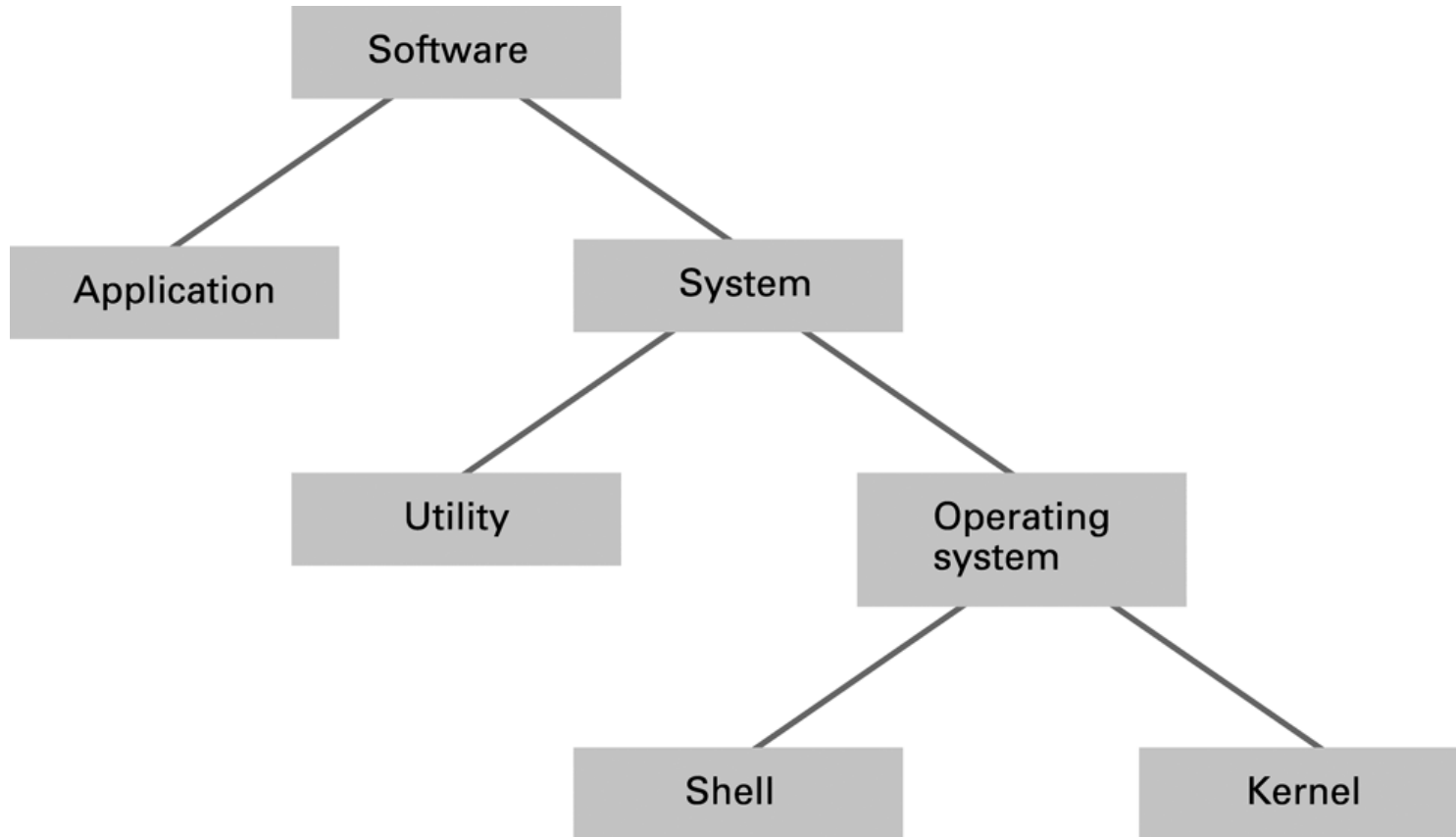


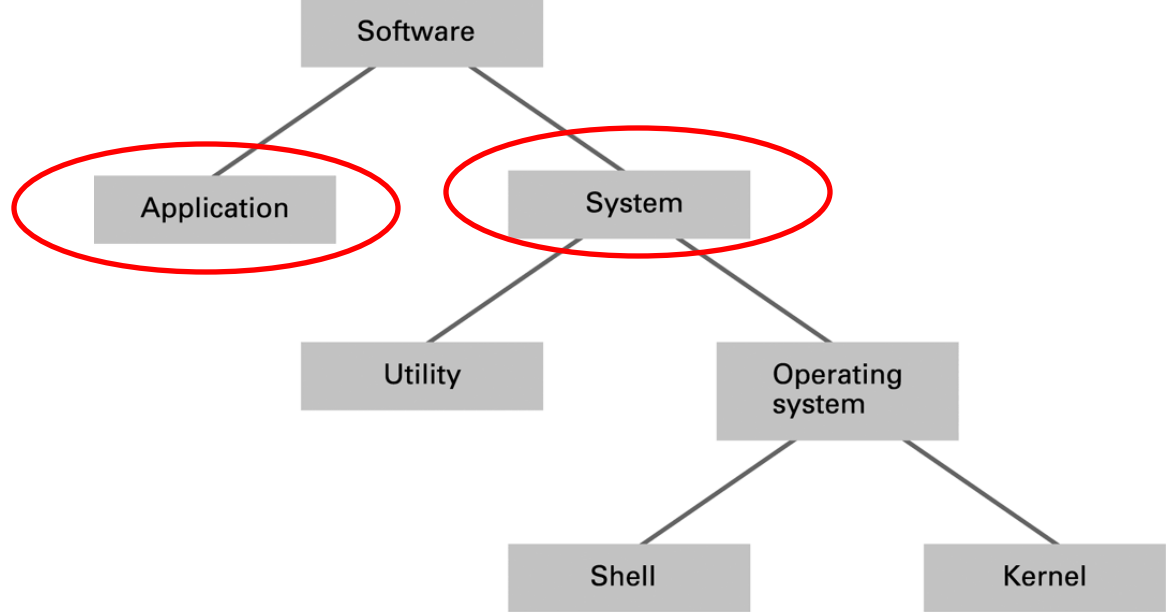
LECTURE-2

OPERATING SYSTEM FUNCTIONS & MULTITASKING & MULTIPROCESSING OS

Software



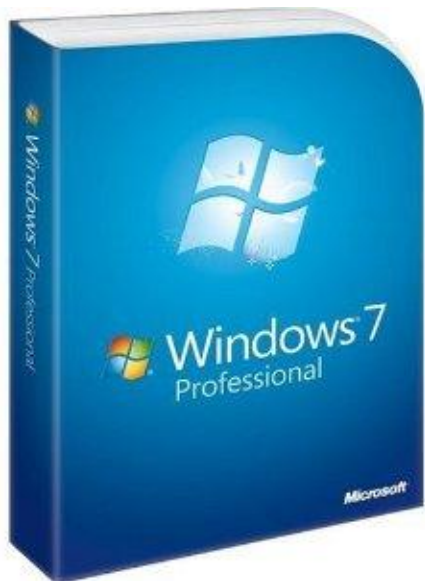
Software



- **Application software:** Programs for performing a specific task
 - Word processing, spreadsheets, gaming, web page design, graphic design
- **System software:**
 - **Operating software:** Software that controls the overall operation of the computer
 - (more next)
 - **Utility software:** Software that extends or customizes the capabilities of the operating system
 - Formatting
 - compress/decompress data
 - network communications
- Distinction between Application and System software can be vague.
 - Anti-trust and unfair business practice lawsuits against Microsoft have been filed over the years.

Operating System Software

- **Operating System (OS)** – Software that controls the overall operation of a computer

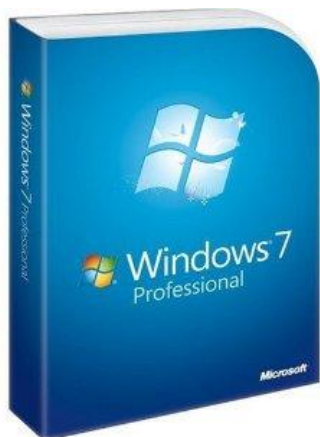


What is an operating system (OS)?

Operating System Software

Software which manages the overall operation of the computer system including:

- hardware (CPU, RAM, I/O)
- security
- system interface
- application interface



What is an operating system (OS)?

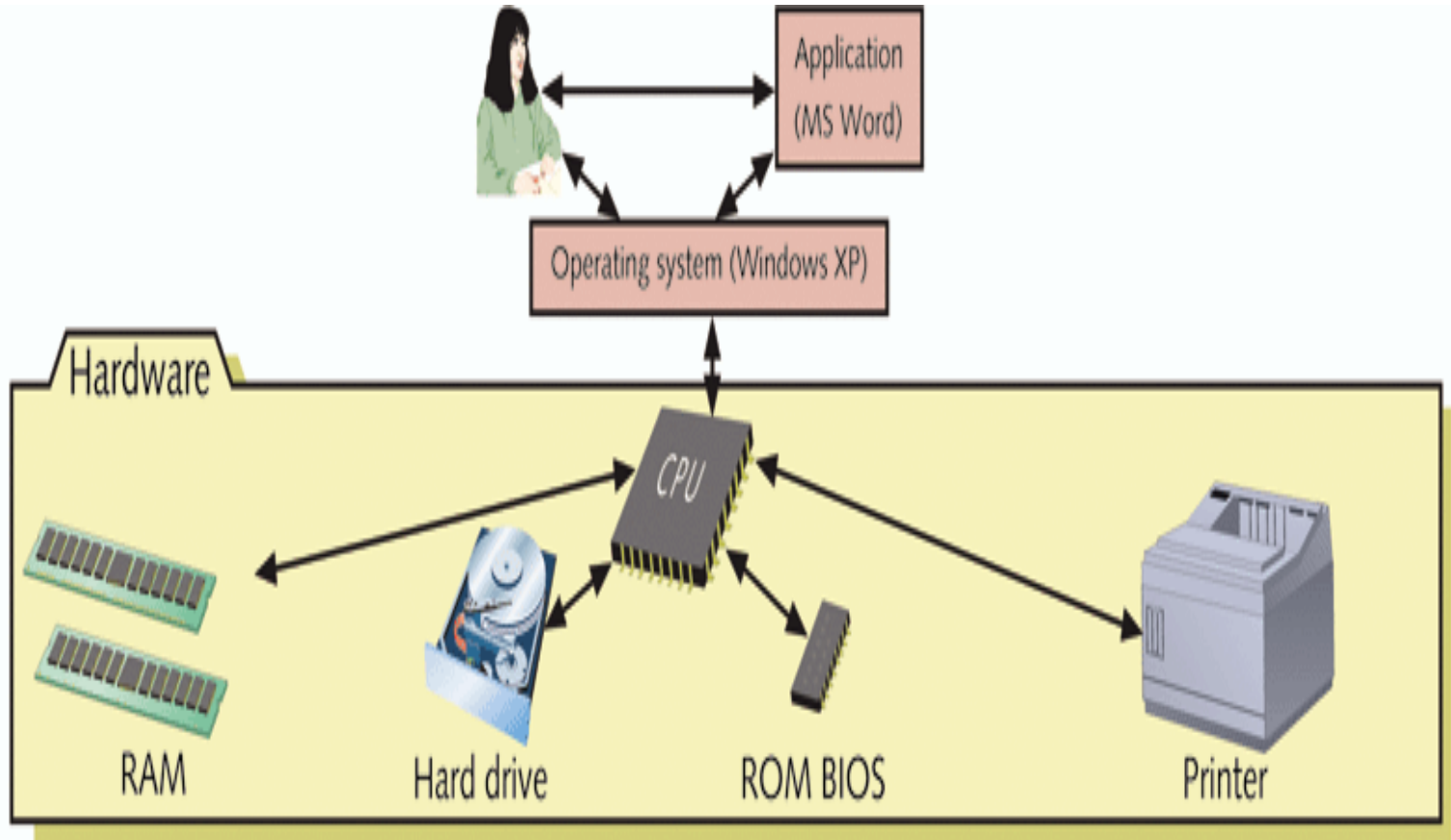
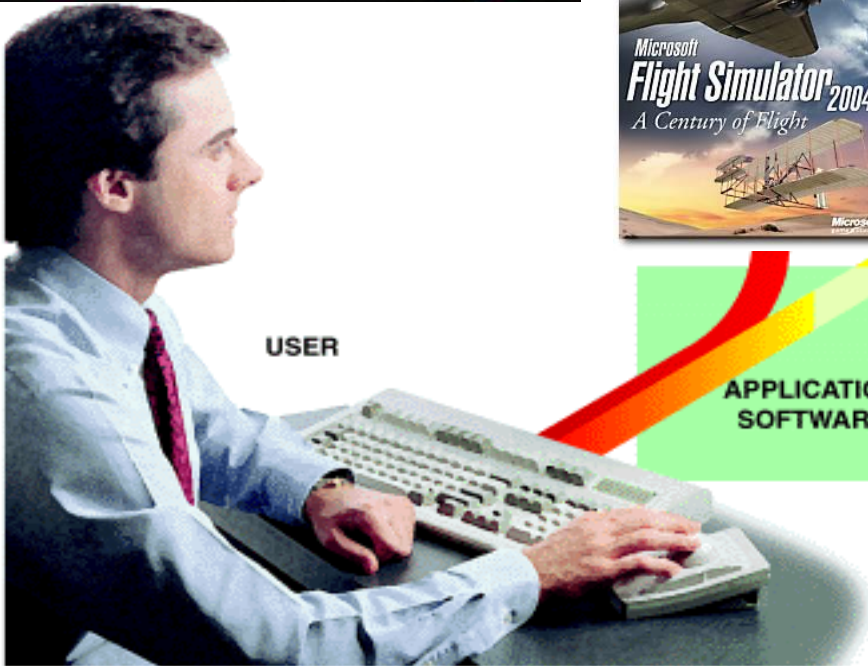
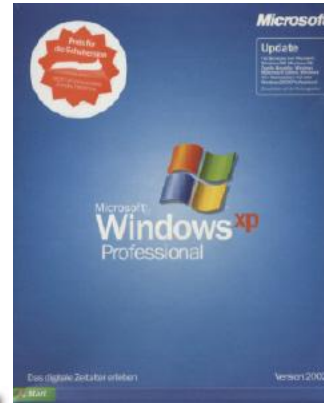
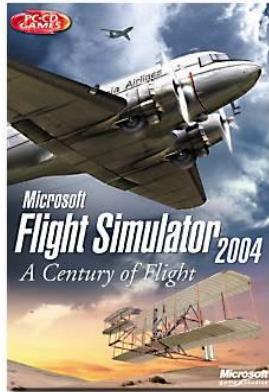


Figure 2-1 Users and applications depend on the OS to relate to all hardware components

The User's View



USER

APPLICATION
SOFTWARE

SYSTEM
SOFTWARE

OPERATING
SYSTEM

SYSTEM
PROGRAMS



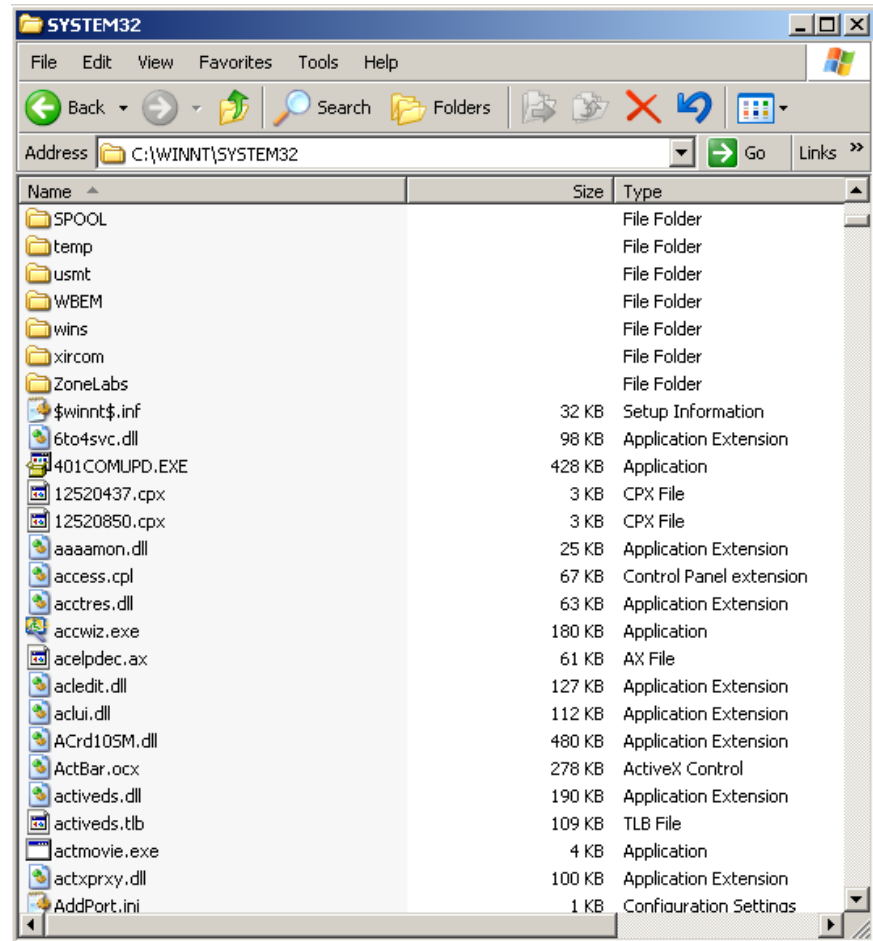
3.2.2002

What “is” an operating system?

Software files (programs) which are stored on the hard disk

- kernel with the internal programs
- external programs

Supporting Data Files



The kernel

The operating system software file (program) which is **copied into RAM**, usually from the hard disk drive, during the **boot-up**.

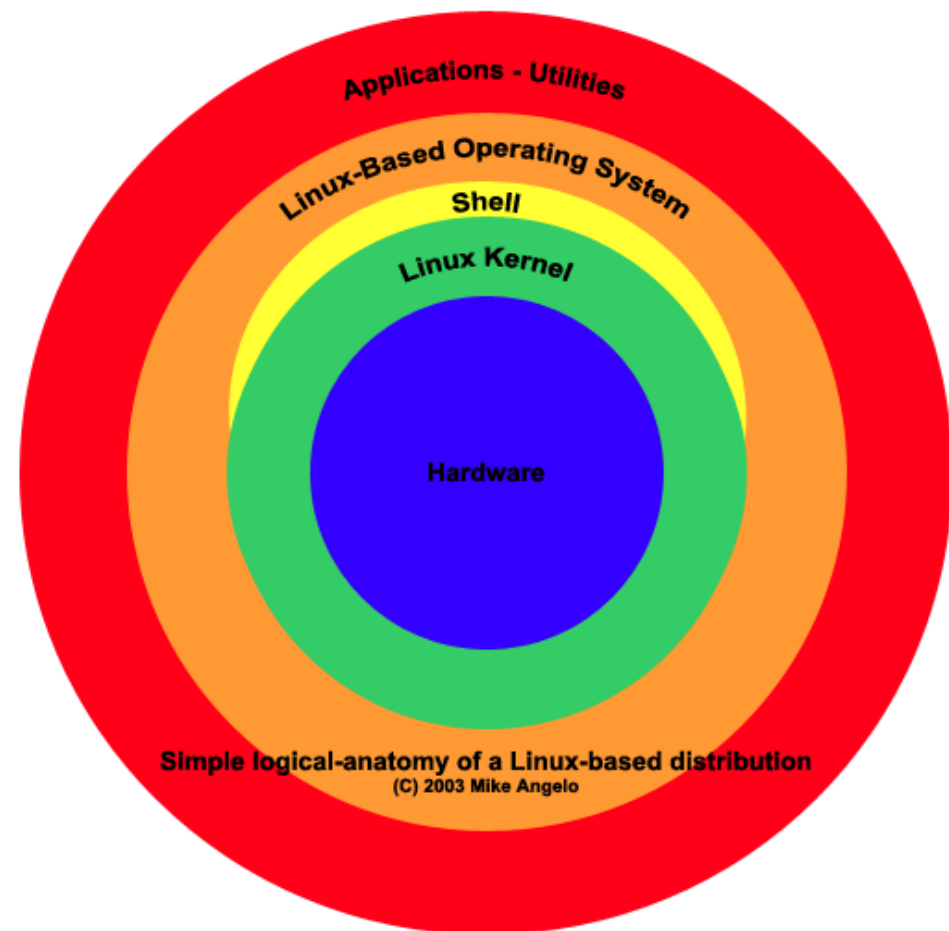
The kernel remains in RAM while the computer is on and is **in charge of the overall operation** of the computer system.

The kernel contains the “**internal programs**” for the most often used operations like copying files.

- kmem (Linux)
- command.exe (Microsoft)



Kernel



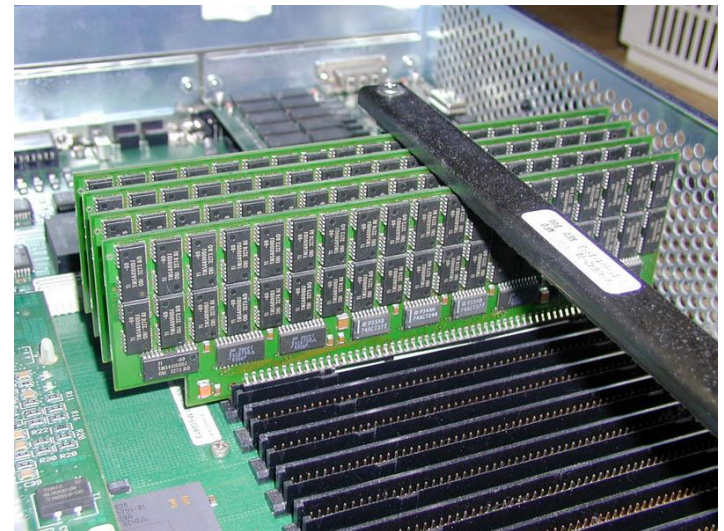
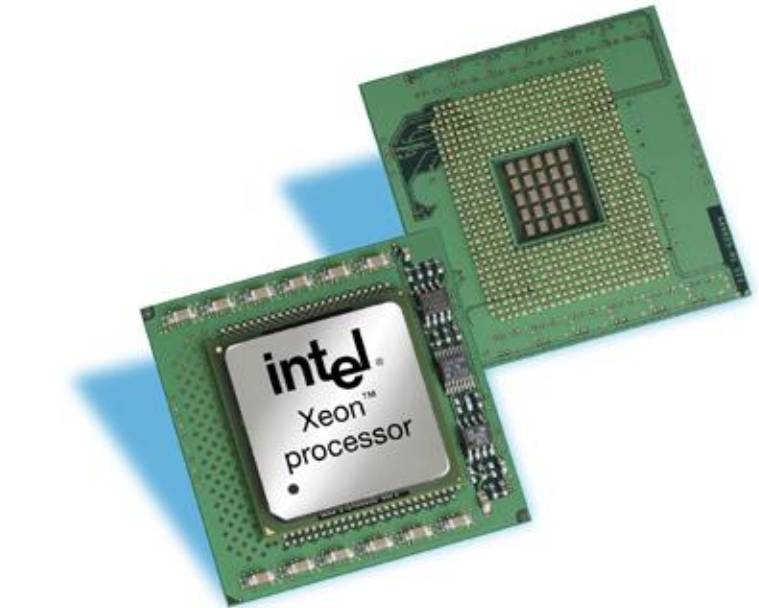
- **Kernel** – The internal part of the operating system.
 - Those software components that perform the basic functions required by the computer.
 - File management
 - Memory management (RAM)
 - Security

The functions of an operating system

1. Manages and Interacts with Computer Hardware
2. Provides and Manages System Security
3. Provides the System Interface
4. Provides the Interface for Application Software

1. Manages and Interacts with Computer Hardware

- Manages the **CPU**
 - What software programs the CPU works on and when
- Manages **RAM**
 - What is stored in RAM and where it is stored
 - Virtual memory
 - OS will send message when RAM is full



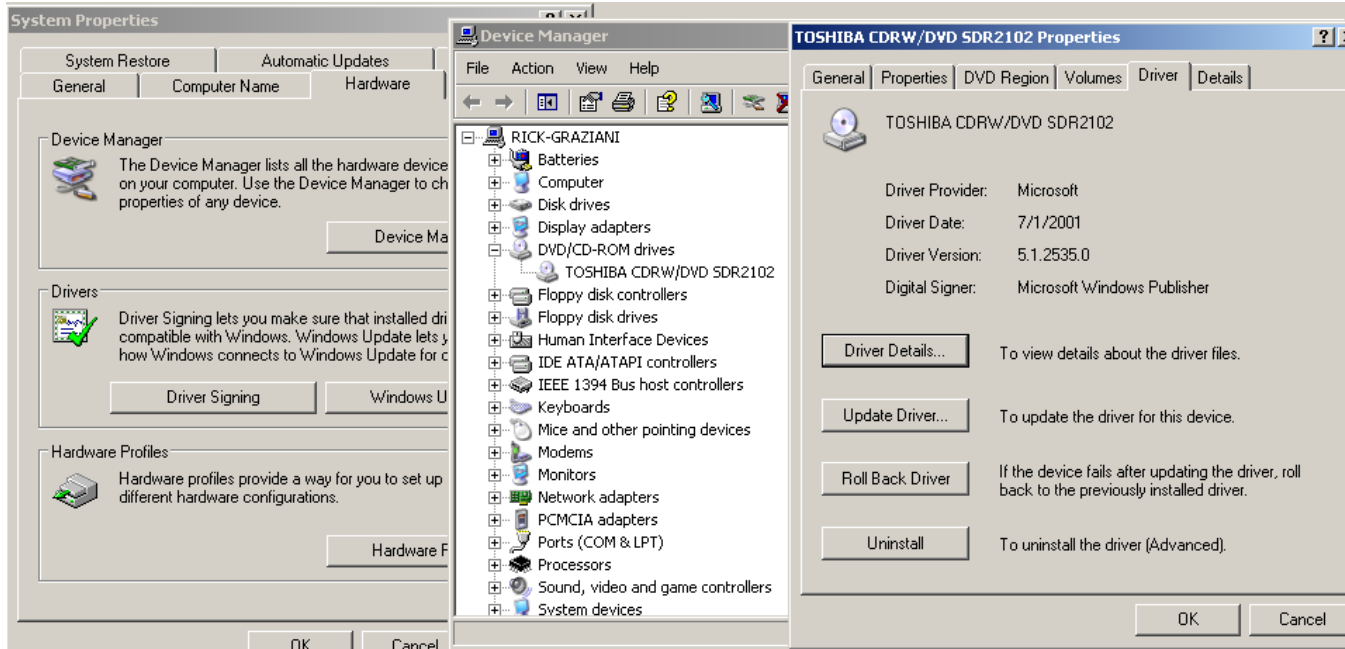
1. Manages and Interacts with Computer Hardware (continued)

- Provides the interface for **storage devices** and manages how data is stored on those devices
 - in charge of formatting disks
 - creates sectors and clusters
 - creates F.A.T. or V.T.O.C.
 - sends message when disk is full or there is some other problem with writing data to the disk
 - virtual memory
 - CD-ROM, DVD-ROM
 - Flash drive



1. Manages and Interacts with Computer Hardware (continued)

- Provides the Interface for **Input and Output Devices**
 - keyboard, mouse, printer,
 - **device drivers** = software programs which allow the hardware device to be used by the operating system and by application software



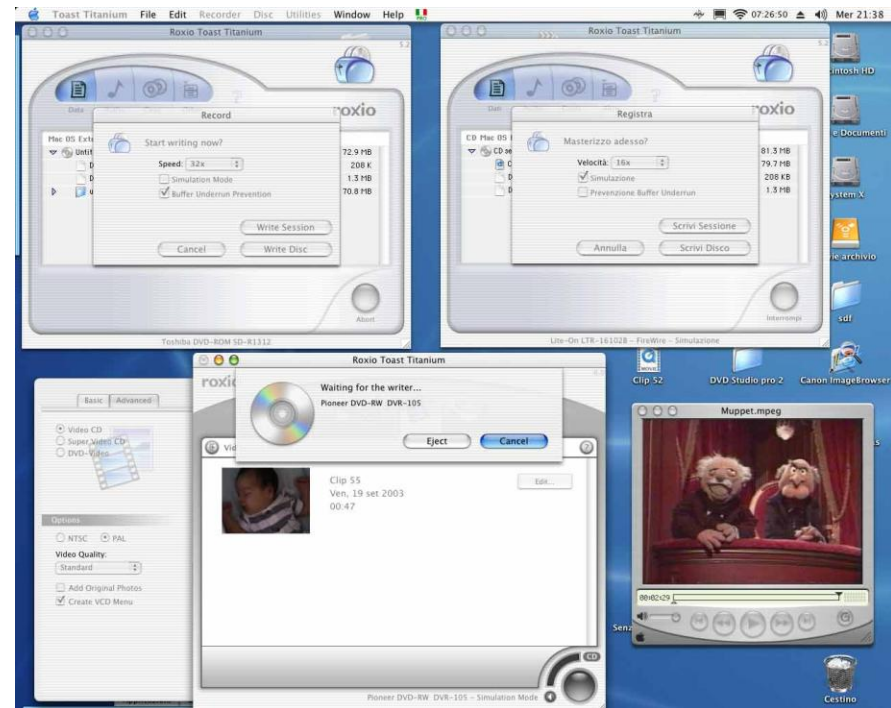
Preemptive Multitasking vs Cooperative Multitasking

Cooperative Multitasking

OS gives CPU processing time to other programs at a logical point, usually during idle time

Preemptive Multitasking

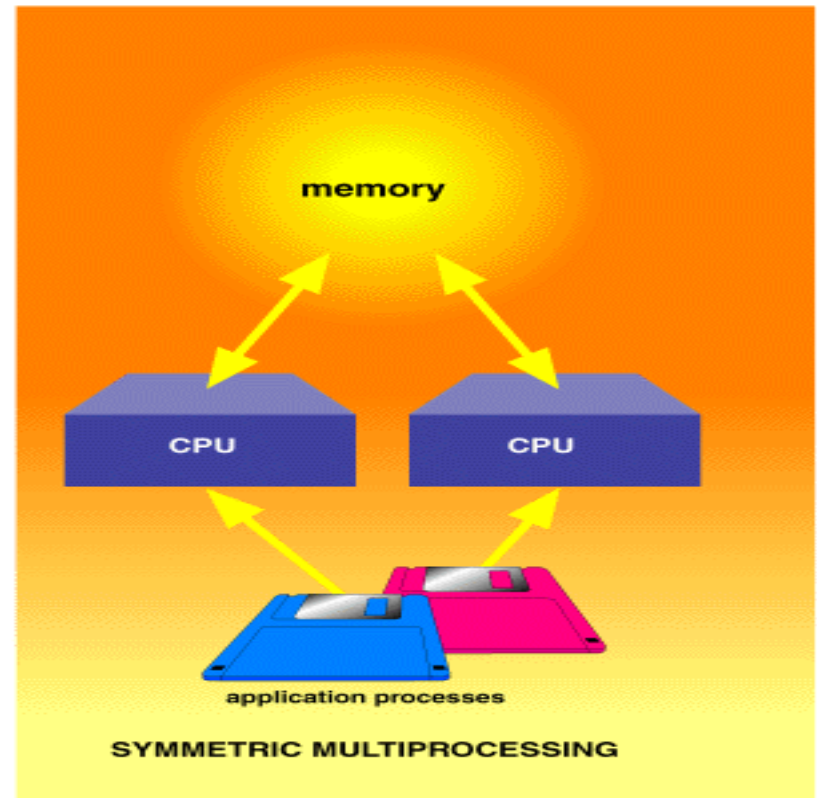
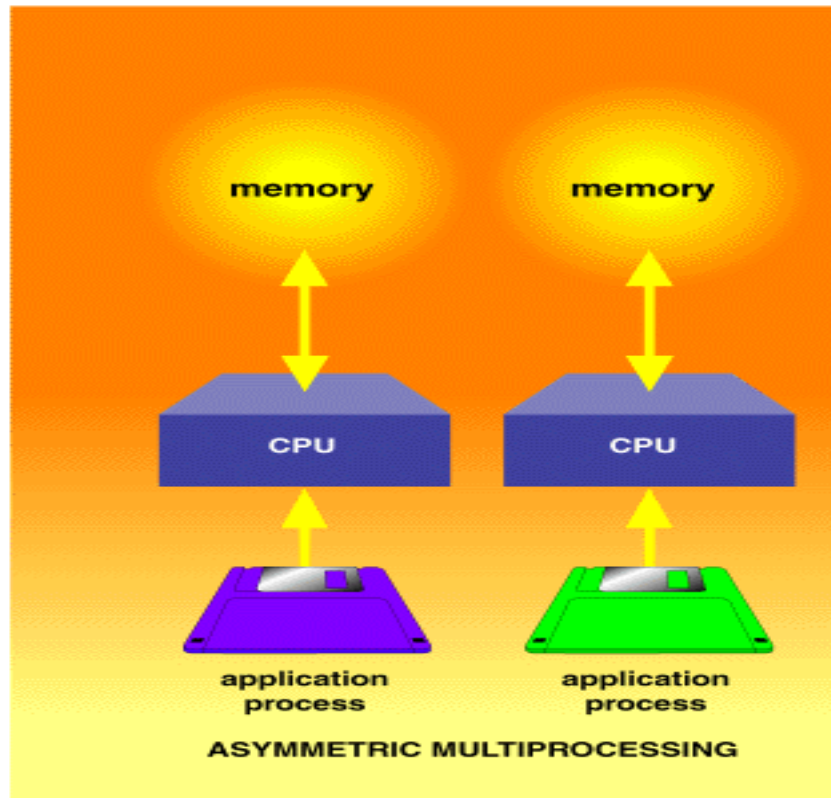
OS allocates CPU time between the different programs based on amount of time and priority of the software application



Multiprocessing with Multiple CPU's

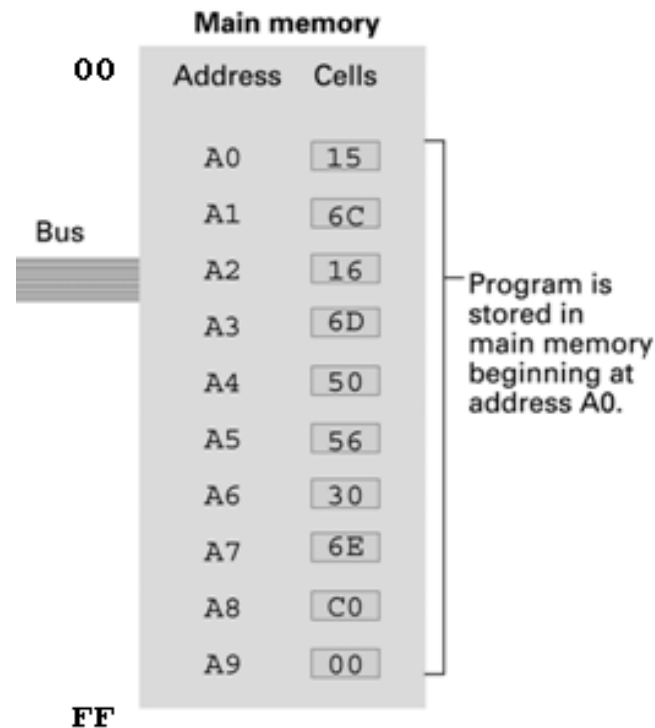
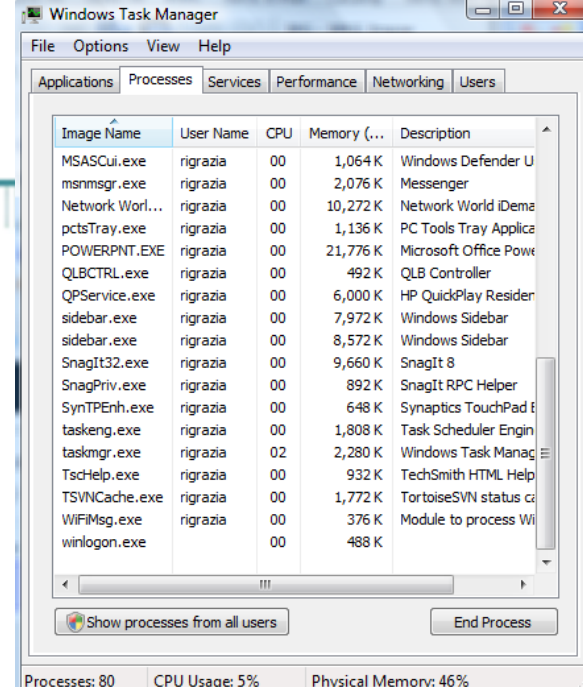
Asymmetric Multiprocessing = Tasks are assigned to a specific CPU and each CPU has its own RAM memory

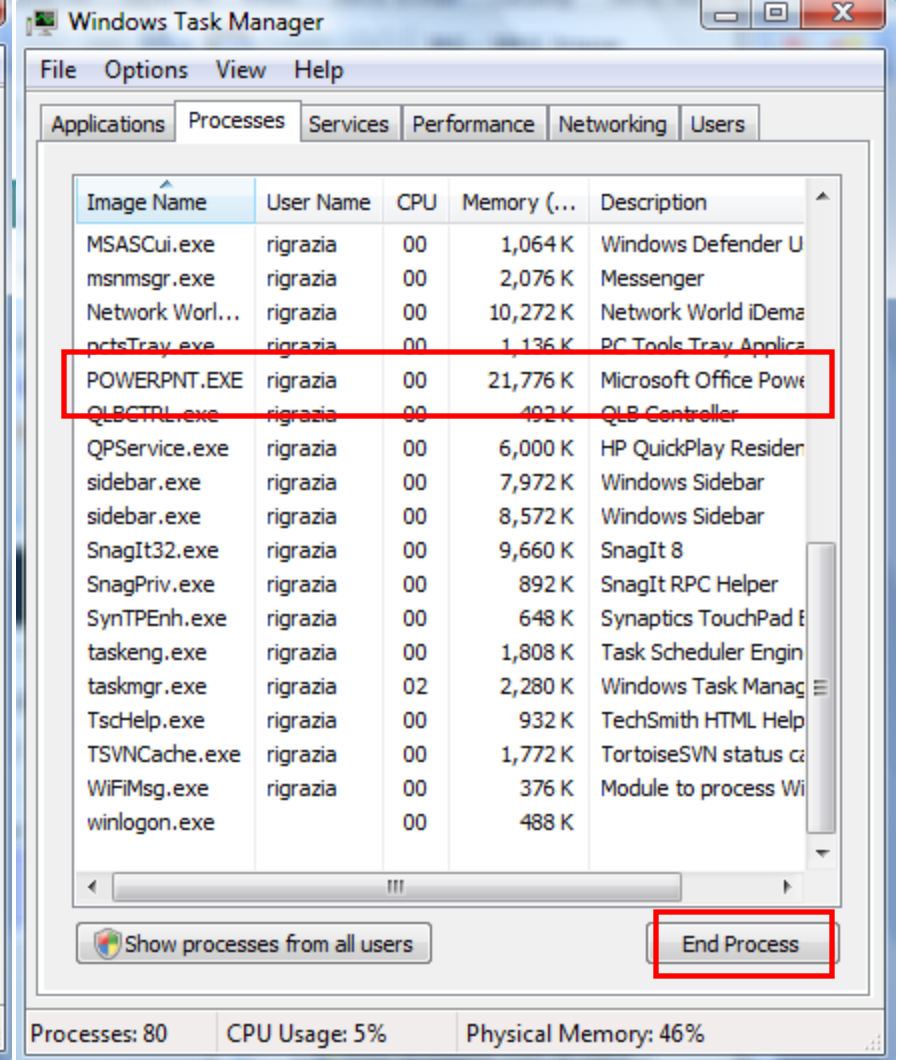
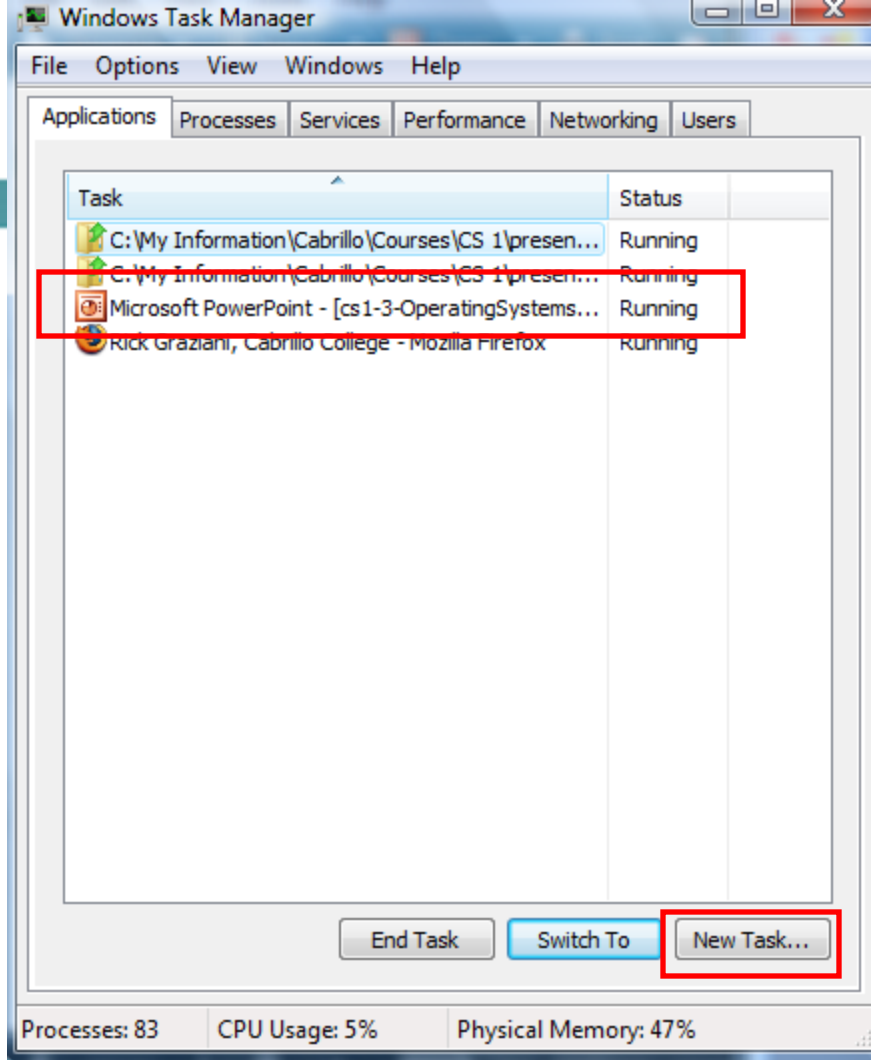
Symmetric Multiprocessing = Tasks are assigned to any available CPU and CPU's can share RAM memory



Processes

- **Scheduler** – Maintains a record of the processes.
 - Adds new processes when launched.
 - Removes old processes when completed.
 - Uses a process table.
- **Process Table** – Information about each process including:
 - Main memory cells (RAM)
 - Priority
 - Running or waiting (input from user or saving to disk)





- Viewing processes with Microsoft Windows
- Task Bar – Right-click, Task Manager
- Ending a process – ***Killing the process***

Processes

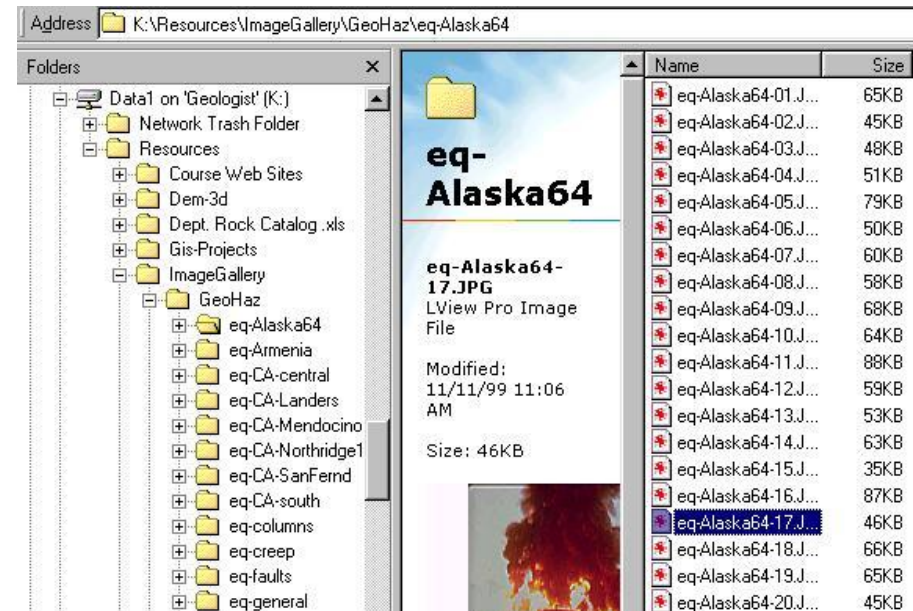
- **Dispatcher** - Oversees the execution of each process by the CPU.
 - Gives each process a time slice of CPU time.
 - Changes between processes.

Image Name	User Name	CPU	Memory (...)	Description
MSASCui.exe	rigrazia	00	1,064 K	Windows Defender U
msnmsg.exe	rigrazia	00	2,076 K	Messenger
Network Worl...	rigrazia	00	10,272 K	Network World IDema
pctsTray.exe	rigrazia	00	1,136 K	PC Tools Tray Applica
POWERPNT.EXE	rigrazia	00	21,776 K	Microsoft Office Powe
QLBCTRL.exe	rigrazia	00	492 K	QLB Controller
QPService.exe	rigrazia	00	6,000 K	HP QuickPlay Residen
sidebar.exe	rigrazia	00	7,972 K	Windows Sidebar
sidebar.exe	rigrazia	00	8,572 K	Windows Sidebar
SnagIt32.exe	rigrazia	00	9,660 K	SnagIt 8
SnagPriv.exe	rigrazia	00	892 K	SnagIt RPC Helper
SynTPEnh.exe	rigrazia	00	648 K	Synaptics TouchPad E
taskeng.exe	rigrazia	00	1,808 K	Task Scheduler Engin
taskmgr.exe	rigrazia	02	2,280 K	Windows Task Manag
TschHelp.exe	rigrazia	00	932 K	TechSmith HTML Help
TSVNCache.exe	rigrazia	00	1,772 K	TortoiseSVN status ca
WiFiMsg.exe	rigrazia	00	376 K	Module to process Wi
winlogon.exe		00	488 K	

Processes: 80 CPU Usage: 5% Physical Memory: 46%

Server (Multiuser) Operating Systems

- Found on mainframes, minicomputers and PCs
- **server** = a computer which processes information (CPU and RAM) , stores information (hard disk), and/or provides access to peripheral devices (printers) for multiple users
 - Email
 - Web
 - Gaming



Examples of Server Operating Systems

- MAC OS X Server
- Windows Server



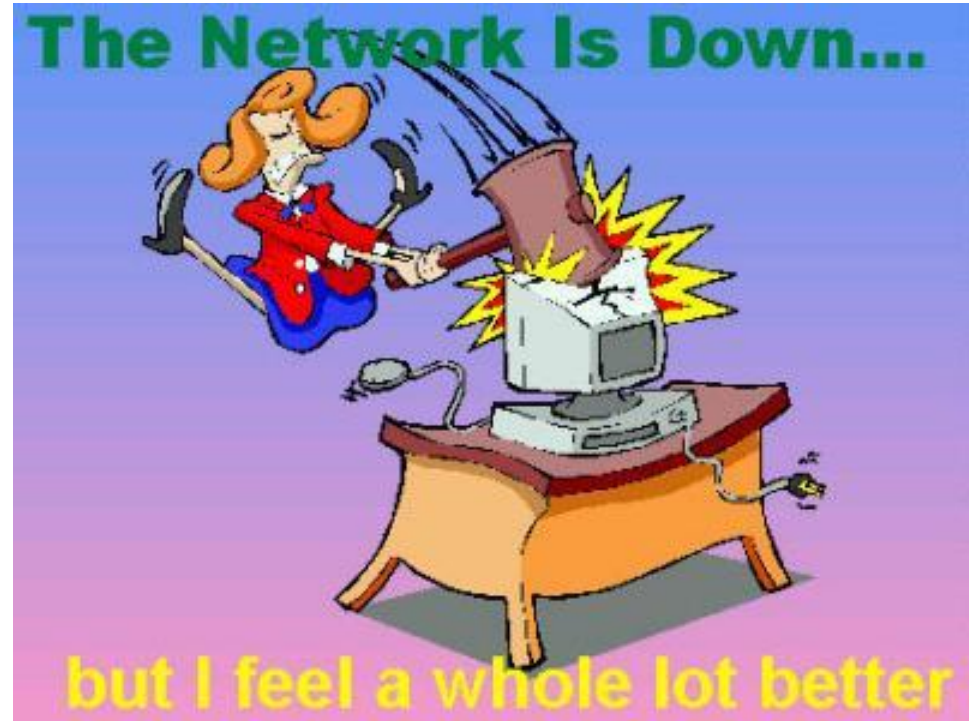
Advantages/Disadvantages of Server Operating Systems

Advantages

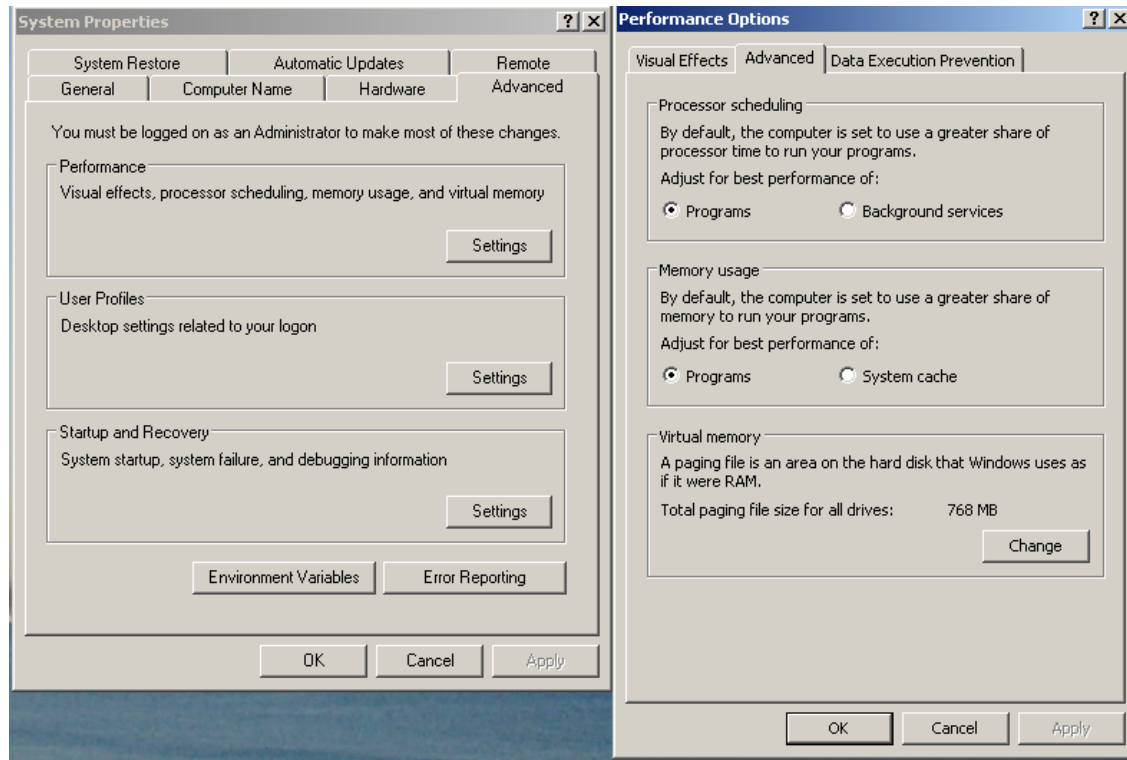
- Central location for the installation and administration of all software and data
- More cost effective - less expensive than multiple computers (PCs, Macs)

Disadvantages

- Single source for possible problems
- Loss of individual user control of their own software, data, and peripherals



Virtual Memory



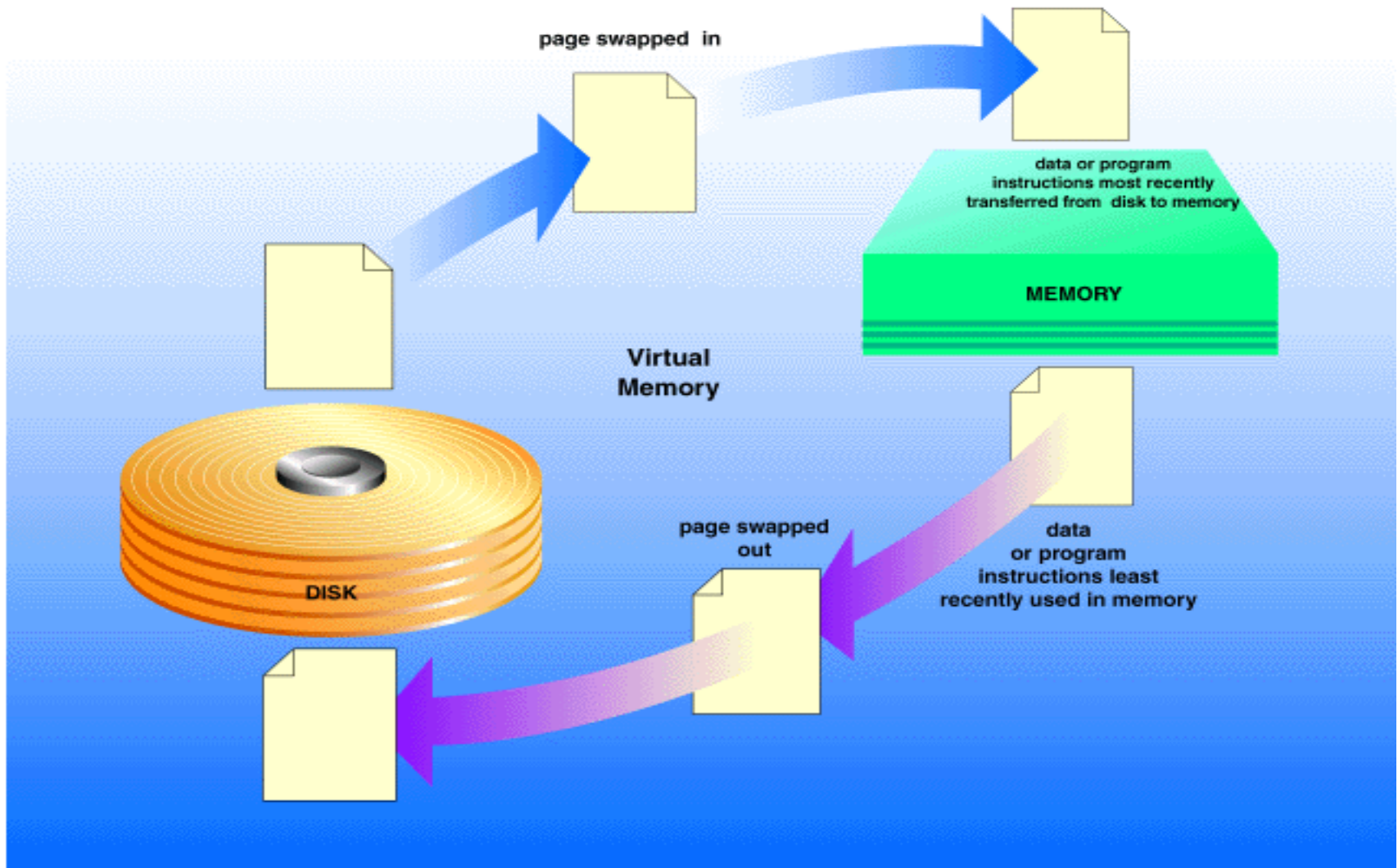
Virtual Memory (VM) = the ability of the CPU and the operating system software to use the hard disk drive as additional RAM when needed (safety net)

Good – no longer get “insufficient memory” error

Bad - performance is very slow when accessing VM

Solution = more RAM

Virtual Memory



2. Provides and Manages System Security

Single-user Operating Systems

- minimal security
- user has full authority

Server Operating Systems

- login and password capability
- protection of user's data stored on the server's central hard disk drives
- protection and security for software programs

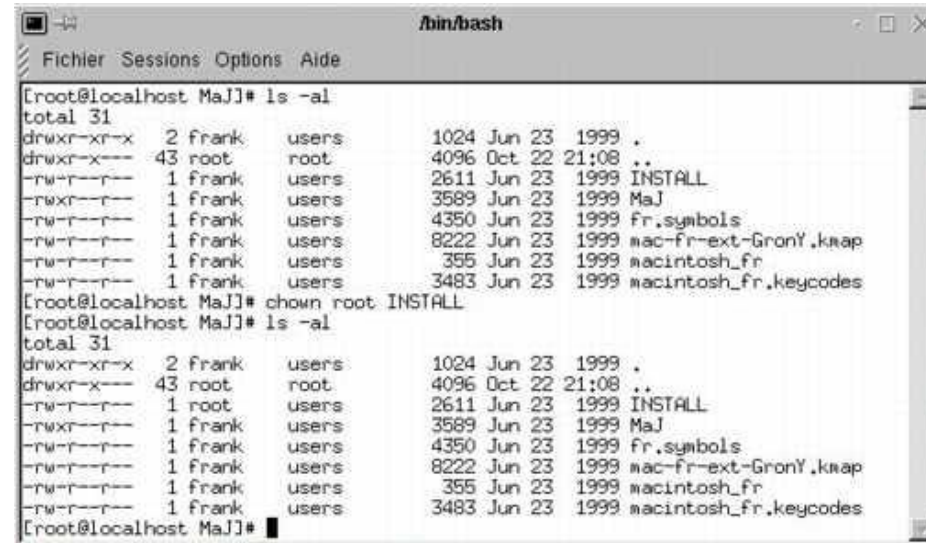


3. Provides the System Interface

System Interface or **shell** = the interface between the user and the computer

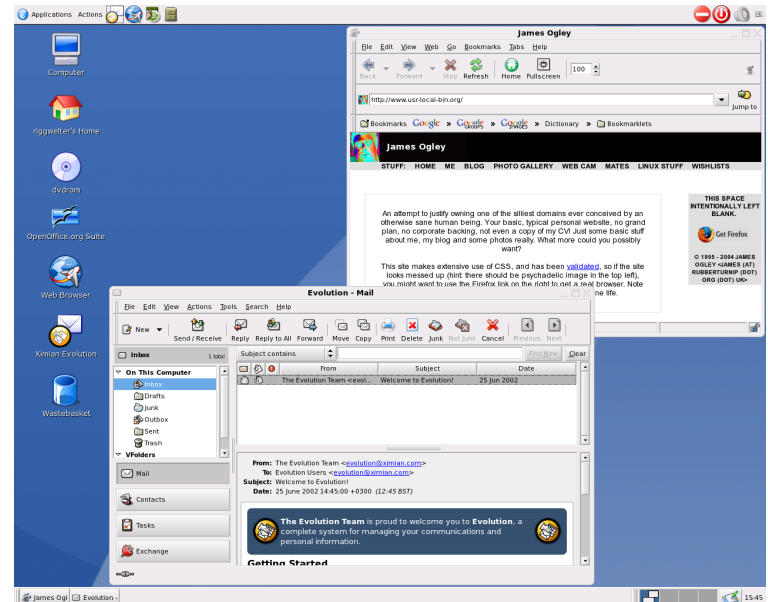
Command Line Interface (CLI)

- Linux, UNIX, DOS, older OS's



```
bin/bash
Fichier Sessions Options Aide
[root@localhost MaJ]# ls -al
total 31
drwxr-xr-x  2 frank  users   1024 Jun 23  1999 .
drwxr-x--- 43 root   root    4096 Oct 22  21:08 ..
-rw-r--r--  1 frank  users   2611 Jun 23  1999 INSTALL
-rwxr--r--  1 frank  users   3589 Jun 23  1999 MaJ
-rw-r--r--  1 frank  users   4350 Jun 23  1999 fr.symbols
-rw-r--r--  1 frank  users   8222 Jun 23  1999 mac-fr-ext-GronY.kmap
-rw-r--r--  1 frank  users    355 Jun 23  1999 macintosh_fr
-rw-r--r--  1 frank  users   3483 Jun 23  1999 macintosh_fr.keycodes
[root@localhost MaJ]# chown root INSTALL
[root@localhost MaJ]# ls -al
total 31
drwxr-xr-x  2 frank  users   1024 Jun 23  1999 .
drwxr-x--- 43 root   root    4096 Oct 22  21:08 ..
-rw-r--r--  1 root   users   2611 Jun 23  1999 INSTALL
-rwxr--r--  1 frank  users   3589 Jun 23  1999 MaJ
-rw-r--r--  1 frank  users   4350 Jun 23  1999 fr.symbols
-rw-r--r--  1 frank  users   8222 Jun 23  1999 mac-fr-ext-GronY.kmap
-rw-r--r--  1 frank  users    355 Jun 23  1999 macintosh_fr
-rw-r--r--  1 frank  users   3483 Jun 23  1999 macintosh_fr.keycodes
[root@localhost MaJ]#
```

Graphical User Interface (GUI)



Command Line Interface

DOS, UNIX, others

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

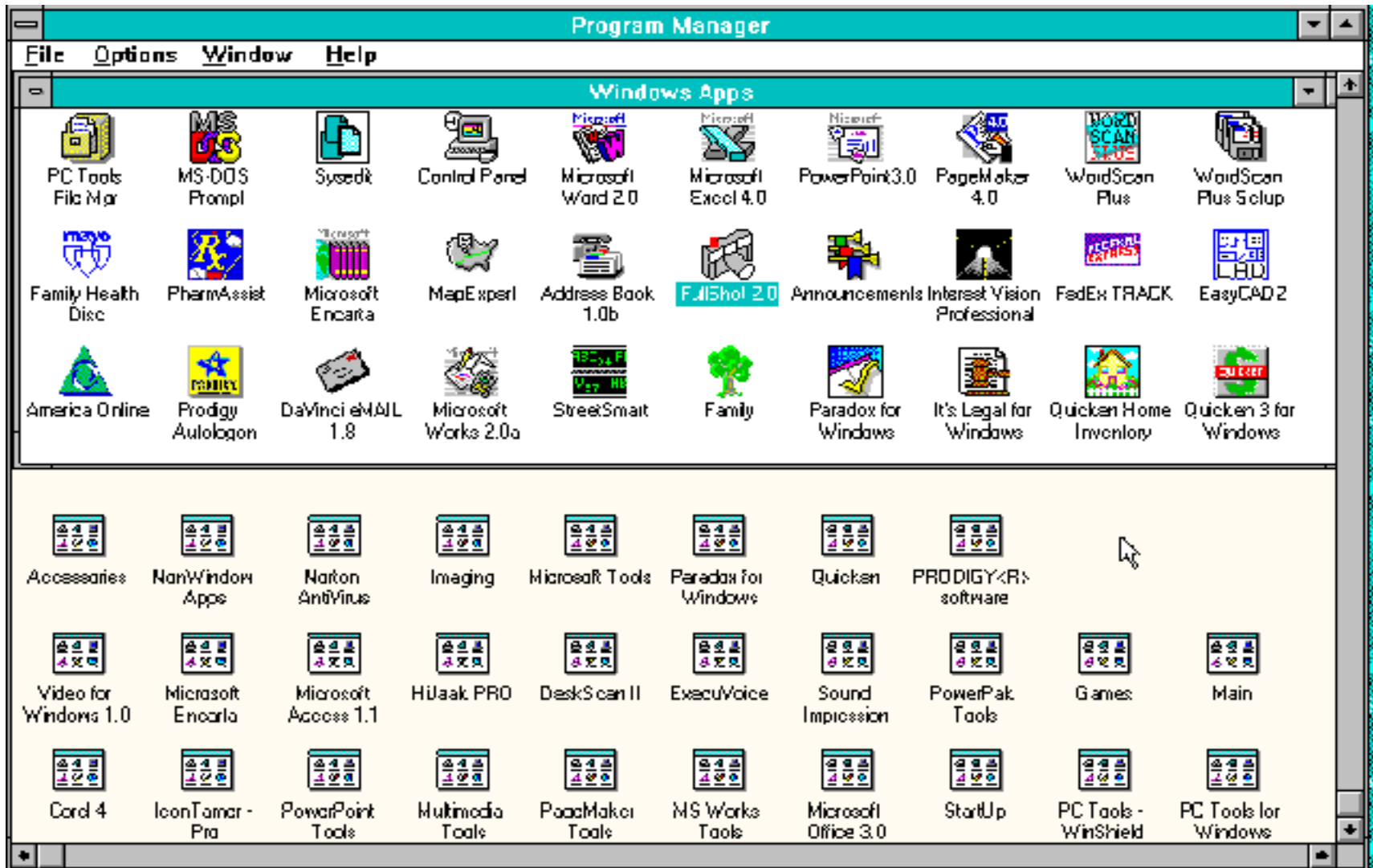
C:\>copy a:\myfolder\budget.xls c:\accounting\newbudget2005.xlsx_

C:\>dir
Volume in drive C has no label.
Volume Serial Number is 3DB0-2A46

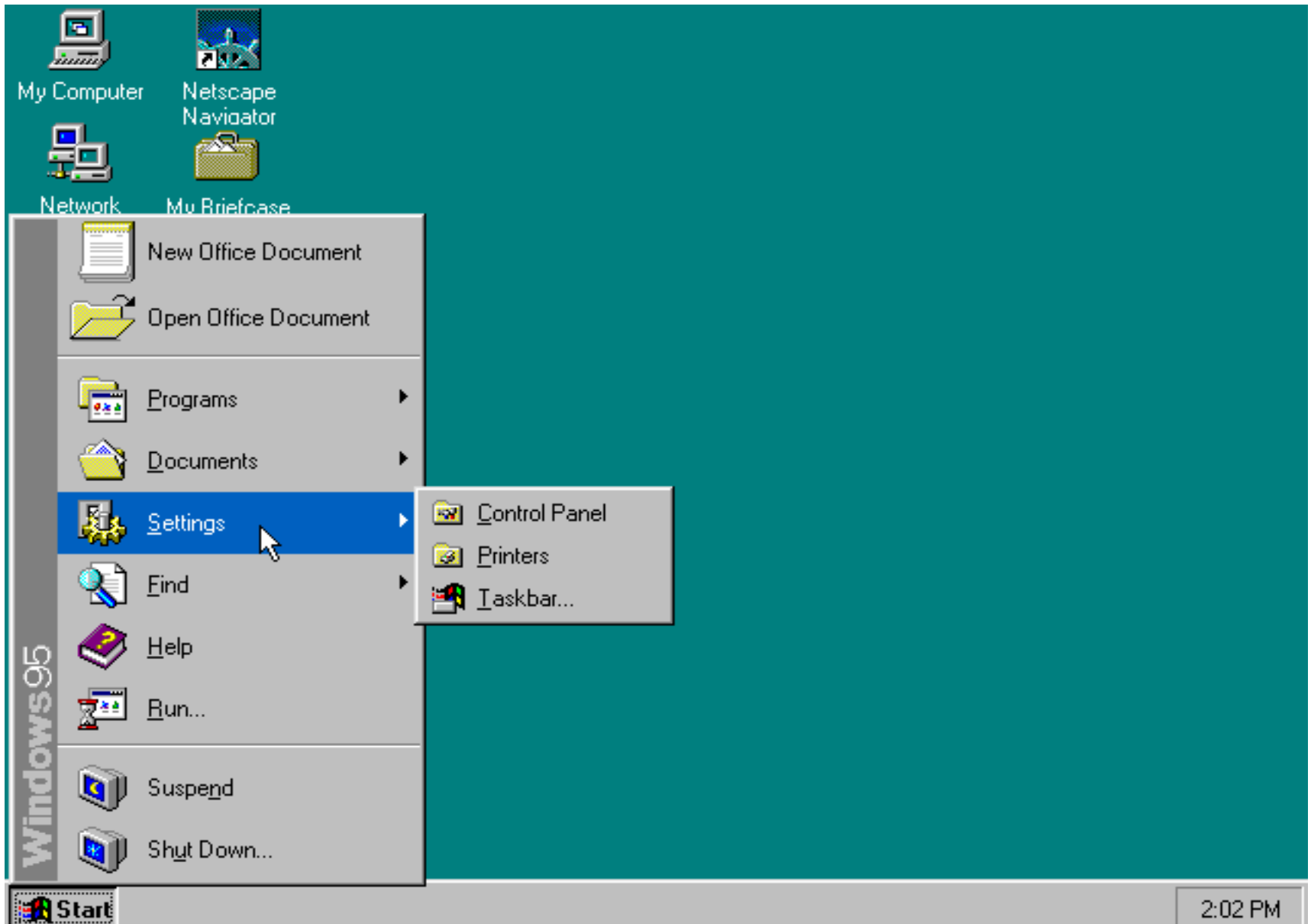
Directory of C:\

10/10/2001  06:41 AM    <DIR>          I386
10/10/2001  06:41 AM    <DIR>          BACKUP
10/10/2001  06:41 AM    <DIR>          WINNT
06/24/2004  12:53 PM                21 dv_trace.log
03/15/2002  08:02 PM                0 CONFIG.SYS
10/16/2001  11:58 AM    <DIR>          FOUND.000
12/17/2001  02:58 PM       76,080 comreads.dbg
12/17/2001  02:58 PM       72,909 comused.dbg
11/21/2001  04:41 PM    <DIR>          UPN304
06/04/2001  08:04 AM      245,814 mping.exe
10/10/2001  06:43 AM    <DIR>          DISCOVER
12/07/2001  11:14 AM    <DIR>          Cisco
01/01/2002  06:33 PM    <DIR>          BDE
11/19/2001  06:06 PM                0 AdobeWeb.log
12/06/2001  10:11 PM    <DIR>          Windows Update Setup Files
10/10/2001  06:41 AM    <DIR>          RECYCLED
```

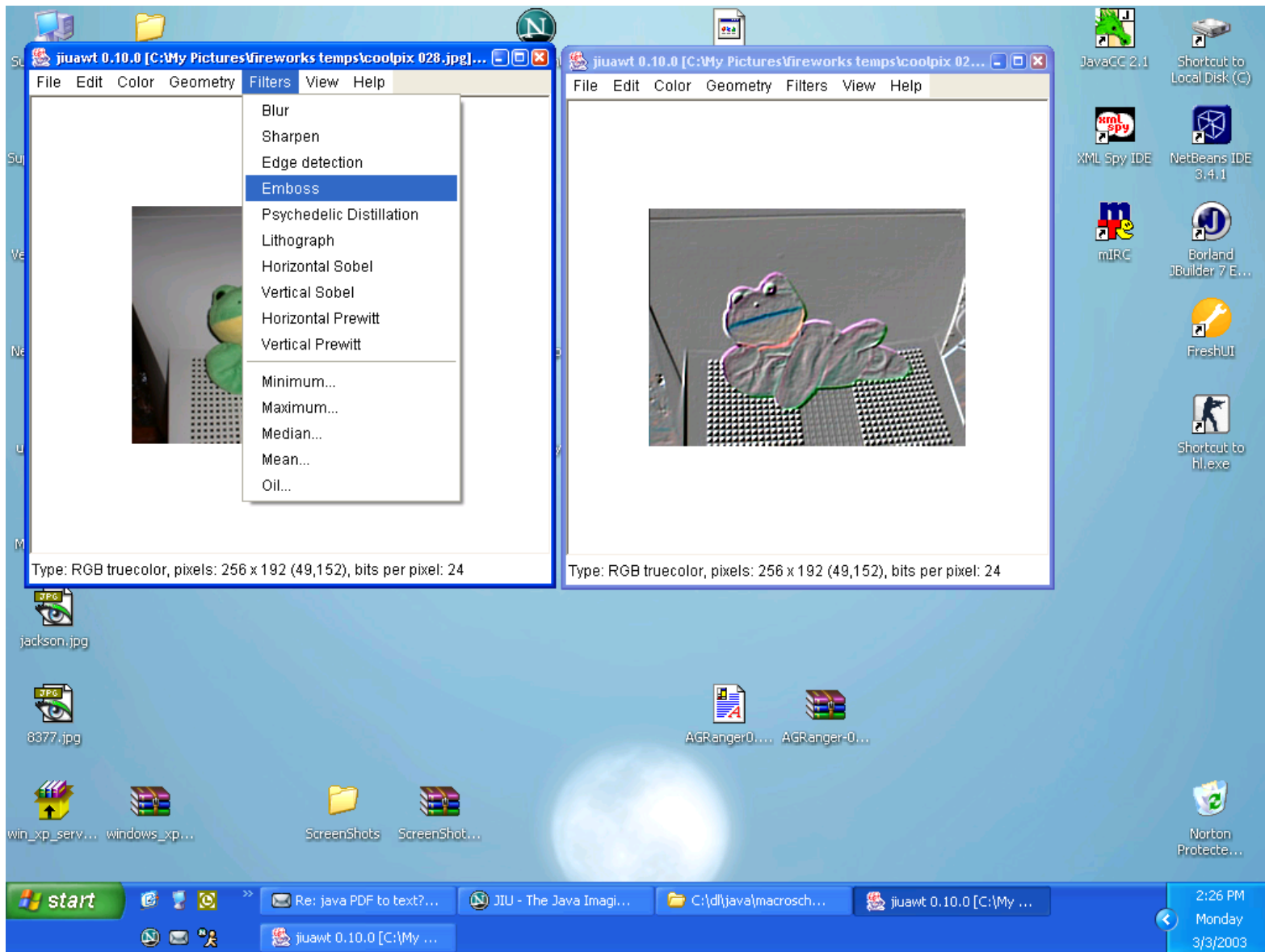
DOS plus Windows 3.1



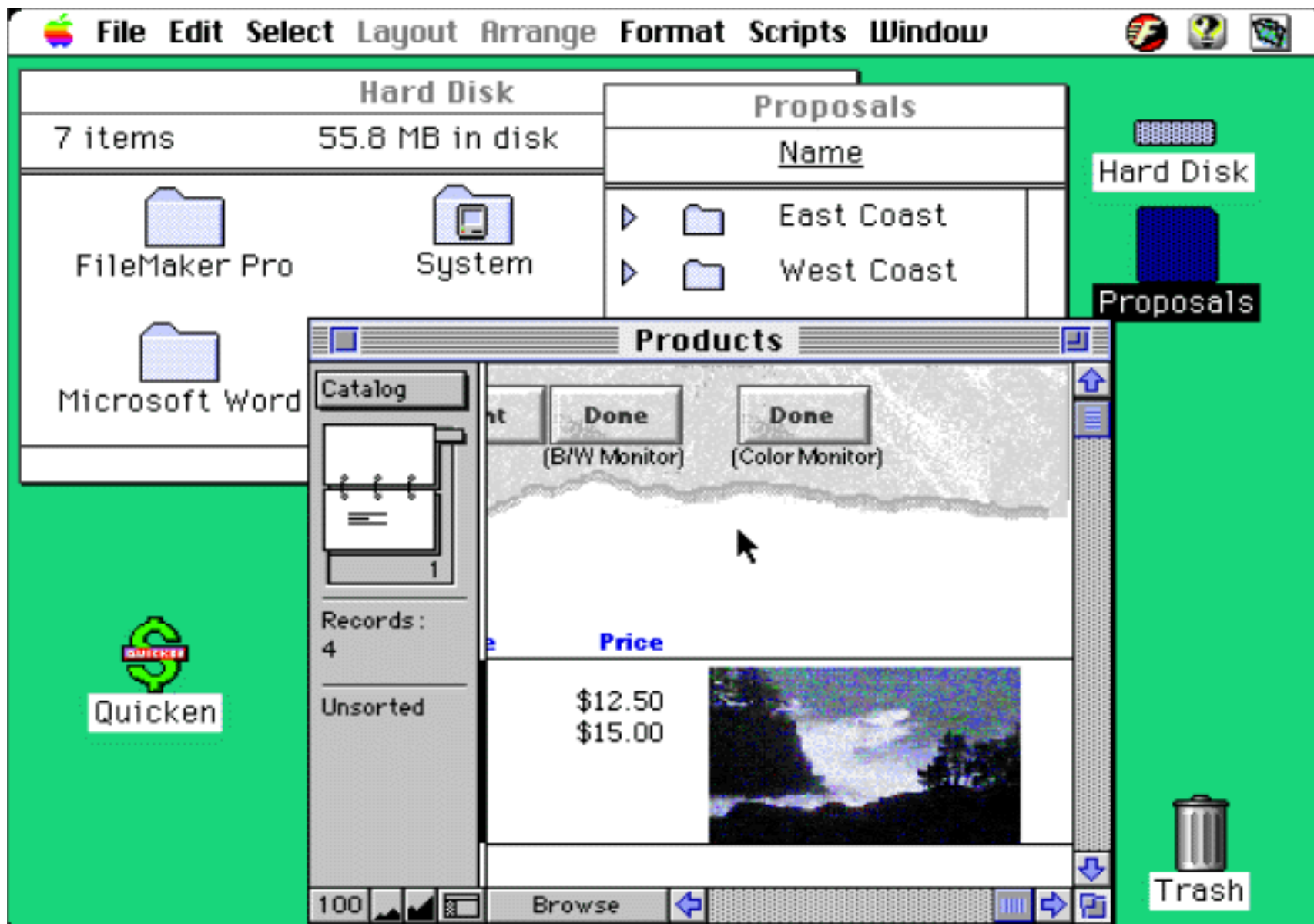
Windows 95



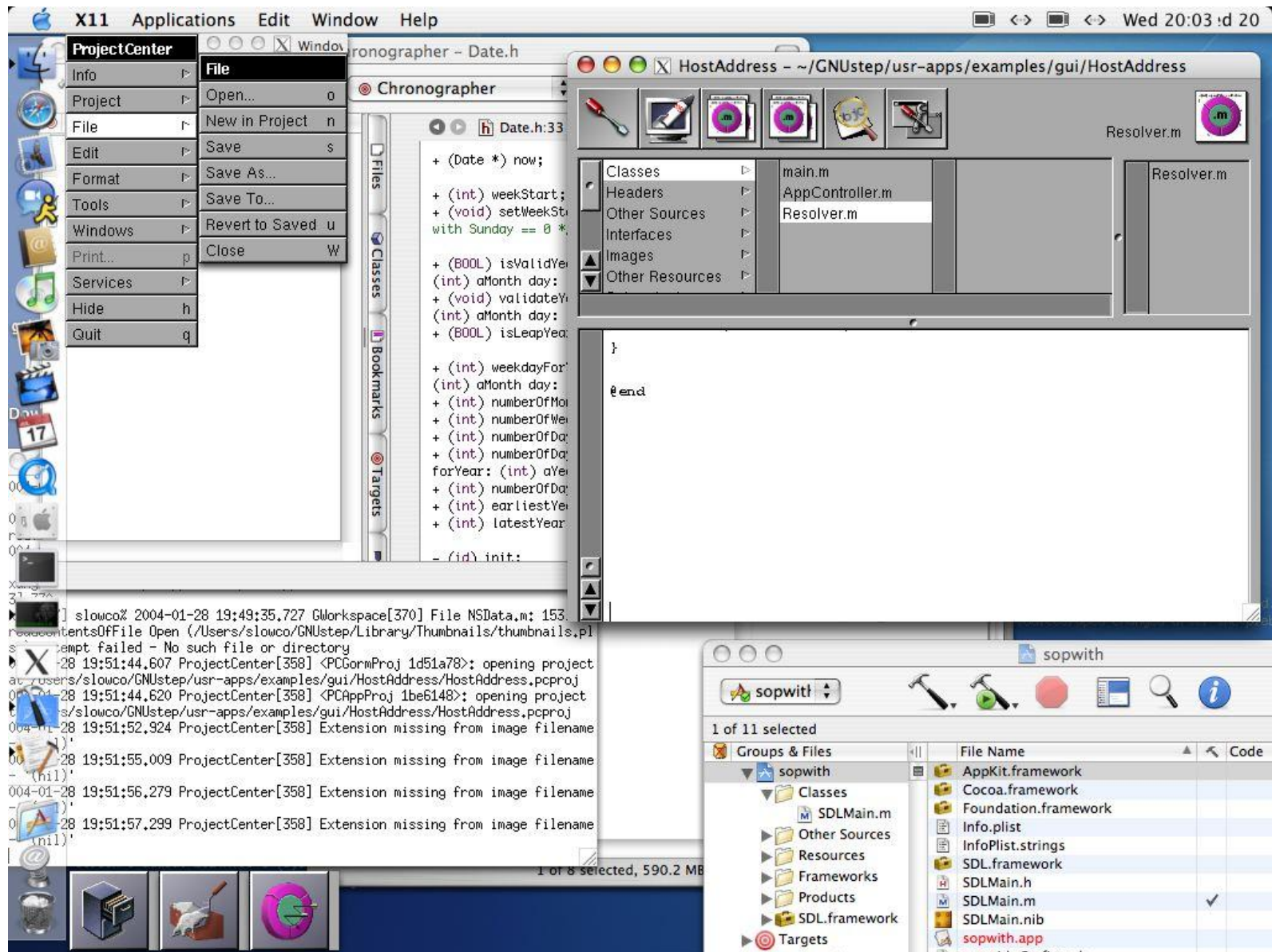
Windows XP



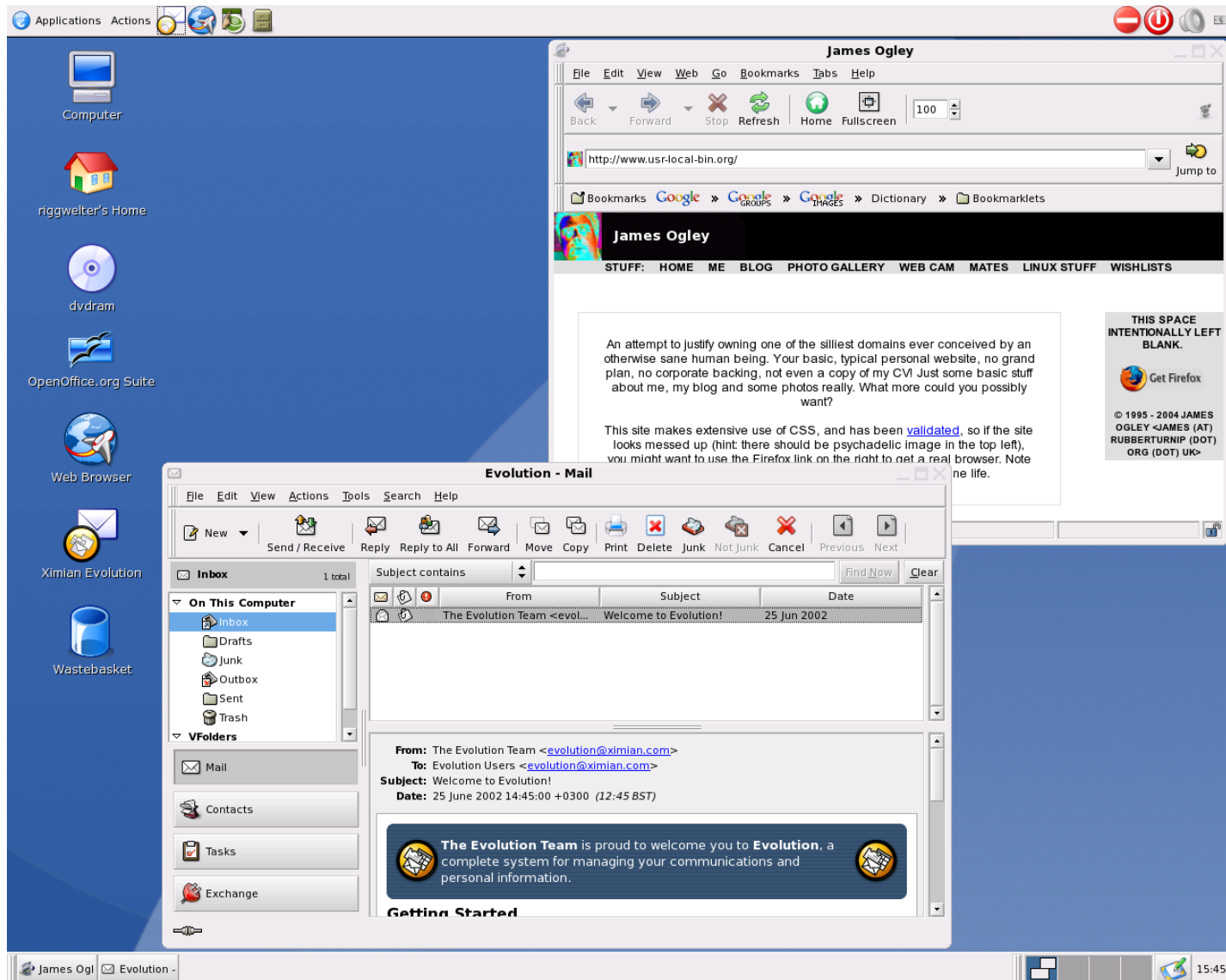
Macintosh



Mac OS X



UNIX with X-Windows

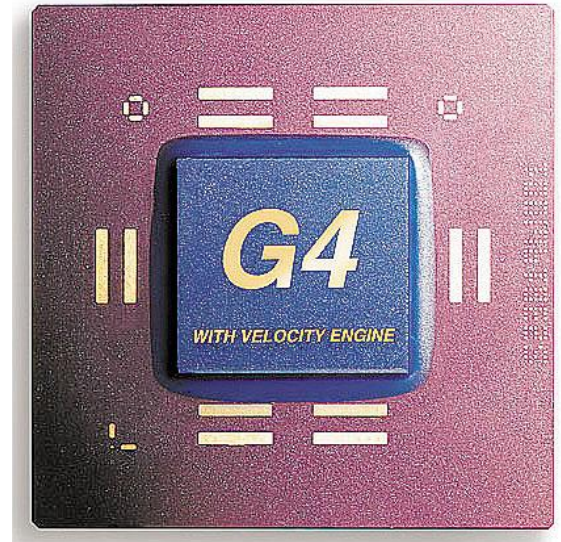


Microsoft Windows 8



4. Provides the Interface for Application Software

- Operating systems are software
- Operating systems are designed and developed for a specific CPU or “family of CPUs”
 - **Macintosh OS:** Motorola 680xx, PowerPC Gx, Intel
 - **DOS:** Intel CPUs
 - **Windows 9x and XP:** Intel 80386, 80486, and Pentium CPUs
 - **Linux:** Intel CPUs
 - **MS NT & 2000:** Intel CPUs



4. Provides the Interface for Application Software (continued)

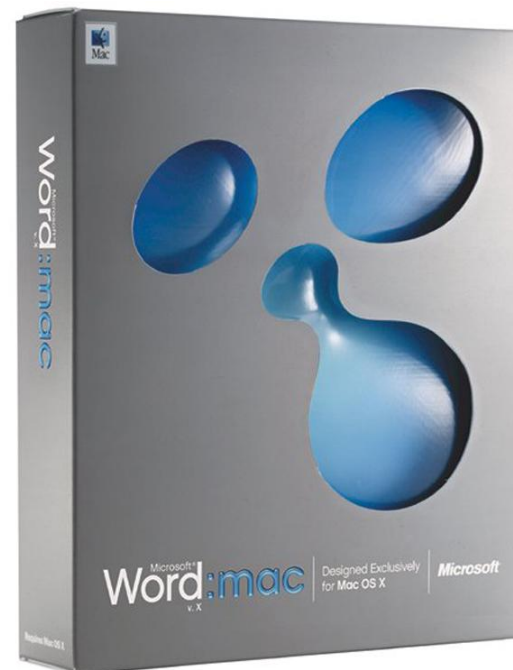
- Application software is developed for an operating system

MS Word for Windows XP

- Windows XP
- Intel CPU

MS Word for the Macintosh

- Macintosh OS X
- Gx CPU or Intel CPU



Compatibility

Question

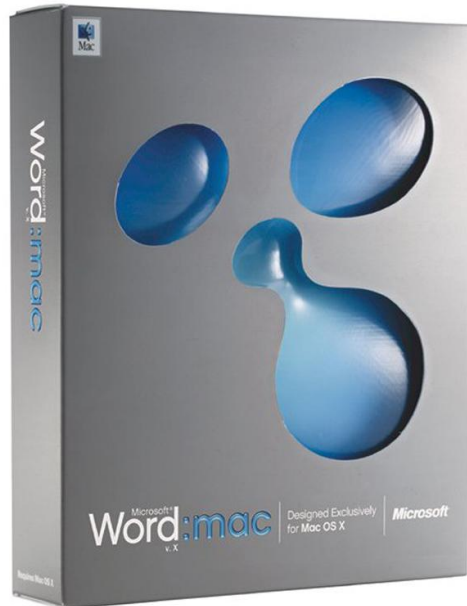
Will software developed for one operating system work on another?

Will MS Word for Macintosh run on a PC with Windows XP?

Answer

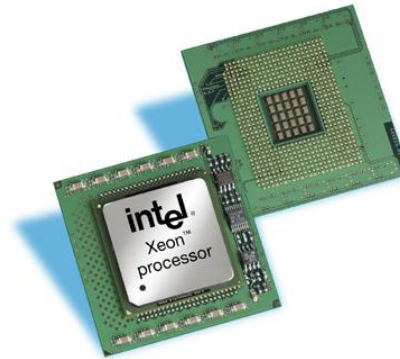
No (unless there is special emulation software or hardware). The software must be developed separately for each operating system.

Much of this is beginning to change with MAC using the Intel CPU.



Order of Development

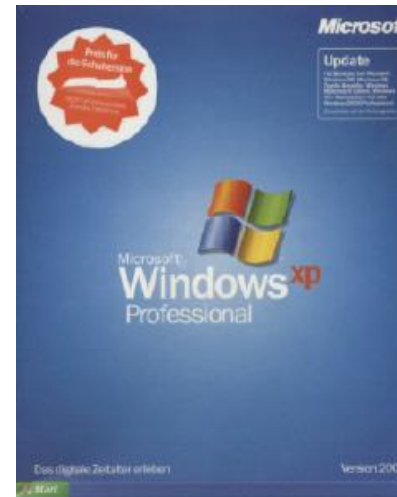
1. The CPU



2. Other Hardware Components



3. Operating System Software



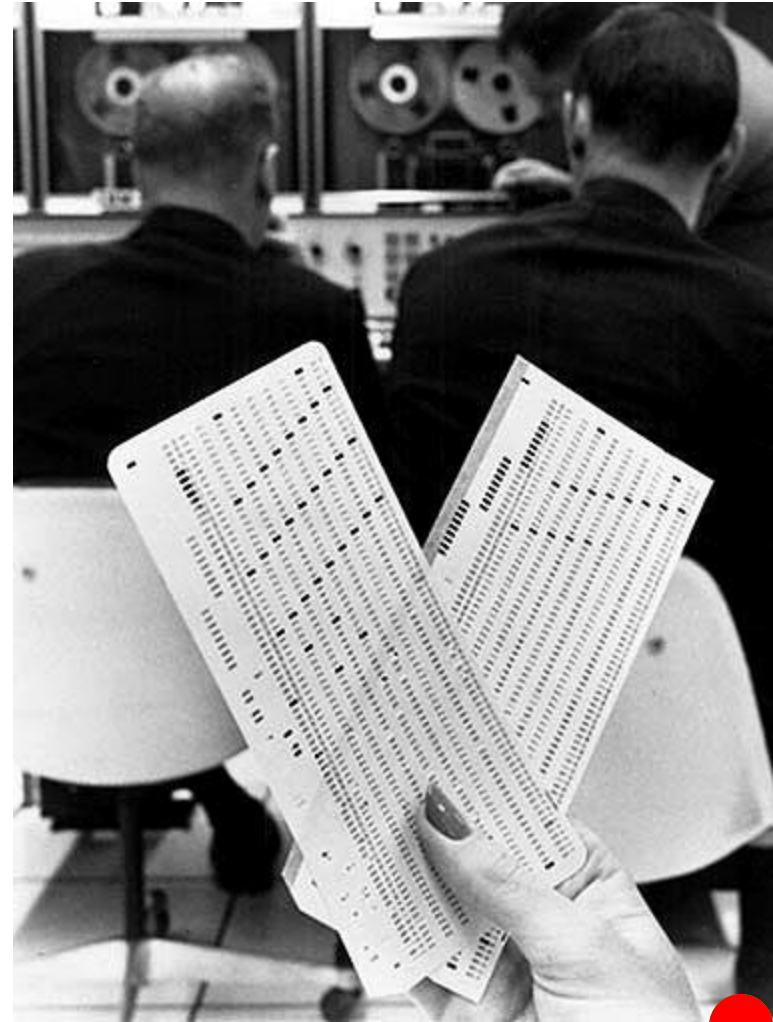
4. Application Software



History of Operating Systems

1940's – 1950's

- Each program (**job**) required significant preparation of equipment.
 - Mounting tapes
 - Loading punch cards
- **Computer Operator** – Person who operated the computer.
 - Mount tapes
 - Load punch cards
 - Take printouts off of printer
- **Batch processing** – The execution of jobs by collecting them in a single batch, the executing them without further interaction with the user.



History of Operating Systems

- **Job queue** – Jobs residing in mass storage (hard disk drives, tape) waiting for execution.
 - FIFO (First-In, First-Out)
 - Job Priorities and scheduling
- **Job Control Language (JCL)** – Set of instructions explaining the steps of a particular job.
 - Operating system sent these to the printer
 - Computer Operator follows the instructions



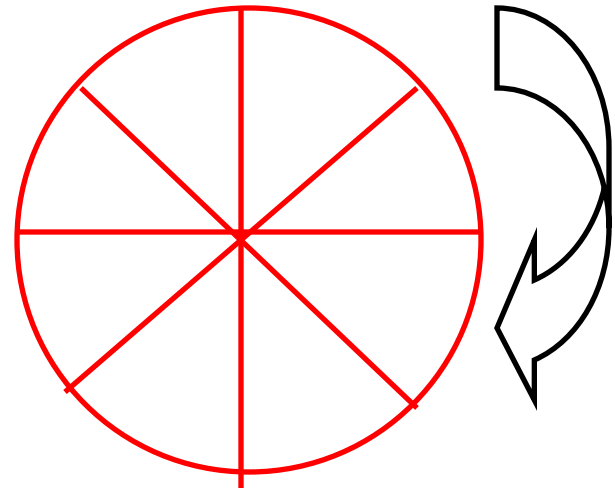
History of Operating Systems

- **Disadvantage to Batch Processing**
 - No interaction with the user.
- Fine for software that does not need user interaction:
 - Payroll systems (creating checks)
 - Reporting systems
- Does not work well for other types of software:
 - Word processing
 - Reservation systems
 - Gaming

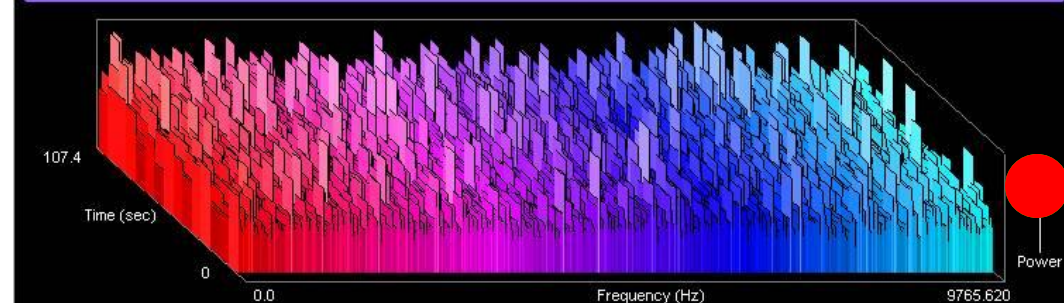
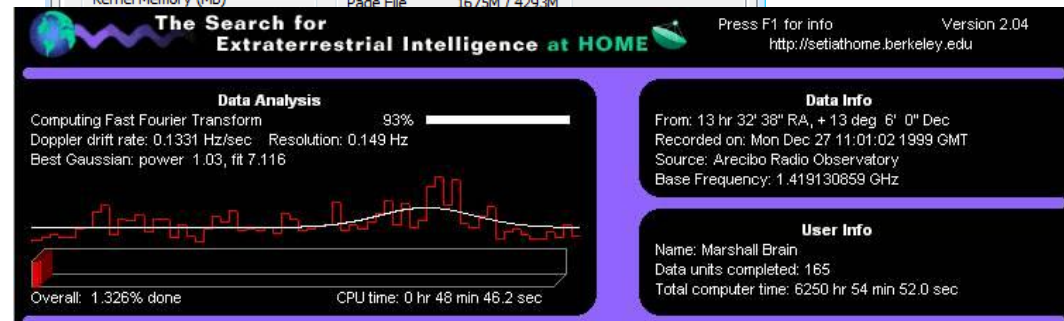
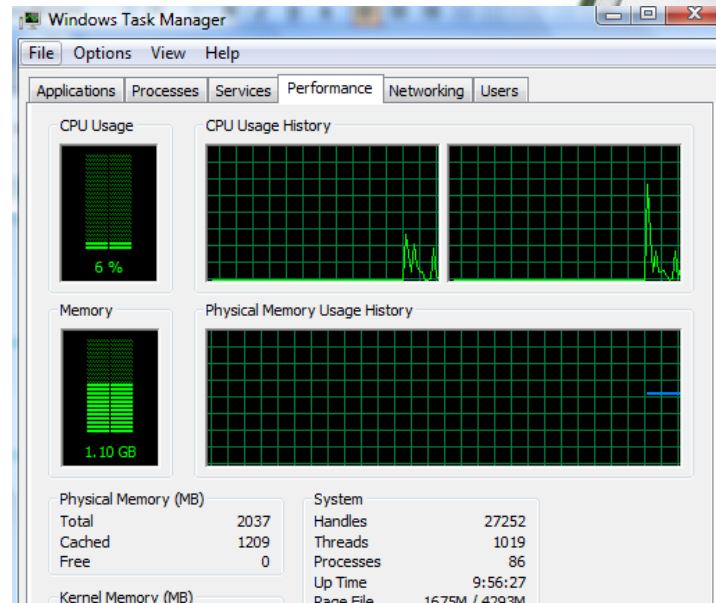
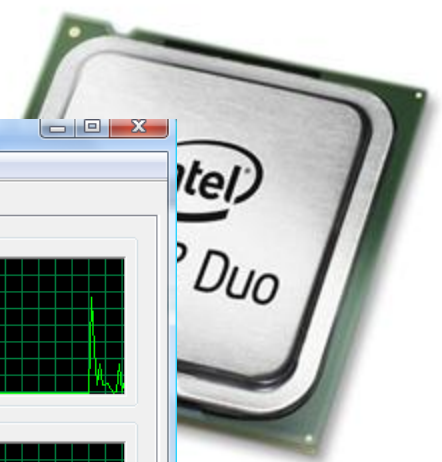


History of Operating Systems

- Newer Operating Systems
- Used **remote terminals** and **interactive processing**
 - Computer must be fast enough to coordinate with the needs of the user.
- **Real-time processing** - Computer must execute tasks under a deadline.
- **Time sharing** – Provides service to multiple users at the same time.
 - **Multiprogramming** - Time divided into intervals.
- **Multitasking** – One user executing numerous tasks (programs) simultaneously



Today's Operating Systems



- **Today's CPUs (multiprocessors)**

- Multiple processors

- Load balancing

- Dynamically allocating tasks to the various processors so that all processors are used efficiently.

- Scaling

- Breaking tasks into a number of subtasks equal to the number of processors available.

- The Network (Internet)

- Becoming a single network-wide operating system rather than a network of individual operating systems.