

Lecture 3

SOFTWARE. OPERATING SYSTEM.

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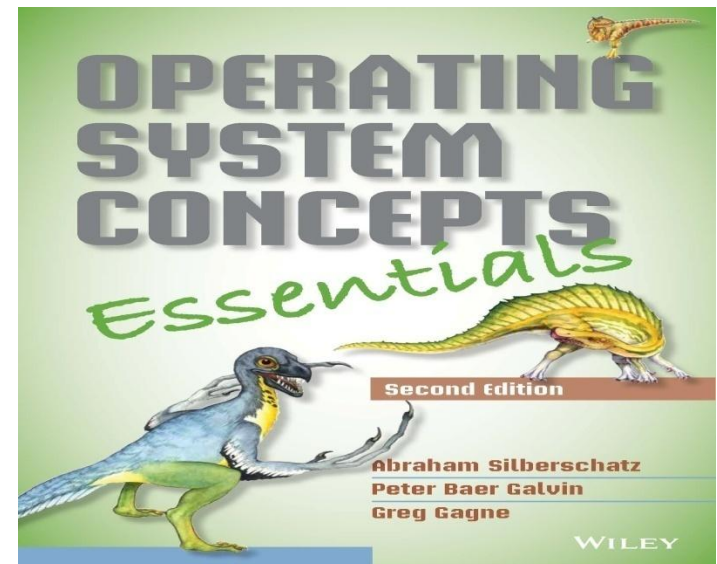
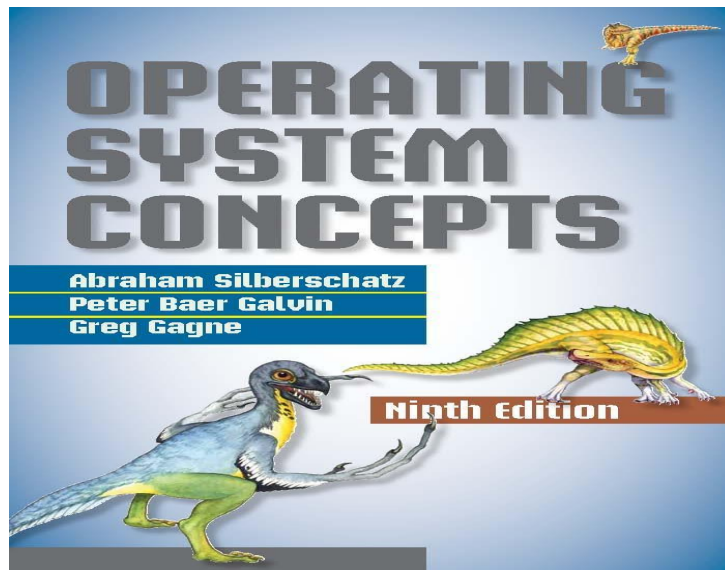
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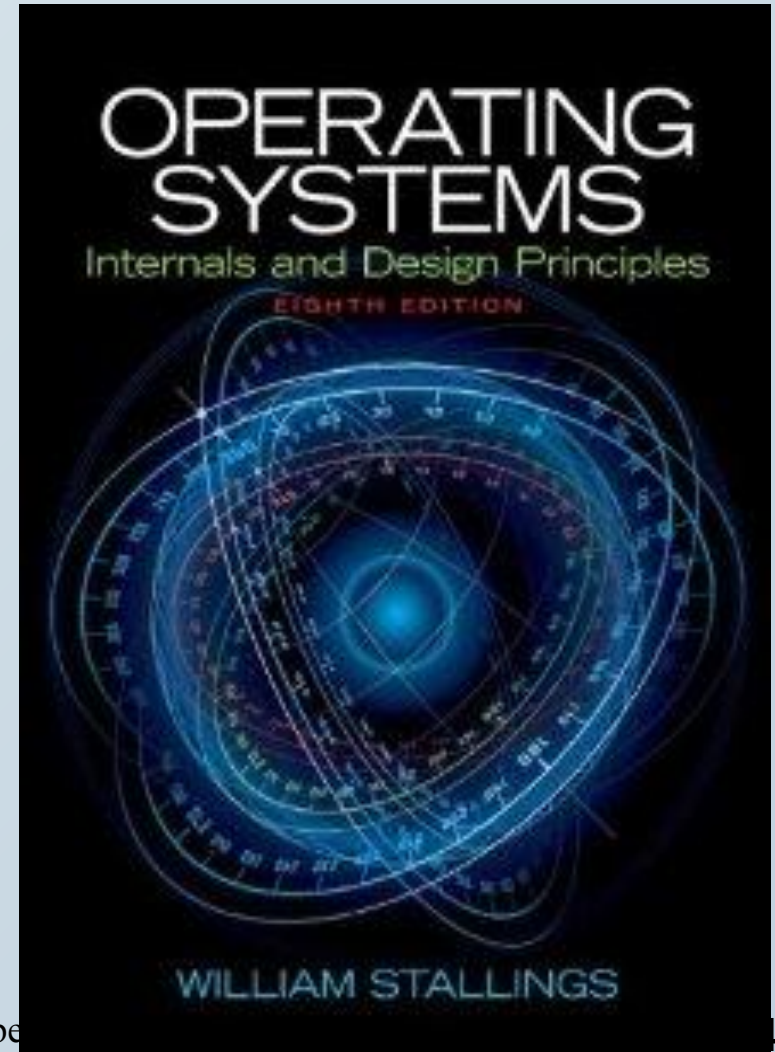


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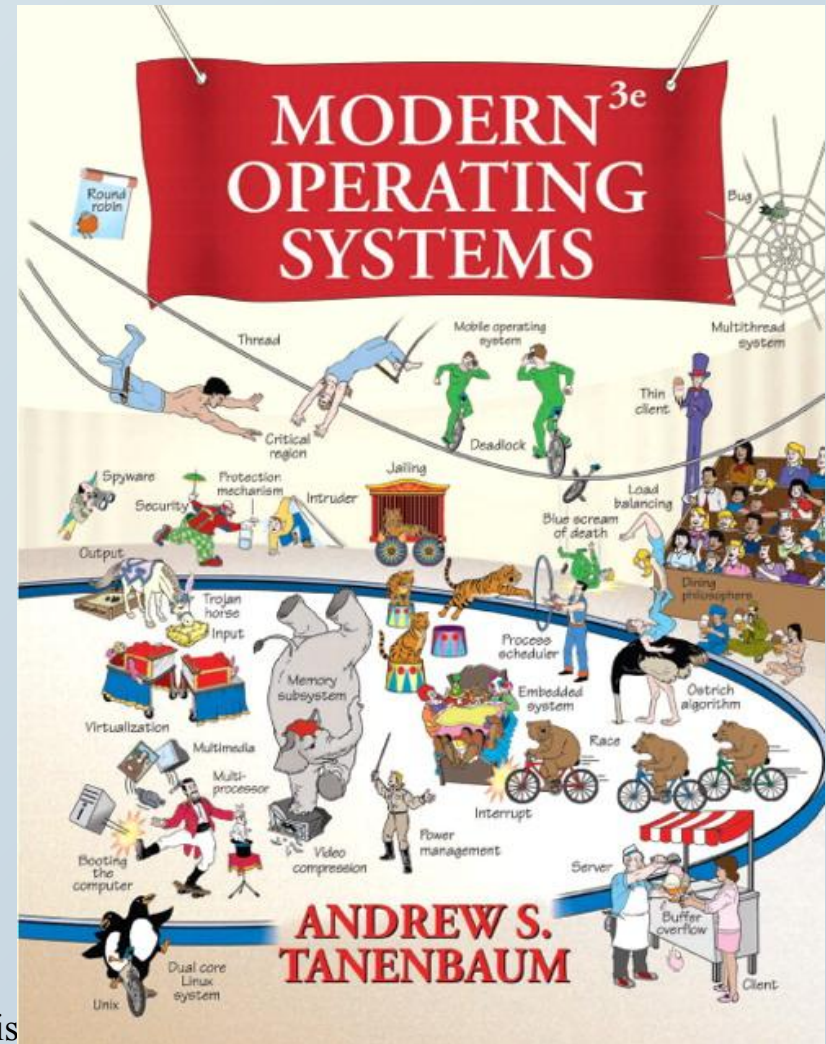
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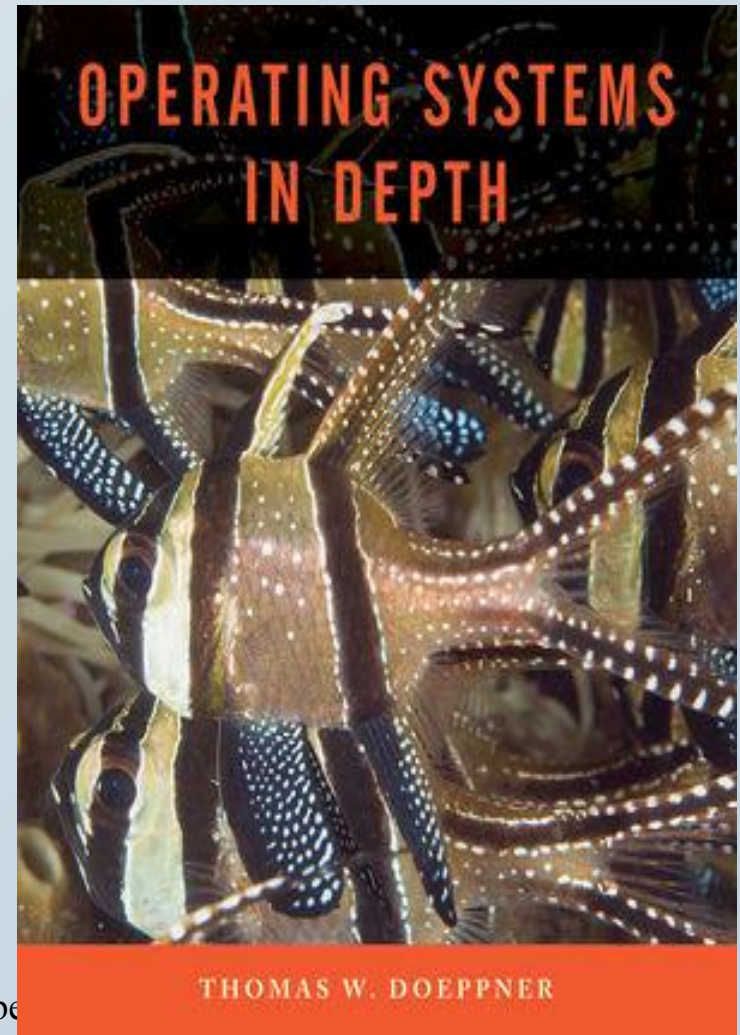
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1. Computer Software

What we'll cover for this lecture topic:

- Software categories
 - **Applications** software
 - **Systems** software
 - What is an **operating system**?
 - What does it do for me?
 - What does it do for application programs?
 - What is a **translator**?

* The Big Picture *

• Application software

- It is the reason that one wants to buy a computer:
 - printout out paychecks
 - play Mortal Kombat
 - keep track of a stamp collection
 - do your taxes
 - generate a fancy newsletter
 - guide robots
 - keep a budget
 - draw a flowchart
 - browse the Web
 - design a car

• System software

- Helps computer carry out its *basic tasks*.
- Includes:
 - **Operating systems (OS)** - master control programs
 - BIOS (Basic Input/Output System)—see Rdg Handout!
 - Some utilities are built into OS
 - **Translators** (program language translators/compilers)

Application

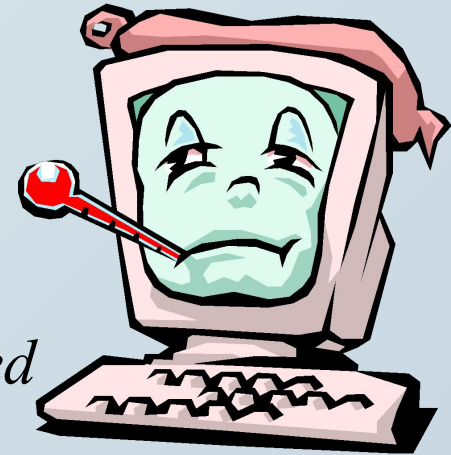
software

- Includes many *executable* files and *data* files:
 - **Installer** program (eg: setup.exe)
 - **Uninstaller** program (*why important?*)
 - **Main** executable file (eg: winword.exe)
 - **Support** modules (eg: .dll files)
 - Called by the PROGRAM, not by the user
 - **Data** modules (eg: MS Word dictionary)

- “**Installing**” has gotten easy...most use **wizards**
- **Excellent** coverage in the textbook Chapter 3 Section D (and an interactive lab you can try).

Digression

- Is *reliable software* an oxymoron?
 - “They recall cars and toys for defects; you’d think a product with 3,000 bugs would be fixed for free” John C. Dvorak
 - TODAY’S QUOTABLES:
 - Origin of “bug”
 - Haventree Software’s Warrantee ...



SYSTEMS Software...

I. The Operating System

- A type of *system* software that underlies *all other software*.
- It manages all software and hardware tasks.
- It provides a common set of computer functions such as input from a keyboard and output to a monitor.
- It provides the user interface.....that is:
- How can something as *simple-minded* as a **processor** and **memory** present you with something as rich as the Mac or Windows GUI?

- What does an OS do for me? **LOTS!**

In general terms.....

- Provides *user interface* ...as we saw.
- Allows applications to run.
- What are some tasks you need done even when no apps are running?
- Does nearly *half* of what we ask an application program to do!
 - **Common** tasks useful to all programs —put those in the OS (the *most basic* are put in BIOS) so each app doesn't have to handle those tasks.
 - So what are some of these tasks?



System calls

- You ask **MS Word** to **OPEN** a document
 - File menu/Open...
 - WHAT WILL YOU SEE?
 - What *really* just happened *in the box*?

WORD called on **O.S.** to present you with that file list!

O.S. must look at:

1. Disk Directory (list of *filenames*)
2. File Allocation Table (**FAT**).... (list of file *locations: starting cluster number on the disk*)



Allows **consistency** from app to app

Input/output

Reads from and writes to the I/O devices.

- In the past, **application** programmers had to write control programs for I/O devices. Painful!
- Today, **O.S.** *reads from and writes to* the I/O devices: mouse, keyboard, printer, monitor...
- About **half** the instructions in today's OS are to manage **input** and **output** operations.



EXAMPLES of I/O operations

- OS reads **mouse movement** and writes to display screen.
 - You *move the mouse*---what do you expect to happen?
 - What that involves...
 - Manage interrupt.
 - OS reads mouse wheels.
 - OS draws cursor arrow (changes pixel colors so arrow *appears* to be “moving”).

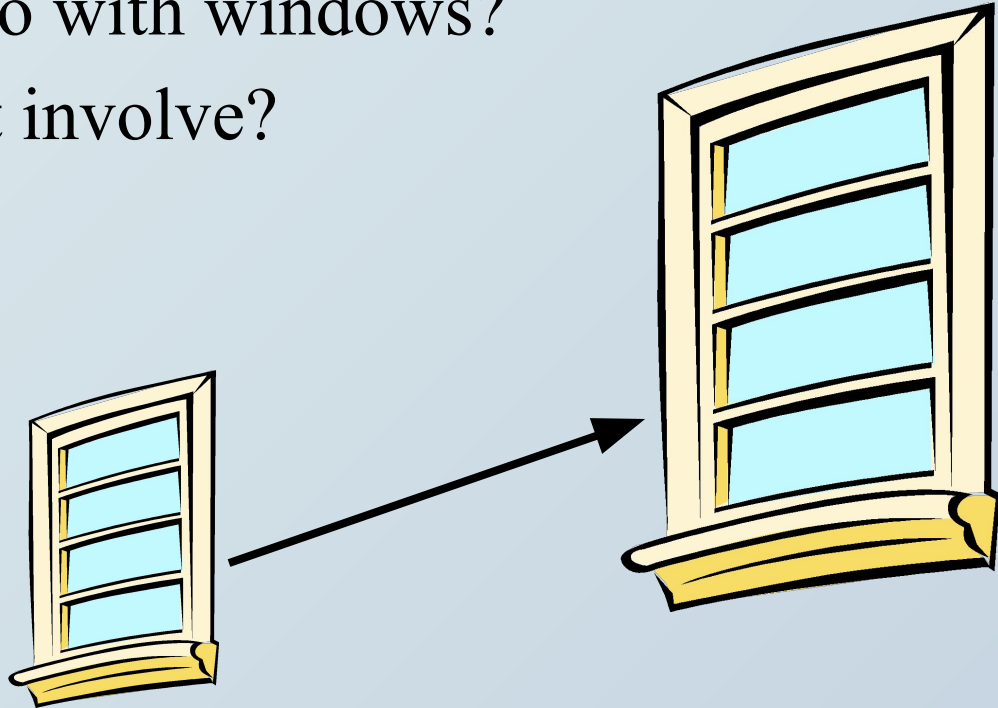


- OS identifies selected objects on the desktop
 - You *select an icon*--what do you expect to see?
 - What that involves...!
 - FIRST: you move the cursor to point to icon...
 - Draws “moving cursor...”
 - OS keeps table of icon placements...
 - Looks at current *cursor placement* and compares it to that table.
 - NEXT: you single-click mouse button to SELECT it:
 - What do you expect to see?
 - OS does all this!



Manages windows

- What do you do with windows?
- What does that involve?



Manages files and folders

- *What do **you** do with files and folders?*
 - You **Create** a new file or folder....
 - You **Move** files and folders; you “nest” folders
 - You **Open** a **document file...** whoa! Let’s see:
 - OS looks at file extension
 - OS checks if enough free memory space
 - **OS finds** and **loads** the APP (*if not loaded*)
 - *OS finds and loads the document*
 - OS keeps track of what data goes with what program
(all sharing same RAM)
 - OS turns **control** over to the APP

IMPORTANT digression:

WHAT HAPPENS when you SHUT DOWN improperly? *Why should you care?*

“Shutting down incorrectly is a little like stopping your car by driving it into a wall. It works, but it can cause some damage.”
(author unknown)

Misc Services and Utilities

- **OS does system control ops from Start button:**
 - Shut down; Restart.
- **OS does universal ops from the Edit menu:**
 - Cut, Copy, Paste, Clear, Select All
 - Clipboard ... (also between different apps)

IMPORTANT:

- Difference between a simple copy/paste, and OLE = object linking & embedding

- **OS** does **universal ops** from the **View menu**:
 - Show/Hide Toolbars & Status bar;
 - Large icons, Small icons;
 - List; Details;
 - Arrange Icons; etc.
- **OS** also has many built-in **UTILITIES** & goodies that are universally provided: *(differs from OS to OS; and version to version)*
 - **Taskbar** and **Start** button: unique to Win O.S.
 - Control panel, Find, Help, Format or Erase disk, Properties
 - **Right-click** menus
 - **Properties**; Rename; Shortcuts, and more
 - And lots more, depending on **OS** you use, and on the **version** you have.

- Lots of *3rd-party* utilities as well!

READ about these utilities in the Reading handout.

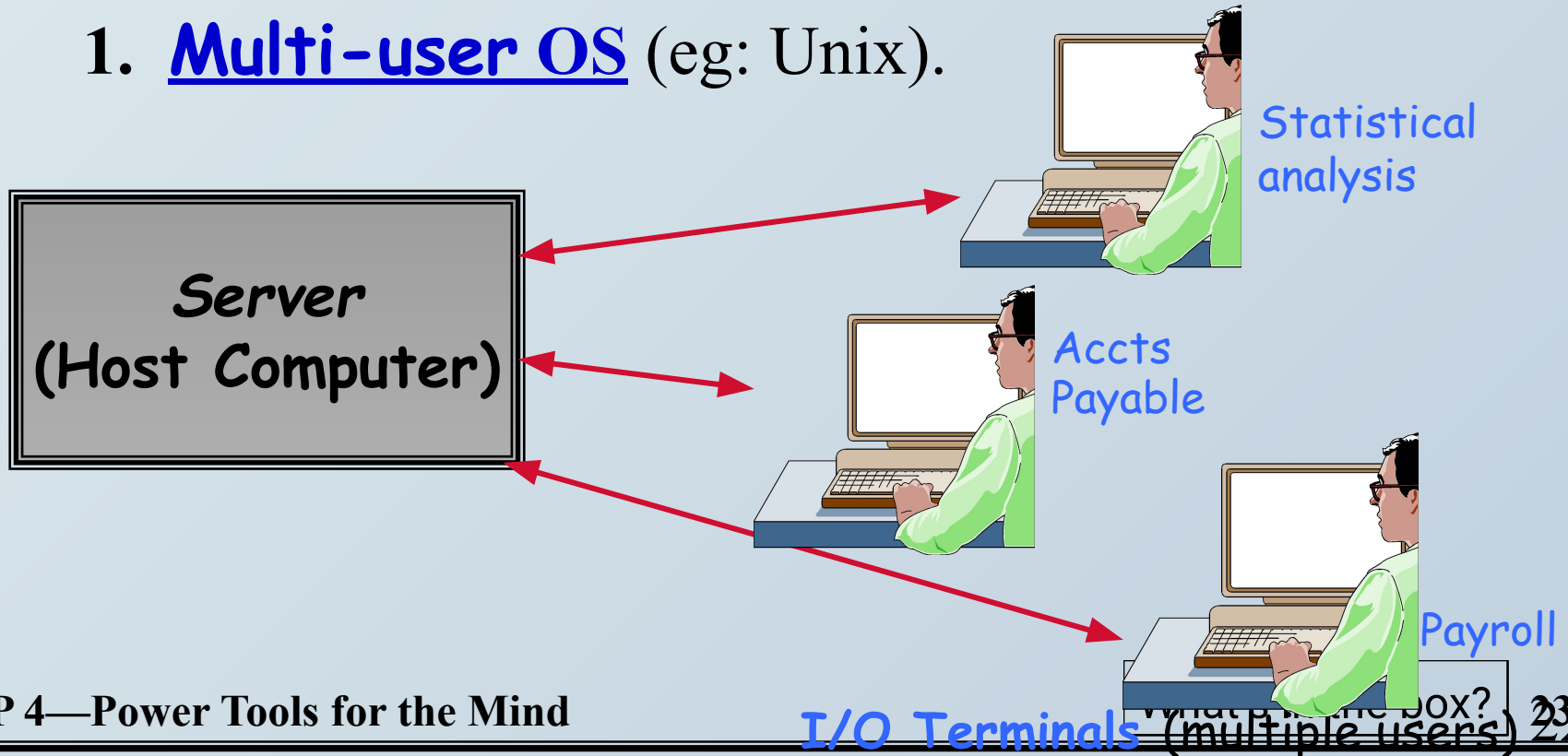
- Data recovery (unerase!)
- Compression (*NOTE: textbook pages 371-375—just know the general gist of how it works, not all the specifics!*)
- Anti-virus protection (*included with Windows XP*)
- Firewalls (*included with Windows XP*)
- Diagnostics
- Uninstall programs
- Screen savers
- File defragmentation
- *and MORE!*

*Try the recommended
*Book-on-CD labs!**

Manages/allocates time & memory space

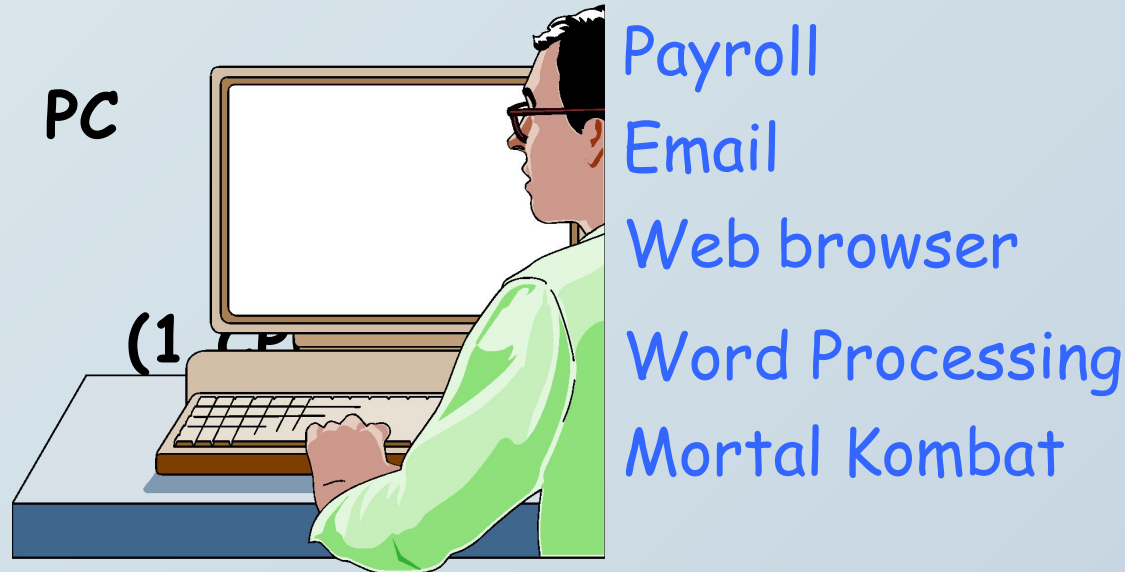
- >1 program *or* person can share computer **resources**.
 - CPU is idle ~90% of time, waiting for user input !
- Multiprogramming
Run two or more programs *concurrently*.
eg: Calculate payroll *and* Accts payable *and* WP *and* ...

1. Multi-user OS (eg: Unix).



2. Single-user OS (eg, Windows)

- Referred to as multitasking, which is multiprogramming for *single-user OS*.
- One active app; others run in the background



OS must protect each program's *memory area* to ensure that instructions and data don't "leak" into an area allocated to *another* program. If it fails, programs can **crash**...more shortly!

Handles interrupts

- Mouse click; mail sound; alarm clock; app bombed...
 - OS breaks into current process and instructs CPU to do something else. *And keeps track!*

Important Digression: software bombs

– APP freezes – – “Program crash”

- Windows OS usually allows you to continue working in other apps; try to close the confused app:

Right-click on the app's button on Taskbar, select Close.

– OS freezes – – “System crash”

- Ctrl/Alt/Del: sometimes can Cancel current Task (Applications Tab, select **End Task**). If that fails, restart (“Soft boot”) from Start button.
- Power off button, wait, then Power on (“Hard boot”). **LAST RESORT!**



Provides (and loads) Device Drivers

- **Small programs** that control a peripheral device (printer, hard disk, tape drive, modem ...)
 - Allow OS & applications to activate (*drive*) the hardware device.
 - The driver accepts commands from the operating system and converts them into a form that a *particular device* can understand.
 - Newer OSs: provide *most* device drivers.
 - Else: find and download device driver program from manufacturer's web site.

• **Digression: The Windows Registry**

- We saw that the OS acts as *intermediary* between software and peripheral devices.
- OS needs to know something *about* these devices (what is it, how installed, any special settings, etc.)
- Windows Registry: keeps track of your computer's peripheral devices & software so the OS can access the information it needs to coordinate the computer's activities.
- See associated text reading for much useful information.

Something you should have learned from all this:

**OS takes up a fair amount of memory....
But it's well worth it! It does a LOT.**

SYSTEMS Software...cont'd

II. Translators *(revisited!)*

- How do people write programs?
- Only language a **computer** understands?
- A translator (or compiler):
 - Program that converts high-level *source code* into low-level *machine language (object code)*-- can then be processed directly by the computer's binary circuits.
 - Running a **source** program is a **two-step process**:
 1. Execute the translator program first:
 - converts ASCII source into **executable** machine language
 - creates a new file containing the **object code**.
 2. Execute that NEW **object code** file.

In ENGLISH:

Find and print the names of all freshmen who scored greater than 79% on the first exam.

High Level: If Year = 1 and Score1 > 79 then put StName

Low Level:

Assembly: LDR A5FD R1 *More readable form of binary;*
 CMP R1, 1 ... *symbolic representation.*

ML: 00000010 10001100 01100000 00010001
 00000111 ...

Translation will:

- chop up every *command* word into ~25+ *op codes*.
- convert *variable names* (Year, Score, StName) into actual binary memory *address* numbers.

2. Operating Systems

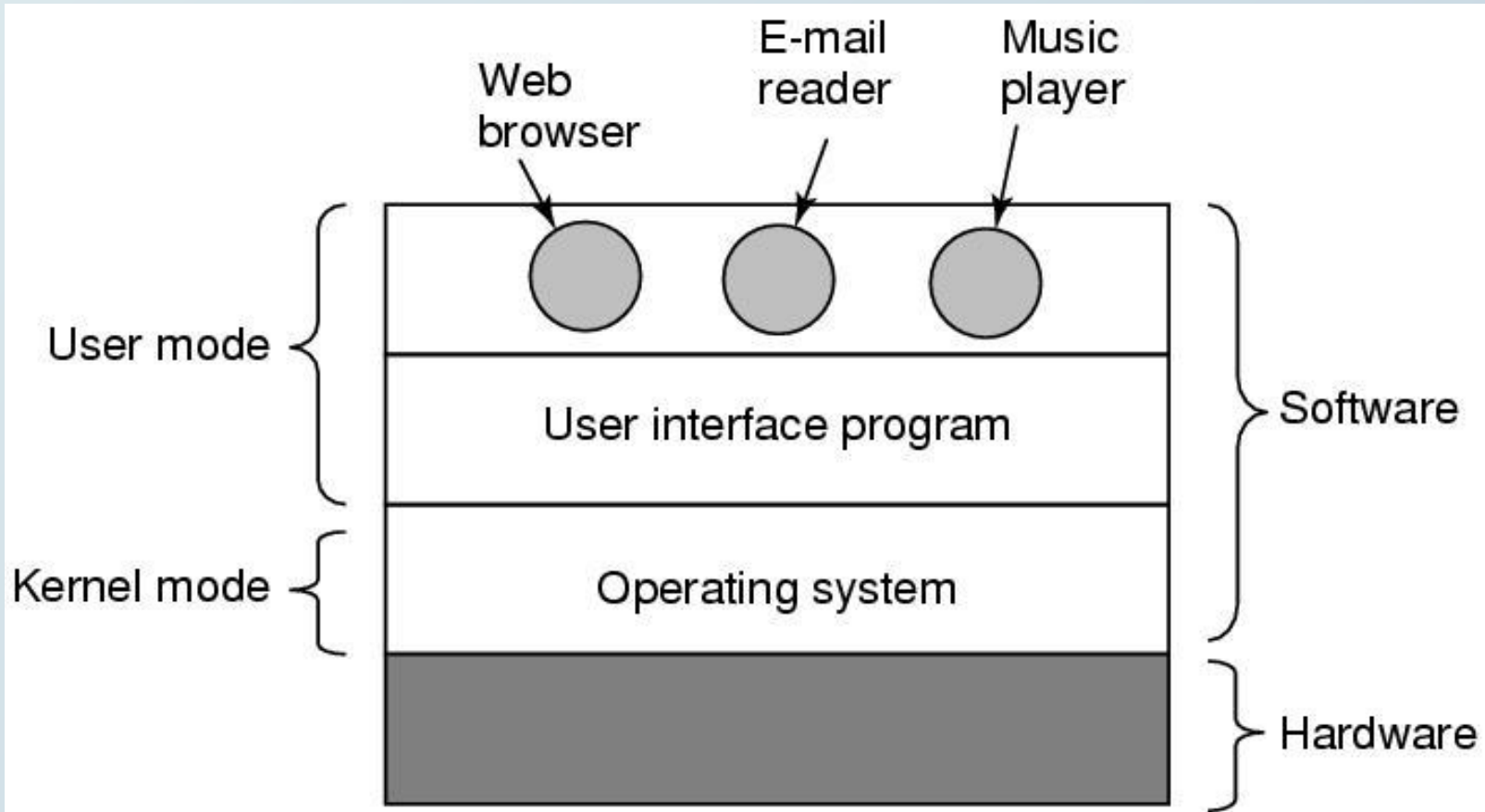
What is an Operating System (1)?

- A modern computer consists of:
 - One or more processors
 - Main memory
 - Disks
 - Printers
 - Various input/output devices.
- Managing all these varied components requires a layer of software – the **Operating System (OS)**.

What is an Operating System (2)?

- An Operating System is a program that acts as an intermediary/interface between a user of a computer and the computer hardware.
- OS goals:
 - Control/execute user/application programs.
 - Make the computer system convenient to use.
 - Ease the solving of user problems.
 - Use the computer hardware in an efficient manner.

Where does the OS fit in?



Services provided by an OS

- Facilities for program creation
 - editors, compilers, linkers, debuggers, etc.
- Program execution
 - loading in memory, I/O and file initialization.
- Access to I/O and files
 - deals with the specifics of I/O and file formats.
- System access
 - resolves conflicts for resource contention.
 - protection in access to resources and data.

Why are Operating Systems Important?

- Important to understand and know how to correctly use when writing user applications.
- Large and complex systems that have a high economic impact and result in interesting problems of management.
- Few actually involved in OS design and implementation but nevertheless many general techniques to be learned and applied.
- Combines concepts from many other areas of Computer Science: Architecture, Languages, Data Structures, Algorithms, etc.

Evolution of Operating Systems

- The evolution of operating systems is directly dependent to the development of computer systems and how users use them. Here is a quick tour of computing systems through the past fifty years in the timeline.

Early Evolution

- 1945: ENIAC, Moore School of Engineering, University of Pennsylvania.
- 1949: EDSAC and EDVAC
- 1949 BINAC - a successor to the ENIAC
- 1951: UNIVAC by Remington
- 1952: IBM 701
- 1956: The interrupt
- 1954-1957: FORTRAN was developed

Operating Systems by the late 1950s

- By the late 1950s Operating systems were well improved and started supporting following usages :
- It was able to Single stream batch processing
- It could use Common, standardized, input/output routines for device access
- Program transition capabilities to reduce the overhead of starting a new job was added
- Error recovery to clean up after a job terminated abnormally was added.
- Job control languages that allowed users to specify the job definition and resource requirements were made possible.
-

Operating Systems In 1960s

- 1961: The dawn of minicomputers
- 1962 Compatible Time-Sharing System (CTSS) from MIT
- 1963 Burroughs Master Control Program (MCP) for the B5000 system
- 1964: IBM System/360
- 1960s: Disks become mainstream
- 1966: Minicomputers get cheaper, more powerful, and really useful
- 1967-1968: The mouse
- 1964 and onward: Multics
- 1969: The UNIX Time-Sharing System from Bell Telephone Laboratories

Supported OS Features by 1970s

- Multi User and Multi tasking was introduced.
- Dynamic address translation hardware and Virtual machines came into picture.
- Modular architectures came into existence.
- Personal, interactive systems came into existence.

Control questions

- What is Software?
- Differentiate System software and Application software.
- What are the responsibilities of Operating Systems?
- Define the following with suitable examples.
- Single-user OS
- Multi-user OS
- What are utility programs? Define some tasks performed by them.
- What is meant by library programs?
- What are program language translators? Briefly describe three translating approaches.
- State the advantages and disadvantages of Bespoke Application Software.