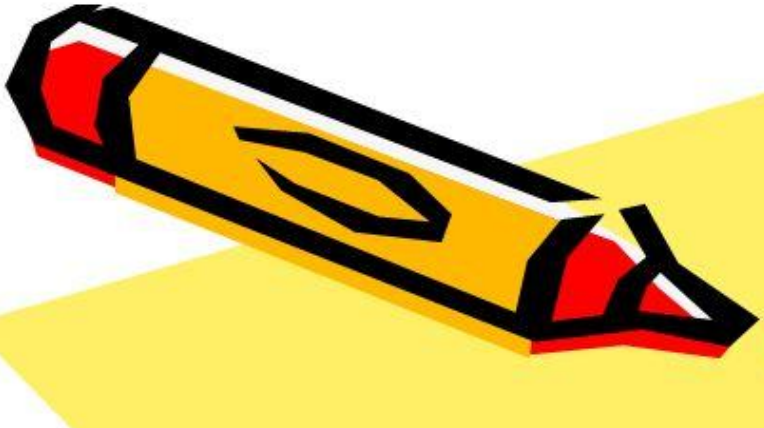


Welcome to My Class!

Nice to see you !

(ISLM-225)

Introduction to Operating System

Department of Information Science & Library Management (ISLM)
University of Rajshahi, Rajshahi-6205, Bangladesh

Course Details

Course Code: ISLM 225

Course Title: Introduction to Operating System

Credit : 3

Total Marks: 100

- **Course Final: 70**
- **In course: 30 (Attn 10, Incourse 20)**

# of Class/ Week: 3

- **TBA**
- **TBA**

Class Types: PPT Visual Presentation (80 %)
Demonstration(20%)

Unit-1: Operating System Overview: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

Unit-2: System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Unit-3: Installing and Configuring OS: Introduction to Installation and Media Types, Performing a Custom OS Installation, Run Levels and the Startup/Shutdown Sequence, Logging In and Out of a Operating System.

Unit-4: Process Management: Processes- Concept of processes, process scheduling, operations on processes, co-operating processes, interprocess communication, Threads- overview, benefits of threads, user and kernel threads., CPU scheduling, process synchronization, deadlocks- system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

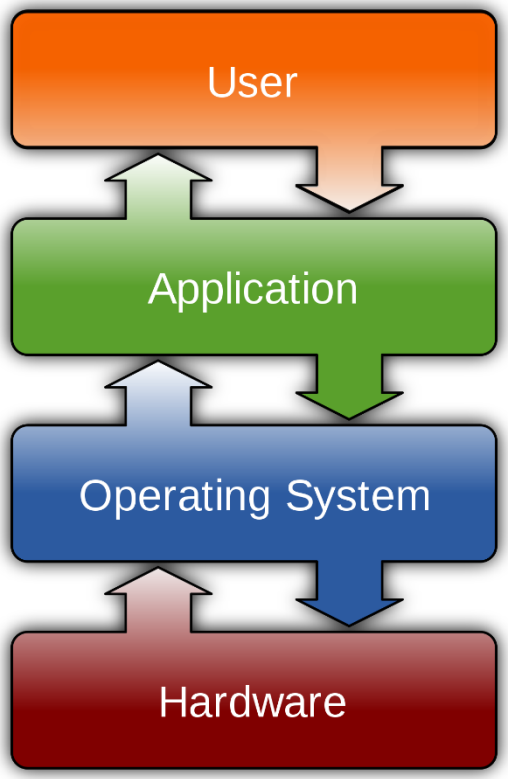
Unit-6: Storage Management: Memory Management- background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging, Virtual Memory- background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing, File Systems, I/O Management, Disk Management.

Unit-7: Distributed OS and File System: Motivation, Types of Network-based OS, Network structure, Distributed File System- Background, Naming and transparency, Remote File Access, State full and Stateless services. Distributed Synchronization: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election algorithm and Reaching agreement.

What is Operating System (OS)?

- An OS is a collection of programs that acts as an interface between a user of a computer and the computer hardware.
- Thus, OS acts as an **intermediary** between the user of a computer and the computer hardware.
- The purpose of an OS is to provide an environment in which a user can execute programs in a convenient and efficient manner.
- OSs are viewed as resource managers.
- The main resource is the computer hardware in the form of **processors, storage, input/output devices, communication devices, and data**.

What is Operating System (OS)?



OS is the most important program

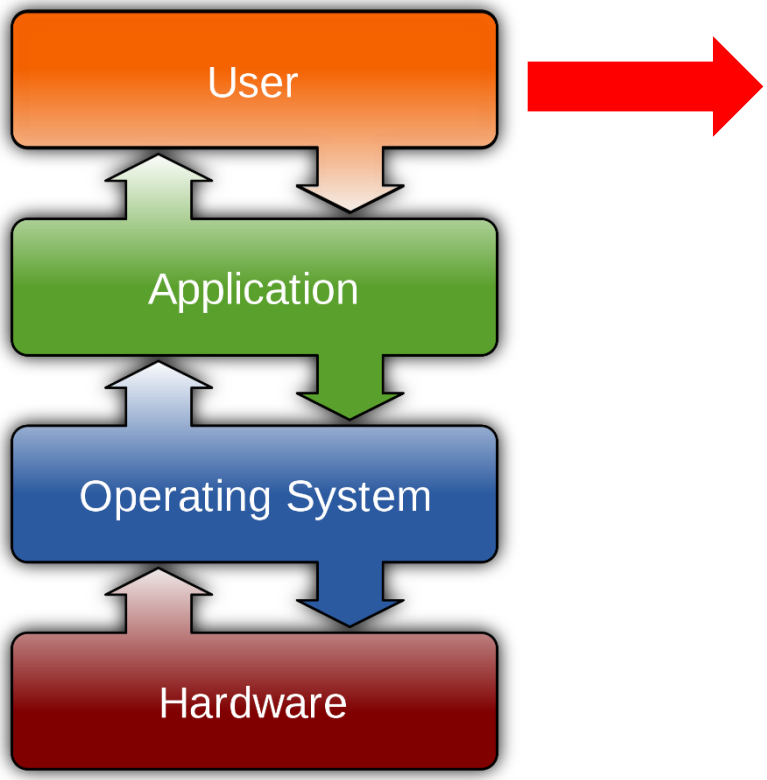
that runs on a computer.

OS also called

System Software

Who are the users of a Computer?

A **user** is a person who uses a **computer**. **Users** generally use a system or a software product within a computer without the technical expertise required to fully understand it.



What is Application Software?

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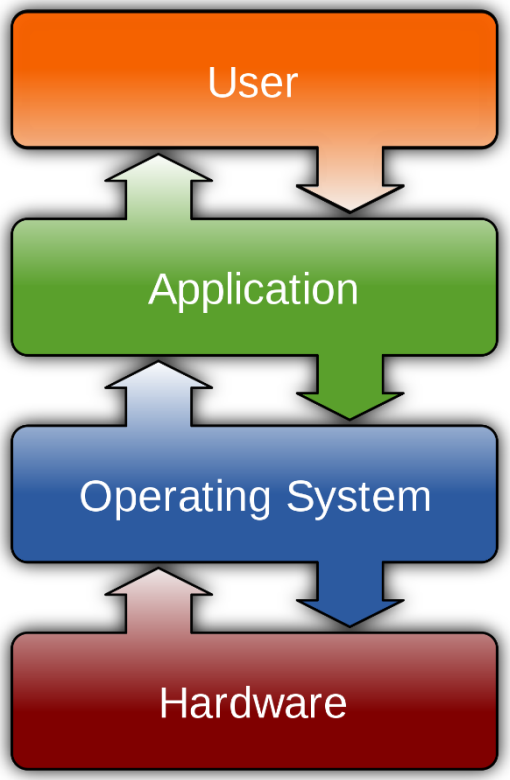
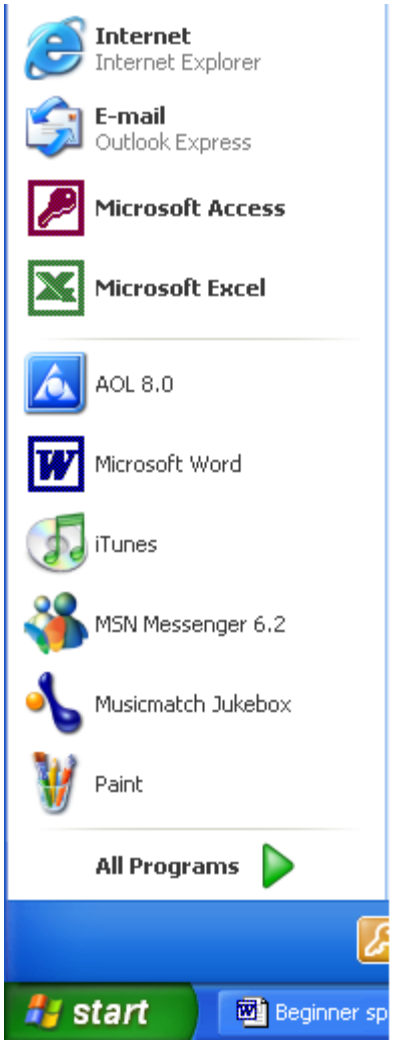
Application Software is a computer software designed to help the user to perform specific tasks.

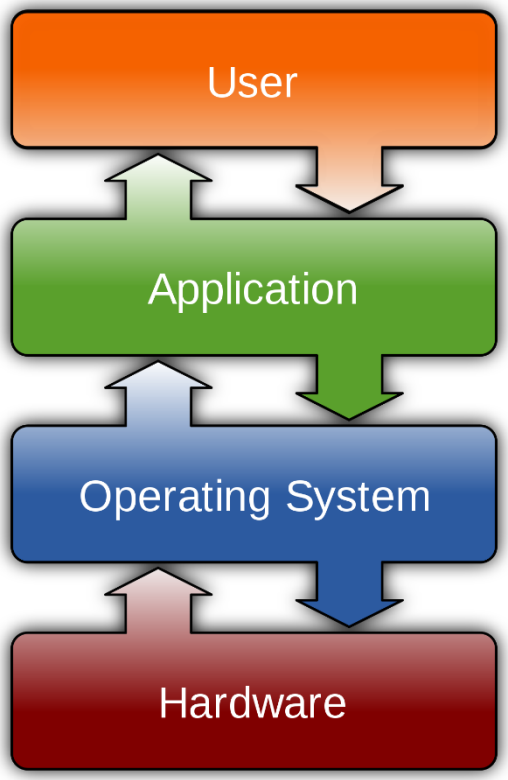


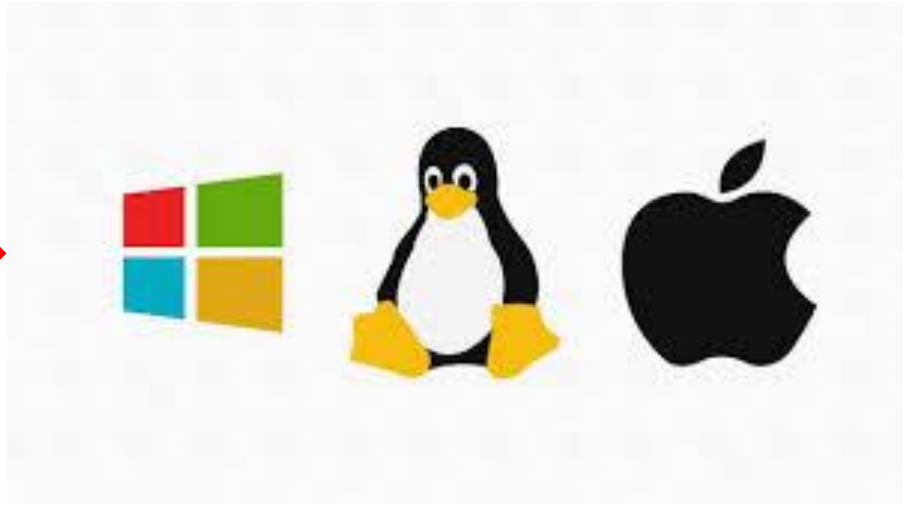
- **Word – letters, memos**
- **Internet Explorer – Browser**
- **Outlook – Mail Client**



What is System Software (OS)?

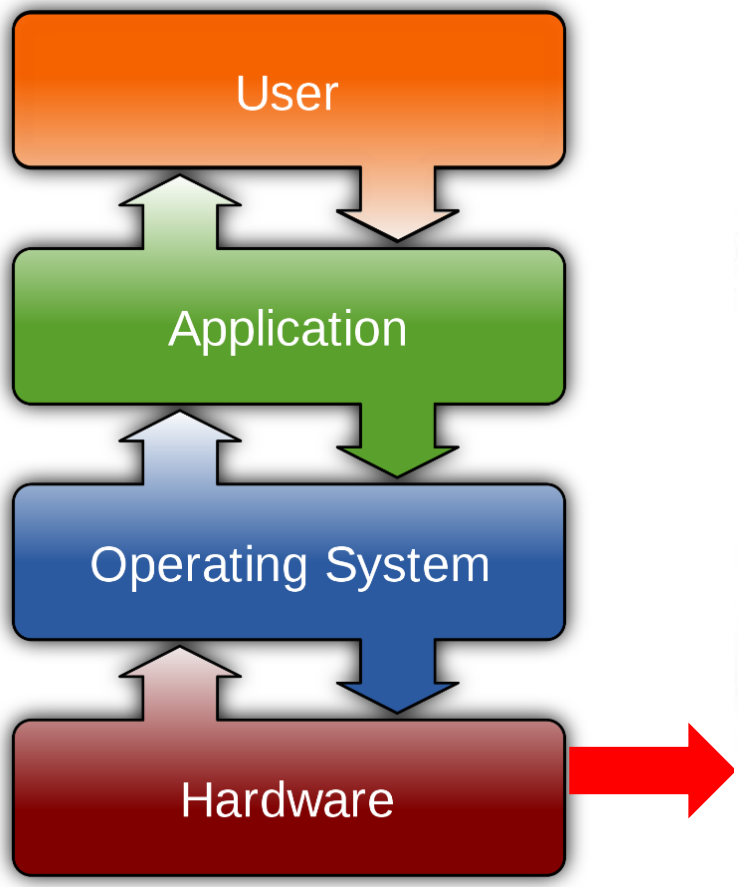
System software is computer **software** designed to operate the computer hardware and to provide a platform for running **application software**. **System Software** Create his own environment to run itself and run other **application**.





What is Hardware?

Computer hardware are the physical parts or components of a computer, such as the monitor, keyboard, computer data storage, graphics card, sound card, and motherboard.



Primary Functions of OS

- Implementing the user interface,
- Sharing hardware among users,
- Allowing users to share data among themselves,
- Preventing users from interfering with one another,
- Scheduling resources among users,
- Facilitating input/output,
- Recovering from errors,
- Accounting for resource usage,
- Facilitating parallel operations,
- Organizing data for secure and rapid access, and
- Handling network communications.

Goals of Operating System (OS)

- The primary objective of a computer is to execute an instruction in an efficient manner and to increase the productivity of processing resources attached with the computer system such as hardware resources, software resources and the users.
- Maximum CPU utilization is the main Goal of a OS, because it is the main device which is to be used for the execution of the programs or instructions. Brief the goals as:
  - ✓Recognizing input from the keyboard,
  - ✓Sending output to the display screen,
  - ✓Keeping track of files
  - ✓Keeping directories on the storage drives, and
  - ✓Controlling peripheral devices, such as printers.

Classification of OS

- **Multi-user**: Allows two or more users to run programs at the same time. Some operating systems permit hundreds or even thousands of concurrent users.
- **Multiprocessing** : Supports running a program on more than one CPU(?).
- **Multitasking** : Allows more than one program to run concurrently.
- **Multithreading** : Allows different parts of a single program to run concurrently,
- **Real time**: Responds to input instantly. General-purpose operating systems, such as DOS and UNIX, are not real-time.

Most Popular Desktop OS

The THREE most popular types of operating systems for personal and business computing include…..

- **Linux,**
- **Windows, and**
- **Mac.**

Most Popular Desktop OS Continue

Windows

Microsoft Windows is a family of operating systems for personal and business computers. Windows dominates the personal computer world, offering a graphical user interface (GUI), virtual memory management, multitasking, and support for many peripheral devices.

- Windows 1.0 (1985)
- Windows 2.0 (1987)
- Windows 3.0 (1990,1992)
- Windows 95 (1995)
- Windows 98 (1998)
- Windows ME (2000)
- Windows XP (2001)
- Windows Vista (2006)
- Windows 7 (2009)
- Windows 8.0 (2012)
- Windows 8.1 (2013)
- Windows 10 (2015)

The latest Windows update is Windows 11, version 22H2, also known as the Windows 11 2022 Update.

Most Popular Desktop OS Continue

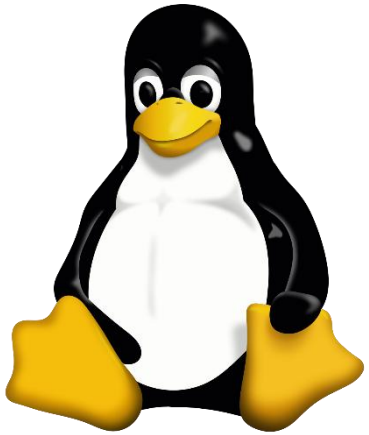
Mac

Mac OS is the official name of the Apple Macintosh operating system. Mac OS features a graphical user interface (GUI) that utilizes windows, icons, and all applications that run on a Macintosh computer have a similar user interface.

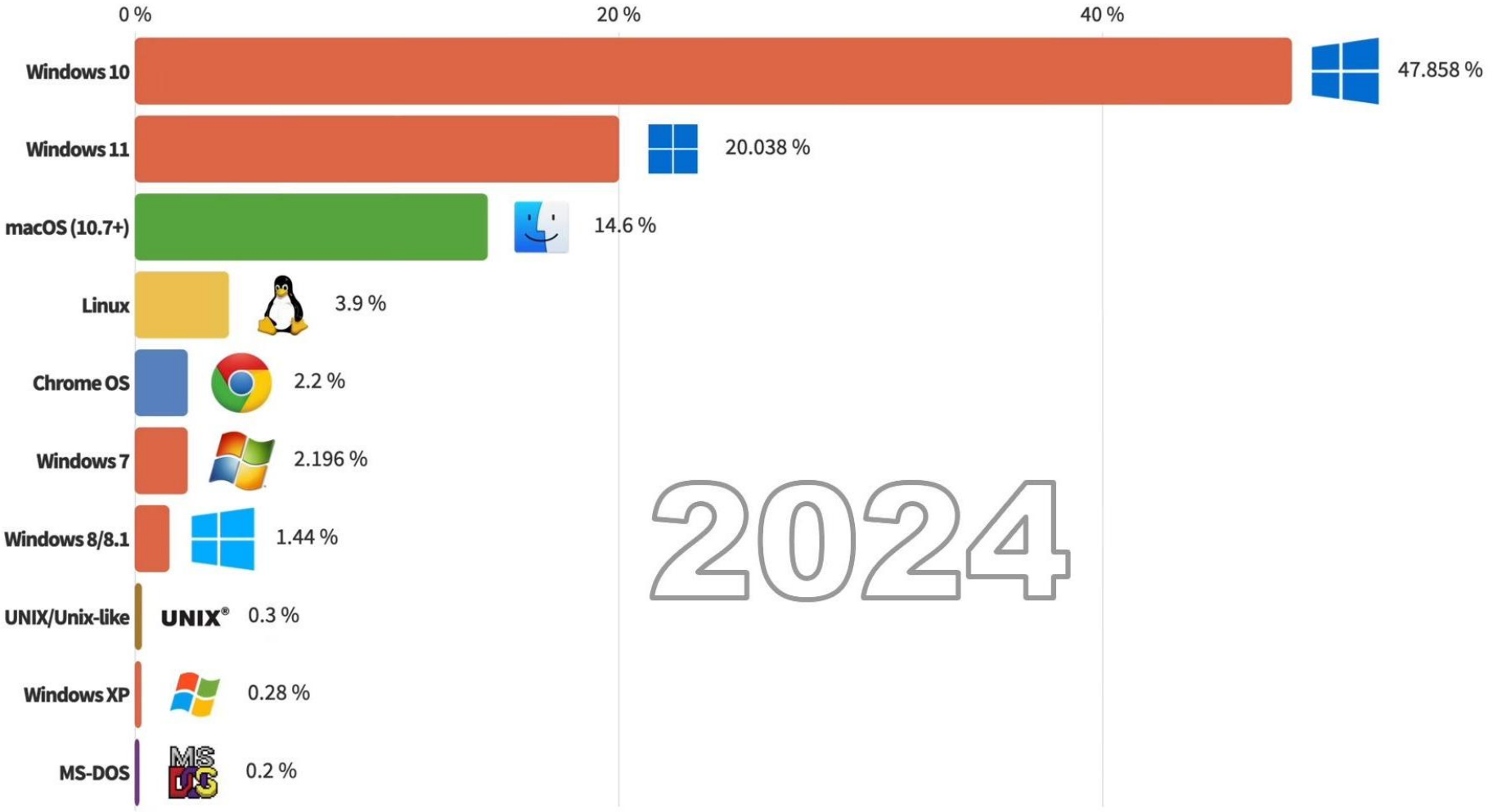
Most Popular Desktop OS Continue

Linux

Linux is a freely distributed open source operating system that runs on a number of hardware platforms. The Linux kernel was developed mainly by Linus Torvalds and it is based on Unix.



Most Popular Desktop OS Worldwide-2024

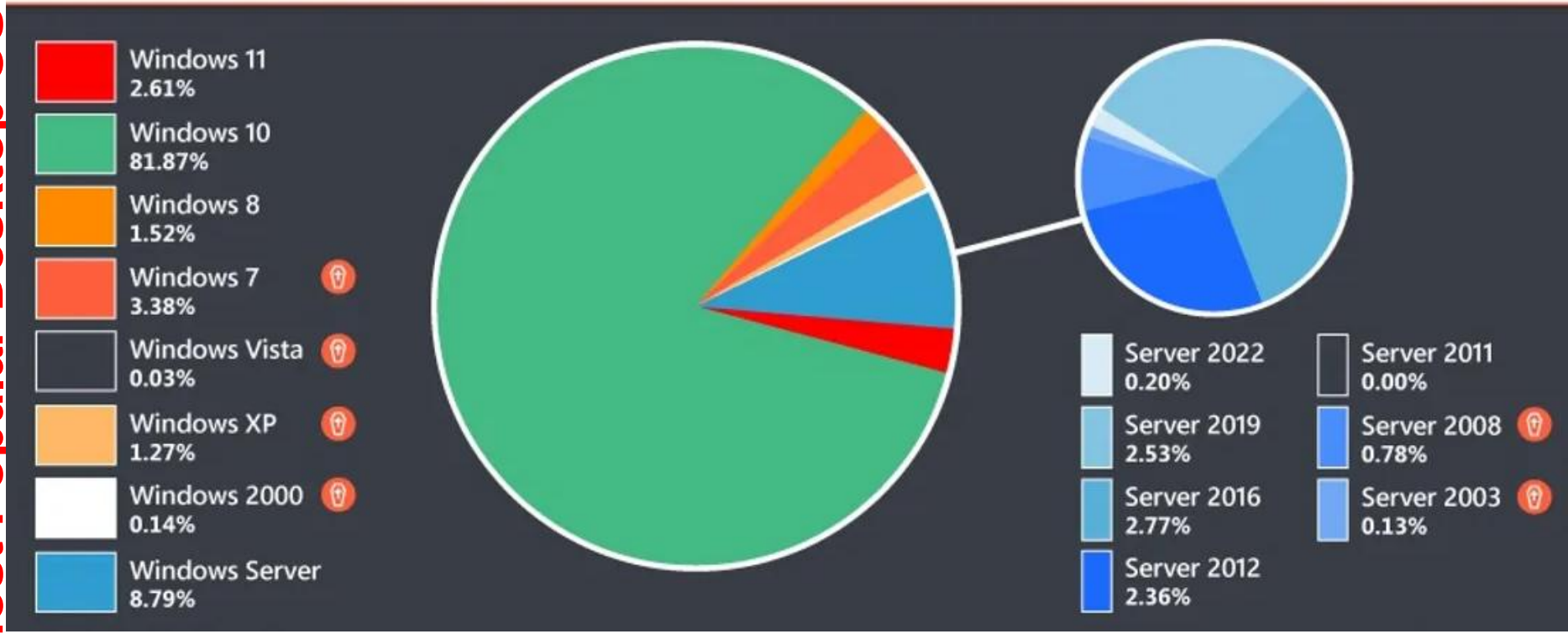


Most Popular Desktop OS Worldwide

Windows 11

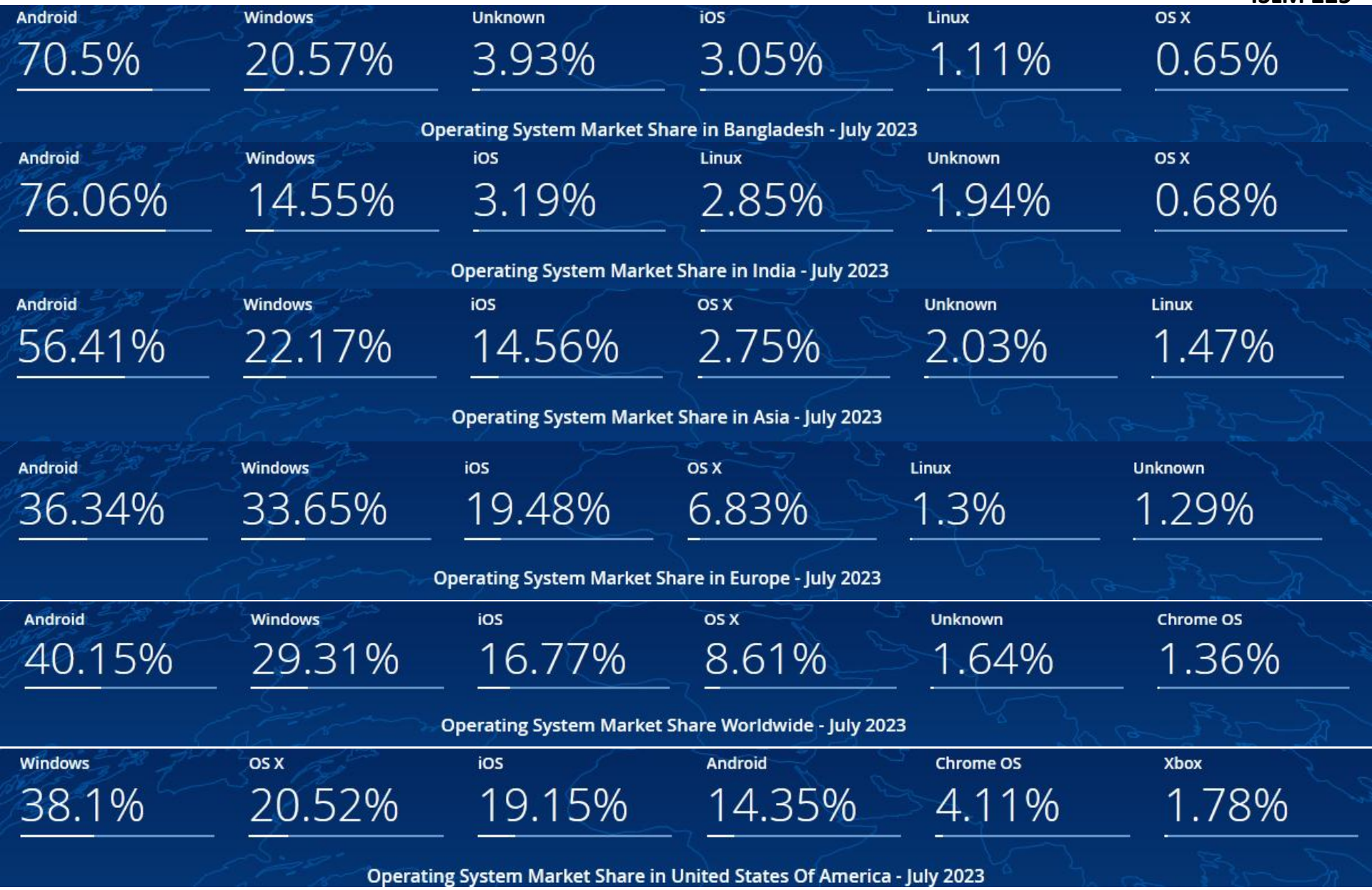
Windows OS Distribution

Snapshot October 2022



Most Popular Desktop OS Continue

Most Popular Desktop OS Continue



5 Best Mobile OS

5 Best Mobile OS

This operating system was launched by Google in 2008 as an open source software. This being the most popular choice for the mobile app developers as it's free of cost. Gradually, it was followed by various updated versions like Cupcake, Honeycomb, and Ice Cream Sandwich, Android P, that not only sounded tempting but were loaded with improvised and advanced features. Smartphone brand such as Samsung, Google, Asus, Huawei, Xiaomi and many more are well compatible with Android.

With the launch of the opulent iPhone by Apple, iOS was revealed in the mobile marketplace. Highly known for its robust performance, speed and responsiveness, this operating system is strictly designed for Apple iPhone users only. The code is not shared with any of the other handset devices. There have been several updated version since its first release, the latest being iOS 18.4.1.

We all are no doubt very familiar with the Windows operating system. Windows by the famous Microsoft is also designed specifically for mobile with/ without a touch screen, smartphones, and Tabs. Though on the basis of popularity and usage it doesn't beat Android and iOS. Moreover, its user interface is a bit complex in contrast to another hot-selling mobile OS.

This closed source operating system is again brand specific that is designed purely for blackberry phones only. Introduced in the year 1999 by 'Research in Motion' stands out completely different from the other major OS existing in the market. The User Interface (UI), Menu, keyboard, and other functionalities are unique to its own self. Similar to iOS, the Blackberry operating system also does not share its code with other brands.

Though not among the most demanding operating system, Symbian (designed by Nokia) was one of the most popular OS. It's well-known for delivering at par integration with communication and personal information management. Presently it's more of use at the lower end. There has been an updated version namely ANNA and BELLE that's being incorporated in NOKIA smartphones.

Operations of OS

- The main operations and functions of an operating system are as follows:
  - ✓ Process Management
  - ✓ Memory Management
  - ✓ Secondary Storage Management
  - ✓ I/O Management
  - ✓ File Management
  - ✓ Protection
  - ✓ Networking Management
  - ✓ Command Interpretation.

Operations of OS-Process Management

- The CPU executes a large number of programs.
- While its main concern is the execution of user programs, the CPU is also needed for other system activities.
- These activities are called processes.
- A time-shared user program is a process.
- For now, a process may be considered as a job or a time shared program.

Operations of OS-Process Management

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

- The creation and deletion of both user and system processes
- The suspension and resumption of processes.
- The provision of mechanisms for process synchronization
- The provision of mechanisms for deadlock handling.

Operations of OS-Memory Management

- Memory is the most expensive part in the computer system.
- Memory is a large array of words or bytes, each with its own address.
- Interaction is achieved through a sequence of reads or writes of specific memory address.
- The CPU fetches from and stores in memory.

Operations of OS-Memory Management

- **The operating system is responsible for the following activities in connection with memory management:**
  - Keep track of which parts of memory are currently being used and by whom.
  - Decide which processes are to be loaded into memory when memory space becomes available.
  - Allocate and deallocate memory space as needed.

Operations of OS-Secondary Storage Management

• The main purpose of a computer system is to execute programs.

• These programs, together with the data they access, must be in main memory during execution.

•Since the main memory is too small to permanently accommodate all data and program, the computer system must provide secondary storage to backup main memory.

Operations of OS-Secondary Storage Management

•Most modem computer systems use disks as the primary on-line storage of information, of both programs and data.

• Most programs, like compilers, assemblers, sort routines, editors, formatters, and so on, are stored on the disk until loaded into memory, and then use the disk as both the source and destination of their processing.

•Hence the proper management of disk storage is of central importance to a computer system.

Operations of OS-Secondary Storage Management

•The operating system is responsible for the following activities in connection with disk (Secondary Storage) management:

- Free space management
- Storage allocation
- Disk scheduling.

Operations of OS-I/O Management

• One of the purposes of an operating system is to hide the peculiarities or specific hardware devices from the user.

•**The operating system is responsible for the following activities in connection to I/O management:**

- A buffer caching system
- To activate a general device driver code
- To run the driver software for specific hardware devices as and when required.

Operations of OS-File Management

•File management is one of the most visible services of an OS.

•Computers can store information in several different physical forms: magnetic tape, disk, and drum are the most common forms.

•Each of these devices has it own characteristics and physical organization.

•For convenient use of the computer system, the OS provides a uniform logical view of information storage.

•The OS abstracts from the physical properties of its storage devices to define a logical storage unit, the file.

•Files are mapped, by the operating system, onto physical devices.

Operations of OS-File Management

- **The operating system is responsible for the following activities in connection to the file management:**
  - The creation and deletion of files.
  - The creation and deletion of directory.
  - The support of primitives for manipulating files and directories.
  - The mapping of files onto disk storage.
  - Backup of files on stable (non volatile) storage.
  - Protection and security of the files.

Operations of OS-Protection

- The various processes in an OS must be protected from each other's activities.
- For that purpose, **various mechanisms** which can be used to ensure that the files, memory segment, CPU and other resources can be operated on only by those processes that have gained proper authorisation from the OS.
- Protection refers to a mechanism for controlling the access of programs, processes, or users to the resources defined by a computer controls to be imposed, together with some means of enforcement.

Operations of OS-Protection

•Protection can improve reliability by detecting **latent errors** at the interfaces between component subsystems.

•Early detection of interface errors can often prevent contamination of a healthy subsystem by a subsystem that is malfunctioning.

•An unprotected resource cannot defend against use (or misuse) by an unauthorised or incompetent user.

✓**Latent Error: An error is detected if its presence is indicated by an error message or error signal. Errors that are present but not detected are latent errors.**

Operations of OS-Networking

- A distributed system is a collection of processors that do not share memory or a clock.
- Instead, each processor has its own local memory, and the processors communicate with each other through various communication lines, such as high speed buses or telephone lines.
- Distributed systems vary in size and function. They may involve microprocessors, workstations, minicomputers, and large general purpose computer systems.

Operations of OS-Networking Management

- The processors in the system are connected through a communication network, which can be configured in the number of different ways.
- The network may be **fully or partially** connected.
- The communication network design must consider routing and connection strategies and the problems of connection and security.

Operations of OS-Command Interpretation

• One of the most important components of an operating system is its command interpreter.

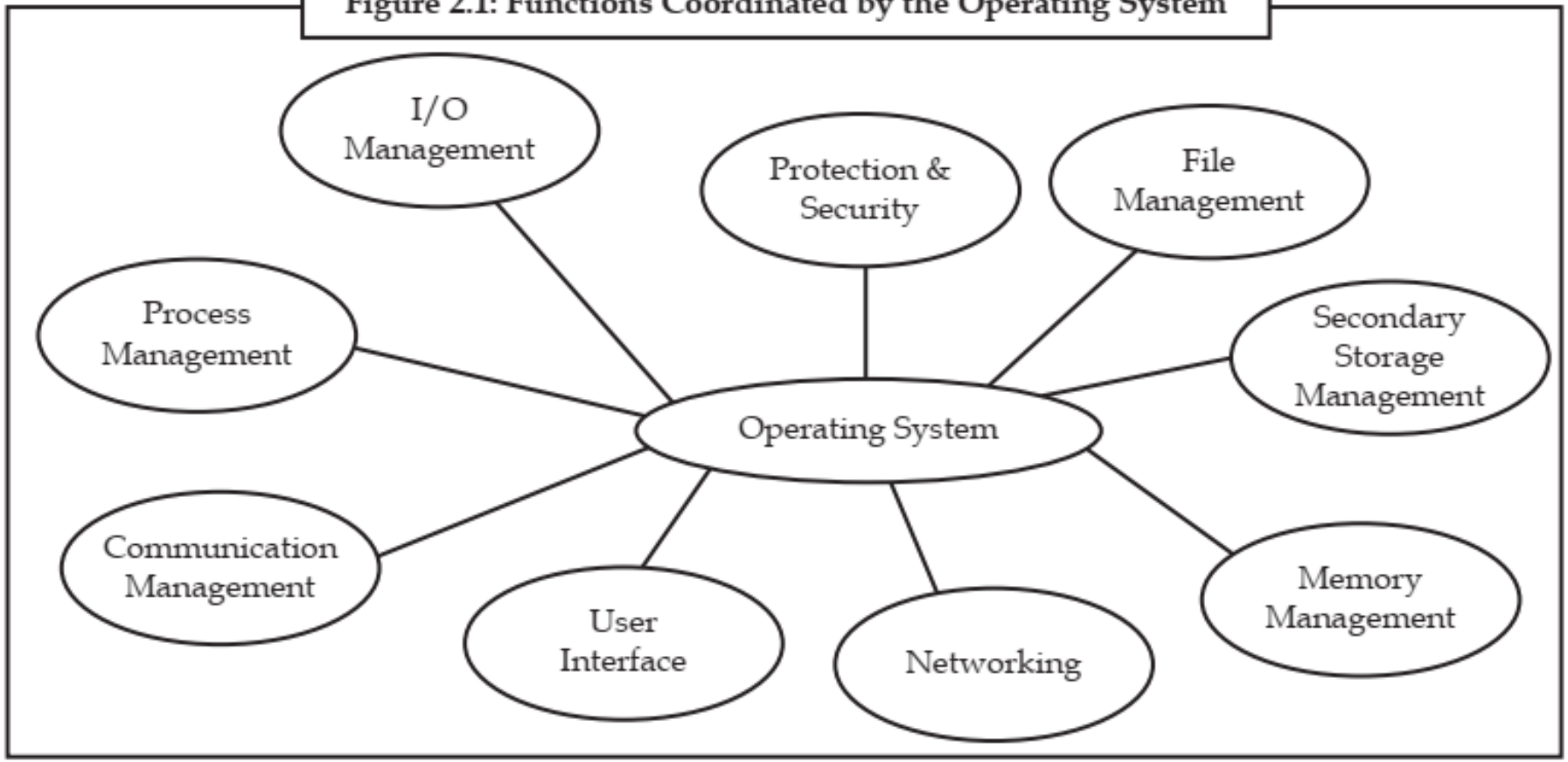
•The command interpreter is the primary interface between the user and the rest of the system.

•When a new job is started in a batch system or when a user logs-in to a time-shared system, a program which reads and interprets control statements is automatically executed.

•The command statements themselves deal with process management, I/O handling, secondary storage management, main memory management, file system access, protection, and networking.

The Figure 2.1 depicts the role of the operating system in coordinating all the functions.

Figure 2.1: Functions Coordinated by the Operating System



Types of OSs

• Modern computer OS may be classified into three groups, which are distinguished by the nature of interaction that takes place between the computer user and his or her program during its processing.

•The three groups are called ……..

- •Batch OS,
- •Time-sharing OS, and
- • Real-time OS

Types of OSs-Batch OS

• In a batch processing OS environment, users submit jobs to a central place where these jobs are collected into a batch, and subsequently placed on an input queue at the computer where they will be run.

• In this case, the user has no interaction with the job during its processing, and the computer's response time is the turnaround time the time from submission of the job until execution is complete, and the results are ready for return to the person who submitted the job.

Types of OSs-Time Sharing OS

• In this environment a computer provides computing services to several or many users concurrently on-line.

•Here, the various users are sharing the central processor, the memory, and other resources of the computer system in a manner facilitated, controlled, and monitored by the OS.

•The user, in this environment, has nearly full interaction with the program during its execution, and the computer's response time may be expected to be no more than a few second.

Types of OSs-Real Time OS

• The third class is the real time operating systems, which are designed to service those applications where response time is of the essence in order to prevent error, misrepresentation or even disaster.

•Examples of real time operating systems are those which handle airlines reservations, machine tool control, and monitoring of a nuclear power station.

•The systems, in this case, are designed to be interrupted by external signals that require the immediate attention of the computer system.

•These real time operating systems are used to control machinery, scientific instruments and industrial systems.

A number of other definitions are important to gain an understanding of OS

- Multiprogramming Operating System
- Networking Operating System
- Distributed Operating System

Generation of OS

ISLM 225

Prepare a report on the topic stated above