

Name - Mohammed Raihan P.S.

Class - MCA 1C

## OS Theory Assignment 1

- 1) List five services provided by the OS. Explain how each provides convenience to the user. Explain also in which cases it would be impossible for user level program to provide these services.

### Functions of OS

- Process Management - A program in execution is a process, OS provides editors & debuggers to assist the programmer in creating programs.
- OS keeps track of the status of processes (New, Ready, Running, Termination)
- OS Decides the order in which process have access to the processor, and how much processing time each process has, This function of OS is called Process Scheduling.
- Memory Management / Resource Allocation <sup>/Accounting</sup> - For a program to be executed, it should be first loaded in the main memory. OS handles it.
- OS keeps track of primary memory. It keeps track of how much memory is used & how much is free
- OS keeps track of how much memory is allocated and to which process it is allocated.
- It allocates the memory to a process when the process requests it and deallocates the memory when the process has terminated.
- Device Management / I/O operations - A running process may require input output. This I/O may involve a file or an I/O device. A user program cannot execute I/O operations directly, the OS must provide some means to do so.
- ~~System~~ System calls allow a running process to directly communicate with OS in case of needs. It acts as an interface b/w running process & the OS



- Error Detection / Correction - Error detection is a crucial thing for every type of OS as it can lead to system failure. Errors may occur in the CPU, memory hardware, I/O devices or while inter process communication which can lead to deadlock. OS needs to detect & correct these errors time to time.
- Security / Protection - The OS provides security mechanism to protect the unauthorized usage of files in the network environment.
- Process Synchronization / Communication
- User Interface

2) What is a directory? What are the different ways to implement a directory.

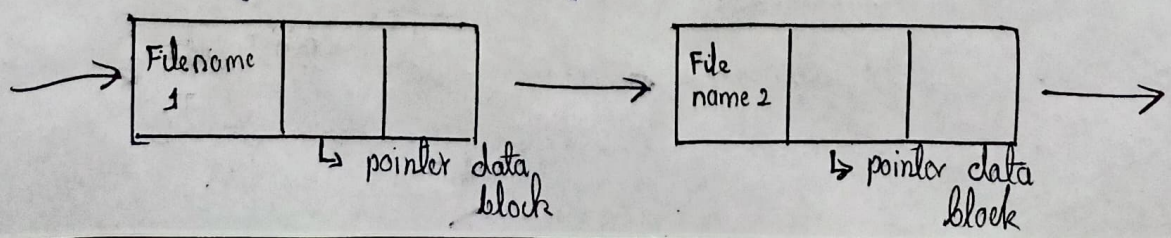
Directory refers to the way a structured list of documents files & folders is stored on the computer. Directory structure is the way an operating system arranges files that are accessible to the user.

There are two ways to implement a directory

- 1) Singly Linked List
- 2) Hash Table

1) Single Linked List - Implementation of directories using a single linked list is easy to program but is time consuming to execute. Here we implement a directory by using a linear list & filenames with pointers to the data blocks.

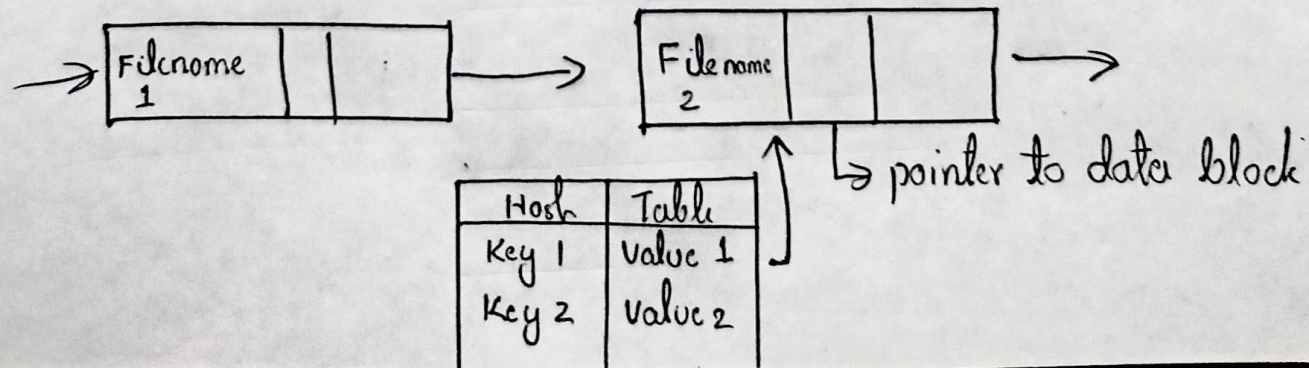
Directory Implementation of single linked list





2) Hash Table - An Alternate data structure that can be used for directory implementation is a hash table. It overcomes the major drawbacks of directory implementation using a linked list.

Directory Implementation using hash table





3) Differentiate how distributed systems differ from multiprogrammed & time shared OS. Give key features of each

| Distributed Systems   | Multiprogramming  | Time Sharing  |
|---|---|---|
| Distributed Systems has more than one processor. These systems have multiprocessor in a single CPU.   | Multiprogramming systems have only one processor.   | Time sharing is a logical extension of Multiprogramming & Multiuser & has single processor.   |
| In Distributed Systems, processors can't share memory or a clock, each processor has its own local memory. The processor communicate with one another through communication lines or buses. | The OS picks one process at a time from the main memory for execution. But when it needs I/O. Then CPU picks another job to execute till this job issues a request for I/O or the first job finishes its I/O. | The CPU executes multiple jobs by switching among them, but the switching occurs so frequently that the user can interact with each program while its running. It allows many users to interact with the computer simultaneously. |
| Processes are executed in parallel. which in return increases throughput & CPU utilization.   | The concept of switching is used in multiprogramming. CPU switches among processes. which reduces CPU idle time.  |   |
| Multiple users can access multiple processors simultaneously which maximizes both processor use & response time. <u>Devices are shared</u>  | Multiprogramming systems maximizes processor use. processor is shared   | Time Sharing minimizes response time. time is shared  |



4) Explain the following (i) Multitasking Systems (ii) Real time Systems

**Multitasking Systems** - Before multitasking, tasks like printing, downloading can be done one after another, leading to wastage of resources, which makes the operating system relatively slow and gives a bad experience. Multitasking operating systems allow multiple users to perform multiple tasks at the same time.

### Features

- 1) Time Sharing
- 2) Context Switching
- 3) Hardware Interrupt
- 4) Multi Threading

**Realtime OS** - These systems are used in environments where a large number of events, mostly external to the computer system, must be accepted & processed in a short time or within certain deadlines. The processing in this type of system must occur within the specified constraints, otherwise, this will lead to system failure.

### Types of Realtime OS

Hard Realtime OS

Soft Realtime OS

### Advantages

- 1) Maximum Consumption
- 2) Focus on Application
- 3) Error Free
- 4) Memory & Resource Management is best managed

### Disadvantages

- 1) Complex Algorithms
- 2) Use of heavy system resources

### Application of RTOS

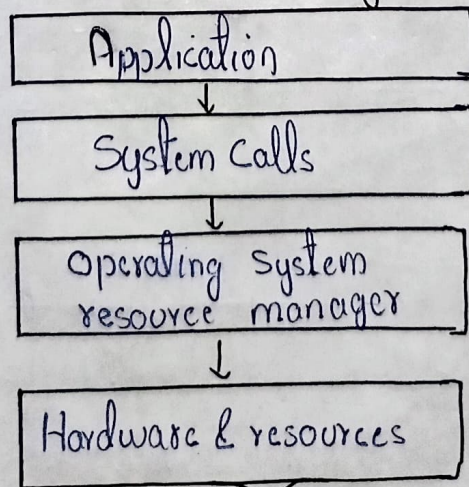
- Air Traffic Control
- Missile operations
- Scientific Research
-



## 5) Differentiate b/w Multiprogramming & Multiprocessing

| Multiprogramming   | Multiprocessing   |
|--|---|
| The number of CPU is one   | The number of CPU is more than one  |
| It takes more time to process the jobs.  | It takes less time for job processing   |
| In this one process can be executed at a time.   | In this more than one process can be executed at a time.  |
| It is economical   | It is not economical  |
| Throughput is less   | Throughput is maximum   |
| Its efficiency is less   | Its efficiency is maximum   |
| The Concurrent application of more than one program in the main memory is known as Multiprogramming. | The availability of more than one processor per system, that can execute several set of instructions in parallel is known as Multiprocessing. |

6) The OS is also called is Resource Manager. Why?





- As a resource manager, OS provides controlled allocation of the processors, memories, & I/O devices among various programs.
- Therefore OS is also called a Resource Allocator which is one of the function of an OS.
- The CPU is also one kind of resource & the OS decides how much processor time should be given for the execution of a particular user program.
- OS also manages memory & I/O devices when multiple users working simultaneously.
- OS keeps track of primary memory. It keeps track of how much memory is used & how much is free.
- OS keeps track of how much memory is allocated & to which process it is allocated.
- OS allocates the memory to a process when the process requests it & deallocates the memory when the process has terminated.

7) What is operating system structure? Explain the different components of the OS with merits & demerits.

The structure of an operating system typically consists of various components, each with its own roles & functions. There are the main components, along with their merits & demerits.

#### • Kernel

##### Merit

The kernel is the core component thus possible for managing hardware resources

##### Demerits

Kernel bugs can lead to system crashes & security breaches



## • File System

### Merits

The file system manages data storage & enabling organized data storage & retrieval

### Demerits

Inefficient file system operations can slow down data access.

## • Process Management

### Merits

It controls the execution of programs, facilitating process scheduling & resource allocation

### Demerits

These processes require CPU cycles & memory which impacts the performance of the system.

## • Memory Management

It optimizes RAM usage ensuring process have the memory they need & tracks various aspects of memory

### Demerits

Inefficient memory management can result in wasted memory fragmentation.