**Operating System**

* An operating system act as an intermediary between the user of a computer and computer hardware. The purpose of an operating system is to provide an environment in which a user can execute programs in a convenient and efficient manner.
* An operating system is a software that manages the computer hardware. The hardware must provide appropriate mechanisms to ensure the correct operation of the computer system and to prevent user programs from interfering with the proper operation of the system.
* A more common definition is that the operating system is the one program running at all times on the computer (usually called the kernel), with all else being applications programs.
* An Operating system is concerned with the allocation of resources and services, such as memory, processors, devices and information. The Operating System correspondingly includes programs to manage these resources, such as a traffic controller, a scheduler, memory management module, I/O programs, and a file system.

**Functions of Operating System**

Operating system performs three functions:

* 1. **Convenience:** An OS makes a computer more convenient to use.

1. **Efficiency**: An OS allows the computer system resources to be used in anefficient manner.
2. **Ability to Evolve:** An OS should be constructed in such a way as to permitthe effective development, testing and introduction of new system functions without at the same time interfering with service.

**Operating System as User Interface**

Every general purpose computer consists of the hardware, operating system, system programs, application programs. The hardware consists of memory, CPU, ALU, I/O devices, peripheral device and storage device. System program consists of compilers, loaders, editors, OS etc. The application program consists of business program, database program.

The fig. shows the conceptual view of a computer system

Every computer must have an operating system to run other programs. The operating system and coordinates the use of the hardware among the various system programs and application program for a various users. It simply provides an environment within which other programs can do useful work.

The operating system is a set of special programs that run on a computer system that allow it to work properly. It performs basic tasks such as recognizing input from the keyboard, keeping track of files and directories on the disk, sending output to the display screen and controlling peripheral devices.

OS is designed to serve two basic purposes :

1. It controls the allocation and use of the computing system‘s resources among the various user and tasks.
2. It provides an interface between the computer hardware and the programmer that simplifies and makes feasible for coding, creation, debugging of application programs

The operating system must support the following tasks. The tasks are :

* 1. Provides the facilities to create, modification of program and data files using and editor.
  2. Access to the compiler for translating the user program from high level language to machine language.
  3. Provide a loader program to move the compiled program code to the computer‘s memory for execution.
  4. Provide routines that handle the details of I/O programming.

**I/O System Management**

The module that keeps track of the status of devices is called the I/O traffic controller. Each I/O device has a device handler that resides in a separate process associated with that device. The I/O subsystem consists of A memory management component that includes buffering, caching and spooling. A general device driver interface.

**Operating System Services**

An operating system provides services to programs and to the users of those programs. It provided by one environment for the execution of programs. The services provided by one operating system is difficult than other operating system. Operating system makes the programming task easier. The common service provided by the operating system is listed below.

1. Program execution

1. I/O operation
2. File system manipulation
3. Communications
4. Error detection
5. **Program execution**: Operating system loads a program into memory andexecutes the program. The program must be able to end its execution, either normally or abnormally.
6. **I/O Operation** : I/O means any file or any specific I/O device. Program mayrequire any I/O device while running. So operating system must provide the required I/O.
7. **File system manipulation** : Program needs to read a file or write a file. Theoperating system gives the permission to the program for operation on file.
8. **Communication** : Data transfer between two processes is required for sometime. The both processes are on the one computer or on different computer but connected through computer network. Communication may be implemented by two methods:
   1. Shared memory
   2. Message passing.
9. **Error detection** : error may occur in CPU, in I/O devices or in the memoryhardware. The operating system constantly needs to be aware of possible errors. It should take the appropriate action to ensure correct and consistent computing.

 **Operating system with multiple users provides following services**.

1. Resource Allocation 2.
2. Accounting
3. Protection

**A) Resource Allocation :**

If there are more than one user or jobs running at the same time, then resources must be allocated to each of them. Operating system manages different types of resources require special allocation code, i.e. main memory, CPU cycles and file storage.

There are some resources which require only general request and release code. For allocating CPU, CPU scheduling algorithms are used for better utilization of CPU. CPU scheduling algorithms are used for better utilization of CPU. CPU scheduling routines consider the speed of the CPU, number of available registers and other required factors.

**B) Accounting :**

Logs of each user must be kept. It is also necessary to keep record of which user how much and what kinds of computer resources. This log is used for accounting purposes. The accounting data may be used for statistics or for the billing. It also used to improve system efficiency.

**C) Protection :**

Protection involves ensuring that all access to system resources is controlled. Security starts with each user having to authenticate to the system, usually by means of a password. External I/O devices must be also protected from invalid access attempts.

In protection, all the access to the resources is controlled. In multiprocess environment, it is possible that, one process to interface with the other, or with the operating system, so protection is required.

**Types of Operating System**

* **Batch operating system :**

The users of batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator.To speed up processing, jobs with similar needs are batched together and run as a group. Thus, the programmers left their programs with the operator. The operator then sorts programs into batches with similar requirements.

**The problems with Batch Systems are following.**

**** Lack of interaction between the user and job.

 CPU is often idle, because the speeds of the mechanical I/O devices are slower than

CPU.

 Difficult to provide the desired priority.

* **Multiprogramming**A multiprogramming operating system is one that allows end-users to run more than one program at a time. The technology works by allowing the [central processing unit](http://www.wisegeek.com/what-is-a-central-processing-unit.htm) ([CPU](http://www.wisegeek.com/how-does-a-cpu-work.htm)) of a computer to switch between two or more running tasks when the CPU is idle.
* **Time-sharing operating systems**

Time sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time. Time-sharing or multitasking is a logical extension of multiprogramming. Processor's time which is shared among multiple users simultaneously is termed as time-sharing. Multiple jobs are executed by the CPU by switching between them, but the switches occur so frequently. Thus, the user can receive an immediate response. For example, in a transaction processing, processor execute each user program in a short burst or quantum of computation. That is if n users are present, each user can get time quantum. When the user submits the command, the response time is in few seconds at most.Operating system uses CPU scheduling and multiprogramming to provide each user with a small portion of a time. Computer systems that were designed primarily as batch systems have been modified to time-sharing systems.

Advantages of Timesharing operating systems are following

 Provide advantage of quick response.

 Avoids duplication of software.

 Reduces CPU idle time.

Disadvantages of Timesharing operating systems are following.

 Problem of reliability.

 Question of security and integrity of user programs and data.

 Problem of data communication.

* **Distributed operating System**

Distributed systems use multiple central processors to serve multiple real time application and multiple users. Data processing jobs are distributed among the processors accordingly to which one can perform each job most efficiently.

The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines). These are referred as loosely coupled systems or distributed systems. Processors in a distributed system may vary in size and function. These processors are referred as sites, nodes, and computers and so on.

The advantages of distributed systems are following.

 With resource sharing facility user at one site may be able to use the resources

available at another.

 Speedup the exchange of data with one another via electronic mail.

 If one site fails in a distributed system, the remaining sites can potentially continue

operating.

 Better service to the customers.

 Reduction of the load on the host computer.

 Reduction of delays in data processing.

* **Network operating System**

Network Operating System runs on a server and and provides server the capability to manage data, users, groups, security, applications, and other networking functions. The primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network, typically a local area network (LAN), a private network or to other networks. Examples of network operating systems are Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD.

The advantages of network operating systems are following.

 Centralized servers are highly stable.

 Security is server managed.

 Upgrades to new technologies and hardware can be easily integrated into the system.

 Remote access to servers is possible from different locations and types of systems.

The disadvantages of network operating systems are following.

 High cost of buying and running a server.

 Dependency on a central location for most operations.

 Regular maintenance and updates are required.

* **Real Time operating System**

Real-time systems are used when there are rigid time requirements on the operation of a processor or the flow of data and real-time systems can be used as a control device in a dedicated application. Real-time operating system has well-defined, fixed time constraints otherwise system will fail. For example Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, and home-appliance controllers, Air traffic control system etc.There are two types of real-time operating systems.

**Hard real-time systems**

Hard real-time systems guarantee that critical tasks complete on time. In hard real-time systems secondary storage is limited or missing with data stored in ROM. In these systems virtual memory is almost never found.**Soft real-time systems**Soft real time systems are less restrictive Critical real-time task gets priority over other tasks and retains the priority until it completes. Soft real-time