

भारतीय ज्ञान परंपरा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक :
डॉ. दिनेश चन्द्र शर्मा

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Ph.D., D.Lit. (Sub.)

निदेशक, कॉम्पिटिशन प्लस ग्रुप ऑफ इन्स्टीट्यूशन,
अजमेर

छवि पब्लिकेशन्स

अजमेर-305001

प्रकाशक :

छवि पब्लिकेशन्स

अजमेर-305001

मो. 9660111549

संस्करण :

प्रथम 2024

ISBN : 978 - 81 - 89435 - 66 - 0

मूल्य - 300/-

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मुद्रक - श्रीनिवास प्रिन्टोग्राफिक्स, अजमेर

Operating System

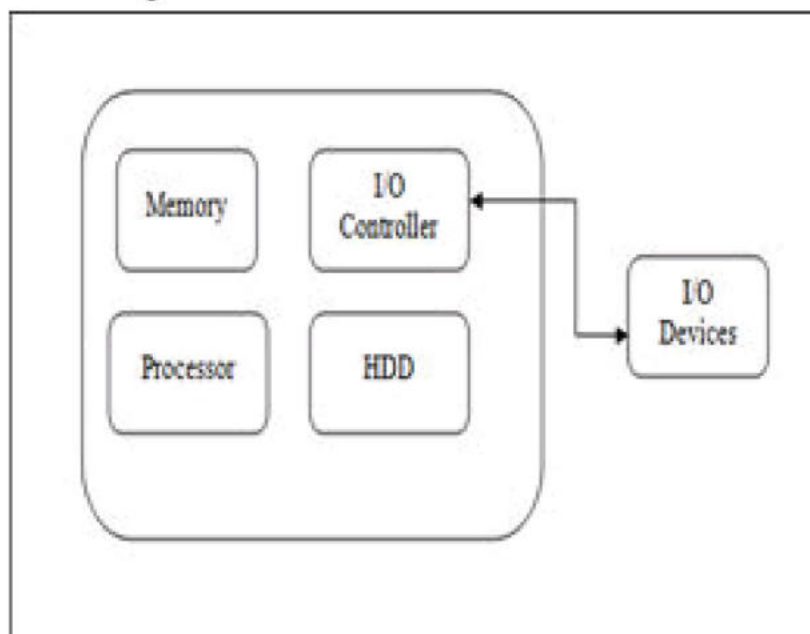
Amit Pathak

**Assistant Professor (Deptt. of Science and Technology)
Hukumchand Noble Institute of Science and Technology, Ajmer**

Operating System:

- * An operating system is a software which governs every computer hardwares.
- * It supports the foundation for an application program and serves as an interface between a user and computer hardware.
- * The operating system has two aims like:
 - * an operating system governs the computer's hardware.
 - * The second aim is to create an interactive interface for the user and translate commands so that it can interface with the hardware.
- * Operating system is a crucial component of nearly every computer system.

Controlling Hardware



The main aim of operating system is to control & manage the different hardware resources of a computer system.

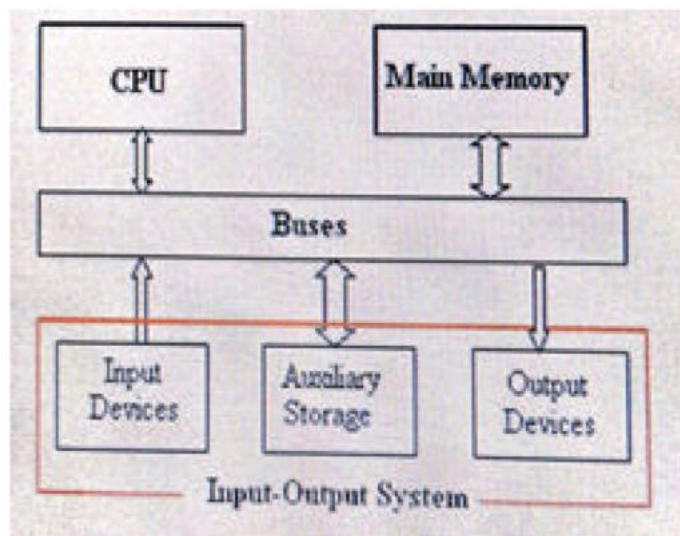
- * Such hardware resources are processor, memory, and disk space etc.

- * The output result was displayed in monitor. Apart from sending commands to the hardware the operating system also offers on error handling procedure and show an error notification.

- * If a device is not working correctly, the operating system is not able to communicate with the device.

Offering an Interface

- * The operating system structures application so that users can easily access, use and save them.

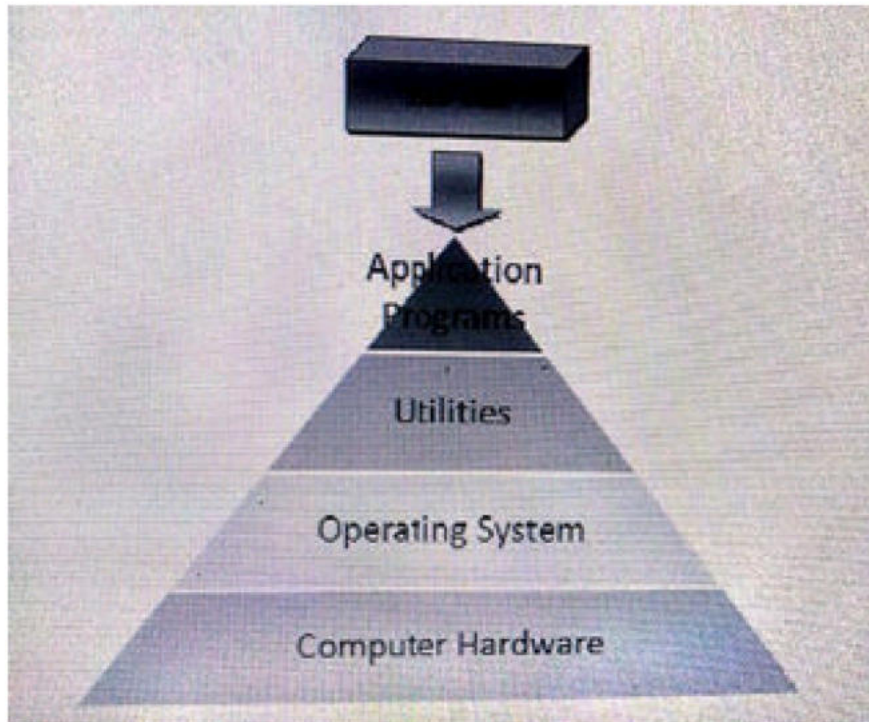


- * It offers a stable and uniform means by which the applications can manage the hardware without the user holding known information of the hardware.

- * When the program is not running smoothly, the operating system takes the control again, terminates the application and shows the respective error message.

- * Components of the computer system are grouped into 5 components

- * Computer hardware
- * operating system
- * utilities
- * Application programs
- * End user



The operating system manages and coordinate a hardware user and multiple application programs for multiple users.

It is a program that operates directly with the hardware.

The operating system is first programmed with the Computer and it stays in the memory all time afterwards.

System goals

- * The goal of an operating system is to be given an environment where an user can run programs.

- * Its primary objectives are to make the computer system convenient for the user.

- * Its secondary objectives are to utilize the computer hardware in an efficient way.

View of operating system

1. User view : The user perspective of the computer differs according to the interface used. The examples are -windows XP, vista, windows 7 etc. The majority of the computer user remain in the front of personal computer (pc) in this situation the operating system is developed primarily for simplicity with a little concern towards utilizing resources. Some user remain seated at a terminal on a mainframe/minicomputer. In this situation other users are using the same computer via the other terminals. There user share resources

and can pass the information to one another. The operating system here is built to optimize the use of resources to presume that all the available CPU time, memory and I/O are utilized effectively and no one user consumes more than his/her proportionate and share. The rest of the users occupy workstations which are linked to network of other workstations and servers. These users are assigned dedicated resources but they do share resources like networking and servers like file, compute and print server. In this case, the operating system is created to balance individual usability and resource usage.

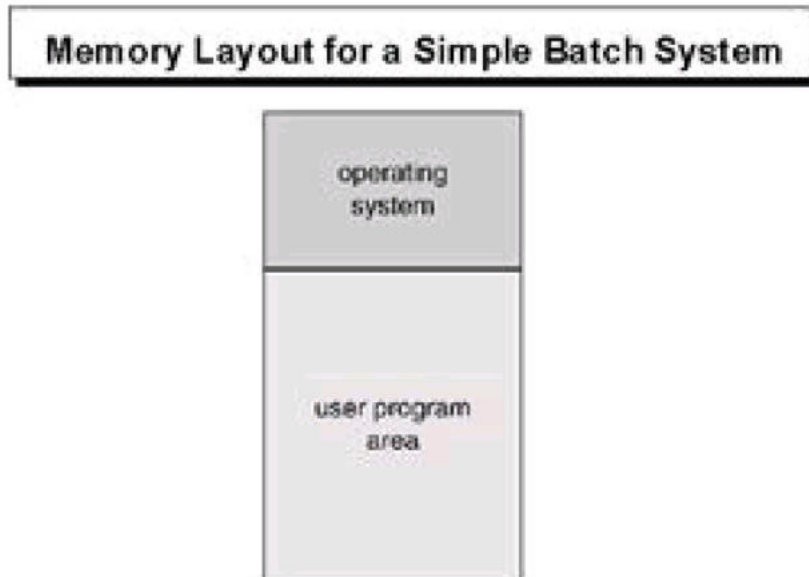
2. System view : From the viewpoint of the computer the operating system is the software which is most intermediate with the hardware. An operating system possesses resources as hardware and software that can be needed to resolve an issue such as CPU time, memory space, file storage capacity and I/O devices etc. That's why the operating system is considered to be a manager of resources. Another perception of the operating system is it is a control program. A control program coordinates the running of user programs to display the errors of correct usage of the computer. It is particularly mindful of the user the functioning and governs the I/O devices.

Types of Operating System

1. Mainframe System : It is the system where the initial computer utilized to process numerous commercial scientific applications. The expansion of mainframe systems dated back from single batch system where the computer processes one and only one application to time shared systems which accommodated user interaction with the computer system

A. Batch /Early System : Early computers were physically big machine. The typical input devices were card readers, tape drivers. Common output devices were line printers, tape drivers and card punches. In these systems the user did not directly interact with the computer system. Rather the user who prepares a job which is comprised of programming data and some control information and then submitted it to computer operator after some time the output is appeared. The output in such early computer was quite straightforward its primary function was to automatically switch control of one job to the next. The operating system is always in the memory. To improve

processing speed operators batched the jobs of similar requirements and executed them collectively as a group. The drawback of batch system is that here in the execution phase the CPU remains idle since the acceleration of I/O devices is extremely slow compared to the CPU.



B. Multiprogrammed System : Multiprogramming idea maximizes the CPU usage by organizing jobs in such a way that the CPU always has one job to execute the idea of multiprogramming concept. The operating system retains multiple jobs in the memory at a time as depicted below figure.

Operating System
Job 1
Job 2
Job 3
Job 4

This collection of job is a subset of the jobs maintained in the job pool. The operating system selects and starting to run one among the jobs present in the memory. In such an environment the operating system just switches and runs another job. When a job has to wait the CPU is just switched to another job and so on. The multiprogramming

operating system is advanced as the operating system decides for the user. This is referred to as scheduling. If a number of jobs are to be executed simultaneously the system selects one out of them. This is referred to as CPU scheduling. Disadvantages of the multiprogrammed system are

- * It does not offer user interaction with the computer system throughout the program execution.

- * Disk technology solved the above problems instead of reading cards from card reader to disk. This type of processing is called spooling. SPOOL is an acronym for simultaneous peripheral operations online. It employs disk as a large buffer for input device reading and for holding output data until the output devices take them up. It is also employed for processing data at remote ends. Remote processing is performed at its own speed without intervention of CPU. Spooling overlaps the input, output one job with calculation of other jobs. Spooling improves the performance of the systems by keeping both the CPU and I/O devices at much higher time.

B. Time Sharing System : The time sharing system is also referred to as multi user systems. The CPU runs several jobs one by one by switching between them but the switch happens so often that the user may interact with every program while it is in execution. An interactive computer system gives direct interaction between a user and system. The user provides instruction to the operating systems or to a program directly through keyboard or mouse and wait for instant outcome. Thus the response time will be minimal. The time sharing system permits numerous users to use the computer at the same time. As every activity in the system is brief, only a small amount of CPU time is required by each user. The system alternates quickly from one user to another so that each user gets the impression that the entire computer system is allocated to his use although it is shared by several users. The disadvantages of time sharing system are:

- * More complex than multiprogrammed operating system
- * System needs memory management & protection, as multiple jobs are maintained in memory simultaneously.
- * Time sharing system also needs to have a file system, so disk management is needed.

* It gives provision for concurrent execution which needs complex CPU scheduling schemes.

2. Personal Computer System/Desktop System : Personal computer emerged in 1970's. They are smaller & cheaper microcomputers than mainframe systems. Rather than maximizing the utilization of CPU & peripherals, the systems choose to maximize user responsiveness & convenience. Initially file protection was not required on a personal computer. But when other computers 2nd other users are able to use the files on a pc file protection is required. The absence of any protection made it simple for viruses to ruin data on such systems. Such programs are self replicating & they spread through mechanisms of worms or viruses. They have the ability to cripple entire companies or even global networks. E.g : windows 98, windows 2000, Linux.

3. Microprocessor Systems/ Parallel Systems/ Tightly coupled Systems : Such Systems contain more than one processor in close communication that share the computer bus, clock, memory & peripheral devices. Ex: UNIX, LINUX. Multiprocessor Systems possess 3 major advantages.

A. Enhanced throughput : No. of processes calculated per unit time. With more no. of processors more work can be accomplished in less time. The speed up ratio with N processors is not N, but it's less than N. Because some amount of overhead is required in keeping all parts functioning properly.

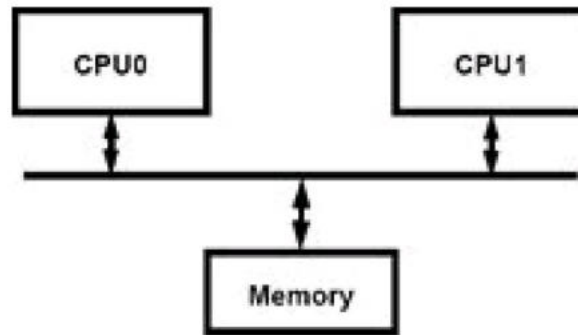
B. Greater Reliability : If several processors can be assigned their functions appropriately, then failure of a single processor will not bring the system to a standstill, but slow it down. Since the system has the capability to keep working despite failure, it is fault tolerant.

C. Economic scale : Multiprocessor systems can reduce costs as they have the capability to share peripherals, storage & power supplies.

The different types of multiprocessing systems are:

* **Symmetric Multiprocessing (SMP) :** Every processor executes the same copy of the operating system & these copies talk to each other as and when required. Eg: Encore's UNIX version for multi max computer. Almost all contemporary operating system such as

Windows NT, Solaris, Digital UNIX, OS/2 & LINUX now support SMP.



* **Master : Slave Processors: Asymmetric Multiprocessing:** Each processor is specialized in a particular task. A master processor manages the system & schedules & assigns the task to the slave processors. Ex- SUNOS version 4 operating system of Sun provides asymmetric multiprocessing.

4. Distributed System/Loosely Coupled Systems : The processors don't have common memory or a clock compared to tightly coupled systems. The local memory for each processor is provided instead. The processors exchange information with one another through several communication lines like high speed buses or phone lines. Distributed systems rely on networking to function. Through communication, distributed systems can share the tasks of computation and give users an abundant set of features. Networks differ based on the protocols employed, the distances between nodes and transport media. TCP/IP is the most widely used network protocol. The processor is a distributed system can be of variable size and purpose. It can include microprocessors, work stations, minicomputer, and big general purpose computers. Network types are determined on the basis of distance among the nodes like LAN (within a room, floor or building) and WAN (between buildings, cities or nations). The benefits of distributed system are resource sharing, speed-up of computation, reliability, communication.

5. Real time Systems: Real time system is utilized when there are strict time constraints on the operation of a processor or data flow. Sensors provide data to the computers. The computer processes data and makes adjustment in controls to change sensors' inputs. System that governs scientific experiments, medical image systems and some display systems are real time systems. The limitations of real time system are:

A. A real time system is said to be correctly functioning only if it gives the right result within the time limit.

B. Secondary storage is restricted or absent rather data is typically stored in short term memory or ROM.

Advanced OS features are lacking. Real time system is of two types like:

- * Hard real time systems : It ensures that the task which is critical has already been done at the right time. The abrupt task is occurs at an abrupt moment of time.

- * Soft real time systems : A less strict variant of real time system in which an important task receives priority over all other tasks and maintains that priority until it performs the computation. These are less useful compared to hard real time systems. It is permissible to miss deadlines periodically

e.g. QNX, VX works. Digital audio or multimedia falls within this category.

It is an OS of special purpose where there are strict time constraints on the execution of a processor. A real time OS consists of fixed and definite time constraints. The processing has to be executed within the constraint of time or else the system will fail. A real time system is said to be correct only if it produces the correct output within the time constraint. Such systems are defined by having time as a parameter of prime importance.

Basic Operations of Operation System:

Different functions of operating system are as mentioned below:

1. Process Management:

- * Unless their instructions are carried out by a CPU, no program does anything. A process is an executing program. A time shared user program like a compiler is a process. A word processing program running on an individual user on a pc is a process.

- * A system task like printing output to a printer is also a process. A process requires some resources like CPU time, memory files & I/O devices to perform its task.

- * These resources are either allocated to the process at the time of its creation or are allocated to it while it is executing. The OS controls the following process management activities.

- * Creating & deleting user & system processes.

- * Suspending & resuming processes.

- * Process synchronization mechanism provision.
- * Process communication mechanism provision.
- * Mechanism for deadlock handling provision.

2 .Main Memory Management :

Main memory is the focal point of operation of a contemporary computer system. Main memory consists of a huge array of words or bytes of size varying from hundreds of thousand to billions. The quickly accessible data which is common to the CPU & I/O device is stored in the main memory. The central processor reads instruction from main memory in instruction fetch cycle & it reads& writes data from main memory in the data fetch cycle. The main memory is usually the single large storage device which CPU can address & access directly. For instance, for the CPU to process disk data. Such data need to be first moved to main memory by CPU initiated E/O calls. Instruction has to be in memory so that the CPU can process them. The OS performs the following tasks as related to memory management.

- * Monitoring which areas of memory are being used & by whom.
- * Determining which processes need to be brought into memory when memory space is available.
- * Allocating & deallocating space in memory whenever required.

3. File Management:

One of the most significant parts of an OS is file management. An OS computer stores data on multiple kinds of physical media magnetic tape, magnetic disk & optical disk being the most popular ones. Every medium is managed by some device like disk drive or tape drive those have distinctive features. These are the characteristics of speed of access, capacity, data transfer rate & access method (sequential or random).For easy utilization of computer system the OS presents a consistent logical image of information storage. The OS generalizes about the physical characteristics of its storage devices in terms of defining a logical storage device the file. A file is a set of related information described by its producer. The OS manages the following file management activities.

File creation & deletion.

- * Directory creation & deletion.

- * Supporting file & directory manipulation primitives.
- * Mapping files into secondary storage.
- * Backing files onto non-volatile devices.

4 .I/O System Management :

One of the functions of an OS is to conceal the idiosyncrasies of particular hardware devices from the user. For instance, in UNIX the idiosyncrasies of I/O devices are concealed from the majority of the OS itself by the I/O subsystem. The I/O subsystem comprises:

- * A memory management component containing buffering, catching & spooling.
- * A generic device-driver interfaces drivers for a particular hardware device. The device driver alone is aware of the idiosyncrasies of the particular device to which it is dedicated.

5 .Secondary Storage Management :

The primary function of computer system is to run programs. These programs along with the data they refer to need to be placed in main memory at the time of execution. Since the main memory is not sufficient in size to hold all programs & data & since the data stored in it is lost when power is gone. The computer system has to supply secondary storage to back up main memory. The majority of current computer systems are disks as the storage medium to store data & program. The operating system manages the following disk management activities.

- * Free space management.
- * Storage allocation.
- * Disk scheduling

Since secondary storage is utilized repeatedly it has to be utilized economically.

