CSC 425 Dr. H. Maalouf

92

DATA COMMUNICATION & COMPUTER NETWORKS

EXAM 2

NAME: .....

ID # : .....

Prohibited:

Cellular Phones

Programmable Calculators

1. MULTIPLE CHOICE — 12 POINTS

In FDDI, if the value of THT is less than zero, then:

- (•) The token is released
- The token is not released
- the ready frame is transmitted
- The token and the ready frame are both transmitted

The designated port in a STA is the one defined as follows:

- The port that becomes the root port.
- (•) The port whose cost to the root port has the minimum value for a specific segment.
- The port switched to the blocked state (stand by).

The OSI layer responsible for bridging is:

- Network
- Physical
- (•) Data Link
- Transport

10

Token-ring networks are more efficient than Ethernet in case of:

- Light network load
- Medium network load
- (•) Heavy network load
- The network newly turned on

A router:

- Provides similar functions as a switch
- Used to connect two bridges
- Ties all hubs together
- (•) Connects two different networks

What will happen in a LAN if there are closed circuits (loops) in it?

- The network will operate normally
- Frames will not reach the destination node
- (•) Collisions will happen when attempting to transmit any frame

2. Answer briefly the following questions: (24 POINTS)

i) Is CSMA/CD used in broadcast or ring networks?

broadcast

ii) Why Token Ring LANs are able to retain connectivity if one of the computers on the ring is powered down (i.e. is off)?

because it acts like a short circuit

iii) What main feature do FDDI and Token Ring have in common?

no collision ✓

iv) How do FDDI and Token Ring differ from each others?

FDDI used as a backbone for long distance ✓

v) Which element of an FDDI network ensure Fault-Tolerance?

self-healing (double ring) ✓+

vi) How many pairs of cable are used for data transmission in 100Base-T4?

4 pairs | 3 pairs Tx
1 pair collision detect ✓+

vii) What is the main advantage of a LAN switch?

less collision ✓

viii) A switch (or bridge) forwarding database is created at start on the basis of Source addresses or Destination addresses?

basis of ~~Destination~~ source addresses ✓

21

ix) If you have 20 active users on an Ethernet hub what would be the approximate bit rate available for every user on that hub?

3 Mbps ✓

x) If you have 20 active users on an Ethernet switch what would be the approximate bit rate available for every user on that switch?

10 Mbps ✓

xi) What problems are related to too long frames in any type of LAN? Long Access delay
it reserves the line for long time ⇒ ~~more Traffic~~ ✓

xii) Why are short frames inefficient in any type of LAN?

it wasts on because there is a little amount of data.

✓+

3) Continuous RQ **(16 POINTS)**

Consider a 1Mbps link between two ground stations that communicate via a satellite relay. A geosynchronous satellite has an altitude of roughly 36,000 Km. Assume that the I-frame size is 8000 bits while the ACK-frame size is negligeable. How many I-frames can the sender device transmit by the time the ACK to the first frame is received? (The propagation speed is $3 \cdot 10^8 \, m/s$).

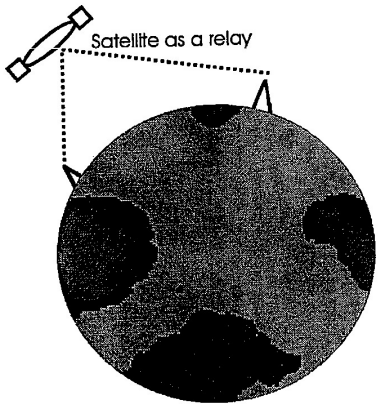
13

$R = 10^6$ bps

36000×10^3 m

8000 bits

$V = 3 \times 10^8$ m/s



$T_t = 2t_p + t_x$

$t_p = \frac{36000 \times 10^3 \text{ m}}{3 \times 10^8 \text{ m/s}} = 0.12 \text{ s}$

$t_x = \frac{8000}{10^6} = 8 \times 10^{-3} \text{ s}$

$\Rightarrow T_t = 2(0.12) + 8 \times 10^{-3} = 0.248 \text{ s}$

$\text{bit time} = \frac{1}{\text{bitrate}} = \frac{1}{10^6 \text{ bps}} = 10^{-6} \text{ s/bit}$

$\Rightarrow \frac{T_t}{\text{bit time}} = \frac{0.248}{10^{-6}} = 248000 \text{ bits}$

$\Rightarrow \frac{248000}{8000} = 31$ I-frames

4) LAN Design **(16 POINTS)**

16

You were asked to design a LAN for a site that has 40 PCs.The following activities exist on the network during the peak time:

- Each PC downloads 10 Mbytes file every 5 minutes from the Internet
- Each PC uploads 400 Kbytes every 8 minutes.

a) Determine the total traffic on the LAN.

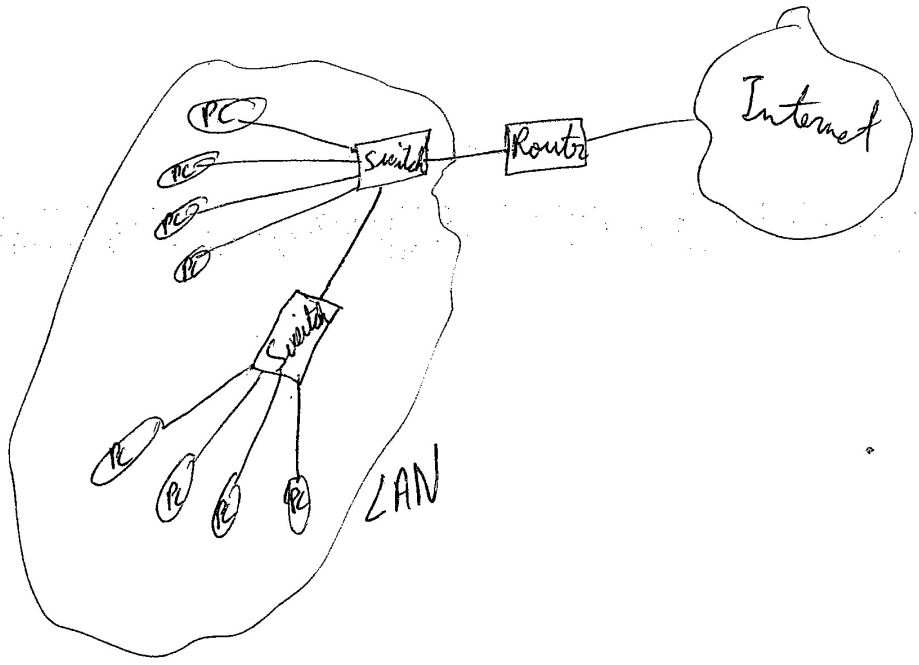
$R_d = 40 \times \frac{10 \times 10^6 \times 8}{5 \times 60} = 10666666 \text{ bps}$

$R_u = 40 \times \frac{400 \times 10^3 \times 8}{8 \times 60} = 266666 \text{ bps}$

$\Rightarrow$ Total Traffic $= 10933332 \text{ bps}$

b) How will you connect these PCs to each others and to the external world? Explain which interconnection devices you will use. Sketch your LAN.

I will connect these PCs to each others using switches to decrease the collisions, to increase the efficiency of my network, and I will connect these PCs to the external world by using Router.



5) Delay & Throughput Calculation **(16 POINTS)**

16

Assume that a file with 2 million characters (Bytes) is transmitted from one station *A* to another station *B* on a LAN with a bus topology. The 2 stations are at a distance of 2km from each other. Each packet is acknowledged with a 100 bit packet before the next packet is sent. The propagation speed on the bus is $2 \cdot 10^8$ m/s. The bit rate is 100 Mbps and the packet size is 2640 bits including an 80 bits header.

- Compute the *total time* required for that file to reach its destination *B*.

$L = 2$ Km ; $V = 2 \times 10^8$ m/s ; $R = 100 \times 10^6$ bps ; Packet = 2640 bits

ACK = 100 bit Data sent in the packet = $2640 - 80 = 2560$ bits

$$\#\text{frames} = \frac{2 \times 10^6 \times 8}{2560} = 6250 \text{ frames}$$

$$\text{bit time} = \frac{1}{100 \times 10^6} = 10^{-8} \text{ s/bit}$$

$T_{frame} = 2T_p + T_x + T_{ACK}$

$$T_p = \frac{2 \times 10^3 \text{ m}}{2 \times 10^8 \text{ m/s}} = 10^{-5} \text{ s}$$

$$T_x = \frac{2640}{100 \times 10^6} = 2.64 \times 10^{-5}$$

$T_{ACK} = 100 \times 10^{-8} = 10^{-6}$ s

$\Rightarrow T_{frame} = 2(10^{-5}) + 2.64 \times 10^{-5} + 10^{-6}$

$= 4.74 \times 10^{-5}$ s

$\Rightarrow$ Total time $= 6250 \times 4.74 \times 10^{-5}$ s

$= 0.29625$ s

- Calculate the Normalised throughput.

$$\text{Normalized throughput} = \frac{\text{amount of data sent / unit of time}}{\text{capacity of the channel}}$$

$$= \frac{16000000 / 0.29625}{100 \times 10^6}$$

$$= 0.54008$$

$n = \frac{T_T}{T_x}$ data

bps / s

bps

$n = \frac{T_T}{T_x}$

7

16

6) Fast Ethernet LAN **(16 POINTS)**

Consider a **Fast Ethernet** network with 9.6μs interframe gap. $R = 100 \times 10^6$ bps

a. Determine the interframe gap in bit times.

$$\text{bit time} = \frac{1}{100 \times 10^6} = 10^{-8} \text{ s/bit}$$

$$\frac{9.6 \times 10^{-6} \text{ s}}{10^{-8} \text{ s/bit}} = 960 \text{ bits}$$

$\text{bit time} = \frac{1}{100 \cdot 10^6}$

$\frac{9.6\mu \times 1}{10^{-8}}$

b. Due to interframe gap how many maximum sized frames are possible to transmit in one second?

maximum frame size = 1518 bytes

$$\frac{1 \text{ s}}{10^{-8} \text{ s/bit}} = 100000000 \text{ bits}$$

$$(1518 \times 8) + 960 = 13104 \text{ bits}$$

$$\Rightarrow \#\text{ of maximized frames} = \frac{100000000}{13104} = 7632 \text{ frames}$$

c. Since each frame is followed by an interframe gap silence, determine the bandwidth lost (in bps) due to the interframe gap.

We have 7632 interframe gap in 1 s
and each gap is formed by 960 bits

$\Rightarrow$ lost bandwidth $= 7632 \times 960$

$= 7.326.720$ bps

bitrate $= 10^{-8}$ s/bit

9.6x $\rightarrow$ 9.6 s

in 1 second

Tx = # frames

1 sec = bit rate

$1 \text{ sec} = \frac{1518 \times}{100 \cdot 10^6}$ x

9.6x 3256 7321456 732

9.6x

lost gap frames

lost (bps)

7632 frames