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# Assignment NO: 01

## Data Communication and Network

NAME: ASHFAQ AHMAD

Reg NO: 19PWCSE1795

Section: B

Batch: # 21

Submitted to:

Prof: Ihsan ul haq Sir

Date: 23/06/2022

Date: __/__/20

## Question No: 01:

**Given:**

length of packet = 1 GB
bandwidth = 10000 bps

**Required:**

Transmission time = ?

**Sol**

In ~~Data~~ Tele-Communication transmission time is the amount of time from beginning until the end of the message transmission. In case of digital message, it is the time from the first bit until the last bit of message has left the transmission mode.

→ The packet transmission time in second can be obtained from packet size in bit and bit rate in bit/s.

Formula is,

Packet transmission time = Packet size / Bit rate

Now packet size in bit

1 GB = 1000,000,000 Bytes

$1GB = 8 \times 10^9$ bits

So

Packet transmission time $= \frac{8 \times 10^9 \text{ bit}}{10^4 \text{ bit/sec}}$

$= 8 \times 10^{9-4}$ sec

**Packet transmission time $= 8 \times 10^5$ sec**

## Propegation delay:

There is difference b/w propegation delay and transmission time.

→ transmission time is the time require for a packet to be send Completly.

→ Propegation delay is the time taken by the first bit of a packet to be travel from Sender to receiver. During this time the receiver is unaware that a message is being transmitted.

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# Question No: 02:

**Given:**

message size = 1 KB
distance = 5 km
velocity = $3 \times 10^8$ m/s
bandwidth = 1000 bps

**Required:**

~~Total time taken =?~~
Packet delivery time =?

**Sol**

As we know that

Packet delivery time = Transmission time + propagation delay

Propagation delay in second can be calculated by dividing distance in meter by its propagation speed in m/s.

So

$$\text{Propagation delay} = \frac{5 \times 10^3 \text{ m}}{3 \times 10^8 \text{ m/s}}$$

$$= 1.67 \times 10^{-5} \text{ s}$$

$$\text{propagation delay} = 16.7 \times 10^{-6} \text{ s}$$

**Propagation delay = 16.7 μsec**

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Now transmission time

$$\text{Transmission time} = \frac{1\times10^3 \text{ Byte}}{1000 \text{ b/s}}$$

$$= \frac{8\times10^3 \text{ b}}{10^3 \text{ b/s}}$$

1 Byte =

transmission time = 8 sec

Now

Packet delivery time = 8 sec + 16.7 μsec

= (8 + 0.0000167) sec

Packet delivery time = 8.0000167 sec

## Question No: 03:

Given:

message size = 1024 bits

bandwidth = 1000 M bit/sec

round trip time = RTT = 1 sec

Required:

Link utilization = ?

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**Sol**

formula for link Utilization or Efficiency ($\eta$)

$$\eta = \frac{1}{1+2a} \quad \text{—— ①}$$

As

$a = T_p/T_t$ where $T_p$ = Propagation delay
$T_t$ = transmission delay

"a" is the ratio of propagation delay and transmission delay.

So first we find $T_p$ and $T_t$ Then a and finally $\eta$

As

Transmission delay = $T_t$ = $\frac{\text{Packet size}}{\text{Bandwidth}}$

$$T_t = \frac{1024 \text{ bits}}{1000,000,000 \text{ bits/sec}}$$

$$\boxed{T_t = 1.024 \text{ usec}}$$

Now

Propagation delay = $T_p = \frac{RTT}{2}$

$$T_p = \frac{1 \text{ sec}}{2}$$

$$\boxed{T_p = 0.5 \text{ sec}}$$

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Now

$$a = \frac{0.5 \text{ sec}}{1.024 \text{ sec}}$$

$$a = 0.488 \times 10^6$$

$$\boxed{a = 488000}$$

Now link Utilization is

$$\eta = \frac{1}{1 + 2(488000)}$$

$$= \frac{1}{976001}$$

$$\boxed{\eta = 0.00000126\ \%}$$

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**Note:**

another formula for link Utilization $\eta$.

$$\eta = \frac{\text{transmission time}}{\text{Round Trip time (RTT)}}$$

where

$$\text{transmission time } T_t = \frac{\text{Packet size}}{\text{bandwidth}}.$$

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ASHFAQ AHMAD
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## Question No: 04:

The HFC (hybrid Fiber Coax) is used for cable Internet access. HFC uses both coaxial cables and fiber. In downstream channel of HFC every packet travel from head end to every home. In upstream channel of HFC every packet sent by a home travel to head end.

Since Cable Internet uses a shared medium to transmit the packet, the HFC transmission rate is shared among the users.

Collision is occured when multiple source sent the packets simultinously into the shared medium. For example, in upstream channel of HFC multiple homes sent packets to head end simultinously. Thus collision are possible in upstream channel.

But in downstream every packet is sent by only single source called head end. Thus, collisions are not possible in downstream.

The END Assignment 1: