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Operating system is a software program which controls the operations of the computer system & manages all of the computer's hardware and programs. It acts as a layer of software between applications programs and hardware and provides an interface through which a user can run an application. It controls how the computer responds to user's requests and how the hardware communicates with each other.

Without an operating system, no matter how many programs you have, the computer is useless. However, not all computers need an operating system. An automated system such as household appliances that is microprocessor-controlled, like a washing machine or a digital camera, has a single control program performing a single task with a fixed set of input and output hardware.

Loading an operating system:

When a user switches on a laptop, desktop it usually has no operating system in internal memory ready to run and manage the computer. Computer then automatically run a small firmware program to start the process of loading the operating system into RAM, ready to take control. In a PC or laptop this firmware is stored in flash memory. The first firmware program performs a power-on selftest (POST). The purpose of Posting is to prevent the computer from starting to run in an unusable state. It checks the integrity of the firmware what external devices are connected and the size of internal memory.

Then it identifies the most promising disk drive from which to load an operating system. The second firmware program called the 'boot loader' then loads the first, tiny portion of the operating system into RAM from a hard disk. This portion of the operating system software can in turn load the rest of the operating system software and associated data into RAM. This process, in which the operating system loads itself and then takes control of the computer, is known as 'bootstrapping'.

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Function of operating system:

1. Manage user accounts and security using one or more usernames and password.
2. Provide an interface for the user that allows the user to:
   a. Run application programs.
   b. Manage files in backing storage.
   c. Read and respond to error messages.
3. Manage the processors time
4. Manage the allocation of internal memory.
5. Control peripheral devices-input devices such as keyboards, output devices such as printers and backing storage such as hard disk drive.
6. Provide spooling (temporary storage of input or output data in a queue on hard disk)
7. Manage interrupt signals to the processor.
8. Perform 'housekeeping tasks', such as defragmenting a drive or file indexing.

Types of Interfaces:

The means of communication between the user and the machine is known as the user interface and consists of both hardware and software. It consist al hardware and software through which a user provide input to a computer or receives information from it. There are different types of interface, which are useful in different situations and for different types of user.

- Command line interface
- Graphical user interface

Graphical user interface

Graphical interfaces are called GUI (graphical user interface) or WIMP (windows, icons, menus, and pointer) because it displays graphics as well as text.

A GUI is very user friendly. The user will expect to be able to select options by use of menus of choices and by using small pictures which represent the different options available. Choices are selected by the user by using some sort of pointing device to indicate choice; typically this would be a mouse.

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Command line interface

Or command based interface is one where the user types a series of commands at the keyboard which tell the computer what their intentions are. The user needs to know what the possible commands are, and also needs to understand the way files are stored on the system. The characteristics of a command based interface are

- The user needs to know what commands are available
- The user needs to understand the commands
- The user needs to understand the way that material is stored in the computer system

Because of the above points there are two very important characteristics about a command based interface. First, the system is very much more open than in the other types of interface. Other interfaces restrict the options that the user has available to them. This can be particularly important for the system manager because different users can only be allowed to have access to specific parts of the system. The second characteristic is that command based interfaces can only be used by computer literate people because you not only have to understand the commands and their uses but you also need to understand something about how the computer operates, particular how information is stored.

Utility software

Utility programs are part of the operating system of a computer and are routines which carry out important tasks which are necessary from time to time on the system. They do not produce a pretty picture, or a letter which can be sent to someone so they are not application programs, but the types of job that they do are so important that the system could not run without them. There are many examples of utility software but we shall limit ourselves to just a few:

1. The surface of a disk can store so much data that the computer cannot handle it all at once so it needs to be split up so that data stored on it can be found again. When it is new a disk surface is blank so the computer "draws lines" on the surface to split it into small areas. The process is called formatting and it is carried out by a utility program called a disk formatter.

2. When files are to be stored on a disk they need to be managed. This includes arranging for them to be stored in a certain place, finding files again after they have been stored, moving them around to get them in a sensible order and deleting them when they are not needed any more. All of these actions are carried out by utility programs called file handlers.

3. A computer system is made up of lots of different sorts of hardware, each piece of which needs instructions about how to work. These programs are called hardware drivers.

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4. Some files are very large. In most files it is possible to find simple ways of reducing the size of the file while keeping all its meaning. This can be very important when files are being sent from one computer to another as the communication is speeded up. The programs that reduce the size of files are called file compressors.

5. When files are being sent from one computer to another it is possible that they may contain a virus which will infect the receiving computer. A virus checker (scanner, killer,..) is a utility program which keeps a constant check on files searching for viruses which it will delete if it finds any.

Buffer

An operating system is often able to pass input data to an application program far faster than an input device can supply it. Similarly, it can often supply the application programs output data far faster than an output device can accept it. To compensate for the difference in rates of data processing and allow the processor to perform other tasks while waiting to receive or send data, system software uses an area of memory to hold data temporarily. Such an area in memory is called a buffer.

Polling

Method in which operating system periodically checks each peripheral device for communication is called polling.

Interrupts

An interrupt is a signal sent from a peripheral device (hardware) or program (software) to the processor to indicate that the sender needs attention. This leaves the operating system entirely free to process other task until its attention is needed.

A processor usually has relatively few hardware interrupt inputs with different priorities. Before fetching each machine code instruction from internal memory, the processor checks an area of memory within the processor called its 'interrupt register' to see whether any interrupts are waiting to be serviced. Programs can also generate interrupts. An application program can use a software interrupt request a service from the operating system.

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Handshaking

Term used to describe the process of one computer establishing a connection with another computer or device. The handshake is often the steps of verifying the connection, the speed, or the authorization of the computer trying to connect to it.

Checksum

A checksum is a way of summarizing a block of data such as a USB or network data packet. At its simplest, it consists of the arithmetical sum of all the numerical values of all the elements of the block. The sum reduced to a standard number of digits and transmitted with the block. When the block of data get to its destination, the same mathematical calculation is performed on the data by the received device and the result is compared with the received checksum. If two checksum match, the integrity of the data has been maintained. If the two checksums do not match then an error has been made in transmitting the data and the receiving device requests the sending device to re-transmit the data. Even if one binary digit has changed in the data, the recalculated check sum does not match the received checksum and the data are rejected.

File Management:

Another part of the operating system is the file manager. While the memory manager is responsible for the maintenance of primary memory, the file manager is responsible for the maintenance of secondary storage (e.g., hard disks)

The operating system is responsible for the following activities in connections with file management:
- File creation and deletion.
- Directory creation and deletion.
- Support for manipulating files and directories.
- Mapping files onto secondary storage.
- File backup on stable (nonvolatile) storage media.
- Identify and locate a selected file
- Use a directory to describe the location of all files plus their attributes
- On a shared system describe user access control
- Blocking for access to files
- provide simple and fast algorithms to read and write files
- give and deny access rights on files to users and programs
- allocate and de-allocate files to processes
- provide users and programs with simple commands for file handling