PRELUDE

- ✓ The operating system is responsible for creating the link between the material resources, the user and the applications (word processor, video game, etc.).
- ✓ When a program wants to access a material resource, it does not need to send specific information to the peripheral device but it simply sends the information to the operating system, which conveys it to the relevant peripheral via its driver.
- ✓ allows the dissociation of programs and hardware, mainly to simplify resource management and offer the user a simplified Man-Machine Interface (MMI) to overcome the complexity of the actual machine.
- ✓ is the infrastructure software component of a computer system responsible for the management and coordination of activities and the sharing of the limited resources of the computer.
- ✓ acts as a host for applications that run on the machine and handle the details of the operation of the hardware.
- ✓ common contemporary OS include Microsoft Windows, Mac OS, Linux and Solaris.
- ✓ the primary purpose of an OS is to maximize the productivity of a system by operating it in the most efficient manner and minimizing the amount of human intervention required.

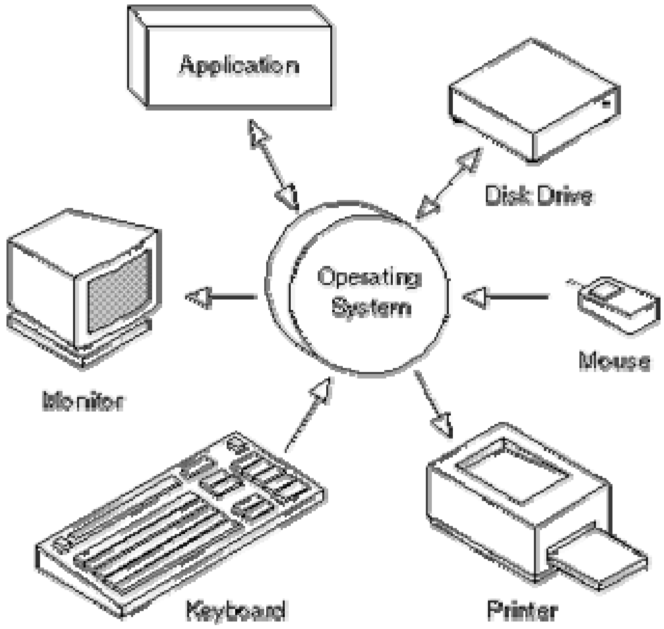

Fig: Operating System Concepts

COMPONENTS OF THE OPERATING SYSTEM

The operating system comprises a set of software packages that can be used to manage interactions with the hardware. The following elements are generally included in this set of software:

- ✓ The kernel, which represents the operating system's basic functions such as management of memory, processes, files, main inputs/outputs and communication functionalities.
- ✓ The shell, allowing communication with the operating system via a control language, letting the user control the peripherals without knowing the characteristics of the hardware used, management of physical addresses, etc.
- ✓ The file system, allowing files to be recorded in a tree structure.

ROLES OF THE OPERATING SYSTEM

The operating system has various roles:

- ✓ Management of the processor: The operating system is responsible for managing allocation of the processor between the different programs using a scheduling algorithm. The type of scheduler is totally dependent on the operating system, according to the desired objective.
- ✓ Management of the random access memory: The operating system is responsible for managing the memory space allocated to each application and, where relevant, to each user. If there is insufficient physical memory, the operating system can create a memory zone on the hard drive, known as "virtual memory". The virtual memory lets you run applications requiring more memory than there is available RAM on the system. However, this memory is a great deal slower.
- ✓ Management of input/output: The operating system allows unification and control of access of programs to material resources via drivers (also known as peripheral administrators or input/output administrators).
- ✓ Management of execution of applications: The operating system is responsible for smooth execution of applications by allocating the resources required for them to operate. This means an application that is not responding correctly can be "killed".
- ✓ Management of authorizations: The operating system is responsible for security relating to execution of programs by guaranteeing that the resources are used only by programs and users with the relevant authorizations.
- ✓ File management: The operating system manages reading and writing in the file system and the user and application file access authorizations.
- ✓ Information management: the operating system provides a certain number of indicators that can be used to diagnose the correct operation of the machine.
- ✓ Job Management: The OS manages the jobs waiting to be processed. It recognizes the jobs, identifies their priorities, determine whether the required main and secondary memory are available or not and schedules and runs each job at appropriate moment.

CLASSIFICATION OF OPERATING SYSTEM

Operating system can be classified as follows.

- ✓ Multi-user
  - o Allow two or more users to run programs at the same time.
  - o Some even permit thousands of concurrent users.
  - o E.g. MVS (Multiple Virtual Storage used in mainframe),UNIX

- ✓ Multi-processing
  - o Multi-processing is a technique that involves operating several processors in parallel to obtain a higher calculation power than that obtained using a high-end processor or to increase the availability of the system.
  - o Uses SMP (Symmetric Multiprocessing) in which all processors access the same shared memory.
  - o Enables several programs to run concurrently
  - o A multiprocessor system must be able to manage memory sharing between several processors but also to distribute the work load.

- ✓ Multi-tasking
  - o allows more than one program to run concurrently
  - o only one CPU is involved unlike multiprocessing
  - o two basic types of multitasking
    - ▪ Preemptive
    - ▪ Cooperative
  - o In preemptive multitasking, the operating system parcels out CPU time slices to each program. Preemptive multitasking moves the control of the CPU to the OS, letting each process run for a given amount of time (a time slice) and then switching to another task. This method prevents one process from taking complete control of the system and thereby making it seem as if it is crashed. This method is most common today, implemented by among others OS/2, Win95/98, WinNT, Unix, Linux, BeOS, QNX, OS9 and most mainframe OS. The assignment of CPU time is taken care of by the scheduler.
  - o In cooperative multitasking, each program can control the CPU for as long as it needs it. If a program is not using the CPU, it can allow another program to use it temporarily. This method is not good since it lets one process monopolize the CPU and never let other processes run. This way a program may be unwilling to give away processing power in the fear of another process hogging all CPU-time. (Microsoft Windows 3.x and MultiFinder for Macintosh)

- ✓ Multi-threading
  - o An operating system is known as multi-threaded when several "tasks" (also known as processes) may be run at the same time.
  - o Is the ability of an OS to execute different parts of a program, called threads, simultaneously
  - o The applications consist of a sequence of instructions known as "threads". These threads will be alternately active, on standby, suspended or destroyed, according to the priority accorded to them or may be run simultaneously.

- ✓ Real Time
  - o Real time systems, used mainly in industry, are systems designed to operate in a time-constrained environment.
  - o An RTOS operates reliably according to specific time constraints
  - o An RTOS facilitates the creation of a real-time system, but does not guarantee the final result will be real-time; this requires correct development of the software.
  - o An RTOS provides facilities which, if used properly, guarantee deadlines can be met generally (soft real-time) or deterministically (hard real-time).
  - o An RTOS will typically use specialized scheduling algorithms in order to provide the real-time developer with the tools necessary to produce deterministic behavior in the final system.
  - o An RTOS is valued more for how quickly and/or predictably it can respond to a particular event than for the given amount of work it can perform over time.
  - o
  - o used in industrial robots, spacecraft, industrial control, scientific research equipment, space navigation, rocket launching
  - o e.g. OS-9; RTLinux (RealTime Linux); QNX; VxWorks.