# Operating System

## 1.1  What is an operating system?

An operating system (OS) is a collection of system programs that together control

The operation of a computer system. Operating system must be installed in every

computer. Users interact with the computer through operating system. An operating

system is a program that act as an interface between the user of computer and the

hardware .the purpose of operating system is to provide and environment in which a user

may execute programs.

An *operating system* is a program that acts as an intermediary between a user

of a computer and the computer hardware.

The purpose of an operating system is to provide an environment in which a user

can execute programs. The primary goal of an operating system is thus to

make the computer system *convenient* to use.A secondary goal is to use the computer

hardware in an efficient manner.  In brief, an operating system is the set of programs

that controls  a computer.   Some  examples of operating  systems  are

UNIX,  Mach,  MS-DOS,  MS-Windows, Windows/NT, OS/2 and MacOS.

An operating system is an important part of almost every computer system.

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### 1.2 Computer system can be divided into three components.

A. Hardware

B. System programs

C. Application programs

## A. Hardware:

Hardware provides basic computing resources. It includes memory, CPU, arithmetic login unit, various storage devices, I/O, peripheral devices and etc.

## B. System programs:

System programs manage the use of hardware among various application programs for various users. System programs include operating system, compiler, loaders, and utilities.

## C .Application programs:

Application programs define the ways in which system resources are used to solve computing problems of the user. Application programs include database systems, business programs etc.

The operating system is the important component of the systems programs. Systems programs are directly executed on computer hardware.

It enables application programmers and other users to access the power of computer fully and efficiently.

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System programming is different from application programming.

It requires deeper knowledge of computer hardware. The system programs are often large

and complex.

## 1.3 Objectives of Operating Systems

- To hide details of hardware by creating abstraction.

- To allocate   resources to processes        (Manage resources).

- Provide a pleasant and effective user interface.

## 1.4 Role of operating-system

The hardware provides the basic computing resources in a computing system. The

application programs define the way in which these resources are used to solve

computing problems of the user.

The operating system controls and coordinates the use of the hardware among various

systems programs and application programs for various users.

The role of opening system can be defined in the following ways.

1. **Government:**

Operating system works as government .the basic resources of computing system are

provided by its hardware, software and data.

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## 2. Resources allocator:

A computer system has many resources. Each resource can be used to solve a problem. The operating system is responsible for managing the use of system resources.

## 3. Control program:

An operating system is a control program that prevents errors. The primary goal of an operating system is convenience for user. A secondary goal is the efficient operation of a computer system.

An operating system is a group of programs designed to serve two basic purposes.

1. To control the allocation and use of the computing system's resources among the various users and tasks.

2. To provide an interface between the computer hardware and the programmers. The programmer creates code, design and maintains application programs.

An effective operating system should accomplish all of the following tasks.

1. Facilitate creation and modification of program and data files through and editor program

2. Provide access to compilers to translate programs from high level languages to machine languages

3. Provide a loader program to move the compiled program code to the computer's memory for executions.

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4.  Take care of storage and device allocation.

## 1.5 Operating Systems Services

### Program Execution

The system must be able to load a program into memory and to run it. The program must

be able to end its execution, either normally or abnormally (indicating error).

### I/O Operations

A running program may require I/O. This I/O may involve a file or an I/O device.

### File System Manipulation

The output of a program may need to be written into new files or input taken From

some files. The operating system provides this service.

### Error Detection

An error is one part of the system may cause malfunctioning of the complete system.

To avoid such a situation the operating system constantly monitors the system

for detecting the errors.

## 1.6 Types of operating system according to user

There are two types of operating systems

- Single user operating system

- Multi user operating system

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## Single-user operating system?

We are all familiar with the concept of sitting down at a computer system and writing documents or performing some task such as writing a letter. In this instance there is one keyboard and one monitor that we interact with.

Operating systems such as Windows 95,   Windows 2000 professional windows xp and windows seven are essentially single user operating systems. They provide us the capability to perform tasks on the computer system such as writing programs and documents, printing and accessing files.

Consider a typical home computer. There is a single keyboard and mouse that accept input commands, and a single monitor to display information output. There may also be a printer for the printing of documents and images.
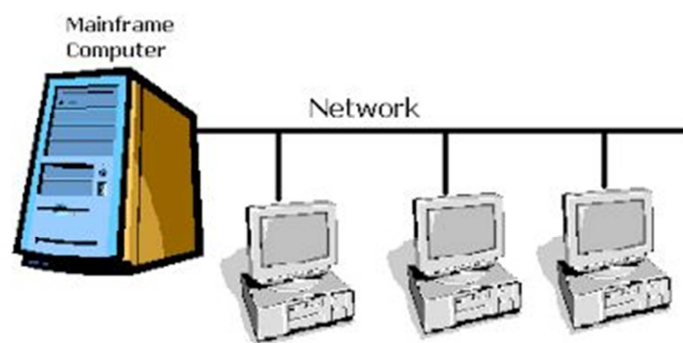
In essence, a single-user operating system provides access to the computer system by a single user at a time. If another user needs access to the computer system, they must wait till the current user finishes what they are doing and leaves.

## ▲What is a multi-user operating system?

A multi-user operating system lets more than one user access the computer system at one time. Access to the computer system is normally provided via a network, so that users access the computer remotely using a terminal or other computer.

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In the early days of large multi-user computers, multiple terminals (keyboards and associated monitors) were provided. These terminals sent their commands to the main multi-user computer for processing, and the results were then displayed on the associated terminal monitor screen.

Today, these terminals are generally personal computers and use a network to send and receive information to the multi-user computer system. Examples of multi-user operating systems are UNIX, Linux and mainframes.



The operating system for a large multi-user computer system with many terminals is much more complex than a single-user operating system. It must manage and run all user requests, ensuring they do not interfere with each other. Following are the most common multiuser operating system.

- Linux/UNIX

- MAC OS X

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- Red Hat Linux

- SUN UNIX

- Mainframe

  **Advantages/Disadvantages of Multiuser Operating Systems**

  **Advantages**

- Central location for the installation and administration of all software and data

- More cost effective - less expensive than multiple computers (PCs, Macs)

  **Disadvantages**

- Single source for possible problems

- Loss of individual user control of their own software, data, and peripherals

## 1.2 Mainframe systems:

Mainframe systems were used to solve commercial and scientific problems. Following is

the brief description of this type of systems.

## 1.2.1 Simple Batch Systems:

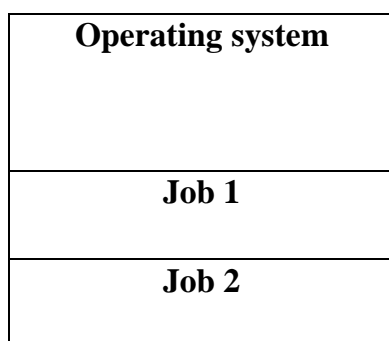Mohammad dawood Email:dawood.csf@gmail.com

The operating system of this system was simple. Its basic job was to transfer control automatically form one job to the next. The operating system was always resident in memory.

The user did not interact directly with computer system. The user prepared a job that considered of program, data and some control information and then submitted it to the computer operator for further processing. The memory contains operating system in one part and user program in other part. The user space can contain only one process at a time I batch system.

## 1.2.2 Multi –programmed systems:

A group of jobs that are ready to to be executed is called job pool. Since there is more than one job that can be executed, it is possible for the operating system to make a decision about Which job  to execute next.

That decision keeps CPU utilization as high as possible.

| **Operating system** |
| :---: |
| **Job 1** |
| **Job 2** |

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| |
|---|
| **Job 3** |
| **Job 4** |
| **Job n** |

In general it is not possible for a single user to keep CPU or I/O devices busy at all times.

Multiprogramming allows the system to increase CPU utilization by ensuring that the

CPU always has a job to execute.

In non multi programmed system if a job had to wait for an I/O operation CPU would

also have to wait until I/O was finished. The operating system must be able to perform

some sort of Scheduling on the jobs in job pool.

It determines which jobs will stay on the disk and which ones will be loaded into

memory.

The operating system must have some form of memory management.

Memory management is used to keep track of which jobs are stored where and how much

space is available.

## 1.2.3 Time Sharing systems

Time sharing system is a multi-user, multi-process and interactive system.

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It allows multiple users to share computer simultaneously. It is used when several users are linked through communication networks to a single computer. The computer first works on one user's task for a fraction of time. It then goes to the next user's task.

A time sharing system is very complex. It is more complex than a multiprogrammed system.

It may be achieved by using virtual memory.

Virtual memory is a technique that allows the execution of a job that may not be completely in the memory. UNIX, Linux, Windows NT server and windows 2000 sever are examples of time sharing systems.

## 1.3 personal computer systems

Computer hardware in the past has been very expensive. It is now possible for individuals to have separate machines as the hardware become cheaper.

Personal computers are primary designed for a single user environment .this is not too concerned with protection because only one user accesses the machine.

## 1.4 Multiprocessor System

Multiprocessing is a type of processing in which two or more processors work together to process more than one program simultaneously.

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It allows the system to do more work in a shorter period of time; UNIX is one of the most widely used multiprocessing systems.

Multiprocessor system is also known as parallel system or tightly-coupled system.

It means that multiple processors are tied together in some manner.

## Advantages of Multiprocessor Systems

Some advantages of multiprocessor system are as follows:

- **Reduced Cost:** Multiple processors share the same resources. Separate power supply or mother board for each chip is not required. This reduces the cost.

- **Increased Reliability**: The reliability of system is also increased. The failure of one processor does not affect the other processors through it will slow down the machine.

  If a processor fails, a job running that processor also fails. The system must be able to reachable the Failed job or to alert the user that the job was not successfully completed.

- **Increased throughput:** An increase in the number of processors completes the work in less time.

### 1.4.1Types of Multiprocessor systems

There are two main types of parallel processing

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### 1. Symmetric Multiprocessing

A method of processing in which multiple processors work together on the same task

is called symmetric multiprocessing. Symmetric multiprocessing treats all processors

equally. I/O can be processed on any processor.

The processors communicate with each other as needed.

Symmetric multiprocessing is easier to implement in operating systems.

### 2. Asymmetric Multiprocessing

A multiprocessing technique in which individual processors are dedicated to

particular tasks such as running the operating system or performing user requests is

called asymmetric multiprocessing .It has one master processor and remainder

processors are called slave. The master distributes tasks among the slaves.

I/O is usually done by the master only.

## 1.5 Distributed Systems

A system that distributes the computation among several physical processors is called

distributed system. It is known as loosely-coupled. It means that the processors do not

share Memory, or data structures. Each processor has its own local memory. It can only

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communicate with other processors through a communication line usually over a network.The processor in distributed system may vary in size, speed and function.

## 1.5.1 Advantages of Distributed Systems

The main advantages of building distributed systems are as follows.

- **Resource Sharing**

Each computer in the distributed system may have specific resources. Other machines may utilize its resources while being part of the distributed system.

- **Computation Speedup**

If a computation can be split up into sections, it is possible to give different sections to different machines. Communication is usually fairly expensive since the machines may not be physically close to each other.

- **Reliability**

It provides more reliability for different jobs. If one system fails, the other sites may be able to continue processing.

### 1.6 Clustered Systems

A clustered system uses multiple CPUs to accomplish a task. It is different from parallel system .that clustered system consists of two or more individual systems coupled together.

The clustered computers share storage and are closely linked via LAN networking.

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The clustered system can be of the following forms:

- **Asymmetric Clustering**:

In this form, one machine is in hot standby mode and other machine is running the application. The hot standby machine performs nothing. It only monitor the server .It becomes the active server if the sever fails.

**Symmetric Clustering:**

In this mode two or more machines run the applications.They also monitor each other at the same time. This mode is more efficient because it uses all available machines. It can be used only if multiple applications are available to be executed.

# 1.7 Real time systems

A real time system is a system that ensures the exact time requirements for a job.

If a real time system does not complete a task in a certain time, it may cause a breakdown of the entire system it is running.

**1.7.1 Types of Real time systems.**   There are two types of real time system.

1. **Hard Real Time System**

A hard real time system guarantees that a job will complete within a specified time period. This system must ensure that all dealys, processing, input and output are bounded.

2. **Soft Real time system**

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A soft real time system is much less restrictive version of hard real time system

A soft real time system does not guarantee that a job will complete within a specific time

period. However it tries its best to finish the job as soon as possible.

The lack of guarantee makes a soft real time system more limited in its application for

industrial activities. Soft real time systems are used in multimedia, virtual reality etc.

The operating system that provides soft real-time support is windows NT/2000 Linux,

Salaries.

## 1.8 Hand-held systems

Hand-held systems include a personal digital assistant or PDA. It is a remarkable    tiny,

fully functional computer that can be held in one hand.PDA can hold download

email and play music.

The small computer organizers were available in 1980s.  The idea of making hand-held

computer for storing addressing and phone numbers. Taking notes and keeping track of

daily appointment originated in 1990s. One of the first PDAs that were commercially

available was Apple computer's Newton Message pad. It was too big, expensive and

complicated.

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### Input and Output devices

Input and output devices are components that form part of the computer system. These devices are controlled by the operating system.

Input devices provide input signals such as commands to the operating system. These commands received from input devices instruct the operating system to perform some task or control its behavior. Typical input devices are a keyboard, mouse, door switch.

Output devices are instruments that receive commands or information from the operating system. Typical output devices are monitor screens, printers, speakers, alarm bells.

## Operating system utilities

the operating system consists of hundreds or thousands of lines of programs code that stored on hard disk. Portions of the operating system are loaded into computer system memory (RAM) when needed. Utilities are provided for

- Managing Files and Documents
- Development of Programs and Software
- Communicating between people and with other computer systems
- Managing user requirements for programs, storage space and priority

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## Utility programs

A utility program is a type of system software that is used for effective management of computer system. The user can use utility program to perform maintenance tasks related to different devices and program.

Most operating system include different built in utility programs.

The user can also buy stand-alone utility programs.

## Types of utility programs

Different types of utilities programs are as follows:

1. **File Manager**

   File manager is used to manage and view files in computer system.

   All operating systems provide file viewers. Windows explorer is an example of file viewer. Some important functions of file manager are as follows.

- Displaying a list of files

- Organizing files in folders

- Copying ,renaming,deleting,moving and sorting files and folders

- Creating shortcuts

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## 2. Image viewer

An image viewer is used to display ,copy and print the contents of a graphics file.the users can see images without opening them in paint or image editing program. Most operating system include image viewer.windows image viewer is called photo gallery. It is used to manage and edit photos in windows operating sytemt.

### 3. File compressor

File compressor is used to shrink the size of files. A smaller size of file makes it easier and  faster to send files over the internet . Winzip is an example of file compressor.

### 4. Diagnostic utility

Diagnostic utility is used to detect problems of hardware and software. However these utilities do not repair these problems. All operating system provide different diagnostic utilitites to manage the computer system

### 5. Disk  scanner

Disk scanner is used to detect physical and logical problems of disk. All operating systems provide disk scanners to manage computer disks.

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### 6. Antivirus

A type of software that is used to detect and remove viruses is called antivirus software. Antivirus program not only detects viruses from computer but also prevent new viruses form entering into the computer. Kaspersky and Norton are two most commonly used antivirus programs in windows operating system.

### 7. Disk Defragmenter

Disk Defragmenter software is used to reorganize the files on the disk. It manages the un-used space on the disk so that the operating system may use data more quickly.

### 8. Task manager utility

Windows task manager appears when the user press CTRL+ALT+DEL key.

It displays information about programs and processes running on the computer.

It also displays data about CPU and memory usage and user information.

### 9. Uninstaller.

An uninstaller is a utility program that removes an installed program from computer properly. The uninstaller deletes files and folders from the hard disk.

It also removers program entries from the system files. Operating systems usually provide an uninstaller.

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**10. Personal firewall**

Personal firewall is used to detect and protect a personal computer from unauthorized instructions. Built in personal firewall is automatically enabled when windows is installed.

# Operating System Interfaces

In addition, the operating system provides each user with an interface that accepts, interprets and executes user commands or programs. This interface is commonly called a SHELL or command line interpreter (CLI). In some systems this might be a simple text mode line-by-line entry using keywords (such as MSDOS or UNIX), in other systems it might be highly graphical for user to use like Graphical user interface (GUI)

# Difference between command line Interface and GUI

The difference between command line interface and GUI is as follows:

| Topic | Command line | GUI |
|-------|--------------|-----|
| Ease | It is difficult to use | It is easier to use |
| Control | It provides more control of file system and operating system | It provides less control of file system and operating system |

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| Multitasking | Some command line environment provide multitasking but it is difficult to view multiple things on one screen | GUI enables a user to easily view and manipulate multiple things at once. |
|---|---|---|
| Speed | Command line users need to use keyboards to execute commands. An advanced command line interface user can perform something faster than an advance GUI user. | GUI uses the mouse for most of the command . it is much slower than working in a command line environment. |
| Scripting | A command line interface enables a user to easily script a sequence of commands to perform a task or execute a program | GUI does not provide the facility to script a sequence of command. |

## A multi-tasking operating system

A multi-tasking operating system provides the ability to run more than one program at once. For example, a user could be running a word processing package, printing a document, copying files to the floppy disk and backing up selected files to a tape unit. Each of these tasks the user is doing appears to be running at the same time.

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A multi-tasking operating system has the advantage of letting the user run more than one task at once, so this leads to increased productivity. The disadvantage is that more programs that are run by the user, the more memory that is required.

## Various parts of an Operating System

In this section we look at that part of the operating system that is responsible for running programs, called the real-time executive or kernel.

An operating system for a large-scale computer that is used by many people at once is a very complex system. It contains many millions of lines of instructions (commands that the computer executes) written by programmers. To make operating systems easier to write, they are constructed as a series of modules (programs), each module responsible for one function. Typical modules in a larger multi-user operating system could be,

- Kernel (also known as the executive)

- Process manager

- Scheduler

- File manager

- **Kernel or a real-time executive**

  the core of all operating systems is called a REAL TIME EXECUTIVE (also known as the kernel). The kernel provides the most basic interface between the computer itself and

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the rest of the operating system. The kernel is responsible for the management of the

central processor.

Some of the main functions that it performs are as follows:

- switching between programs

- hardware device control and programming

- memory management

- process management

- scheduling (deciding what programs to run)

- inter-process communication

- processing of exceptions and interrupts

An operating system designed to handle a large number of people would need a real-time

executive that performs all of the above. User programs are generally stored on disk, thus

need to be loaded into memory before being executed. This presents the need for memory

management, as the memory of the computer would need to be searched for a free area in

which to load a person's program into. When the user was finished running the program,

the memory consumed by it would need to be freed up and made available for another

user when required.

Process scheduling and management is also necessary, so that all programs would be

executed and run fairly. There is no point if a program by a specific user runs to such an

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extent that it denies the running of any other programs, making every other user wait. In addition, some programs might need to be executed more frequently than others, for example, checking network communications or printing.

## A computer program

Programs are a series of instructions to the computer. When a software programmer (a person who writes programs to run on a computer system) develops a program, it is converted into a long list of instructions that is executed by the computer system.

In operating systems we talk more of a process (part of a program that is in some stage of execution) than a program. This is because in modern operating systems, only a portion of a program is loaded at any one time. The rest of the program sits waiting on a disk unit till it is needed. This saves memory space.

Processors execute computer programs. A processor is a chip in the computer that executes program instructions. Processors execute millions of instructions per second.

## How do operating systems run more than one program at once

some systems run only a single process at a time, other systems run multiple processes at once? Most computer systems are single processor based, and a processor can only execute one instruction at a time, so how is it possible for such a single processor system run multiple processes? The simple answer is that it doesn't. The processor of the

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computer runs one process for a short period of time, then is switched to the next process and so on. As the processor executes millions of instructions per second, this gives the appearance of many processes running at once.

## Co-operative and preemptive switching

in a computer system that supports more than one process at once, some mechanism must be used to switch from one task to another. There are two main methods used to perform this switching.

- **Co-operative switching** means that a task that is currently running will voluntarily give up the processor at some time, allowing other processes to run.

- **Preemptive switching** means that a running task will be interrupted (forced to give up) and the processor given to another waiting process.

The problem with co-operative switching is one process could hang and thus deny execution of other processes, resulting in no work being done. An example of a co-operative system was Windows 3.1

Pre-emptive scheduling is better. It gives more response to all processes and helps prevent (or reduce the number of occurrences of) the dreaded machine lockup. Windows NT workstation is an example of such as operating system.

## What is dispatcher?

Dispatcher is a program that actually gives control of CPU to a process selected by CPU Scheduler. It is another part of the scheduling system.

It will be noted that it takes time to save/restore the programs state and switch from one program to another (called **dispatching**). This action is performed by the kernel, and must execute quickly, because we want to spend most of our time running user programs, not switching between them.

The main functions of dispatcher modules are as follows:

- Switching context

- Switching to user mode

- Jumping to the proper location in the user program to restart it

## Context switching

When the processor is switched from one process to another, the state (processor registers and associated data) must be saved, because at some later data the process will be restarted and continue as though it was never interrupted. Once this state has been saved, the next waiting process is activated. This involves loading the processor registers and memory with all the previously saved data and restarting it at the instruction that was to be executed when it was last interrupted.

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- The process of switching from one process to another is called **context switching**. A time period that a process runs for before being context switched is called a **time slice** or **quantum period**.

# What is required to switch from one program to another?

This switching between user programs is done by part of the kernel. To switch from one program to another requires,

- a regular timed interrupt event (provided by a clock)
- saving the interrupted programs state and data
- restoring the next programs state and data
- running that program till the next timed interrupt occurs

The timed event is usually about 1 to 10 milliseconds apart and generated by a real-time clock. To save and restore program states requires hardware support, a feature supported by Intel processors.

# Interrupts

An interrupt is a hardware generated change of flow within the system. An interrupt handler deal with the cause of the interrupt. The control is then returned to the interrupted context and instructions.

# Common functions of Interrupts

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Each computer architecture has its own interrupt mechanism but they all have several functions in common. Below is a brief list of the common functions of interrupts.

- When an interrupt occurs, the control is transferred to the interrupt service routine.

- The interrupt architecture must save the address of the instruction that has been interrupted.

- An interrupt is generally caused by a hardware device.

- A trap is a software generated interrupt that either caused by an error or by a user request from an I/O operation.

- An operating system is interrupt driven

- The operating system must determine which type of interrupt has occurred.

- The operating system provides a segment of code that specifies what action is to be taken in the event of an interrupt.

## What is scheduling?

Deciding which process should run next is called **scheduling**, and can be done in a wide variety of ways.

Co-operative schedulers are generally very simple, as the processes are arranged in a ROUND ROBIN queue. When a running process gives itself up, it goes to the end of the queue. The process at the top of the queue is then run, and all processes in the queue move up one place.

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Pre-emptive scheduling uses a real-time clock that generates interrupts at regular intervals (say every 1/100th of a second). Each time an interrupt occurs, the processor is switched to another task. Systems employing this type of scheduling generally assign priorities to each process, so that some may be executed more frequently than others.

## First in First Out Scheduling

A FIFO queue is a list of available processes awaiting execution by the processor. New processes arrive and are placed at the end of the queue. The process at the start of the queue is assigned the processor when it next becomes available and all other processes move up one slot in the queue.

## Round Robin Scheduling

One of the problems with the FIFO approach is that a process may in fact take a very long time to complete, and thus holds up other waiting processes in the queue. To prevent this from happening, we employ a pre-emptive scheduler that lets each process run for a little while. When the time-slice is up, the running process is interrupted and placed at the rear of the queue. The next process at the top of the queue is then started

## 2.1 process

In this section we look at how the operating system manages the various programs or tasks that need to be run.

An operating system executes a variety of programs depending on the system .In batch system a program is called job. In time shared system it might be called a user program or task. A more precise definition of the term process is than "A process is a program in execution" A process is controlled and scheduled by operating system.

A process or task is a portion of a program in some stage of execution. A program can consist of several tasks.

Each process that runs in an operating system is assigned a process control block that holds information about the process, such as a unique process ID (a number used to identify the process), the saved state of the process, the process priority and where it is located in memory.

The process priority is used to determine how often the process receives processor time. The operating system may run all processes with the same priority, or it may run some processes more often that others. Processes that have been waiting a long time for execution by the processor may have their priority increased so that they will be more likely to be executed in the future.

### 2.1.1 process Attributes

A process has the following attributes:

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**A program counter:** is used to keep track of the address of the next instruction to be executed.

**A stack** is used to store temporary data for the process.

**A data section** : is used that may contain global variables

## 2.1.2 process states

Process state describes the nature of current activity in a process. As process executes its state changes. A process may be in one of the following states.

- New – the process is being created (it is not yet in memory)

- Running –the process has an instruction that is being executed

- Waiting (Blocked) – the process is waiting for some event to occur.

- Ready- the process is waiting to be executed

- Terminated- the process has finished execution and is no longer in memory.

## 2.1.3 A process control blocks

a process control block or PCB is a data structure (a table) that holds information about a process. Every process or program that runs needs a PCB. When a user requests to run a particular program, the operating system constructs a process control block for that program.

Typical information that is stored in a process control block is

- the location in memory of where the process is

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- the priority of the process

- a unique process identification number (called PID)

- the current process state (ready, running, blocked)

- associated data for the process

## How do processes inter-communicate?

Processes can intercommunicate by sending messages, data or code between them. A

process can use OS calls like send message () and get message () to exchange messages.

Two processes might want to co-operate in performing a particular task. For example a

process might want to print to document in response to a user request, so it starts another

process to handle the printing and sends a message to it to start printing.

There are other ways in which processes can communicate with each other, such as using

a shared memory space.

## 2.1.4 Process Management

A process is a program execution. A process needs certain resources, including CPU

time, memory, files and I/O devices in order to accomplish its task.

The operating system is responsible for the following activities in connection with

process management.

- Process creation

- Process deletion

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- Process suspension

- Process resumption

- Provision of a mechanism for process synchronization

- Provision of a mechanism for process communication

## 2.1.5 Process Synchronization

A cooperating process is one that can affect or be affected by the other processes executing in the system.Cooperating processes may either directly share a logical address space(that is, both code and data), or be allowed to share data only through files. The former case is achieved through the use of *lightweight processes or threads.  Concurrent access to shared data* may result in data inconsistency.

 In this lecture, we discuss various mechanisms to ensure the     orderl execution of cooperating processes that share a logical address space, so that data consistency is maintained.

## 2.1.6 Cooperating Processes

The concurrent processes executing in the operating system may be either

 independent processes  or cooperating processes.

A process is *independent if it cannot affect or be affected by* the other processes executing in the system. On the other hand, a process is *cooperating if it can affect or be affected by the other processes executing in the system.*

## DEADLOCKS

A process requests resources; if the resources are not available at that time, the process enters a wait state. It may happen that waiting processes will never again change state because the resources they have requested are held by other waiting processes. This situation is called a *deadlock.*

## Necessary Conditions

A deadlock situation can arise if the following four conditions hold Simultaneously in a system:

- Mutual exclusion

- Hold and wait

- No preemption

- Circular wait

## Methods for Handling Deadlocks

Principally, there are three different methods for dealing with the deadlock problem:

· We can use a protocol to ensure that the system will *never enter a deadlock state.*

· We can allow the system to enter a deadlock state and then recover.

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· Ignore the problem and pretend that deadlocks never occur in the system;

used by most operating systems, including UNIX

## Main memory management

Memory management is a process of optimizing the use of main memory.RAM is used to store data and instructions temporarily during execution. Operating system allocates memory area to perform different programs. The allocated memory area is de allocated when the program finishes.

Some operating systems allocate a part of storage medium like hard disk as additional RAM. A part of a running program can be in RAM and the remaining part may be on hard disk. This is known as virtual memory. The area of hard disk used for virtual memory is called swap file.  It is used to exchange data, information an instruction between memory and hard disk.

## The major activities of an operating system in regard to memory-management are:

- Keep track of which part of memory are currently being used and by whom.
- Decide which processes are loaded into memory when memory space becomes available.
- Allocate and deallocate memory space as needed

## Secondary Storage management

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Main memory or primary storage is volatile and too small to accommodate all data and programs permanently. The computer system must provide secondary storage to back up main memory. Most modern computer systems use disks as the principle storage medium for both programs and data.

The operating system is responsible for the following activities in connection with disk management.

- Free space management

- Storage allocation and de allocation

- Disk scheduling

# What is a thread?

A thread is a basic unit of CPU utilization. It is also called a lightweight process.

A thread is a separate part of a process. A process can consist of several threads, each of which execute separately. For example, one thread could handle screen refresh and drawing, another thread printing, another thread the mouse and keyboard. This gives good response times for complex programs. Windows NT is an example of an operating system which supports multi-threading.

**Thread consists of the following:**

- Thread ID

- Program counter

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- Register set

- Stack

A thread shares some things with its peer threads.

The things that it shares are:

- Code section

- Data section

- Any operating system resources, which are available to the task.

## Multithreading:

Multithreading is useful in programs such as web browsers where you may wish to download a file, view an animation and print something at the same time.

## Advantages of Multithreading

1. **Responsiveness**

   Multithreading approach increases responsiveness of the process. As a process consists of more than one thread, if one thread is blocked or busy in a lengthy calculation. Some other thread may still be executing .So the user gets more response from the executing process. For example a browser allows a user to interact with it while a file is being downloaded.

2. **Resource sharing :**

All threads of one process share the memory and resources of that process.

3. **Economy**

Allocation of memory and resources for process creation is costly.

## Types of Threads

Threads may be handled at different levels.

### 1. Kernel –level threads

Kernel-level threads are seen by the operating system and must be scheduled by

the operating system .one multithreads process may have multiple kernel threads.

### 2. User- level Threads

User level threads are not seen by operating system and are also very fast.

Switching from one thread to another in a single process does not require a context

switch.

## Multithreading models

Different multithreading models are as follows:

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### a. Many –to- one Thread

In many to one thread model, many user level threads are mapped to one kernel thread. It is efficient because it is implemented in user space.

### b. One –to-one Model

In this model each user thread is mapped to a kernel thread, each user thread requires a kernel thread which may affect the performance of the system.

This model is used by windows NT,winows 2000 etc.

### c. Many-to-many model

This model multiplexes many user level threads to a smaller or equal number of kernel threads. The number of kernel threads may be specific to either a particular application or a particular machine.

It is used by Solaris, etc.

## ▲What is a background and foreground process?

Multi-tasking systems support foreground and background processes (tasks). A foreground task is one that the user interacts directly with using the keyboard and screen. A background task is one that runs in the background (it does not have access to the screen or keyboard). Background tasks are usually used for printing. Windows NT Workstation and Windows 95/98 assign a higher priority to foreground tasks.

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## How does an Operating System load itself?

In this section we look at how the operating system loads when the computer is first turned on.

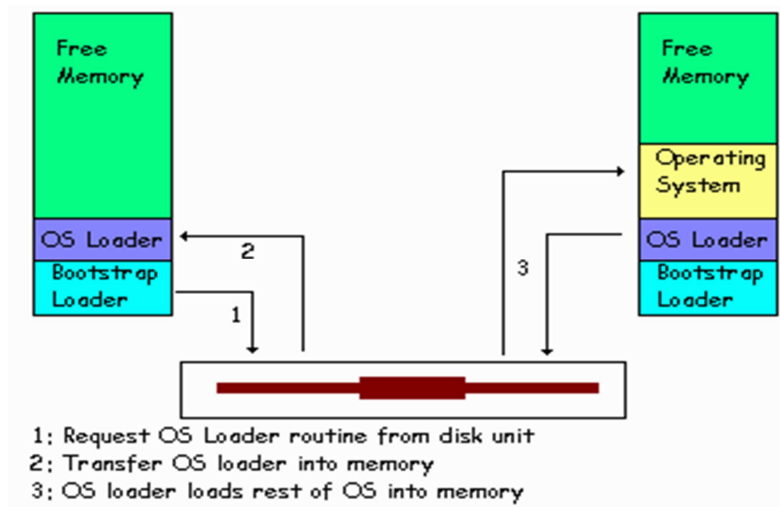The operating system may be loaded into the computer's memory in two ways.

- it is already present in ROM (so is permanent, immediately accessible and difficult to update)

- it is loaded from disk when the computer is turned on.

If the operating system is already present in ROM (for systems like industrial controllers, petrol pumps etc), it will gain control immediately the processor is powered on. This method is best suited for small appliances and hand held devices where the operating system is relatively simple and small.

For more complex systems, the operating system is usually stored on secondary media (such as disk), and is loaded into the computer memory (RAM) when the computer is powered on.

## ▲What is the BOOTSTRAP PROCESS?

The bootstrap process describes the task of initially loading the operating system from disk into RAM. A small routine stored in ROM, called the BOOTSTRAP LOADER or IPL (Initial Program Loader), reads a special load routine from the diskette.

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1: Request OS Loader routine from disk unit
2: Transfer OS loader into memory
3: OS loader loads rest of OS into memory

# ALL ABOUT FILE MANAGEMENT

In this section we take a brief look at how the operating system deals with files.

## ▲What is a file?

File is a collection of data that normally is stored on a secondary storage device such as a

hard disk or floppy diskette.

## ▲What are the typical operations performed on files?

An operating system must provide a number of operations associated with files so that

users can safely store and retrieve data.

Typical operations are

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Open

Close

Create

Copy

Rename

List

In addition, operations on single data elements within a file are supported by

Read

Write

Seek

## ▲What are File Control Blocks?

File control blocks (FCB), sometimes referred to as file descriptors, are data structures that hold information about a file. When an operating system needs to access a file, it creates an associated file control block to manage the file.

The structure of the file control block differs between operating systems, but most file control blocks include the following parts

Filename

Location of file on secondary storage

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Length of file

Date and time or creation or last access

## ▲What are file types?

File types refer to classifying the content of the file, such as a program, text file,

executable program or data file.

In Windows operating systems, the file type is derived from the filename extension.

Typical file types and their extensions are

| File Extension | File Type |
|---|---|
| .bas | basic source program |
| .c | c source program |
| .dll | system library |
| .doc | Word document |
| .exe | executable program |

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| .txt | text file |
|------|-----------|

Windows associates applications (programs) with specific file types. For example, the default application that opens to process a file of type .txt is the Notepad editor.

## ▲What is a root file system?

When the operating system is first installed, it creates a root file system on the disk that specifies how many sectors are available and how they will be allocated.

The root file system is a table of entries like a directory. In general, this is a fixed size, and once full, no more entries can be added.

Each entry can be either a file or another directory table. The following table depicts this structure.



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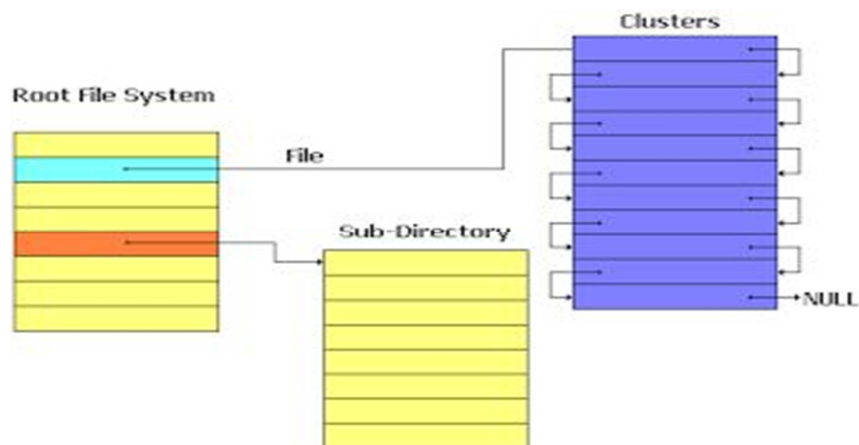
## ▲What does a root file system entry look like?

This is highly operating system specific, but an entry might look like,

Name of file

beginning cluster number

Length of file in bytes

Type of file

Creation date and last modified right

File permissions (an access control list)

## ▲What is a cluster?

To make things a little simpler than managing a large number of sectors, the operating system groups sectors together into a minimum allocation unit called a cluster. When a request to create a file occurs, the operating system allocates a cluster at a time until the all the data is stored.

## ▲What file systems are supported by Windows operating systems?

The Windows operating system supports the following file systems.

| FAT | The MS-DOS operating system introduced the File Allocation Table system of keeping |
|-----|-----|

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| | track of file entries and free clusters. |
|---|---|
| FAT32 | An updated version of the FAT system designed for Windows 98. It supports file compression and long filenames. |
| NTFS | Windows NT introduced the NT File System, designed to be more efficient at handling files than the FAT system. It spreads file tables throughout the disk, beginning at the center of the storage space. It supports file compression and long filenames. |

## ▲What are access-control lists and file permissions?

In multi-user operating systems, files may be accessed by multiple users. Permission rights associated with folders (directories) and files are used to protect or restrict access to files. In UNIX these rights are known as Read, Write and Execute. In Windows NT and Windows 2000 (using the NTFS file-system), additional file permissions are available.

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## ▲What is file-system integrity?

File-system integrity refers to whether the file-system contains errors. Sometimes this is caused by a user turning off the computer system without first shutting the computer down properly.

During the shutdown process, a flag can be written to the file-system. At startup, this flag can be detected, and if not present, means the computer system was not shut down correctly.

UNIX provides the fsck program to check the file-system. The Windows operating systems provide Scandisk or Chkdsk (check disk).

## ▲What is fragmentation and what does defragging a drive do?

When files are created and data written to the file, the operating system allocates space for the file from the free cluster list. Over a period of time, the clusters that are allocated to a file may no longer be sequential (contiguous or one after the after) but scattered over the disk.

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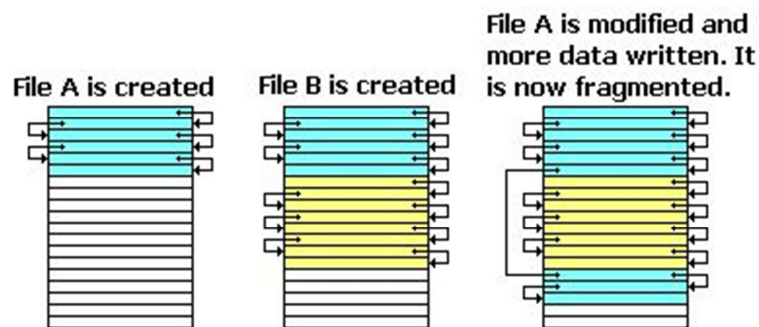
Why is this a problem? An operating system reads data from secondary storage in contiguous clusters more efficiently and faster than from non-contiguous clusters. Windows operating systems such as Windows 95/98 provide a defragmentation utility that scans the file system for fragmented files and moves them to a contiguous space. This results in faster loading and accessing of files.

## ▲SOFTWARE TOOLS

this section introduces you to some of the utilities associated with the development of programs. These program development tools allow users to write and construct programs that the operating system (or another) can run.

## ▲EDITORS

Editors are programs used to create documents. They provide facilities for

- Loading/Editing/Saving of source documents

- Change/Replace text strings, characters or words

- Find/Search for text strings, characters or words

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- Move/Copy/Delete blocks of text

Editors consist of two basic types, line based and screen based.

## Line Based Editors

The line based editor presents a single line for editing.  Standard facilities exist to perform search/find/replace/move items of text. These types of editors are cheap, provide a basic set of functions, and are reasonably small in terms of code size. A limited number of commands are offered that people can quickly learn. Examples of line-based editors are edlin and VI.

## Screen Based Editors

these provide a range of enhanced features, and editing is performed using the whole screen (multiple lines are shown at a time). The cursor may be moved in any of the four directions. Provision is made for scrolling the text when the cursor exceeds the boundary of the display window. Screen based editors are normally written for specific types of computers, and thus tend to be more costly, but provide a greater range of facilities, and can be more readily customized for particular applications (such as standard mail/form generation).

The screen editors may be command driven, where all functions to be performed are entered as commands on a single command line, or may be key generated, where pressing

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certain keys perform the desired function. Command driven editors tend to be the easiest and quickest to learn.

By displaying more than one line at a time, screen editors facilitate the speedy modifications required for source documents. Examples of screen-based editors are Notepad, WordPad, and Word 2000.

## ▲THE PROGRAM TRANSLATION SEQUENCE

In developing a software program to accomplish a particular task, the program developer chooses an appropriate language, develops the algorithm (a sequence of steps, which when carried out in the order prescribed, achieve the desired result), implements this algorithm in the chosen language (coding), then tests and debugs the final result. There is also a probable maintenance phase.

When you write a program in a source language such as Pascal  C or c++ the program statements (in the source text file) needs to be converted into the binary bit-patterns which make sense to the target processor (the processor on which the software will be run). This process of conversion is called translation.
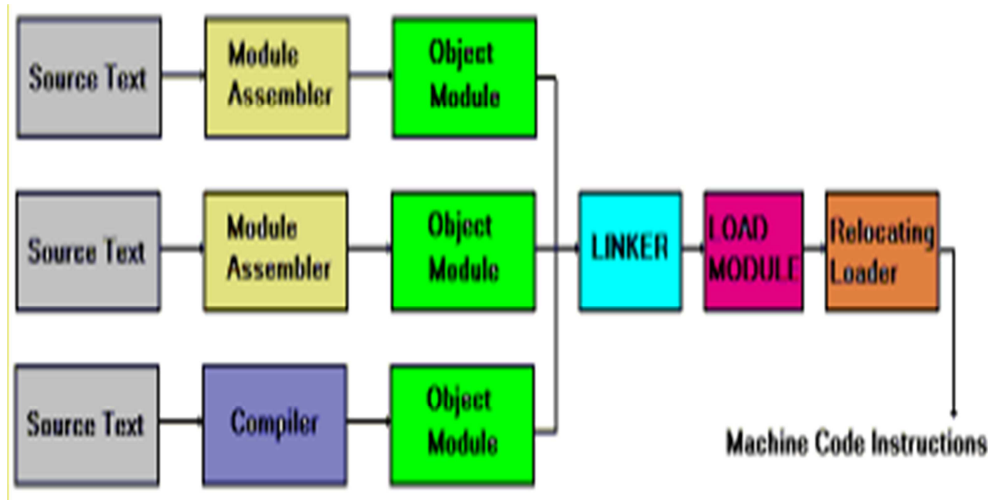
## ▲ASSEMBLERS

Assemblers are programs that generate machine code instructions from a source code program written in assembly language. The features provided by an assembler are,

- allows the programmer to use mnemonics when writing source code programs.

- variables are represented by symbolic names, not as memory locations

- symbolic code is easier to read and follow

- error checking is provided

- changes can be quickly and easily incorporated with a re-assembly

- Programming aids are included for relocation and expression evaluation.

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## What is an assembler mnemonic?

A mnemonic is an abbreviation for a machine code statement. During the translation

phase, each mnemonic is translated to an equivalent machine code instruction.

MOV AX, 0ffh

is translated to the binary bit patterns

10111000 (this means MOV AX)

11111111 (this is ff hexadecimal)

00000000 (this is 0)

## ▲WHAT IS AN INTERPRETER?

The source code program is run through a program called an interpreter. Each line of the

program is sent to the interpreter that converts it into equivalent machine code

instructions. These machine code instructions are then executed. The next source line is

then fetched from memory, converted and executed. This process is repeated till the

entire program has been executed.

Examples of interpreted languages are BASIC (Beginners All Purpose Symbolic

Instruction Code) and Java.

## ▲WHAT DOES A COMPILER DO?

Compilers accept source programs written in a high level language and produce object

code programs that are then linked with standard libraries to produce an executable file.

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Compilers generate code that is reasonably fast, but is target specific (it only runs on a particular computer system).

The source program is written using an editor. Most compiled languages do not use line numbers. The example on the right is a C program.

```
#include <stdio.h>
main {
        printf("Hello world\n');
        return 1;
}
```

Once the program has been written using the appropriate source statements, it is then passed to a compiler that converts the entire program into object code. The object code cannot be run on the computer system, so the object code file is then sent to a linker that combines it with libraries (other object code) to create an executable program. Because the entire program is converted to machine code, it runs very quickly.

## ▲WHAT DOES A LINKER DO?

The BASIC interpreter already has its own libraries for Input and Output (I/O), so BASIC programs don't need linking. The source program is converted directly into executable code.

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Compiled languages (as well as assembled) need both linking and loading. The output of compilers and assemblers are stored in an intermediate format called object code. This is stored as a file on disk. The object code must be combined with other object code files or libraries (special object code files) before execution.

The linker combines the programs object code with the runtime object code files (for handling files, screen output, the keyboard etc) into an executable format.

The types of files that exist at each phase of the program translation sequence are,

| | |
|---|---|
| myprog.c | source code program |
| myprog.obj | object code produced by compiler |
| myprog.exe | executable file produced by linker |

## ▲LOADERS

It is normally the responsibility of the Operating System to load and execute files. The part of the operating system that performs this function is called a **loader**.

### The absolute loader

There are two types of loaders, relocating and absolute. The absolute loader is the simplest and quickest of the two. The loader loads the file into memory at the location specified by the beginning portion (header) of the file, then passes control to the program.

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If the memory space specified by the header is currently in use, execution cannot proceed, and the user must wait until the requested memory becomes free.

**The relocating loader**

The relocating loader will load the program anywhere in memory, altering the various addresses as required to ensure correct referencing. The decision as to where in memory the program is placed is done by the Operating System, not the programs header file. This is obviously more efficient, but introduces a slight overhead in terms of a small delay whilst all the relative offsets are calculated. The relocating loader can only relocate code that has been produced by a linker capable of producing relative code.

A loader is unnecessary for interpreted languages, as the executable code is built up into the memory of the computer.

# WHAT ARE DEBUGGERS AND MONITORS?

A monitor is a small program that allows machine code access. A monitor provides,

- manipulation of memory
- manipulation of processor registers
- simple trace, single step, go commands
- breakpoints
- disk/tape i/o

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Debuggers provide much the same facilities as monitors, but generally provide a wider range of features,

- provision for HLL source debugging

- reference by symbols, module names and labels

- radix changing

- dynamic tracing of hardware interrupts

- Operating System calls and stack tracing

## ▲WHAT IS A CROSS ASSEMBLER?

Cross assemblers allow a programmer to develop machine code programs on one computer system for another system (target). In this way, a programmer can develop a machine code program for a Macintosh computer system using an IBM-PC. The cross-assembler running on the PC generates the machine code instructions necessary for the Macintosh.

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## Windows 2000 ,xp or seven File systems

Windows 2000,xp and seven systems can support the following file systems:

- FAT (File allocation table)

- FAT32

- NTFS - New Technology File System

- CDFS - Compact Disk File System

- UDF - Universal Disk Format for DVDs.

- EFS - Encrypting File System runs as a service and is used to encrypt and decrypt files on an NTFS file system for security purposes. The EFS is not a file system like NTFS since it does not create partitions and control the placement of file data, it only is used to control the encryption of data.

## FAT File system Characteristics

Used with DOS, it can only support partitions up to 4 G. No spaces are allowed in the file name.

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# FAT32 or VFAT File system Characteristics

VFAT - Virtual File Allocation Table introduced by Windows 95 which allows long file names. VFAT is not natively supported by Windows 2000.

- FAT32 file systems support partitions up to 32GB.

- Filenames up to 255 characters long.

- Filenames begin with a letter and exclude " / \ [ ] : ; | = , ^ * ?

- The last part is the extension but spaces can be used

- It supports file attributes used by DOS such as read-only, archive, system, and hidden.

FAT partitions provide no local security, only share level security across a network.

# NTFS File system Characteristics

Windows 2000 NTFS file systems are newer than Windows NT NTFS file systems. In order for Windows NT and Windows 2000 to use the Windows 2000 file system together, the Windows NT system must have service pack 2 or later installed.

\* Filenames up to 255 characters long

\* Filenames preserve case but are not case sensitive.

\* Filenames exclude " / \ < > : | * ?

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Supports built in file compression as a file attribute. Compression is applied to files in a folder if that folder has its compression attribute set. Also optionally sub folders and their contents may be compressed.

* Attribute, but if they are copied they will assume the compression attribute of the target folder.

* Provides automatic transaction tracking of disk activity for correcting corrupt or failed operations.

* Supports auditing.

* There is a recycle bin for each user.

* Windows 16 bit and DOS environments can't use this filesystem.

* A master file table is used to save individual file, boot sector, disk structure, and file recovery information.

* Provides file logging ability and file recovery.

* Maximum file or partition size of 16 exabytes.

* Supports file sharing with Macintosh clients.

* Supports file encryption with the Encrypting File System (EFS) on Windows 2000.

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    \* Allows volumes on remote computers or local computers to be mounted as though they are part of the same partition they are mounted on. This feature is available on Windows 2000.

    \* Disk quotas (tracking of disk space) on a user by user basis are tracked.

    \* Removable media formatted in NTFS can be changed and accessed without rebooting the system in Windows 2000 (not NT).

**CDFS**

The file system that supports compact disks (CDs) is the Compact Disk File System (CDFS).

**UDF**

The file system that supports DVDs is the Universal Disk Format (UDF).

## File systems and Windows Systems

| Operating System | NTFS | FAT32 | FAT | CDFS | UDF |
|---|---|---|---|---|---|
| Windows 2000 | Yes | Yes | Yes | Yes | Yes |
| Windows NT 4.0 | Yes | No | Yes | Yes | Yes |
| Windows NT 3.51 | Yes | No | Yes | Yes | No |

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| | | | | | |
|---|---|---|---|---|---|
| Windows 98 | No | Yes | Yes | Yes | Yes |
| Windows 95 | No | Yes | Yes | Yes | Yes |
| Windows 3,x | No | No | Yes | Yes | No |
| OS/2 | No | No | Yes | Yes | No |
| MS-DOS | No | No | Yes | Yes | No |

The FAT file system does not support file compression on Windows 2000 systems. The file compression utilities with Windows 95 and Windows 98 are not supported by Windows 2000.

FAT file systems may be converted to NTFS file systems using the command line convert utility. Once converted, they may not be changed back to FAT.

Windows 2000 contains an NTFS file defragmentation utility which Windows NT does not contain.

## Support for Security

Each object has an **Access Control List (ACL)** which defines users and group permissions for the object. Each entry **(ACE - Access Control Entry)** in an ACL defines the permissions a specific user or group has for the object. Access token attributes are added to the object's ACL. The user's **security identifier (SID)** is

compared to the contents of the ACL to determine if the user has the correct privileges to access the object.

The NTFS file system supports Access Control Lists for objects.

## Disk Tools

The Computer Management Console Tools, Storage section describes these tools in greater detail.

* Disk Defragmenter - Used to analyze volumes and defragment the disk.

* Disk Management - Used to create, format, and manage volumes.

* Logical Drives

* Removable Storage

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# 1. Types of operating system

Earlier many operating systems were device dependent and proprietary. A type of software that runs only on a specific type of computer is called device dependent. Manufactures normally introduced different operating system for each new computer model. It was a problem for the user to switch from one computer model to another.

A type of operating system that runs on variety of computer models is called device independent operating system.

A type of operating system that recognizes and works with application software written for an earlier operating system is called downward-compatible.

## 1. 1 Stand alone operating system

An operating system that works on a desktop or notebook computer is called stand alone operating system.

some example of currently used standalone operating system are DOS,Windows xp,windows vista, windows 7,UNIX,Linux and Mac os.

## 1. Dos (Disk operating system)

DOS stands for Disk operating system .It was developed by Microsoft in early 1980 for personal computers. It is a single user operating system. A type of operating system in which only one user can work at a time is called single user operating system.

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## 2. Windows 7

A Microsoft window is the most widely used operating system. It uses graphical user interface.some important versions of windows operating system are windows 7,windows vista and windows xp.

Windows 7 is the latest operating system by Microsoft that was released in 2009.

It is the fastest and most efficient operating system than previous versions of windows.

It provides better security and improved graphical capabilities. It is available in six different versions. Most common are Home, premium, professional and ultimate.

Some improvements in windows 7 over window xp and vista are as follows.

- New taskbar and system tray

- New wallpapers and themes

- Advanced calculator functions including saving history

- Improved start up ,sleep and resume performance

- Libraries to improve file access and organization

- Reconnect to wireless network more quickly

- Recognize USB device faster

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Different versions of windows operating system are as follows.

| **Windows version** | **Year of Release** |
|---|---|
| Windows 3.x | 1990 |
| Windows NT 3.1 | 1993 |
| Windows 95 | 1995 |
| Windows NT workstation 4.0 | 1996 |
| Windows 98 | 1998 |
| Windows 2000 professional | 2000 |
| Windows xp | 2001 |
| Windows xp sp2 | 2004 |
| Windows vista | 2006 |
| Windows 7 | 2009 |

# Features and Editions

Windows 7 comes in 6 different editions which in most cases will be available in a 32bit

and 64bit edition.This sections looks at the difference between 32bit and 64bit and

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compares the features of the six editions.

Understanding which features are available for each edition will allow you to make an infor

med decision about which edition of Windows 7 will meet your needs.

Understanding the features of each edition will mean you will purchase the right

edition the first time without having to pay for extra features that aren't really needed

or paying for an upgrade later on.

32Bit verses 64bit  All editions of Windows 7 are available in 32bit and 64bit

except for the Starter edition. Depending on how Windows 7 was purchased,

you may have the option to install either one. The number of bits refers to the central

processing unit (CPU) inside the computer. A 64bit CPU has the potential to run software

and process data a lot faster than a 32bit CPU if the software on the computer has

been designed to utilize it. Besides the processing power inside the CPU, the biggest

difference between a 32bit CPU and a 64bit CPU is that a 32bit CPU can only use

a maximum of 4GB of RAM. A 64bit CPU will still run 32bit software so it's possible to

install the 32bit version of Windows 7 on a 64bit system. However, installing

a 32bit operating system will mean you will only be able to utilize a maximum

of 4GB of ram, even if more than 4GB of ram is installed in the computer.

If you purchase a new 64bit system, check that the operating system installed is 64

bit. Sometimes a manufacturer will install a 32bit operating system on a 64bit system.

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If you want to use all the features 64bit hardware has to offer it is a good idea to re-install the operating system straight away.

It is not possible to upgrade a 32bit operating system to a 64bit operating system at a later date.

## Starter Edition

The starter edition has the least amount of features out of all the editions of Windows 7. The starter edition is also the only edition of Windows 7 that does not support 64bit. Even though all other 32bit editions of Windows 7 support a maximum of 4GB of RAM, the starter edition is limited to a maximum of 2GB of RAM. The Starter edition is often packaged with netbooks. Netbooks are noticeably smallerin comparison to other laptops and are lower priced. They are most often used while commuting and to log into social media sites, email and surfing the web.

## Home Basic

The Home Basic Edition is only available in what Microsoft refers to as emerging markets and thus only available in certain parts of the world. It has more features than the starter edition, for example it includes an improved desktop experience using the Aero interface. The Aero interface provides the 3D looking glass effect in Windows.

Most editions of Windows 7 offer full support for the Aero interface,except for Home Basic which only partially supports it.

## Home Premium

This edition of Windows 7 is aimed for consumer use in the home. Most home users will find it will have enough features for general home use. The home premium edition lacks a lot of business and high performance features.Most noticeably lacking is the limitation of only being to install a maximum 16 GBRAM and having support for only one CPU. The Home Premium is fine for the average home user that does not require extra performance, generally only needed for a high performance work station or computer enthusiasts.

## Professional

The professional edition is aimed at the business user and computer enthusiasts. It offers additional features like encryption and domain support. Domains are used in business to centralize management of computers. This edition also supports 192GB RAM and two CPU's. Due to the extra hardware and features it supports it is often used in high performance workstations.

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## Enterprise/Ultimate

The Enterprise and Ultimate editions have all the features that are available in Windows 7.

These editions are essentially the same, with the big difference being how they

are purchased. The Enterprise edition is only available via a software agreement with

Microsoft.

These agreements are available to large customers.

The Ultimate edition is available via retail or online to the consumer.

## N Editions

Sold in Europe, any edition ending with N does not have Windows Media Player

and other related technologies such as Windows Movie Maker. N editions come in

Windows 7 Home Premium N or Windows 7 Professional N. The missing software

can be downloaded and added to the operating system.

For more information about the N edition and how to download the missing software, see th

e following web address. http://windows.microsoft.com/en-us/windows7/products/What-is-

Windows-7-N-edition

## K Editions

Editions ending with K are sold in Korea and come with hyperlink shortcuts already

installed on the desktop to non-Microsoft instant messaging and media-player software.

There is no difference in the edition besides the additional shortcuts found on the

desktop.

### KN Editions

Editions of Windows 7 ending in KN are the same as the K and N editions combined

### Minimum Requirements

Before you start installing Windows 7, you should first check to ensure that the

computer meets theminimum requirements to run Windows 7.

Listed in the table below are the minimum requirements to run Windows 7. As stated above,

if the computer has a Windows 7 sticker on it, it will already meet or

exceed these requirements.

| CPU | 1 Gigahertz (GHz) or faster 32bit or 64bit CPU |
|---|---|
| RAM | 1 gigabyte (GB) RAM 32 bit or 64 bit |
| Hard disk | 32bit 16 GB hard disk space or 64bt 20 GB Hard Disk Space |
| Video card | DirectX 9 graphics device with WDDM 1.0 higher driver |
| Optical drive | For installation only |

Refer to the following web page for more information about minimum requirements.

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http://windows.microsoft.com/en-us/windows7/products/system-requirements

## 3. Mac OS

Macintosh operating system is a product of Apple. It was one the first successful GUI. It was released with Macintosh computers in 1984. The latest version of this operating system is called Mac OS X Snow Leopard. It was introduced in 2009.

## 4. UNIX

UNIX is a multitasking operating system. It was developed in early 1970 at Bell Labratories.Many versions of this operating system are available. Some versions of UNIX have a command –line interface but most versions of UNIX provide graphical user interface. The manufactures such as Sun and IBM sell personal computers and workstations with a UNIX operating system.

## 5. LINUX

Linux is free and multitasking operating system. It was developed in 1991. It is open source software. It means that its code is available to the public. The code can be used, modified and redistributed. It has no copyright restrictions.

Some versions of Linux use command line interface and others use GUI.

Some most widely versions of Linux are from Red Hat and Caldera.

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## 1.2 Server operating systems

An operating system that is designed to support a network is called server operating system. It is also called network operating system. A server operating system usually resides on a server. The client computers on the network depend on the server for resources. Many standalone operating system work as clients and interact with a server operating system.

Some examples of server operating systems are windows server 2008, UNIX, LINUX Salaries and Netware.

## 1.  Windows Sever 2008

Windows server 2008 is an upgrade to windows server 2003. It includes the features of previous windows server versions. It provides the following important capabilities.

- Improved web server management

- Enhanced sever security

- Network access protection

- Protection against malicious software attacks

- Client support using windows,Mac,UNIX and Linux

The windows server 2008 family includes many editions to meet the needs of all sizes of organizations. Some common editions are as follows.

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- **Windows server 2008 standard** for small to medium sized business network

- **Windows server 2008 Enterprise** for medium to large business

- **Windows server 2008 Datacenter** for business with huge volumes of transactions and large scale database

- **Windows web server** for web server and web hosting business.

## 2. UNIX

UNIX is also used as server operating system. It can handle a high volume of transactions in a multiuser environment.  It can work with multiple processors using multiprocessing. It is also known as multipurpose operating system because it is both a standalone and server operating system. UNIX is widely used on web server.

## 3. LINUX

Linux is also used on network server. A network administrator can configure the network, administrator security; run a web server using Linux .clients on the network can run Linux, UNIX or windows.

### 4. Solaris

Solaris is a version of UNIX operating system. It was developed by Sun Microsystems. It is  a server operating system designed for e-commerce application.

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It can mange high traffic accounts and security for web transactions.

## 5. Netware

Novell's Netware is a server operating system. It is designed for client/server networks. The server portion of this operating system resides on network server and clients portion resides on each client computer.

## 1.3 Embedded operating system

An operating system that is used in most handheld computers and small devices is called embedded operating system. It resides on a ROM chip. Some examples of embedded operating system are windows embedded CE,windows mobile and palm OS tec.

### 1. Windows Embedded CE

Windows embedded CE was developed by Microsoft. It is designed for use on communications, entertainment and computing devices with limited functionality.
It is used in digital cameras, VoIP telephones, portable media players, computerized sewing machines and ticked machine etc.

### 2. Windows Mobile

Windows mobile was designed by Microsoft for pocked pc and smart phone. Pocket pc is used to access PIM (personal information manager) functions like contact list, schedules

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Tasks, canalerdars and notes etc. it provides the facilities to check email, use internet and watch video etc. It supports the version of Microsoft applications word and excel that run on mobile device.

### 3. Palm operating system

Palm operating system is an operating system for handheld computers.

PDAs (personal digital assistance)using palm OS can recognize and support Microsoft word, excel and power point files. The user can use palm os to view movies or listen Mp3 files. Some handheld computers provide wireless access to the internet and email.

Palm operating system is used on the PDAs which are made by palm and Sony.

### 4. I phone OS

I phone operating system is developed by Apple. It is an operating system for iphone and iPod touch. These devices are multi touch. This feature enables users to inteact with iphone os devices using finger motions such as sliding the finger to drag an object. iPhone OS can be used to manage contacts and notes, send or receive e-mail and text messages

### 5. Google Android

Google Android is an operating system designed by Google. It is designed for mobile devices. It is used on more than 20 different types of mobile devices. It provides many

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features such as access to email accounts, alarm clock, video capture, Google

Appls,Wifi and easy web browsing .

## Short Difference between Linux and Windows

The difference between Linux and windows is as follows:

| LINUX | WINDOWS |
|---|---|
| Linux is available for free or at a much Lower price than Microsoft windows. | Windows is available between $50.00-$150 US dollars per copy |
| Linux is reliable and often runs for months and years without rebooting | Microsoft windows is less reliable than linux |
| Many programs ,utilities and games available on linux are freeware or open source | The majority of windows programs,utilities and games cost between $20-$200 US dollars per copy. |
| Its supports for hardware devices is less than windows | Windows has a much larger support for hardware devices than Linux |
| It is very secure operating system | It is the most vulnerable to viruses and other attacks |
| Many linux variants and programs are open source and be customized | Windows and majority fo window programs are not open source |

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