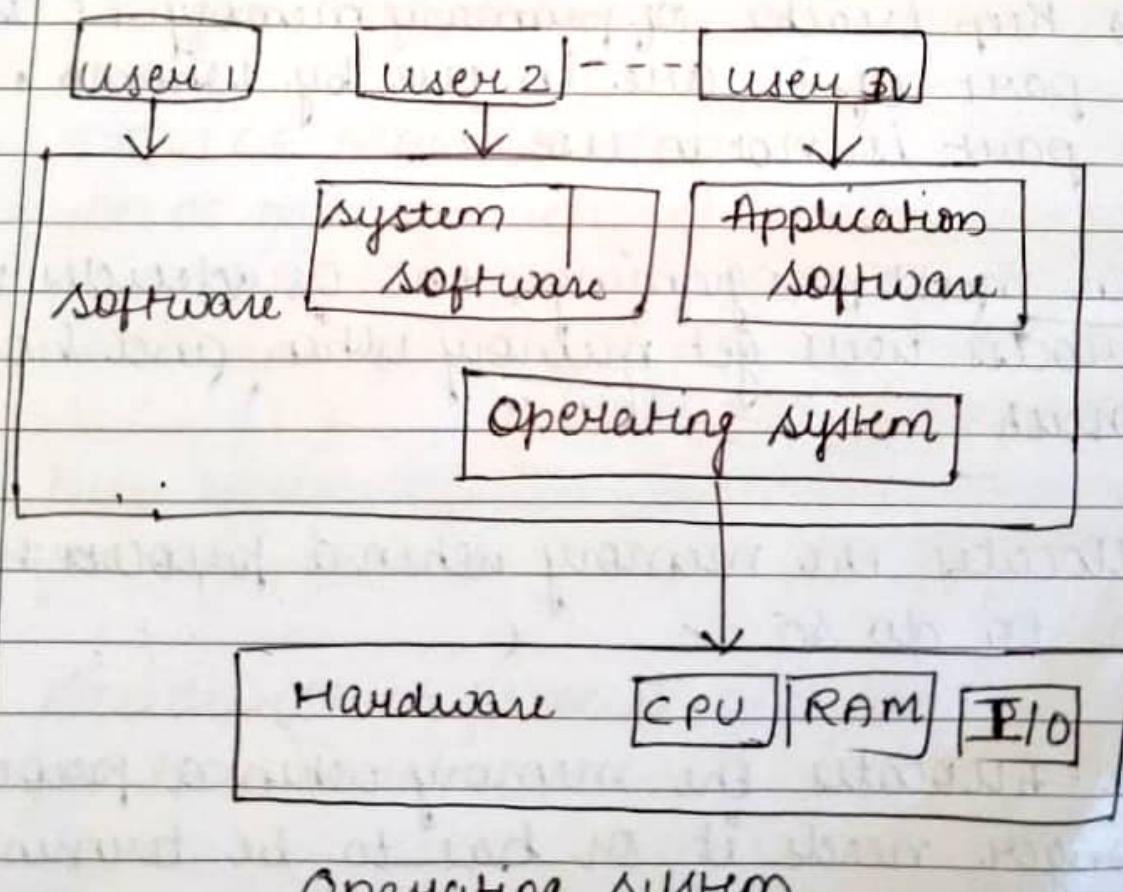


An operating system is an interface b/w computer user and computer hardware. An operating system is a software which performs all the basic task like file management, memory management, process management, handling Input/Output and controlling peripheral devices such as disk, drives and printers.

Examples:- Some popular OS include Linux OS, Windows OS, OS/400 etc.

Definition

An OS is a program that acts as an interface b/w user and computer hardware and controls the execution of all kinds of programs.



Operating System

Characteristics and features of an OS

1. MEMORY MANAGEMENT

Memory management refers to management of primary memory or main memory. Main memory is a large array of words or bytes where each word or byte has its own address.

Main memory provides a fast storage that can be accessed directly by the CPU for a program to be executed, it must be in the main memory. An OS does the following activities for memory management.

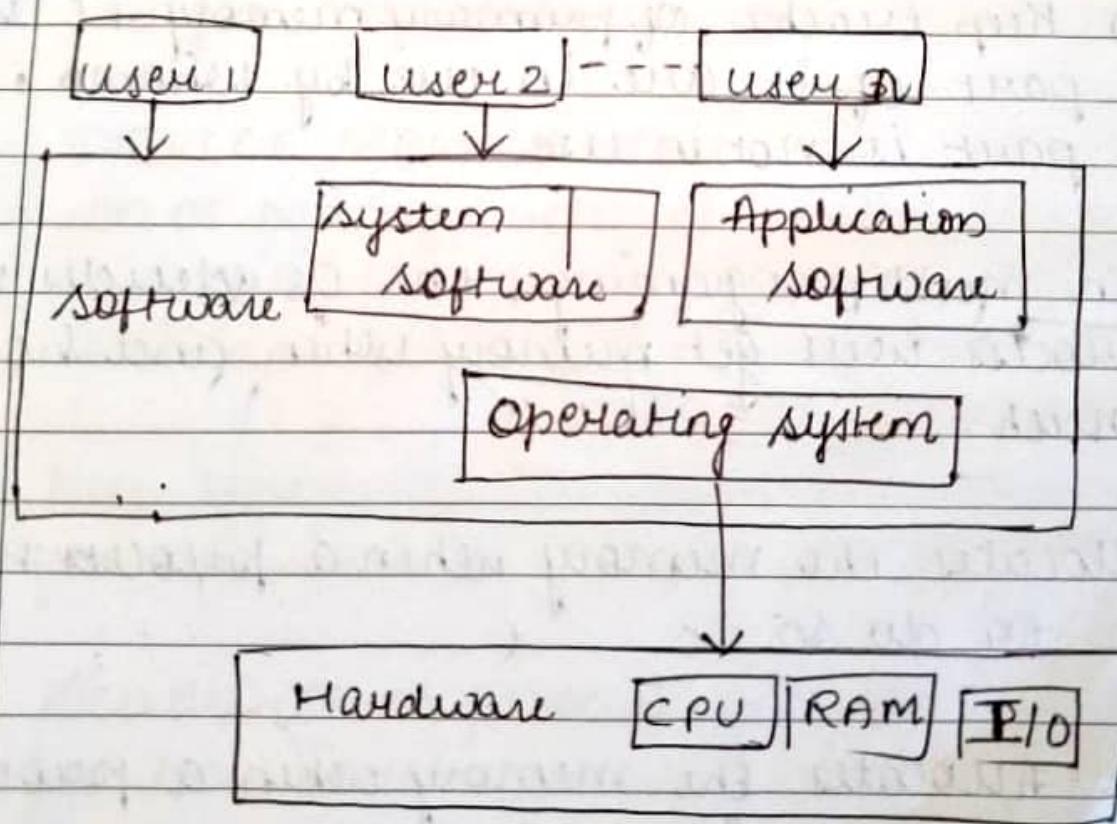
- (a) Keep track of primary memory i.e. what part of it are in use by whom, what part is not in use.
- (b) In multiprogramming, the OS decides which process will get memory when and how much.
- (c) Allocates the memory when a process request it to do so.
- (d) De-allocates the memory when a process no longer needs it or has to be terminated.

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2. PROCESSOR MANAGEMENT

In multi programming environment the OS decides which process gets the processor when and for how much time. This function is called as process scheduling. An OS does the following activities for processor management-

- (a) • Keep tracks of processor and status of process
The program responsible for this task is known as Traffic controller
- (b) Allocates the processor (CPU) to a process.
- (c) De-Allocates processor when a process is no longer required.

3. DEVICE MANAGEMENT

An OS manages device communication via their respective drivers it does the following activities for device management

- (a) Keep tracks of all devices. Program responsible for this task is known as I/O controller
- (b) Decides which process gets the device when and for how much time
- (c) Allocates the device in the efficient way
- (d) De-Allocates the device

4. FILE MANAGEMENT

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directories.

An OS does the following activities for file management-

- (a) Keeps track of information, location, uses, status etc. The collective facilities are often known as file system
- (b) Decides who gets the resources
- (c) Allocates the resources
- (d) De-Allocates the resources.

5. OTHER IMPORTANT

Security :- By means of password and similar other techniques it prevents unauthorised access to programs & data

Control over System performance

Recording delays b/w request for a service and response from the system.

Job Accounting

Keeping track of time and resources used

by various jobs and users

Error detecting aids

Production of dumps, traces, error messages
and other debugging and error detecting aids

Coordination b/w other software and user
coordination and assignment of compilers,
interpretive assemblers, another software to
the various users of computer systems

TYPES OF OS

OS are there from the very first computer generation and they keep evolving with time

Some commonly used OS are

1. Batch Operating System.

The users of a batch OS do not interact with the computer directly. Each user prepares his job on an offline device like punch cards and submits it to computer operator. To speed up processing, jobs with similar needs are batched together and run as a group.

The programmers leaves their program with the operator and the operator then sorts the program with similar requirement into batches.

Drawbacks of batch OS

- (a) Lack of interaction b/w user and the job
- (b) Difficult to provide the desired priority
- (c) CPU is often idle, because the speed of mechanical

I/O device is slower than CPU

2. Time sharing Operating System

Time Sharing is a technique which enables many people, located at various terminal to use a particular computer system at the same time. Time sharing or multitasking is a logical extension of multiprogramming. Processors time which is shared among multiple users simultaneously is termed as time sharing.

The main difference b/w multiprogram batch system and time sharing system is that in case of multiprogram batch system, the object is to maximize processes whereas in time sharing the objective is to minimize object time.

Multiple jobs are executed by the CPU by switching b/w them, but the switches occur so frequently. Thus the user can receive an immediate response.

For eg. in a transaction processing, the processor executes each user program in a short time.

The OS uses CPU scheduling and multiprogramming to provide each user with a small portion of time. Computer systems that were designed primarily as batch

System @ have been modified to time sharing system

Advantages

- (a) Provides the advantage of quick response
- (b) Reduces CPU idle time
- (c) ~~Reduces~~ avoids duplication of software

Disadvantages

- (a) Problem of reliability
- (b) Problem of data communication
- (c) Question of security and integrity of users, program and data.

3. Distributed Operating System

Distributed systems use multiple central processors to serve multiple real time applications and multiple users. Data processing jobs are distributed among the processors accordingly.

The processor communicate with one another through various communication lines such as High Speed based 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 processor are referred as sites, nodes, computers and so on.

Advantages

- (a) With resource sharing facility, a user at one

site may be able to use the resources available at another

- (b) Speed up the exchange of data with one another via electronic mail
- (c) Better service to customers
- (d) Reduction of the load on the host computer
- (e) Reduction of delays in data processing
- (f) If one site fails in a distributed system the remaining sites can potentially continue operating

4. Network Operating System

A network operating system runs on a server and provides the server the capability to manage data, user 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, a private network etc.

Examples of Network Operating System:-

Microsoft Windows Server 2003, Microsoft Windows Server 2008, Unix, Linux, Mac OS etc.

Advantages

- (a) Centralised servers are highly stable
- (b) Security is server managed

- (c) Upgrades to new technologies and hardware can be easily integrated into the system.
- (d) Remote access to servers is possible from different locations and types of systems.

Disadvantage:

- (a) High cost of buying and running a server.
- (b) Regular maintenance and updates are required.
- (c) Depending on a central location for most operations.

5. Real Time Operating System:

A Real time system is defined as a data processing system in which the time interval is required to process and respond to input is so small that it controls the environment.

The time taken by the system to respond to an input and display of required updated information is termed as the response time. So in this method the response time is very less as compared to online processing.

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. A Real time OS must have well defined fixed time constraint, otherwise the system will fail.

for eg:- scientific experiments, medical image systems, industrial control system, weapon system

There are 2 types of real time OS

1. Hard Real Time System

Hard Real time system guarantee that critical task complete on time. In hard real time system, secondary storage is limited or missing and data is stored in ROM. In this system virtual memory is almost never form.

2. Soft Real Time System.

Soft real time system are less restrictive. A critical real time task get priority over other task and retains the priority until it completes. Soft real time systems have limited utility than hard real time system.

eg:- Multimedia, virtual reality, advance scientific projects etc.

Operating System Services

Types Of Services

OS services are responsible for the management of platform resources, including the

processor, memory files, I/O

Types of OS Services are:

1. Kernel Operations provide low level services necessary to
 - (a) Create and manage processes and threads of execution
 - (b) Execute programs
 - (c) Define and communicate asynchronous events
 - (d) Define and process system clock operations
 - (e) Implement security features
 - (f) Manage files and directories
 - (g) Control I/O processing to and from peripheral devices
2. Command Interpreter and Utility services include mechanism for services at the operator level such as
 - (a) Comparing, printing and displaying file contents
 - (b) Editing files
 - (c) Searching patterns
 - (d) Evaluating expressions
 - (e) Logging messages
 - (f) Moving files b/w directories
 - (g) Sorting data
 - (h) Executing common scripts
 - (i) Scheduling signal execution processes
 - (j) Accessing environment information

3. Batch processing Services

support the capability to queue work (jobs) and manages the sequencing of processing based on job control commands and list of data. These services also include support for the management of the output of batch processing, which frequently includes updated files or data bases and information products such as printed reports or electronic documents. Batch processing is performed asynchronous from the user requesting the job.

4. File and directory Synchronisation

Services allow local and remote copies of files and directories to be made identical. Synchronisation services are usually used to update files after periods of offline working on a portable system.

Operating System - Important Services

An OS provides services to both the user and to the programs

- It provides programs and environment to execute
- It provides users the services to execute the programs in a convenient manner.

DATE / /
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Following are a few common services provided by an OS

Program execution

I/O operations

File system manipulation

Communication

Error detection

Resource allocation

Protection

Program execution

OS handle many kind of activities from user programs to system programs like printer spooler, named servers, file servers etc. Each of these activities is encapsulated as a process.

A process includes the complete execution context (code to execute, data to manipulate, registers, OS resources in use).

Following are the major activities of an OS with respect to program management.

- loads a program into the memory
- executes the program
- Handles programs execution
- Provides a mechanism for process synchronisation
- Provides a mechanism for process communication

(f) provides a mechanism for deadlock handling

2. I/O Operations

An I/O sub system comprise of I/O devices and their corresponding driver software. Drivers hide the peculiarities of specific hardware devices from the user.

An OS manages the communication b/w user and device drivers

(a) I/O operation means read or write operation with any file or any specific I/O device

(b) OS provides the access to the required I/O device when required.

3. File System Manipulation

A file represents a collection of related information. Computers can store files on the disc (Secondary Storage), for long term storage purpose.

Eg of storage Media include
Magnetic tape

Magnetic disc

Optical disc drives

like CD, DVD etc. Each of these media has its own properties like Speed Capacity and data transfer rate and data

access methods

A file system is normally organised into directories for easy navigation and usage these directories may contain files and other directories. Following are the major activities of an OS with respect to file management

Program needs to read a file or write a file

The OS gives the permission to the program for operation on a file

Permission varies from read only, read write, denied and so on.

OS provides an interface to the user to create, delete files

OS provides an interface to the user to create, delete directories

OS provides an interface to create the backup of file system.

Communication

In case of distributed systems which are a collection of processes that do not share memory, peripheral devices or a clock, the OS manages communication b/w all the processes. Multiple processes communicate with one another through communication link in the network.

The OS handles routing and connection strategies and the problems of contention & security. following are the major activities of an OS with respect to communication

- Two processes often require data to be transferred b/w them.
- Both the processes can be on one computer or on different computers, but are connected through a computer network.
- communication may be implemented by two methods either by shared memory or by message passing.

5. Error handling

Errors can occur any time and anywhere. An error may occur in CPU, in I/O devices or in the memory hardware. Following are the major activities of an OS wrt error handling area.

- The OS constantly checks for possible errors.
- The OS takes an appropriate action to ensure correct and consistent computing.

6. Resource Management

In case of multiuser or multitasking environment, resources such as main memory, CPU cycles & file storage are to be allocated to each user or job. Following are major activities of OS wrt Resource management.

- The OS manages all kinds of resources using schedules.
- CPU Scheduling algorithms are used for better utilization of CPU.

Protection

considering a computer system having multiple users and concurrent execution of multiple processes, the various processes must be protected from each other's activities.

protection refers to a mechanism or a way to control the access of programs, processes or user's to the resources defined by a computer system.

Following are the major activities of an OS with respect to protection:

The OS ensures that all access to system resources is controlled.

The OS ensures that external I/O devices are protected from invalid access attempts.

The OS provides authentication features for each user by means of passwords.

Different ways of providing the services

Utility programs

A program performs very specific task these programs usually related to manage system resources. OS contains a number of utilities for managing ~~the~~ disc drives, printers and other devices. Utilities differ from applications. Mostly in terms of size, complexity and function. for eg:- word processors, spreadsheet programs and database applications are considered because they are large programs.

that perform a variety of functions not directly related to managing computer resources.

e.g.: Antivirus software, Backup software & disc tools.

System calls:

A system call is a programmatic way in which a computer program requests a service from the Kernel of the OS. It is executed on a system call if a way for programs to interact with the OS & compiler program makes a system call when it makes a request to the OS Kernel.

System call provides the services of the OS to the user programs via API (Application program Interface)

It provides an interface b/w a process & OS to allow user level processes to request services of OS. System calls are the only entry points into the Kernel system. All programs needing resources must use system calls.

Services Provided by System calls:-

process creation & management

Main Memory Management

File access, directory and file system management

Device Handling (I/O)

Protection, Networking etc

Types of System call.

There are Five different categories of System call

Process Control - Find, Abort, Create, terminate
allocate and Free memory.

File Management - Create, open, close, delete, read
File etc.

Device Management

Information Maintenance
Communication

OS PROPERTIES

Batch Processing

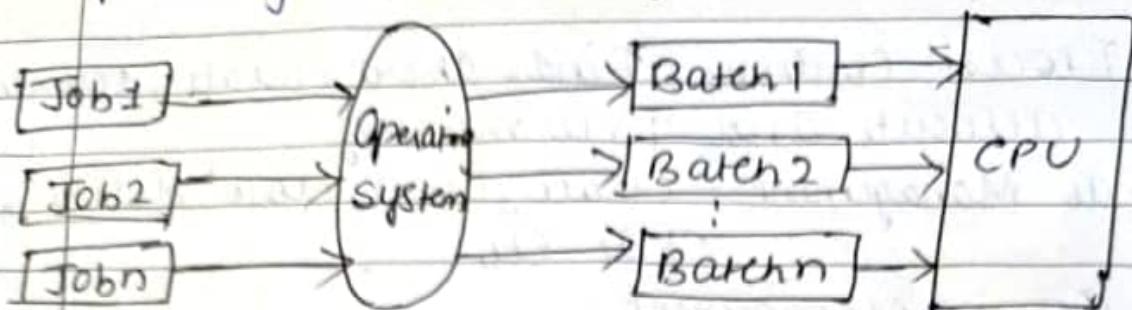
Batch processing is a technique in which an OS collects the programs and data together in a batch before processing starts an OS does the following activities related to batch processing.

The OS defines a job which has predefined sequence of commands programs & data as a single unit

The OS keeps a number of job in memory & executes them without any manual information. Jobs are processed in the order of Submission i.e. first come first serve fashion

When a job completes its execution its memory is released & the output for the job gets

copied into an output spool for later printing or processing



Batch processing

Advantages.

1. Batch processing takes much of the work to the care of the Operator to the computer
2. Increased performance as a new job gets started as soon as the previous job is finished without any manual intervention

Disadvantage

1. Difficult to debug program.
2. A Job could enter an infinite loop.
3. Due to lack of protection scheme one batch job can affect pending jobs.

(b.) Multi Tasking

Multi Tasking is when multiple jobs are executed by the CPU simultaneously

by switching b/w them. Switches occur so frequently that the user may interact with each program while it is running. An OS does the following activities related to multitasking.

The user gives instruction to the OS or to program directly, and receives an immediate response.

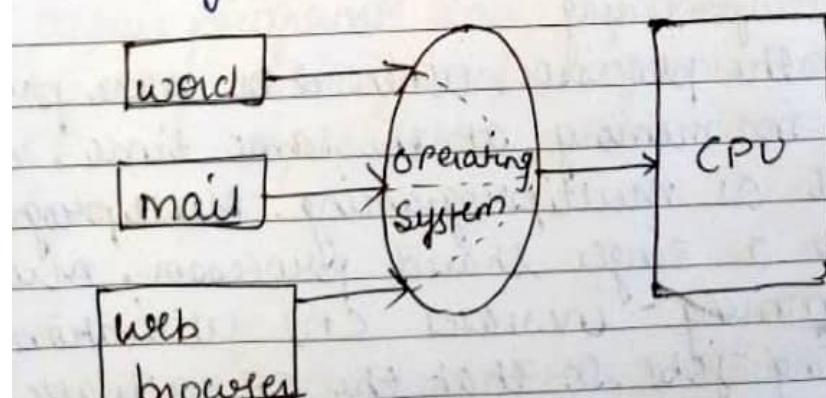
The OS handles multitasking in the way that it can handle multiple operations / execute multiple programs at a time.

Multitasking OS are also known as time sharing.

These OS were developed to provide interactive use of a computer system at a reasonable cost.

A Time shared OS use the concept of CPU Scheduling & multiprogramming to provide each user with a small portion of a time shared CPU.

Each user has atleast one separate program in memory.



MultiTasking

A program that is loaded into memory and is executing is commonly referred as a process.

When a process executes, it typically executes for only a very short time before it either finishes or needs to perform I/O.

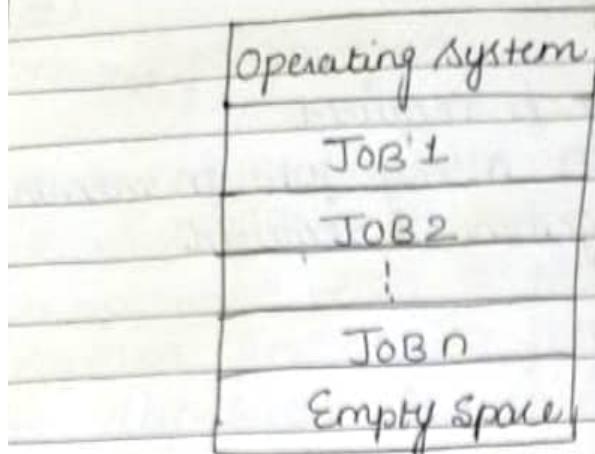
Since interactive I/O typically runs at slower speeds, it may take a long time to complete. During this time a CPU can be utilized by another process.

The OS allows the user to share the computer simultaneously since each action or command in a time shared system tends to be short, only a little CPU time is needed for each user.

As the system switches CPU rapidly from one user ~~to~~ program to the next, each user is given the impression that they have their own CPU, whereas actually one CPU is being shared among many users.

Multi Programming

Sharing the processor. When 2 or more programs reside in memory at the same time, it is referred as multiprogramming. Multiprogramming assumes a single shared processor. Multi programming increases CPU utilisation by organising jobs so that the CPU always has one to execute.



Multi Programming

The above figure shows the memory layout for multiprogramming system

An OS does the following activities related to multiprogramming

The OS keeps several jobs in memory at a time
 These set of jobs is a subset of the jobs kept in the job pull.

The OS picks and begins to execute one of the jobs in the memory

Multiprogramming OS monitor the state of all active programs and system resources using memory management programs to ensure that the CPU is never idle unless there are no jobs to process.

Advantage.

High and efficient CPU utilisation

User feels that many programs are allotted to CPU simultaneously

Disadvantage:

1. CPU scheduling is required.
2. To accommodate many jobs in memory, memory management is required.

INTERACTIVITY

Interactivity refers to the ability of user to interact with the computer system. An OS does the following activities related to interactivity.

1. Provides the user an interface to interact with the system.
2. Manages input devices to take inputs from the user.
e.g.: Keyboard
3. Manages output devices to provide output to the user.
e.g.: Monitor
4. The response time of the OS needs to be short, since the user submits & waits for the result.

Real Time System.

Real time systems are usually dedicated, embedded systems. An OS does the following activities related to Real time system.

1. In such systems, OS typically reads from and writes to sensor data.
2. The OS must guarantee response to events within fixed periods of time to ensure

correct performance.

Distributed Environment

A distributed environment refers to multiple independent CPUs or processors in a computer system and OS the following activities related to distributed Environment.

- The OS distributes computation, logics among several physical processor
- The processors do not share memory or a clock instead each processor has its own local memory
- The OS manages the communications b/w the processors. They communicate b/w the processors, they communicate with each other through various communication lines.

SPOOLING.

Spooling is an acronym for simultaneous peripheral online. Spooling refers to putting data of various I/O jobs in a buffer. This buffer is a special area in memory or hard disk which is accessible to I/O devices. An OS does the following activities related to spooling.

- Handles I/O devices data spooling as devices have different data access rates
- Maintains the spooling buffer with provides a

a waiting station where data can rest while slower devices catch up.

Maintain parallel computation because of Spooling process as a computer can possibly to have the computer read data from a tape, write data to discs & to write out to write out to a tape printer while it is doing its computation task.

