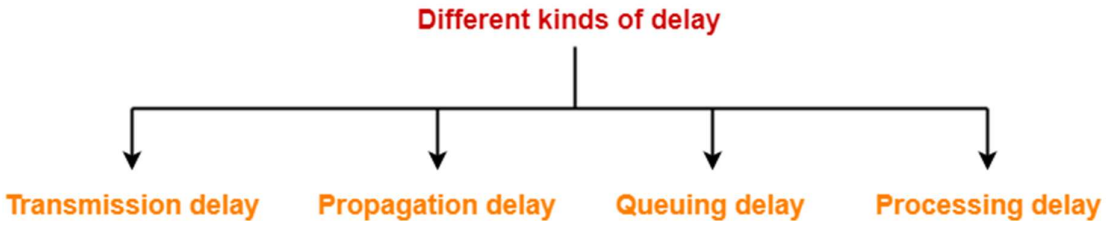
Delays in Computer Networks-

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-



1. Transmission delay
2. Propagation delay
3. Queuing delay
4. Processing delay

1. Transmission Delay-

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

Mathematically,

- Transmission delay ∝ Length / Size of data packet
- Transmission delay ∝ 1 / Bandwidth

Thus,

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

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 ∝ Distance between sender and receiver
- Propagation delay ∝ 1 / transmission speed

Thus,

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

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 = 2.1×10^8 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 = 2.1×10^8 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 = 10^3 bytes per second
- 1 kilo bits per second = 10^3 bits per second
- 1 Mega bytes per second = 10^6 bytes per second

Delays in Computer Network

The delays, here, means the time for which the processing of a particular packet takes place. We have the following types of delays in computer networks:

1. Transmission Delay:
The time taken to transmit a packet from the host to the transmission medium is called Transmission delay.

For example, if bandwidth is 1 bps (every second 1 bit can be transmitted onto the transmission medium) and data size is 20 bits then what is the transmission delay? If in one second, 1 bit can be transmitted. To transmit 20 bits, 20 seconds would be required.

Let B bps is the bandwidth and L bit is the size of the data then transmission delay is,

Tt = L/B

This delay depends upon the following factors:

- If there are multiple active sessions, the delay will become significant.
- Increasing bandwidth decreases transmission delay.
- MAC protocol largely influences the delay if the link is shared among multiple devices.
- Sending and receiving a packet involves a context switch in the operating system, which takes a finite time.

2. Propagation delay:
After the packet is transmitted to the transmission medium, it has to go through the medium to reach the destination. Hence the time taken by the last bit of the packet to reach the destination is called propagation delay.

Factors affecting propagation delay:

1. **Distance –** It takes more time to reach the destination if the distance of the medium is longer.
2. **Velocity –** If the velocity(speed) of the signal is higher, the packet will be received faster.

Tp = Distance / Velocity

Note:
Velocity =3 X 10^8 m/s (for air)

Velocity= 2.1 X 10^8 m/s (for optical fibre)

3. Queueing delay:
Let the packet is received by the destination, the packet will not be processed by the destination immediately. It has to wait in a queue in something called a buffer. So the amount of time it waits in queue before being processed is called queueing delay.
In general, we can't calculate queueing delay because we don't have any formula for that.

This delay depends upon the following factors:

- If the size of the queue is large, the queuing delay will be huge. If the queue is empty there will be less or no delay.
- If more packets are arriving in a short or no time interval, queuing delay will be large.
- The less the number of servers/links, the greater is the queuing delay.

3. **Processing delay:**

Now the packet will be taken for the processing which is called processing delay. Time is taken to process the data packet by the processor that is the time required by intermediate routers to decide where to forward the packet, update TTL, perform header checksum calculations.

It also doesn't have any formula since it depends upon the speed of the processor and the speed of the processor varies from computer to computer.

Note: Both queueing delay and processing delay doesn't have any formula because they depend on the speed of the processor
This delay depends upon the following factors:

- It depends on the speed of the processor.

Ttotal = Tt + Tp + Tq + Tpro

Ttotal = Tt+Tp

(when taking Tq and Tpro equals to 0)

Process Creation and Deletions in Operating Systems

- Difficulty Level : Medium
- Last Updated : 24 Dec, 2021

Prerequisite – States of a Process in Operating Systems
There are two basic operations that can be performed on a process: Creation and Deletion. They are explained as

Process creation:
1. When a new process is created, the operating system assigns a unique Process Identifier (PID) to it and inserts a new entry in the primary process table.

2. Then required memory space for all the elements of the process such as program, data, and stack is allocated including space for its Process Control Block (PCB).
3. Next, the various values in PCB are initialized such as,

1. The process identification part is filled with PID assigned to it in step (1) and also its parent's PID.
2. The processor register values are mostly filled with zeroes, except for the stack pointer and program counter. The stack pointer is filled with the address of the stack-allocated to it in step (ii) and the program counter is filled with the address of its program entry point.
3. The process state information would be set to 'New'.
4. Priority would be lowest by default, but the user can specify any priority during creation.

4. Then the operating system will link this process to the scheduling queue and the process state would be changed from 'New' to 'Ready'. Now the process is competing for the CPU.

5. Additionally, the operating system will create some other data structures such as log files or accounting files to keep track of processes activity.

Process Deletion:
Processes are terminated by themselves when they finish executing their last statement, then operating system USES exit( ) system call to delete its context. Then all the resources held by that process like physical and virtual memory, 10 buffers, open files, etc., are taken back by the operating system. A process P can be terminated either by the operating system or by the parent process of P.

A parent may terminate a process due to one of the following reasons:

1. When task given to the child is not required now.
2. When the child has taken more resources than its limit.
3. The parent of the process is exciting, as a result, all its children are deleted. This is called cascaded termination.

Difference between Memory and Storage

Memory:

Memories are made up of registers. Memory refers to the location of short-term data. Each register in the memory is one storage location. Storage location is also called as memory location. Memory locations are identified using Address. The total number of bit a memory can store is its capacity.

Memory are of three type:
1. Primary Memory
2. Secondary Memory
3. Cache Memory

Storage:
Storage allows you to store and access data on a long-term basis.Data remains the same and nothing changes in the hard disk drive: everything gets pulled off into the main memory. Storage allows you to access and store your applications, operating system and files for an indefinite period of time.
For Example:
1. HDD
2. SDD
3. SD Cards
4. CD, DVD, etc
Let's see the difference between Memory and Storage:

S.NO.	MEMORY	STORAGE
1	Memory is an electronic component that is capable of storing data and information on a temporary basis.	Storage refers to physical storage devices.

S.NO.	MEMORY	STORAGE
2	It is temporary data storage.	Data is stored both temporarily and permanently.
3	Memory is faster than storage.	Storage is slower than memory
4	Memory can access data and information instantly.	Storage cannot access or modify data as fast as the memory.
5	It is a collection of computer chips installed in memory modules.	It is a technology consisting of core components of a computer.
6	When the computer loses the power, Data is lost .	No data is lost.
7	The memory module are expensive than storage.	Storage devices are cheaper.
8	There size are not much larger and goes upto GBs.	There size are much larger than memory and goes upto TBs.
9	It is used when data is stored for short time.	It is used when data is stored for long term.