Computer Science

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Chapter-19: Software

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Software

Computer systems consist of both hardware and software.

Software: Software is a collection of instructions and data that tell the computer how to work. This is in contrast to physical hardware, from which the system is built and actually performs the work.

There are two main types of software:

1. systems software
2. applications software

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Systems software

Systems software helps run and maintain the computer. It includes the operating system, drivers and utility software.

Operating system:
The biggest part of systems software is the operating system. It is an essential part that allows other systems software, and application software, to communicate with hardware.

All computers have an operating system. They cannot operate without one.

The operating system is needed to perform a number of tasks. It provides a user interface, manages the use of memory and the opening, closing, saving and deleting of files. Most operating systems have features that look after the security of the computer with usernames and passwords. Examples of operating systems include Windows, Linux, Mac OSX, Android and iOS.
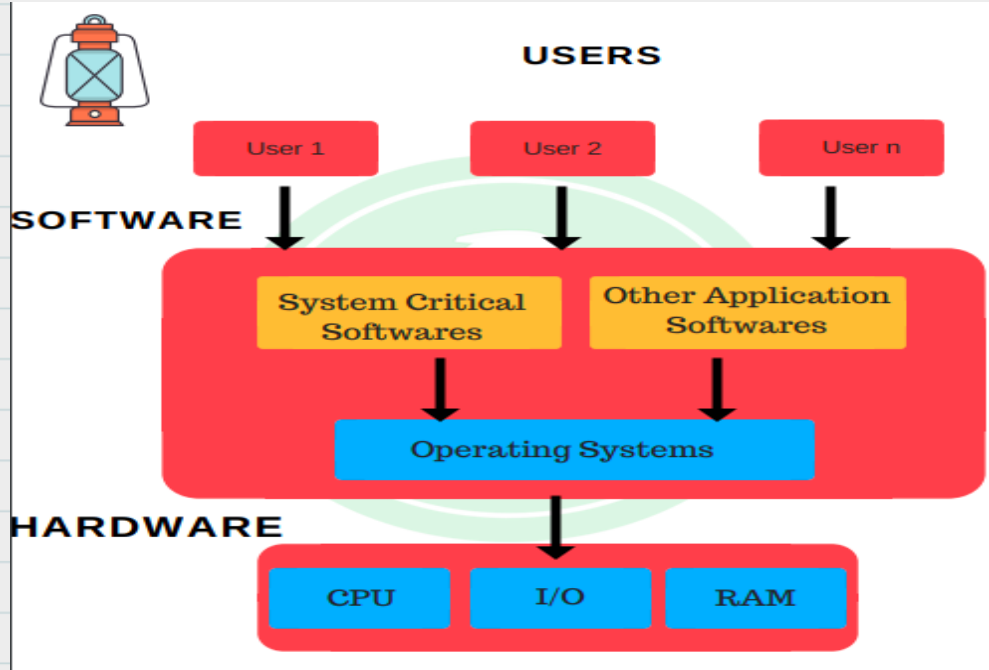
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Fig: relations of software and hardware

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Systems software

Software written for general-purpose computers needs to be able to run on a range of different hardware, for example your favorite web browser runs on your laptop or desktop computer and also on your mobile phone or tablet.

One of the jobs of an operating system is to manage whatever input and output devices the computer has. A programmer writing an application uses simple commands, say Open File, and the operating system deals with exactly how to open a file. This will depend on what sort of secondary storage the file happens to be on. You might have realized this is yet another example of abstraction. This system means applications have to be written for a particular operating system but will work on any hardware. You will probably already be familiar with this idea because you know, for example, that Android apps run on any Android device. Many different models of smartphone or tablet will run the app, but the same apps won't run on your friend's iOS phone.

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Multi-programming — Burn disk? No Yes

Real-time processing — 24 / 24

Interactive processing — Database

Batch processing — Electricity

Multi-tasking — Tutorial

Multi-access or multi user — Chat / Chat

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System Software (Operating Syatem)

The operating system provides developers of **application programs** like word processors with a set of commands such as Open File or Display JPEG: this set of commands is usually called an **application programming interface** or **API**.

➢ Using the operating system rather than accessing hardware directly means that an application program will run on the operating system no matter what hardware it is installed on.

➢ It also means that the **operating system** controls what **application programs** are allowed to do. This helps to reduce the risk of programs crashing and to maintain security. **Managing files** and the **directory structure**, and **input/output** in general, is one of the **important jobs of the operating system**.

➢ An operating system also shares access to the hardware among the different programs that are running Two important pieces of hardware that have to be shared are the **CPU** and **RAM**.

Scheduling: When you have several applications open they can't really be running simultaneously. The operating system keeps up this illusion by allowing each program to use the CPU for a short time before switching to the next program. This is called **scheduling**.

Paging, Swapping Memory: It is possible to load many applications all at the same time and each uses some memory. What if you keep loading applications until RAM is full? In this case the operating system creates another illusion, by moving programs from RAM to hard disk and back again when needed. This called **paging, swapping or virtual memory**. You might notice this as a lot of disk activity and your computer running more slowly when lots of applications are open.

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Some features of OS (Operating System)

➤ Controls the backing store and peripherals such as scanners and printers.
➤ Deals with the transfer of programs in and out of memory.
➤ Organizes the use of memory between programs.
➤ Organizes processing time between programs and users.
➤ Maintains security and access rights of users.
➤ Deals with errors and user instructions.
➤ Allows the user to save files to a backing store.
➤ Provides the interface between the user and the computer - for example, Windows Vista and Apple OSX. For more information, see the User Interfaces study guide.
➤ Issues simple error messages.

In a larger computer such as a mainframe the operating system works on the same principles.

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Application Software

Applications software is used to carry out tasks on a computer, such as writing an email, making a poster, doing homework and messaging friends. Some of the applications we might use to do this include a word processor, web browser and graphics software.

Some software, such as word processors, spreadsheets and desktop publishers are called general purpose software because it is possible to carry out lots of different tasks using that application.

Some software is called special purpose software because it performs one specific task. This might include a flight simulator, payroll software or an application for revising math's.

Applications are also used on smartphones to do lots of things, such as social networking, listening to music and messaging.

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Application Software

Fig: application software

Utility Software

Utility software is software that does a useful job for the user. It is
- inessential to the operating system, and
- not the reason for using a computer in the first place that is, it is not application software).

Utility software, sometimes called tools, can be split into three areas:
- basic tools;
- file management;
- Security

Basic tools:

Basic tools include things like a simple text editor (eg. Notepad or nano), calculator, command prompt, hex editor and software for accessibility such as for producing large print. They are usually included as part of the operating system.

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File management tools

No matter how much storage you have, somehow you always manage to fill up the space with files. This brings problems such as not being able to find your favorite photos, losing files if there is a fault and things simply running slower on your computer.

➢ **File management tools** include software to keep your data secure by making a back-up copy of your files in another location. Some programs can recover files that have been deleted or repair files that might have become corrupted.

➢ Another useful file management tool is for converting files between different formats. This is especially useful for multimedia files where there are a large number of common formats (eg.jpg, gif, png).

➢ Another important file management tool is a defragmenter which is used to speed up access to data stored on magnetic hard disk drives, Files are not stored on disk in one large chunk. They are stored in smaller pieces called sectors or clusters and a single file's clusters can be spread across the disk Accessing these fragmented files can be slow, so a defragmenter moves the bits of files around so they are closer together, speeding up disk access (at least in theory).

➢ Note that, unlike magnetic disk drives, solid state/flash drives do not require defragmentation as access times are the same across the entire volume. You can also use a file management tool to compress the files you don't use very often. This frees up space on the disk but those compressed files are then slower to access as they have to be uncompressed to open them.

Security tools

Security tools include anti-virus and anti-spyware software. Computer viruses and spyware can be used to capture private information, to introduce a process on your computer to do a job for the attacker such as send out spam email, or to crash an important machine such as a web server. Some are simply written to annoy users. Such software is called a virus because it copies itself and spreads: anti-virus tools try to identify code that copies itself and prevent those processes from running.

➢ Firewall software controls your connection to a network, deciding which infection by viruses. Data on your tutor's laptop might be encrypted so that it is not understandable if the laptop is stolen.

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Computer Simulation and modelling

One important application for computer science is the ability to do experiments that can't be done in the real world. For example:

✓ you can't increase the average temperature of the Earth to see what happens to our weather, However you can write a computer program to model or simulate these situations and see what results you obtain. Scientists, engineers, economists and other experts can ask 'what if?' questions using computer models, for example: what if the bridge were twice as long?

There are two big problems with this approach.

- The model or simulation includes assumptions. It is not reality so the answers might not be right.
- The real world is far too complicated to allow for every possible factor in your model, so you have to use abstraction to simplify it.

This makes it even less likely that you will get a totally right answer. Nevertheless, computer models can reveal some interesting things.

Thanks!