Chapter

6

OPERATING SYSTEM

Introduction:

An Operating System (OS) is an interface between computer user and computer hardware. An operating system is software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Some popular Operating Systems include Linux, Windows, OS X, VMS, OS/400, AIX, z/OS, etc.

6.1 Definition of operating system

An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.
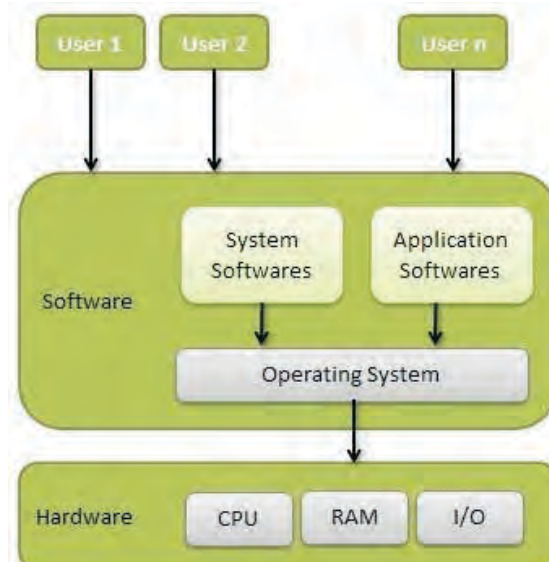

Fig 6.1 Operating System

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6.1.1 Services provided by operating System

An Operating System provides services to both the users and to the programs.

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

Following are a few common services provided by an operating system

- Program execution
- I/O operations
- File System manipulation
- Communication
- Error Detection
- Resource Allocation
- Protection

6.1.1.1 Program execution

Operating systems handle many kinds of activities from user programs to system programs like printer spooler, name servers, file server, 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 operating system with respect to program management

- Loads a program into memory.
- Executes the program.
- Handles program's execution.
- Provides a mechanism for process synchronization.
- Provides a mechanism for process communication.
- Provides a mechanism for deadlock handling.

6.1.1.2 I/O Operation

An I/O subsystem comprises of I/O devices and their corresponding driver software. Drivers hide the peculiarities of specific hardware devices from the users.

An Operating System manages the communication between user and device drivers.

- I/O operation means read or write operation with any file or any specific I/O device.

- Operating system provides the access to the required I/O device when required.

6.1.1.3   File system manipulation

File manipulation refers to wide variety of operations which are available and allow us to delete ,copy, move. As we know a file represents a collection of related information. Computers can store files on the disk (secondary storage), for long-term storage purpose. Examples of storage media include magnetic tape, magnetic disk and optical disk drives like CD, DVD. Each of these media has its own properties like speed, capacity, data transfer rate and data access methods.

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

- Program needs to read a file or write a file.
- The operating system gives the permission to the program for operation on file.
- Permission varies from read-only, read-write, denied and so on.
- Operating System provides an interface to the user to create/delete files.
- Operating System provides an interface to the user to create/delete directories.
- Operating System provides an interface to create the backup of file system.

6.1.1.4   Communication

In case of distributed systems which are a collection of processors that do not share memory, peripheral devices, or a clock, the operating system manages communications between all the processes. Multiple processes communicate with one another through communication lines in the network.

The OS handles routing and connection strategies, and the problems of contention and security. Following are the major activities of an operating system with respect to communication

- Two processes often require data to be transferred between 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.

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6.1.1.5 Error Detection

Errors can occur anytime and anywhere. An error may occur in CPU, in I/O devices or in the memory hardware. Following are the major activities of an operating system with respect to error Detection

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

6.1.1.6 Resource Management

In case of multi-user or multi-tasking environment, resources such as main memory, CPU cycles and files storage are to be allocated to each user or job. Following are the major activities of an operating system with respect to resource management

- It acts like a resource manager. The OS manages all kinds of resources using schedulers.
- CPU scheduling algorithms are used for better utilization of CPU.

6.1.1.7 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 users to the resources defined by a computer system. Following are the major activities of an operating system 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.

6.2 Types of Operating Systems

Operating systems are there from the very first computer generation and it keep evolving with time. In this chapter, we will discuss some of the important types of operating systems which are most commonly used.

6.2.1 Batch operating system

The users of a 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

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needs are batched together and run as a group. The programmers leave their programs with the operator and the operator then sorts the programs with similar requirements into batches.

The problems with Batch Systems are as follows

- Lack of interaction between the user and the job.
- CPU is often idle, because the speed of the mechanical I/O devices is slower than the CPU.
- Difficult to provide the desired priority.

6.2.2 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. 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. Computer systems that were designed primarily as batch systems have been modified to time-sharing systems. Advantages of Timesharing operating systems are as follows

- Provides the advantage of quick response.
- Avoids duplication of software.
- Reduces CPU idle time.

Disadvantages of Time-sharing operating systems are as follows ?

- Problem of reliability.
- Question of security and integrity of user programs and data.
- Problem of data communication.

6.2.3 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 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, computers, and so on.

The advantages of distributed systems are as follows

- With resource sharing facility, a 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.

6.2.4 Network operating System

A Network Operating System runs on a server and provides the 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 include Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD.

The advantages of network operating systems are as follows

- 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 as follows

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

6.2.5 Real Time operating System

A real-time system is defined as a data processing system in which the time interval required to process and respond to inputs 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. A real-time operating system must have well-defined, fixed time constraints, otherwise the system will fail.

For example, Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc.

6.3 Difference between DOS And Windows Operating System

Disk Operating System abbreviated as DOS is a product of Microsoft Corporation released in 1981 and it comes as part-and-parcel with Microsoft Windows operating system.To get to DOS prompt and give commands for performing tasks on files and directories,

Click Start > Run… and type command or cmd and press ENTER.

Windows is a series of most popular operating systems developed by Microsoft for use on personal computers. First edition of Windows that runs on MS-DOS 5.0 was released in 1985, as a 16-bit OS. Of all the editions of Windows OS released by Microsoft Corporation from 1985 till date, the popular ones include Windows 98, Windows 2000 Professional, Windows XP, Windows Vista and Windows 7,Windows8,Windows10 Coming to differences, here are 5 basic ones that differentiate DOS and Windows:

DOS	Windows
Single user	Multi User
Single tasking	Multi tasking
Not time Sharing	Time sharing
Input device keyboard	Standard Input devices are keyboard and mouse
Character User Interface (CUI)	Graphical User Interface (GUI)

6.4 Linux

Linux is one of popular version of UNIX operating System. It is open source as its source code is freely available. It is free to use. Linux was designed considering UNIX compatibility. Its functionality list is quite similar to that of UNIX.

6.4.1 Basic Features

Following are some of the important features of Linux Operating System.

- **Portable :** Portability means software can works on different types of hardware in same way. Linux kernel and application programs supports their installation on any kind of hardware platform.

- **Open Source :** Linux source code is freely available and it is community based development project. Multiple teams work in collaboration to enhance the capability of Linux operating system and it is continuously evolving.
- **Multi-User :** Linux is a multiuser system means multiple users can access system resources like memory/ ram/ application programs at same time.
- **Multiprogramming :** Linux is a multiprogramming system means multiple applications can run at same time.
- **Hierarchical File System :** Linux provides a standard file structure in which system files/ user files are arranged. Files and directories are arranged in tree structure form
- **Shell :** Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs. etc.
- **Security :** Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data.

6.5 Computer Security

Computer security is the process of preventing and detecting unauthorized use of our computer. Prevention measures help us to stop unauthorized users (hackers) from accessing any part of our computer system. Detection helps us to determine whether or not someone attempted to break into our system, if they were successful, and what they may have done.

Our computers have become an extension of everything we do from banking and investing to shopping and communicating with others through email or chat. We may not consider our communications "top secret," most likely we do not want strangers reading our email, using our computer to attack other systems, sending forged email from our computer, or examining personal information stored on our computer.

Hackers do not care about our identity. Often they want to gain control of our computer so they can use it to launch attacks on other computer systems. Having control of our computer gives the hackers the ability to hide their actual location as they launch attacks, often against high-profile computer systems such as government or financial systems.

Hackers have the ability to watch all our actions on the computer, or cause damage to our computer by reformatting our hard drive or changing our data.

Internet Security is the most important aspect that everyone using the internet should understand. Here we are describing a few important tips to keep ourself secure and protect our Information from Security threats.

6.5.1 Latest Anti-virus software:

New viruses and threats are being discovered everyday and to cope with that we need to have a latest version of the Anti-virus software. Even to make our Version of Anti- Virus software effective, we need to update it with latest updates available. There are many Anti- Virus Software available, both free and paid.

6.5.2 Anti-Spyware Software:

Anti-virus software alone is not enough. To be secure from Internet Security threats we also need Anti-spyware software. Spyware programs are different from viruses in a way that unlike virus it does not alter the way in which our machines works or corrupt any data but it installs itself on our machine to send important data like passwords, Credit card numbers stored on your machine to its server. So in order to detect spyware programs & prevent one from getting into our machine we need latest Anti-spyware software.

6.5.3 Password protection :

Passwords are the most important aspect of various online accounts. They provide access to online accounts and enable us to perform various activities linked with account like shopping, emailing, online transactions etc. Keeping our password secure is like keeping money secure. Never keep same passwords for different accounts. Never keep password's that can be guessed or password relating to our personal's like telephone number, date of birth etc. Use long Password's consisting of both letters and digits and may be some special characters. Always Access Websites Related to our password directly by opening a new webpage and never through a link in email or provided otherwise.

6.5.4 Apply Latest Updates & Patches:

No software installed on our system is perfect for life. Apply the latest updates & patches to the software. These updates and patches are made available from time to time by the software manufacturer.

6.5.5 Firewall:

If possible try to Use a firewall to prevent hackers from attacking our system. Firewall blocks traffic not authorized to access our PC. Firewall enables us to access internet securely and prevent unauthorized applications and people from accessing our PC.

Exercise

1. Multiple Choice Questions:

1) An operating system is a
   a. Terminal
   b. Software
   c. Storage system
   d. Processor

2) The process of running multiple applications at the same time is known as
   a. Multi application
   b. Multi processing
   c. Multi programming
   d. Multi timing

3) It enables us to access internet securely and prevent unauthorized applications and people from accessing our PC.
   a. Anti-Virus
   b. Security
   c. Firewall
   d. None of these

4) The time taken by the system to respond to an input and display of required updated information is
   a. Response time
   b. Access time
   c. Output time
   d. Total time

5) Remote access to servers is possible from different locations in .
   a. Batch Processing System
   b. Time Sharing System
   c. Network Operating System
   d. Distributed system

2. Fill in the Blanks.

1) A _____ represents a collection of related _____.
2) _____System use multiple _____ processors to serve multiple real-time applications and multiple users.
3) _____ is the process of preventing and detecting _____ use of our computer.
4) _____provide access to _____ accounts and enable us to perform

various activities linked with account like shopping, emailing, online transactions etc.

5) _____ are used when there are _____ time requirements on the operation of a processor or the flow of data.

3. True/False

1) The time taken by the system to respond to an input and display of required updated information is termed as the **response time**.

2) Anti-virus software alone is enough to be secure from Internet Security threats.

3) An Operating System cannot manage the communication between user and device drivers.

4) Linux source code is freely available and it is community based development project.

5) The OS manages all kinds of resources using schedulers.

4. Very short Answers type questions:

1) An interface between computer user and computer hardware is call as......

2) What hides the peculiarities of specific hardware devices from the users.

3) A mechanism or a way to control the access of programs, processes, or users to the resources defined by a computer system is called as......

4) The process of preventing and detecting unauthorized use of our computer is called as......

5. Short answer type Questions:

1) What is an operating System?
2) List type of operating systems.
3) Explain real time operating system.
4) What are the functions of operating system? Make a list.
5) What do you mean by computer security?

6. Long Answer Type Questions:

1) Explain functions of operating system.
2) What are the basic features of Linux?

Answers Key

Questions	Multiple Choice	Fill in the Blanks	True or False	Very Short Answer
1	Software	File, Information	True	Operating System
2	Multi programming	Distributed, Central	False	Drivers
3	Firewall	Computer Security,Unauthorized	False	Protection
4	Response Time	Passwords, Online	True	Computer Security
5	Network Operating System	Real Time Systems, Rigid	True	