1.1 OBJECTIVES AND FUNCTIONS

OBJECTIVES:

The few **objectives of operating system are**

1. Convenience.
2. Efficiency.
3. Resource Management.
4. Security.

1. **Convenience**:

a) **User-friendly interface**

- OS should provide an,
  - ✓ easy-to-understand
  - ✓ interface for users to interact with the computer system.

b) **Simplified access to resources:**

Hardware and software resource should be easy for users to access and utilize

c) **Efficient program execution:**

The OS should provide the necessary environment and services for users to run their programs effectively.

2. **Efficiency**:

a) Resource management:

The OS is responsible for managing all the resources of the computer system, including the CPU, memory, storage, and input/output devices.

b) Fair resource allocation:

It needs to ensure that resources are allocated efficiently and fairly among different users and programs.

c) Optimization:

The OS aims to optimize the utilization of resources to improve overall system performance.

3**. Resource Management**:

a) CPU management:

The OS manages the allocation of CPU time to different processes, ensuring that no single process monopolizes the CPU.

b) Memory management:

It manages the computer's memory, allocating space to different programs and data, and preventing conflicts.

c) File management:

The OS handles the storage and retrieval of files, providing a structured way to organize and access data.

d) Input/output (I/O) management:

It manages the interaction between the computer and external devices, like printers and keyboards.

4. Security:

a) Protection of system resources:

The OS needs to protect itself and user data from unauthorized access, ensuring the confidentiality, integrity, and availability of information.

b) Access control:

It implements access control mechanisms to regulate who can access specific resources.

Simple responsibility/objectives

1. Maintain the list of resources in the system.
2. Maintain the list of allocated resources.
3. Maintain resource usage list.
4. Maintain the list of authorized users
5. To hide the details of the hardware resources from the users
6. Provide **convenient** for the user to use the system in an efficient manner.
7. OS should act as an interface between user and hardware of the computer.

FUNCTIONS OF OPERATING SYSTEM

The various functions of operating system are

1. Process Management.

2. Memory Management.

3. Storage Management.

   a) File-System Management.

   b) Mass-Storage Management.

4.Caching.

5.I/O Systems

6. Protection and Security.

1. Process Management:

A program in execution known as process.

A process is the unit of work(job/task) in a system. A system consists of a collection of processes, some of which are operating-system processes (those that execute system code) and the rest of which are user processes (those that execute user code). All these processes can execute concurrently—by multiplexing on a single CPU.

The operating system is responsible for the following process management activities:

- Scheduling processes and threads on the CPUs
- Creating and deleting both user and system processes
- Suspending and resuming processes
- Providing mechanisms for process synchronization
- Providing mechanisms for process communication

2. Memory Management:

The main memory is generally the storage device that the CPU is able to address and access directly.

As the program executes, it accesses program instructions and data from memory by generating these absolute addresses. Eventually, the program terminates, its memory space is declared available, and the next program can be loaded and executed.

The operating system is responsible for the following activities in connection with memory management:

- Keeping track of which parts of memory are currently being used and who is using them
- Deciding which processes (or parts of processes) and data to move into and out of memory
- Allocating and deallocating memory space as needed

3.Storage Management:

To make the computer system convenient for users, the operating system provides a uniform, logical view of information storage. The operating system abstracts from the physical properties of its storage devices to define a logical storage unit, the **file**. The operating system maps files onto physical media and accesses these files via the storage devices.

a)File-System Management:

Computers can store information on several different types of physical media. Magnetic disk, optical disk, and magnetic tape are the most common. Each medium is controlled by a device, such as a disk drive or tape drive.

A file is a collection of related information. Commonly, files represent programs (both source and object forms) and data. Data files may be numeric, alphabetic, alphanumeric, or binary.

Files are normally organized into directories to make them easier to use. Finally, when multiple users have access to files, it may be desirable to control which user may access a file and how that user may access it (for example, read, write, append).

Activities of file management:

- Creating and deleting files
- Creating and deleting directories to organize files
- Supporting primitives for manipulating files and directories
- Mapping files onto secondary storage
- Backing up files on stable (non-volatile) storage media

b) Mass-Storage Management:

The main memory is too small to accommodate all data and programs, and because the data that it holds are lost when power is lost, the computer system must provide secondary storage to back up main memory.

The operating system is responsible for the following activities in connection with disk management:

- Free-space management
- Storage allocation
- Disk scheduling

Because secondary storage is used frequently, it must be used efficiently. The entire speed of operation of a computer may hinge on the speeds of the disk subsystem and the algorithms that manipulate that subsystem.

4.Caching:

In order to increase the execution speed the frequently access data is kept in an small high speed temporary storage called **cache**. Information is normally kept in some storage system (such as main memory). As it is used, it is copied into a faster storage system—the cache—on a temporary basis.

cache management:

It is an important design problem. Careful selection of the cache size and of a replacement policy can result in greatly increased performance.

cache coherency

The various CPUs can all execute in parallel; we must make sure that an update to the value of A in one cache is immediately reflected in all other caches where A resides. This situation is called **cache coherency**.

When we need a particular piece of information, we first check it in the cache. If it is there, then use the information directly from the cache. If it is not, we use the information from the source, putting a copy in the cache under the assumption that we will need it again soon.

(For example, suppose that an integer A that is to be incremented by 1 is located in file B, and file B resides on magnetic disk. The increment operation proceeds by first issuing an I/O operation to copy the disk block on which A resides to main memory. This operation is followed by copying A to the cache and to an internal register. Thus, the copy of A appears in several places: on the magnetic disk, in main memory, in the cache, and in an internal register. Once the increment takes place in the internal register, the value of A differs in the various storage systems. The value of A becomes the same only after the new value of A is written from the internal register back to the magnetic disk.)

5.I/O Systems:

One of the purposes of an operating system is to hide the details of hardware devices from the user. For example, in UNIX, the details of I/O devices are hidden from the bulk of the operating system itself by the **I/O subsystem**.

The I/O subsystem consists of several components:

- A memory-management component that includes buffering, caching, and spooling
- A general device-driver interface
- Drivers for specific hardware devices

Only the device driver knows the details of the specific device to which it is assigned.

6. Protection and Security:

Protection provides a mechanism for controlling access to processes, programs, and user resources.

Security provides a mechanism to safeguard the system resources and the user resources from all internal and external users.

- Huge range, including denial-of-service, worms, viruses, identity theft, theft of service
- Systems generally first distinguish among users, to determine who can do what
- User identities (**user IDs**, security IDs) include name and associated number, one per user.
- User ID then associated with all files, processes of that user to determine access control
- Group identifier (**group ID**) allows set of users to be defined and controls

managed, then also associated with each process, file

- **Privilege escalation** allows user to change to effective ID with more rights