3 \times 10^3\ rad/s$$

$$f_c = \frac{\omega_c}{2\pi} = 9.76\,KHz$$

Ans.