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Introduction to Operating Systems (OS)

"Hey, hey, hey, it's the big 'Master Control Program' everybody's talking about."

-- Kevin Flynn, (Tron 1982)
Not every computer has an OS

• Computers are everywhere!
  ◦ Watches
  ◦ Phones
  ◦ Appliances (Microwaves, Refrigerators)
  ◦ Vehicles (All modern cars, buses, motorcycles)
  ◦ Pacemakers
  ◦ RFID tags

• If a computer only one set of tasks to perform and uses very simple input (a few buttons) it usually doesn't need an operating system.

• Simple computers run one program at a time, and that program talks directly to the hardware.
What is an OS?

- A computer program (also a software program, or program) is a sequence of instructions written to perform a specified task for a computer.

An operating system is a *special type of program* designed to run other programs on a computer.

- The "Universal Machine" was a long sought goal of early computer scientists. Before operating systems were developed a programmer:
  - Had to know the exact hardware details of the machine they were working on.
  - Had to recompile and reload entire program to make even trivial changes.
  - Couldn't really reuse functionality (keyboard, mouse).
The most important program

- A computer’s OS is its most important program.
  - The OS is the backbone of a computer, managing both software (other programs) and hardware resources.
  - An OS is responsible for everything from the control and allocation of memory, to recognizing input from external devices and transmitting output to computer displays.
  - They also manage files on computer hard drives and control peripherals, like printers and scanners.
- An operating system is usually stored on the hard-drive (when the machine is off) and is loaded into main RAM by the BIOS on the motherboard.
Modern Operating Systems

- The operating system of a large computer system does more than just manage hardware and program.
  - A modern OS may monitor many different programs and users, making sure everything runs smoothly, without interference, despite the fact that numerous devices and programs are used simultaneously.
  - An operating system also has a vital role to play in security. Its job includes preventing unauthorized users from accessing the computer system.
Multi - Systems

- There are multiuser, multiprocessing, multitasking, multithreading, and real-time operating systems.
- A multiuser operating system enables multiple users to run programs simultaneously.
  - This type of operating system may be used for just a few people or hundreds of them.
  - There are some operating systems that are used to allow thousands of people to run programs at the same time.
Multi - Systems (2)

- A multiprocessing or multiprocessor, operating system allows programs to run on more than one central processing unit (CPU) at a time.
  - This can come in very handy in some work environments, at schools, and even for some home-computing situations.
  - Of course you need to actually have multiple cpus.
- Multitasking operating systems work a little differently; they make it possible to run more than one program at a time.
- Multithreading operating systems are even more different, allowing varied parts of one program to be used simultaneously.
Real-time Systems

- Real-time operating systems are designed to allow computers to process and respond to input instantly.
  - Usually, general-purpose operating systems, such as disk operating system (DOS), are not considered real time, as they may require seconds or minutes to respond to input.
  - Real-time operating systems are typically used when computers must react to the consistent input of information without delay.

- Examples:
  - Real-time operating systems are used in navigation, medicine and energy fields.
Command Line Interfaces (CLI)

- A command-line interface (CLI) is a mechanism (sometimes a program) that is used to interact with a program or operating system.
- A CLI requires specific commands to be typed in by the user to perform specific tasks.
- Programs can be written to run inside a CLI. These programs (sometimes called "batch scripts") can be used to automate common tasks.
- There are many different kinds of CLI.
  - On windows there is `cmd.exe`
  - On MAC and Linux machines there are the "shells" sh, ksh, csh, tcsh, and bash.
BASH and CMD.exe CLIs
The GUI

- Almost all operating systems tend include or support a graphical user interfaces (GUIs) that allow the use of devices for input. A mouse is an example of such a pointing device, as is a stylus.

- In many (non-windows) systems this GUI is a separate program, that can be stopped, started and modified. Most linux systems can run many, many different GUI's:
  - Gnome
  - KDE
  - Fluxbox
  - XFCE
  - icewm
  - Windowmaker
  - Ion
MS Windows 7
Ubuntu 10.04 with Gnome 2.30
Common Operating Systems

- Commonly used operating systems for IBM-compatible personal computers include Microsoft Windows Variants, Linux Variants, and Unix Variants.

- For Macintosh computers, Mac OS X, Linux, BSD, and some Windows variants are commonly used.

- Cellphones and other portable devices usually have their own custom build Operating Systems (Apple) but other portable OS are coming online (Android).
Application Program Interface

- A consistent application program interface (API) allows a programmer to write a program that will run on different computers, even if the hardware (memory, CPU, etc.) is different on the two machines.
- Applications continue to run when hardware upgrades and updates occur because the operating system -- not the application -- is charged with managing the hardware and the distribution of its resources.
- Today's systems can accommodate thousands of different, CPU's printers, disk drives and special peripherals in any possible combination.
Key Points

- Operating Systems manage the hardware (especially the CPU).
- Operating Systems manage the software (other programs on the machine).
- Operating Systems provide the User Interface (usually graphical, GUI) that allow human beings to interact with the computer.
- Finally, Operating Systems provide a consistent environment for programmers to work within.
6 primary functions

1. Processor management
2. Memory management
3. Device management
4. Storage management
5. Application interface
6. User interface
The End