Understanding Computer Hardware

Continued...

How fast is your computer?

- Depends on a lot of factors
  - Processor design
  - Clock Speed
  - Size of Cache memory
  - Bus Width
  - Math-Coprocessor
  - Graphics processor, Video Processor, Audio Processor
  - RAM Size
How Fast is your Computer?

- Also depends on performance of your hard drive
- Why?
  - The concept of Virtual RAM
- Average Access Time
  - Combination of how fast the drive is spinning and how fast the head can move from track to track
  - HD: 6-12 ms
  - CD: 80-800 ms
- Data Transfer Rate (or Throughput)
  - Max rate at which data can be transferred
  - Typically b/w 15/80 Mbps
- Performance improves with Defragmentation, scanning disk for errors, and cleaning up unnecessary files

Operating Systems

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Operating Systems

- You have already had ample experience with at least one of them
  - IBM PCs commonly come with Windows XP Operating System... Some may have Windows 2000 on them
  - Macs have MAC OS operating system
  - Sun machines use UNIX or LINUX operating systems
  - Palm PDAs come with PalmOS

- Operating systems is how Bill Gates got so rich!
What is an Operating System?

- An operating system is a ‘program’, a piece of software, rather than hardware.
- It is the first program to be loaded in memory, after POST is completed.
- It is a rather special program – it manages the computer and everything that runs on it.
- Amongst other things, the operating system provides you with a User-Interface, so you can actually use the computer.

More on Operating Systems

- A microwave oven has a computer in it which manages the keypad, the display, as well as does computations about cooking.
- Microwave ovens do not need an operating system, because they do the same simple task over and over again.
- An oven runs a single program all the time.
- All desktop computers have an operating system.
- The operating system creates the ability to:
  - Serve a variety of purposes
  - Interact with the user in more complicated ways.
- At a simple level, OS does two things:
  - Manages hardware and software resources.
  - Provides a way for the user to deal with hardware, without knowing all its details.
Device Drivers

- Communication with all hardware not on the motherboard is done through *device drivers*
- Driver performs the role of a translator between hardware signals and programs
- E.g. Driver would translate a file sent to it by OS and convert it into series of laser pulses for a printer

What does an Operating System do?

- User i.e. YOU
- Operating System e.g. Windows 2000
- Applications e.g. MS Word, Calculator
- Hardware CPU, Monitor, Keyboard

You can think of the operating system as a factory manager, who manages resources, inventory, workers and jobs
What does an Operating System do?

- The operating system manages a lot of things
- Including
  - Memory
  - Processor
  - Other hardware
  - Applications
  - File System

Ref: http://computer.howstuffworks.com/operating-system.htm

Types of Operating Systems

Operating Systems for Desktops

- Single-User, Single-Task
  - At one time, only one task (application, program) can run on the computer
  - Eg. DOS, Palm OS
- Single-User, Multi-Task
  - Most common type on desktops
  - E.g. Microsoft Windows, Apple’s MacOS
- Multi-User
  - Allows several users to work simultaneously on a computer
  - Mainly run on servers
  - E.g. UNIX or LINUX
Types of Operating Systems

- **Real-Time Operating Systems (RTOS)**
  - Normally used to control scientific machinery
  - Ensures that a given task occurs in precisely the time allocated for it
  - Typically not user friendly
  - Often is an embedded OS
- **Embedded Operating Systems**
  - Operating system built into the circuitry of a device, e.g. cell phones, medical equipment, bar-code scanners
  - Eg Windows XP Embedded, Windows CE (also an RTOS), Symbian
- **Network Operating Systems**
  - Designed to work on network servers
  - Such machines often have multiple processors and fault-tolerance built into them
  - High level of reliability is required
  - Eg. Windows NT Server, Windows Server 2003, Unix/Linux for servers, Novell Netware

Multi-tasking

**How Windows Multitasks**

1. When an application needs more memory, it requests excess from Windows. If it finds it has enough memory, it allocates it to that application.

2. A thread is the smallest unit of a Windows application. Threads of a process share the same memory space. Each thread runs a set of instructions in a loop that continues as long as the application runs.

3. Over the processor, the number of windows will vary depending on the number of threads running in the system. Each thread will have its own set of resources and can be independently executed.

4. The operating system allows the user to create multiple windows, each running a different application. Windows share the same memory space, allowing for multitasking.

5. The operating system manages the memory space of the applications running in the system. Each thread runs in its own memory space, and the operating system ensures that they do not interfere with each other.

6. The operating system allows the user to create multiple windows, each running a different application. Windows share the same memory space, allowing for multitasking.

7. The operating system manages the memory space of the applications running in the system. Each thread runs in its own memory space, and the operating system ensures that they do not interfere with each other.

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PCB – Process Control Block

Multi-Tasking

RAM

Process PCB

Process PCB

Process PCB

CPU

Required Reading: Chapters 5b and 6 of text

Useful link to understand more about operating systems...
http://computer.howstuffworks.com/operating-system.htm

Figure Acknowledgement: “How Computers Work” 6th Ed by Ron White (Illustrated by Timothy Edward Downs) © Que Corp 2002