

# AS/A Level Computing Syllabus 2011

# Section 1

- Computer Systems -
- Communications -
- Software -

# Chapter 1.2

## System Software

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS

#### OPERATING SYSTEM

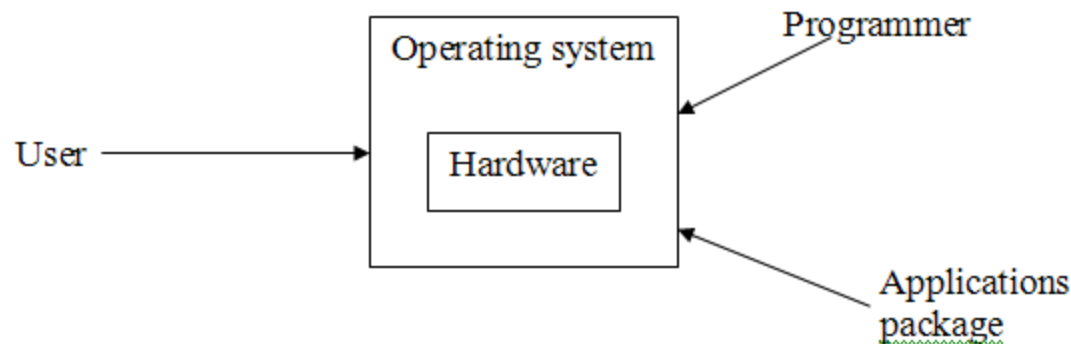
An operating system (OS) is a set of programs that control and manage the hardware and other software in a computer system.

- An OS performs three important tasks:
  1. It controls and manages all the hardware in a computer system.
  2. It provides a 'user interface'.
  3. It facilitates other software (application software) to be executed.
  4. It provides and controls the functionality of a computer system.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

- An OS is a foundation software on which all other software depend.
- An OS is usually a large set of programs.
  - Some parts are kept in RAM at all times.
  - Other, lesser used parts, are loaded as and when needed.
  - 'Kernel' is the main part of the OS.
- In most cases, the OS is installed just like any other software on the hard disk.
  - It can be changed, upgraded or modified.
  - This changes the behavior of the computer.
- The OS provides an 'interface layer' to the hardware for users, programmers and other software.



## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

- The operating systems can be classified in many different way.
  - Processing type
  - Number of users using the OS concurrently
  - Number of programs running concurrently
  - Interface type

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### TYPES OF OPERATING SYSTEMS (PROCESSING TYPE)

##### BATCH PROCESSING OPERATING SYSTEM

A Batch Processing OS collects jobs in the form of batches and then processes them in one go.

- Used when:
  - Large amount of data is present
  - Data is similar in nature
  - Free time for processor is either fixed or is easily identifiable
  - Processing doesn't require human intervention/supervision
- Very common type of OS during the early days of computing.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### Advantages:

- No need for an administrator to be present (unattended processing).
- Processing is done at off-peak hours to save processor time.
- Solves the “speed mismatch” problem. Takes out the slowest component of a computer system – human being.

#### Disadvantages:

- Doesn't produce immediate processing output.
- Process may run into a problem and stop.
- Errors are not immediately identifiable.

#### Example:

- Printing of Bank Statements
- Producing Utility Bills (electricity, gas, telephone etc.)
- Compiling of large and complex high level programs.



## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### REAL TIME PROCESSING OS

A real time processing OS responds to the input quickly enough to affect the next input.

- Input is processed without any delay and output is produced quickly so that the user can decide what to do next.
- Real time processing OS are almost always used with “dedicated” computers.

#### Advantages

- No wait time between input and processing.
- Fastest response needed for mission/time critical applications.

#### Disadvantages

- Limits the usage of the OS.
- Processor almost always must be 'dedicated' to the job running and can't multitask.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### REAL TIME PROCESSING OS

##### Example:

- Missile warning system of a fighter aircraft.
- Temperature monitoring system of a nuclear power plant.
- Process control systems in a chemical plant.
- Process control systems for robotic arms in a car assembly plant.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### **DISTRIBUTED PROCESSING OS**

A distributed processing OS distributes data and processing among different computers that then form a large computer system.

- Different software and data may be stored on different computers reducing the load and bottlenecking problems.
- Processing a task may also be distributed among different computer greatly reducing the overall processing time, and load on the main computer.

#### **Advantages**

- Inexpensive hardware can produce results matching speed and storage of very large computers.
- No limit to the number of computers that can be connected together.
- Practically unlimited processing and storage.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### DISTRIBUTED PROCESSING OS

##### Disadvantages

- Difficult to manage at times.
- Nodes may not be available at all time.
- Data lose is possible if a node gets infected with virus or if it breaks down.

##### Example:

- OS used in cluster super computers.
- SETI's volunteer based distributed data processing program.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### TYPES of OPERATING SYSTEMS (NUMBER of CONCURRENT USERS)

##### SINGLE USER OS

A single user OS can be used by one user at a time.

- In some cases, many users can use the OS but only one user can log on at any given time.

##### Advantages

- Exclusive access to processing and storage facility for a single user.

##### Disadvantages

- A user usually doesn't use the full processing power of a computer. Processor stays idle most of the times.

##### Example:

- Your home computer operating system.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### MULTI USER OS

A multi user OS can be used by more than one user concurrently.

- Usually, these OS are run on very powerful computer with ample resources such as RAM, storage space etc.
- Multi user OS are of two types:
  - Network OS
  - Time Sharing OS
- Multi user OS has added responsibilities of:
  - data security
  - access authentication
  - user privileges
  - some other features that we will discuss later

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### NETWORK OS

- It is run on the server (computer controlling the network).
- Manages user access to the network.
- Manages the shared resources such as software, hardware, services etc.
- Provides data security.

#### TIME SHARING OS

- Run on a very powerful computer connected to terminals ([dumb terminals](#) with limited or no processing functionality).
- Allocates a slice of time to each user creating an illusion that each user is using the computer on his own.
- Manages user access to the computer.
- Manages shared resources such as software, hardware, services etc.
- Provides data security.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### Advantages

- Allows processing and storage capacity to be utilized to full extent.
- Lowers the cost of ownership.
- Sharing of hardware resources and software.
- Easy to maintain one computer than many.

#### Disadvantages

- Increased risk of system failure.
- Data security becomes a concern.
- Performance may become slow if number of user are not managed or if user are using processing intensive applications.

#### Example:

- Networked (Client/Server) Operating Systems
- Operating Systems running on large mainframe and mini computers



## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### TYPES OF OPERATING SYSTEMS (NUMBER OF CONCURRENT PROGRAMS)

##### SINGLE TASKING OS

- A single tasking OS can run only one program at a time.
- Used in the early days of computing when computer hardware was primitive and less powerful.
- Still are used in devices where only one program is supposed to run.

##### • Advantages

- Simpler to write and are smaller in size than multitasking OS.
- Simple hardware needed to run these OS

##### • Disadvantages

- No much productive as only one job can be done at a time.

##### Example:

- Old Command-line OS.
- OS in simple devices.

## 1.2 System Software

### 1.2.1 OPERATING SYSTEMS *(continued...)*

#### TYPES OF OPERATING SYSTEMS (NUMBER OF CONCURRENT PROGRAMS)

##### MULTI TASKING OS

A multitasking OS can (apparently) run many programs at the same time.

• In actuality, the OS is giving a very small portion of time to each program creating an illusion that all programs are running at the same time.

##### • Advantages

- Can perform multiple jobs concurrently thus saving time.
- Can take full advantage of available hardware resources.

##### • Disadvantages

- Requires more processing power and resources than Single Tasking OS.
- Deadlocks and violations of memory and resources may occur making system unstable.

##### Example:

- Your home computer's operating system.
- Most operating systems today are multitasking.

## 1.2 System Software

### 1.2.2 USER INTERFACES

#### USER INTERFACE

An interface is the means by which human-machine, machine-software or machine-machine interaction is made possible.

- Users need to communicate with the computers. This includes sending input to the computer and receiving output from the computer.
- An interface is any mean by which commands and data can be input and the result of processing can be output.
- The user interface may include both software and hardware.
- There are five type of Human-Computer Interfaces (HCI):
  - Command-line interface (CLI)
  - Graphical user interface (GUI)
  - Form based interface
  - Natural language interface
  - Menu based interface

## 1.2 System Software

### 1.2.2 USER INTERFACES *(continued...)*

#### TYPES OF HUMAN-COMPUTER INTERFACES

##### COMMAND-LINE INTERFACE (CLI)

A command-line interface using plain text as a method to communicate between the user and the computer.

- User provides input by typing in the commands and computers responds by showing output in text form.

##### Advantages

- The system is more open. User can access most parts of the system.
- Simpler to write and requires very little resources. Good for simple devices.

##### Disadvantages

- User needs to understand how computer works.
- User needs to remember exact syntax of the commands and their modifiers.
- User needs to understand the filing structure of the system.

**Example:** Old Disk Operating Systems used by early computers in 1980s.

## 1.2 System Software

### 1.2.2 USER INTERFACES *(continued...)*

#### GRAPHICAL USER INTERFACE (GUI)

A graphical user interface (GUI) represents files and commands with pictures.

- GUI uses a technique called WIMP (Windows, Icons, Menus and Pointer) to show pictorial representations of files and commands.
- Each program or file directory is shown within a bordered area called a Window. Files are represented with Icons. Commands are shown as items in the Menus. A Pointer is used to selected the desired command/file, usually using a mouse.

#### Advantages

- Very user friendly, easy to understand and operate.
- Doesn't require the user to remember each command or its exact syntax.
- Novice users cannot enter dangerous commands or perform harmful procedures.

#### Disadvantages:

- Difficult to program.
- Requires a lot of resources (RAM, storage space etc.)

**Example:** Interfaces of modern operating systems.

## 1.2 System Software

### 1.2.2 USER INTERFACES *(continued...)*

#### FORM BASED INTERFACE

A form based interface use a form with fields to be filled on the screen for the input.

- This type of interface is used where the input is of standard type.
- Typically features:
  - Boxes for textual input. Command Buttons represent various commands.
  - Check boxes and Radio buttons for options.
  - Combo boxes or List boxes for selective input from a list.
  - Different validation techniques to ensure valid input.
  - Verification of required input before the data could be saved.

#### Advantages

- Fast data entry with validation of data input.
- Restricts user from doing anything other than the task available.

#### Disadvantages

- Not too intuitive with limited use.

**Example:** Interface used by a Customer Services Representative at a Call Center.