

Operating System: A Survey

¹S.V. Sangeetha, ²S.Saranya and ³N. Kanimozhi,

^{1,2}Scholars, ³Assistant Professor,

^{1,2,3}IT Department, Shri Krishna College of Arts and Science College, Coimbatore, India.

Abstract- Operating System becomes increasingly ever-present. In today's world, without OS nothing is possible because everything is managed by the OS, even in smart phones too. Operating System comprises of Top-down layered approach, in which the Top layer providing the easier interface to the user that interacts with the system. The actual work of Operating system is to control all executions and manage CPU, Memory, I/O devices, etc. Operating system demonstrates the power of providing a common set of services to wide area applications including the mechanisms for naming persistent storage, remote process execution, resource management, authentication and security.

Keywords- System Software; Kernel; Multi-Tasking; Virtual Memory; Communication medium; Operating System in Security issues.

I. INTRODUCTION

An operating system is the System software that maintains both the Computer hardware and system software. In the computer system it is the essential component for the system software. An operating system also called as "OS" is the program that, after initially getting loaded into the computer by the boot program, manages all the other programs in the computer. The other programs are also called as applications or application programs [3]. Operating System is essential to manipulate the Application Programs. The operating system is meant for the interface between the user and the hardware of the computer system. It is considered as the backbone of a computer. Each and Every desktop computers, tablets, and smart phone includes an operating system that provides the basic functionality for the device [6]. Operating system basically allocates schedule for each process to run by means of processor time, mass storage, printing, and other resources for Time sharing. Examples of popular modern operating systems include Android, BlackBerry, IOS, Linux, Microsoft Windows[1].

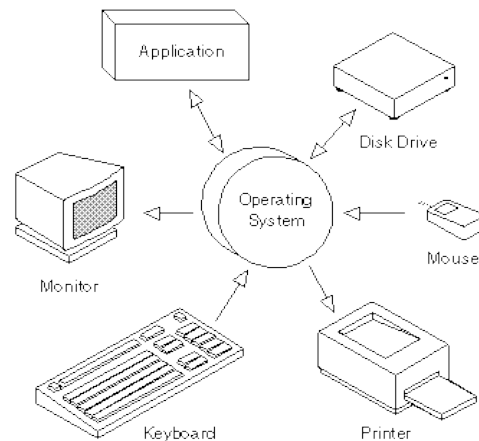


Figure 1: OS That Does Multiple Access

II. TYPES OF OPERATING SYSTEMS

Broadly speaking, there are following types of operating systems, such as batch and multi processing OS, distributed OS, embedded OS, real time OS and library OS.

A. Batch and multiprocessing OS

A Batch processing system can run only one program at a time where as Multi processing program can run more than one program at a time concurrently. This is achieved by TIME SHARING, dividing the available processor time between multiple processes which are each interrupted repeatedly in time-slices by a task scheduling subsystem of the operating system [1]. Multi-tasking can also be characterized in pre-emptive and co-operative types [4].

B. Distributed OS

A distributed OS that handles a group of distinct computers and makes them appear to be a single computer. The development of networked computers that could be linked and communicate with each other

gave rise to distributed computing. Distributed computations are carried out on more than one machine. When the computers in a group works in cooperation, leads to distributed system[1].

C. Embedded OS

A Embedded OS are designed for operating on small machines like PDAs with less autonomy. They have the capacity to operate with a limited number of the resources. Windows CE and Minix3 are some examples of embedded operating systems [1].

D. Real-time OS

A Real time OS guarantees to process events or data within a certain short amount of time. A real-time operating system can either be single or multi-tasking, but if Multi-tasking it uses specialized scheduling algorithms so that a deterministic nature of behavior is achieved. An event-driven system switches between task which is based on their priorities or external events whereas time-sharing operating systems switch tasks based on clock interrupts [1].

III. COMPONENTS OF OPERATING SYSTEM

The components of an operating system exists that makes the different parts of a computer work together. All user software needs to undergo the operating system in order to use any of the hardware, whether it may either be as a mouse or keyboard (or) as complex as an Internet component. Some of the components are:

A. Kernel

With the help of the firmware and device drivers, the kernel provides the most basic level of control over all of the computer's hardware devices. It handles memory access for programs in RAM, so that it determines which programs get access to which of the hardware resources, it either sets up or resets the CPU's operating states for the ideal operation at all the times, and it organizes the data for the long-term non-volatile storage with the file systems on such media as disks, tapes, flash memory, etc. A kernel that connects the application software to the hardware of a computer is represented in fig2.

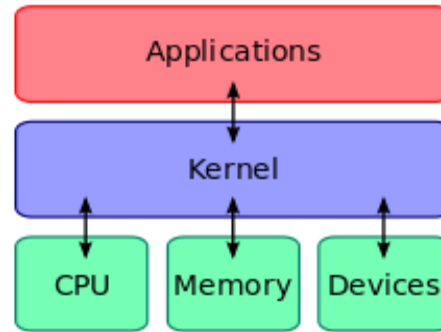


Figure 2: Kernel with Application Software And Hardware

B. Program execution

The OS provides an interface between application program and the computer hardware, so that an application program would interact with the computer hardware only by obeying the rules and then procedures programmed into the OS. The OS is a set of services which simplifies the development and execution of application programs. Executing an application program involves the creation of a process by the operating system kernel which assigns memory space and other resources, and which establishes a priority for the process in multi-tasking systems, loads program binary code into memory, and initiates execution of the application program which then interacts with the user and with hardware devices[1]. Based on the priorities each and every program gets executed in order to avoid the deadlock condition. The Deadlock condition occurs when there is no availability of resources.

C. Interrupts

Interrupts are also said to be Request. Request-based programming is directly supported by most of the modern CPUs. When an interrupt is being received, the computer's hardware automatically suspends whatever program is currently running, saves its status in the process control block, and runs for the request based on the priority of interrupt. In modern operating systems, interrupts are handled by the operating system's kernel. Interrupts may come from either the computer's hardware or from running the program [1]. The volume of code being run depends on the priority of interrupts. The processing of the hardware interrupts is the task that is usually represented to software called as the device driver, which might be the part of the operating system's kernel, or part of another program, or both.

D. Modes

Contemporary CPUs support multiple modes of operation. CPU's with such capabilities use at least two modes: such as protected mode and supervisor mode. The supervisor mode is used by the kernel for low level tasks that need an unrestricted access to the hardware, such as controlling how the memory is written and can be erased, and communication with the devices like graphics cards. The Protected mode is used for applications to operate within the mode, and can only use the hardware by interacting with the kernel, which manages everything in the supervisor mode. Once when a computer first starts up, it automatically starts running in supervisor mode. In protected mode, programs may have an access to a more finite set of the CPU's instructions. A user program may leave protected mode only by the events of an interrupt, causing the control to pass back to the kernel. Privilege rings for the x86 available in protected mode.

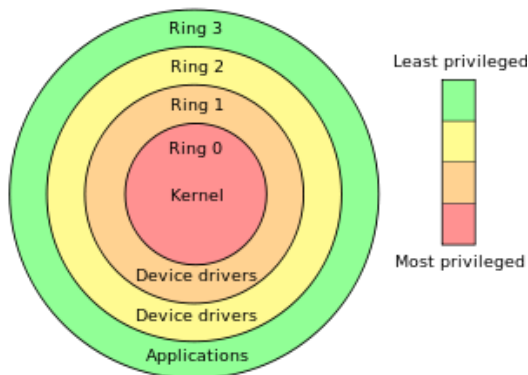


Figure 3: Which Process Runs In Each Mode

E. Memory management

A multiprogramming operating system kernel should be responsible for maintaining all system memory which is currently in use by programs. Since programs time share, each program must have independent access to memory [1]. It manages the sharing of internal memory among multiple applications [3]. Protection of Memory enables the kernel to limit a process' that gets access to the computer's memory. Various methods of memory protection exist, including memory segmentation and paging. In both segmentation and paging, certain protected mode registers specify to the CPU what memory address it should allow a running program to access [1].

F. Virtual memory

The use of virtual memory addressing (such as paging or segmentation) means that the kernel can pick what memory each program can use at any of the given time, allowing the OS to use the same memory place for multiple tasks. Under UNIX such kind of interrupt is being referred to as a page fault. When the kernel finds the page fault it modifies the virtual memory range of the program that events it, consenting it access to the memory requested. In modern OS, memory which is accessed with less frequently can temporarily be stored on the disk or the other media to make that space available for the usage of the other programs. This is called as swapping, as an area of memory can be accessed by multiple programs, and that memory area contains can be swapped [1]. "Virtual memory" provides the programmer or the user with the perception that there is a much larger amount of RAM in the computer than which is really there [7].

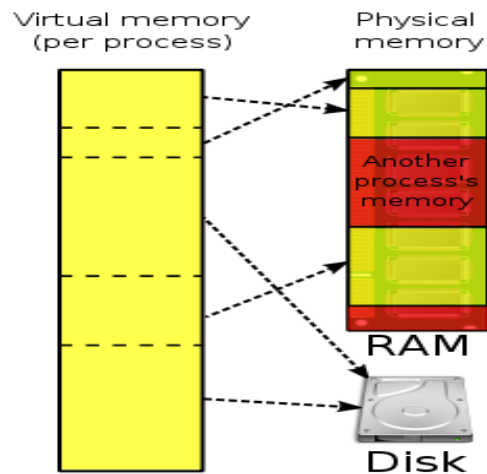


Figure 4: Virtual Memory .

G. Multitasking

Multitasking refers to the running of multiple self standing computer programs on the same computer; giving the appearance that is performing the tasks at the same time. Since most computers can do maximum one or two things at one time, this is collectively done via time-sharing. An OS kernel contains a scheduling program that determines how much time each process spends executing, and in which order execution control should be passed to the programs. Control is being passed to a process by the kernel that allows the program access to the CPU and

memory. Later, control is returned to the kernel by some of the mechanism, so that another program may be allowed to use the CPU. This is so-called passing of control between the kernel and applications is called as a context switch. Modern operating systems extend the concepts of application preemption to device drivers and kernel code, so that the operating system has preemptive control over the internal run-times.

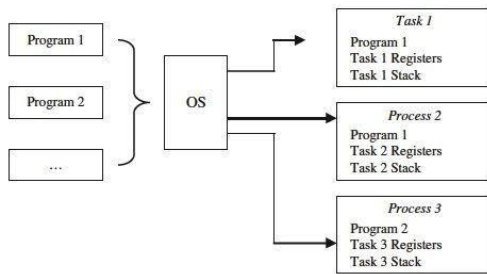


Figure 5: Multitasking.

H. Disk access and file systems

The File system allows the users and programs to organize and sort files on the computer, mostly through the use of directories. The specific way in which the files can be stored on a disk is called a file system, and enables files to have the names and attributes. An OS such as UNIX supports a enormous array of storage devices, which allows them to be accessed through the common application programming interface (API). The device driver understands the specific language of the drives and is able to translate that language into a standard language used by the OS to access all the disk drives. Programs can then deal with these file systems on the basis of the filenames, and directories/folders, contained in a hierarchical structure. They can create, delete, open, and close files, as well as gather various information about them, including access permissions, size, free space, and creation and modification dates too[1].

IV. TYPES OF SCHEDULERS

Schedulers are often special system software which manages the process scheduling in different ways. Their main working objective is to select the jobs to be handed into the system and to decide which process to run. Schedulers are comprised of three types [7]

- Long Term Scheduler

- Short Term Scheduler
- Medium Term Scheduler

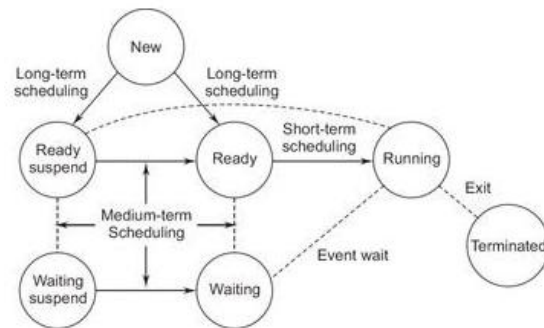


Figure 6: Process Of Scheduling

A. Long Term Scheduler

Long Term Scheduler, which is also called job scheduler, determines which programs are submitted to the system for processing. Their main objective is to provide a balanced mix of jobs, such as I/O and processor bounds and controls the degree of multiprogramming. When process is changed from new to ready state, then there is use of long term scheduler [7].

B. Short Term Scheduler

The Short Term Scheduler (CPU scheduler), is increasing system performance in accordance with the chosen set of criteria. It changes ready state to the running state of the process. Short term scheduler ,which is also known as dispatcher, executes frequent and fine grained decision of which process to execute next and faster than long term scheduler.[7]

C. Medium Term Scheduler

Medium term scheduler consists of a part of the swapping, which removes the processes from the memory and reduces the degree of multiprogramming. Running process is made suspended, if it makes an I/O request .By the swapping process, the suspended process or rolled out process are removed from memory and make space for other process and moved to the secondary storage. [7]

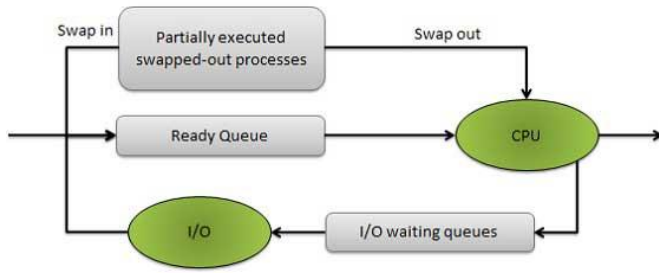


Figure 7: Swapping Process

V. THREAD

A thread a light weight process ,is a flow of execution through the process code ,with its own program counter, system registers and stack. Threads provide a way to improve application performance through parallelism. Each thread belongs to exactly one process and no thread can exist outside a process [7].

A. Types of Thread

Threads are implemented in following two ways

User Level Threads – It is also known as User-managed threads. The thread library contains creation of code and destruction of threads, by message passing and data passing between threads, for scheduling thread execution and for saving and restoring thread contexts. This application begins with a single thread and begins running in there.[7]

Kernel Level Threads - Operating System manages the threads acting on kernel, which is an operating system core. All of the Kernel Level threads within an application are supported within a single process and are generally slower to create and manage than the user threads.[7]

VI. NETWORKING

Most of the operating systems supports the variety of networking protocols, hardware, and applications for using them at present. This means that the computers that runs different operating systems can even participate in a common network for sharing the resources such as computing, files, printers, and scanners using either wired or wireless connections. Client/server networking allows the program on a computer, called a client, to connect via a network to

another computer, called a server. Servers offers(or host) various services to the other networks computers and users. These services are habitually provided through the ports or numbered access points beyond the server's network address. Each port number is generally associated with the maximum of one running program, which is responsible for handling the requests to that port

VII. SECURITY

The operating system is also responsible for *security*, making sure that the unauthorized users should not be permitted to access the systems [4]. An OS also has the vital role to play in security issues. Its job includes the prevention of the unauthorized users from the accessing of the computer system [5]. The OS must be capable of distinguishing between the interrupts that could be allowed to be processed, and the remaining which should never be processed. External security involves a request from outside the computer, such as a login at a connected console or some kind of network connection. Network services includes the offerings such as the file sharing, print services, email, web sites, and file transfer protocols (FTP), most of which can be compromised security. At the front line of security are hardware devices known as firewalls or intrusion detection/prevention systems. At the operating system level, there are number of software firewalls available, as well as intrusion detection/prevention systems. Most modern operating systems include a software firewall, which is enabled by default. Internal security is especially relevant for multi-user systems.

CONCLUSION

Operating System, in its current attractive form empowers users of all the ages, as well as all kinds of businesses and more specialized, productive and engineer/constructive areas of work. It has a mass market, on a global scale, getting enlarged year by year. Currently, Computer interfaces are based upon its visual aspects for users to handle and understand it and perhaps designers and developers gain success in this regard, for there will be no return to text-base interface/system. On concluding, the belief that, the computer is here to stay, and therefore it will require an OS, the OS represent the persona of the computer and its persona will continue to evolve and evolve and our expectation grows and by Gordon Moore's Law,

bearing the silicon chip in mind, about every two years , the expected dramatic changes with an equal dramatic rein on cost.[8]

References

- [1]. Stallings (2005). Operating Systems, Internals and Design Principles. Pearson: Prentice Hall. p. 6.
- [2]. Dhotre, I.A. (2009). Operating Systems. Technical Publications. p. 1.
- [3]. <http://whatis.techtarget.com/definition/operating-system-OS>
- [4]. http://www.webopedia.com/TERM/O/operating_system.html
- [5]. <http://www.wisegeek.org/what-is-an-operating-system.htm>
- [6]. http://techterms.com/definition/operating_system
- [7]. http://www.tutorialspoint.com/operating_system
- [8]. <http://lawoflaws.com/uni/tmo3/Tma03WebRePort.htm>