

## Delays in Computer Networks-

Consider-

Two hosts A and B are connected over a transmission link / transmission media.

A data packet is sent by the Host A to Host B.

Following different types of delay occur during transmission-

- Transmission delay
- Propagation delay
- Queuing delay
- Processing delay

### 1. Transmission Delay-

Time taken to put the data packet on the transmission link is called as transmission delay.

Mathematically,

Transmission delay  $\propto$  Length / Size of data packet

Transmission delay  $\propto$  1 / Bandwidth

$$\text{Transmission delay} = \frac{\text{Length / Size of data packet}}{\text{Bandwidth of Network}}$$

### 2. Propagation Delay-

Time taken for one bit to travel from sender to receiver end of the link is called as propagation delay.

Mathematically,

Propagation delay  $\propto$  Distance between sender and receiver

Propagation delay  $\propto$  1 / transmission speed

$$\text{Propagation delay} = \frac{\text{Distance between sender and receiver}}{\text{Transmission speed}}$$

### 3. Queuing Delay-

Time spent by the data packet waiting in the queue before it is taken for execution is called as queuing delay.

It depends on the congestion in the network.

#### 4. Processing Delay-

Time taken by the processor to process the data packet is called as processing delay.

It depends on the speed of the processor.

Processing of the data packet helps in detecting bit level errors that occurs during transmission.

Important Points-

**Note-01:**

Total delay in sending one data packet or End to End time

= Transmission delay + Propagation delay + Queuing delay + Processing delay

**Note-02:**

In optical fibre, transmission speed of data packet =  $2.1 \times 10^8$  m/sec

In optical fibre, signals travel with 70% speed of light.

70% speed of light

=  $0.7 \times 3 \times 10^8$  m/sec

=  $2.1 \times 10^8$  m/sec

So, consider transmission speed =  $2.1 \times 10^8$  m/sec for calculations when using optical fibre.

**Note-03:**

Both queuing delay and processing delay are dependent on the state of the system.

This is because-

If destination host is busy doing some heavy processing, then these delays will increase.

If destination host is free, then data packets will be processed immediately and these delays will decrease.

**Note-04:**

For any particular transmission link, bandwidth and transmission speed are always constant.

This is because they are properties of the transmission medium.

**Note-05:**

Bandwidth is always expressed in powers of 10 and data is always expressed in powers of 2.

(Remember while solving numerical problems)

Examples-

1 kilo bytes =  $2^{10}$  bytes

1 kilo bits =  $2^{10}$  bits

1 Mega bytes =  $2^{20}$  bytes

1 kilo bytes per second =  $2^{10}$  bytes per second

1 kilo bits per second =  $2^{10}$  bits per second

1 Mega bytes per second =  $2^{20}$  bytes per second