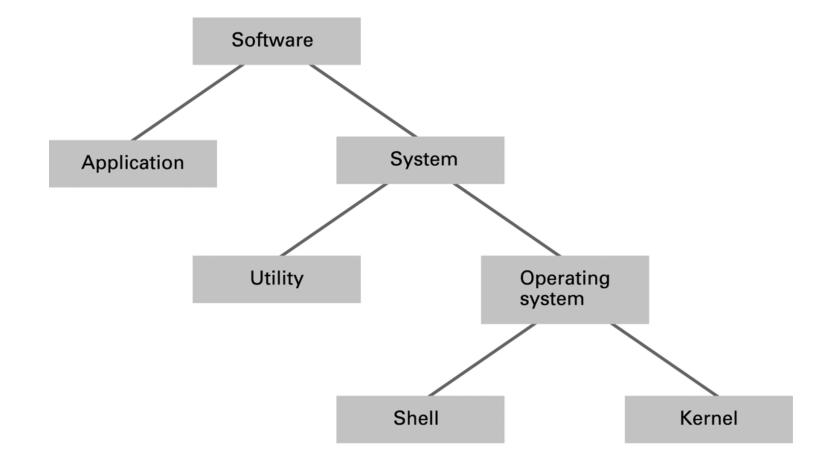
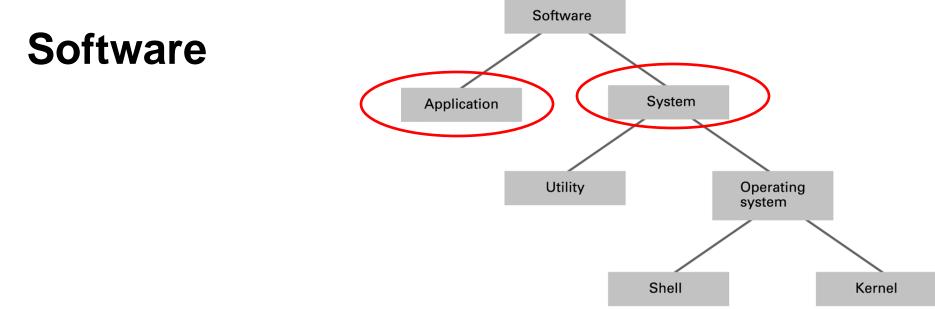


#### **OPERATING SYSTEM FUNCTIONS & MULTITASKING & MULTIPROCESSING OS**

### Software





- **Application software**: Programs for performing a specific task
  - Word processing, spreadsheets, gaming, web page design, graphic design
- System software:
  - <u>Operating software</u>: Software that controls the overall operation of the computer
    - (more next)
  - <u>Utility software</u>: 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 <u>controls the overall operation</u> of a computer

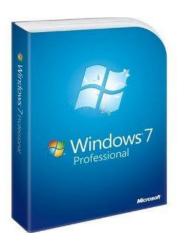


### What is an operating system (OS)?

#### **Operating System Software**

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

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







### What is an operating system (OS)?

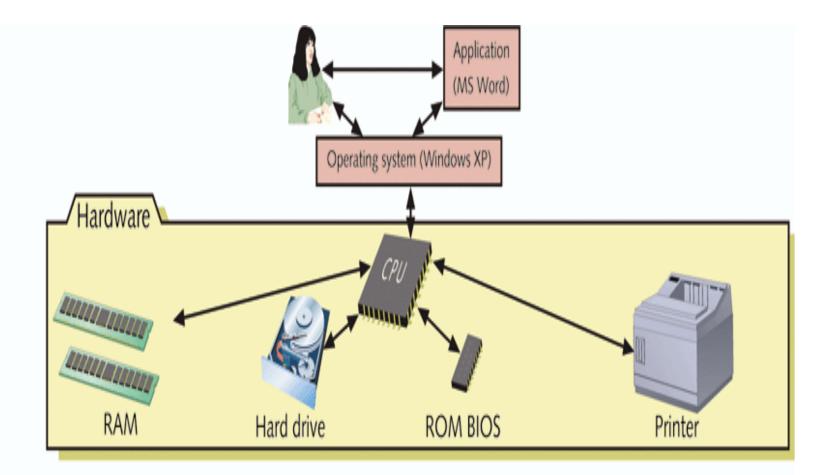
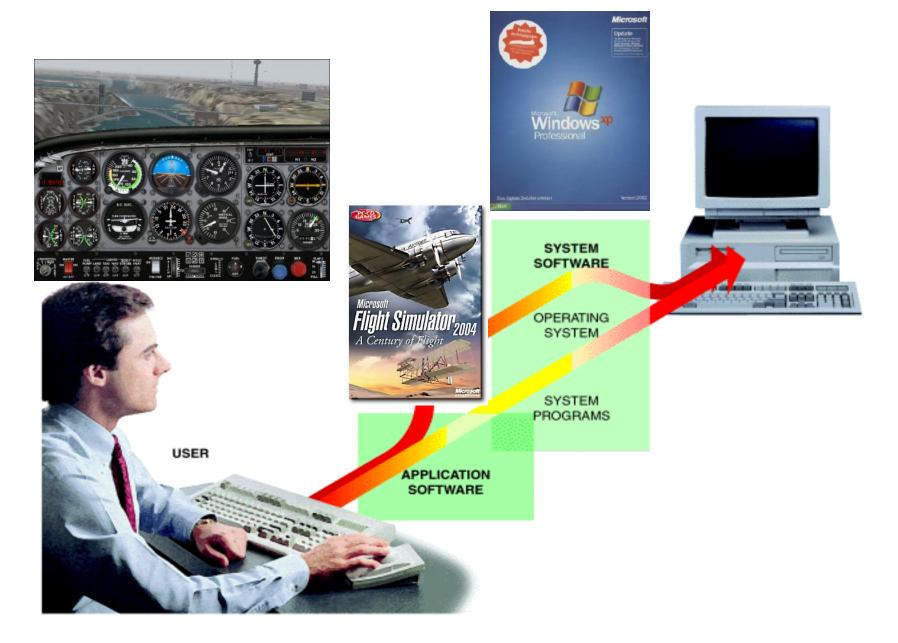


Figure 2-1 Users and applications depend on the OS to relate to all hardware components

### The User's View





### What "is" an operating system?

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

- <u>kernel</u> with the internal programs
- <u>external programs</u>

**Supporting Data Files** 

SYSTEM32				_
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Address 🛅 C:\WINNT\SYSTEM32			🔽 ラ Go 🛛 Links	5
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🚞 temp			File Folder	
🚞 usmt			File Folder	
D WBEM			File Folder	
🚞 wins			File Folder	
🚞 xircom			File Folder	
DoneLabs			File Folder	
🢁 \$winnt\$.inf		32 KB	Setup Information	
၍ 6to4svc.dll		98 KB	Application Extension	
401COMUPD.EXE		428 KB	Application	
🔟 12520437.cpx		3 KB	CPX File	
🔤 12520850.cpx		3 KB	CPX File	
🧕 aaaamon.dll		25 KB	Application Extension	
🧕 access.cpl		67 KB	Control Panel extension	
💁 acctres.dll		63 KB	Application Extension	
accwiz.exe		180 KB	Application	
🔤 acelpdec.ax		61 KB	AX File	
💁 acledit.dll		127 KB	Application Extension	
💁 aclui.dll		112 KB	Application Extension	
ACrd105M.dll		480 KB		
💁 ActBar.ocx		278 KB	ActiveX Control	
activeds.dll		190 KB	Application Extension	
🔤 activeds.tlb		109 KB	TLB File	
actmovie.exe		4 KB	Application	
💁 actxprxy.dll		100 KB	Application Extension	
AddPort.ini		1 KB	Configuration Settings	4

### The kernel

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

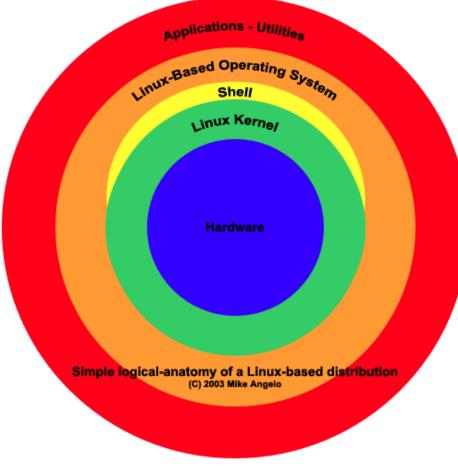
The kernel remains in RAM while the computer is on and is **in charge of the overall operation** of the computer system.

The kernel contains the "internal programs" for the most often used operations like copying files.

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



### Kernel



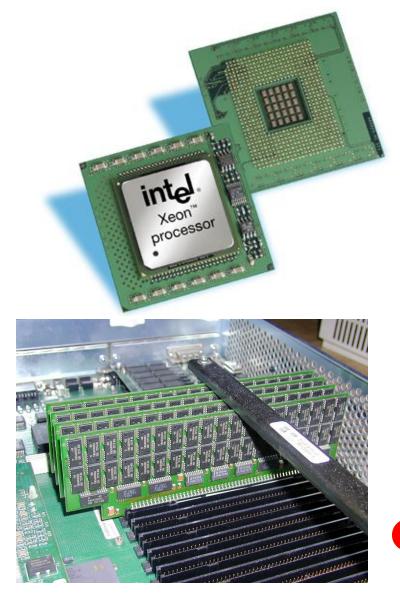
- **Kernel** The internal part of the operating system.
  - Those software components that perform the basic functions required by the computer.
    - File management
    - Memory management (RAM)
    - <u>Security</u>

### 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 <u>CPU works on</u> and when
- Manages RAM
  - What is <u>stored in RAM</u> 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 <u>F.A.T</u>. 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

#### Found New Hardware Wizard



#### Welcome to the Found New Hardware Wizard

This wizard helps you install a device driver for a hardware device.

To continue, click Next,

Cancel

Next >

em Properties		
	💻 Device Manager	TOSHIBA CDRW/DVD SDR2102 Properties
System Restore Automatic Updates General Computer Name Hardware	File Action View Help	General Properties DVD Region Volumes Driver Details
Device Manager The Device Manager lists all the hardware devic on your computer. Use the Device Manager to c properties of any device.	n 🕂 🐨 🚽 Computer Er 🥪 Disk drives	Driver Provider: Microsoft Driver Date: 7/1/2001
Device M	DVD/CD-ROM drives TOSHIBA CDRW/DVD SDR2102	Driver Version: 5.1.2535.0 Digital Signer: Microsoft Windows Publisher
Driver Signing lets you make sure that installed d compatible with Windows. Windows Update lets how Windows connects to Windows Update for	i B-J Floppy disk drives B-D Human Interface Devices DE ATA/ATAPI controllers B-C IDE ATA/ATAPI controllers	Driver Details To view details about the driver files.
Driver Signing Windows I		Update Driver To update the driver for this device.
Hardware Profiles Hardware profiles provide a way for you to set up different hardware configurations.	- ⊕	Roll Back Driver If the device fails after updating the driver, roll back to the previously installed driver.
Hardware	Ports (COM & LPT) Processors ⊕	Uninstall To uninstall the driver (Advanced).
OK ( Owned	Svstem devices	OK Cancel

#### **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**

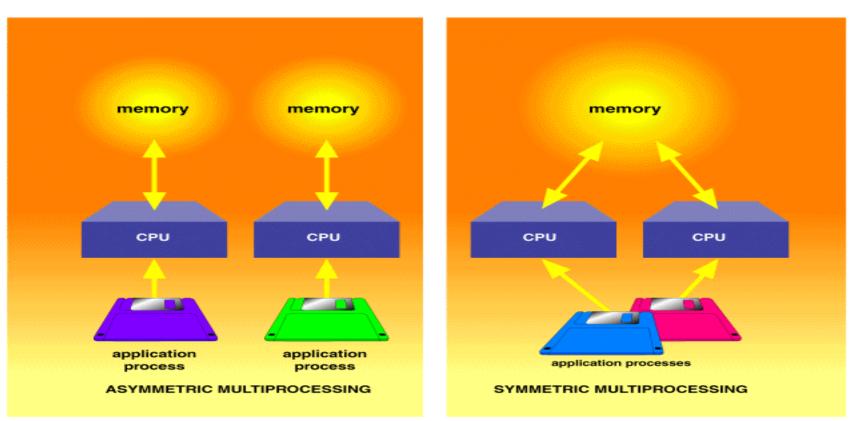
OS allocates CPU time between the different programs based on amount of time and priority of the software application



### Multiprocessing with Multiple CPU's

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

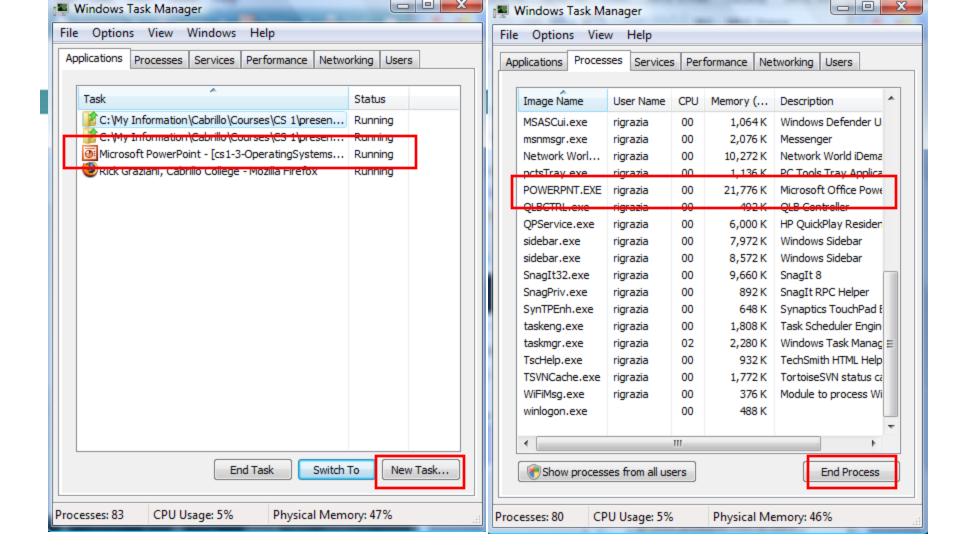
**Symmetric Multiprocessing** = Tasks are assigned to any available CPU and CPU's can share RAM memory



### Processes

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

Appli	Options Vi		lelp Service	s Per	formance N	etworking Users				
	codona		Der vice.	s j r ci						
I	mage Name	User	Name	CPU	Memory (	Description 🔺				
M	ISASCui.exe	rigra	zia	00	1,064 K	Windows Defender U				
	nsnmsgr.exe	rigra	zia	00	2,076 K	Messenger				
	letwork Worl	rigra		00	10,272 K					
	ctsTray.exe	rigra		00	1,136 K					
	OWERPNT.EXE	-		00	21,776 K 492 K					
	LBCTRL.exe	rigra rigra		00 00	6,000 K	•				
	idebar.exe	rigra		00	7,972 K					
	idebar.exe	rigra		00	8,572 K					
	nagIt32.exe	rigra		00	9,660 K					
	nagPriv.exe	rigra		00	892 K	SnagIt RPC Helper				
S	ynTPEnh.exe	rigra	zia	00	648 K	Synaptics TouchPad E				
ti	askeng.exe	rigra	zia	00	1,808 K	Task Scheduler Engin				
	askmgr.exe	rigra	zia	02	2,280 K	-				
	scHelp.exe	rigra		00	932 K					
	SVNCache.exe			00	1,772 K					
	ViFiMsg.exe	rigra	zia	00	376 K	Module to process Wi				
· · · ·	inlogon.exe			00	488 K	-				
•						•				
	· · ·									
	f Show proce	sses fro	om all us	ers		End Process				
Proces	ises: 80 C	PU Usa	age: 5%		Physical M	lemory: 46%				
0			mer	nor						
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	Add A	ress 0		nor Cell	s	<sup>–</sup> Program is				
	Add A A	res: 0 1 2		nor Cell 15 6C	s	<sup>–</sup> Program is stored in				
	Add A A A	res: 0 1 2 3		nor Cell 15 6C 16	s	Program is stored in main memory beginning at				
	Add A A A A	ress 0 1 2 3 4		nor Cell 15 6C 16 6D 50	s	<sup>–</sup> Program is stored in main memory				
	Add A A A A A	ress 0 1 2 3 4 5		mor Cell 15 6C 16 6D 50 56	s	Program is stored in main memory beginning at				
	Add A A A A	ress 0 1 2 3 4 5		mor Cell 15 6C 16 6D 50 56 30	s	Program is stored in main memory beginning at				
	Add A A A A A	ress 0 1 2 3 4 5 6		mor Cell 15 6C 16 6D 50 56	s	Program is stored in main memory beginning at				
3	Add A A A A A A	ress 0 1 2 3 4 5 6 7		mor Cell 15 6C 16 6D 50 56 30	S	Program is stored in main memory beginning at				



- 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.

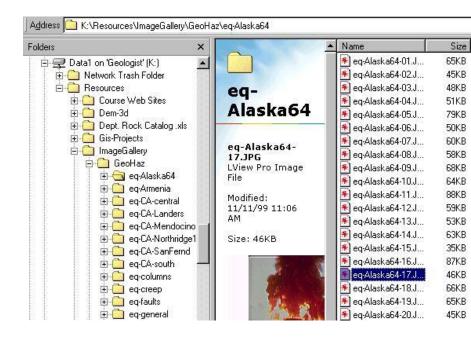
- Gives each process a time slice of CPU time.
- Changes between processes.

Applications Processes Services Performance Networking Users									
Image Name	User Name	CPU	Description						
MSASCui.exe			Memory (	Windows Defender U					
	rigrazia	00	1,064 K						
msnmsgr.exe	rigrazia	00	2,076 K	Messenger Network World iDema					
Network Worl	rigrazia	00	10,272 K						
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 Windows Sidebar					
sidebar.exe	rigrazia	00	7,972 K	Windows Sidebar Windows Sidebar					
sidebar.exe	rigrazia	00	8,572 K						
SnagIt32.exe	rigrazia	00	9,660 K	SnagIt 8					
SnagPriv.exe	rigrazia	00	892 K 648 K	SnagIt RPC Helper					
SynTPEnh.exe	rigrazia	00	1,808 K	Synaptics TouchPad E					
taskeng.exe taskmgr.exe	rigrazia rigrazia	00	2,280 K Wind	Task Scheduler Engin Windows Task Manac ≣					
TscHelp.exe	rigrazia	02		TechSmith HTML Help					
TSVNCache.exe	rigrazia	00	1,772 K	TortoiseSVN status c					
WiFiMsg.exe	rigrazia	00	1,772 K 376 K	Module to process Wi					
winlogon.exe	rigrazia	00	488 K	Module to process wi					
winiogon.exe		00	N OOF						
•				•					
	es from all us			End Process					

### Server (Multiuser) Operating Systems

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





### **Examples of Server Operating Systems**

- MAC OS X Server
- Windows Server



and a second second



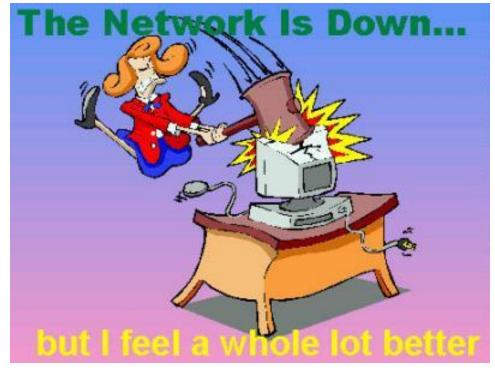
## Advantages/Disadvantages of Server Operating Systems

#### Advantages

- <u>Central location</u> 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



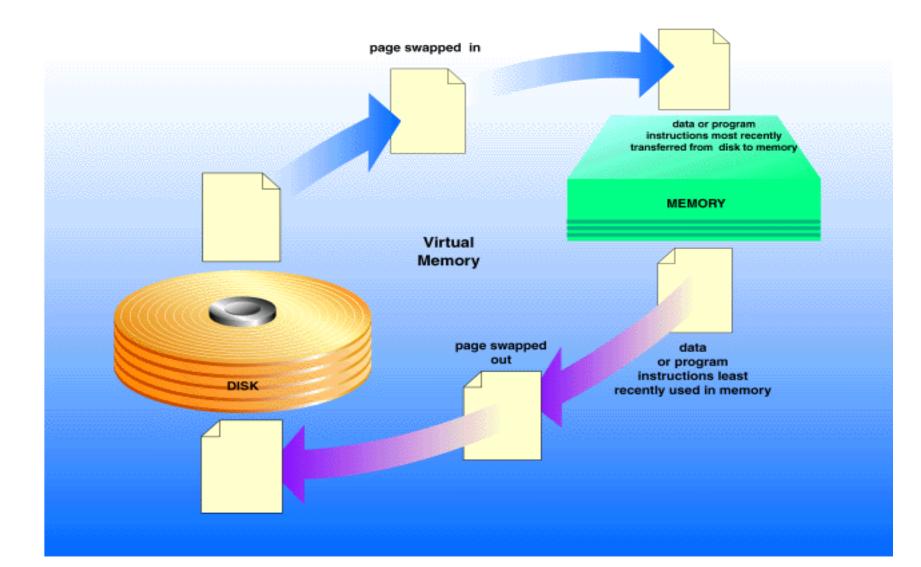
### **Virtual Memory**

System Properti	es		? ×	Performance (	ptions			?×
System Res	store Automa	atic Updates	Remote	Visual Effects	Advanced	Data Executio	n Prevention	
General	Computer Name	Hardware	Advanced	Processor :	scheduling —			[]
Performance Visual effects	ngged on as an Administra , processor scheduling, m ngs related to your logon			By default processor Adjust for Progra Memory us By default memory to	the compute time to run yo best performa ms age	our programs. ance of: Backgrou r is set to use a grams.	a greater share of nd services a greater share of	
Startup and F System startu	Recovery p, system failure, and deb	ugging information	Settings	if it were R	nory le is an area o		ache k that Windows uses 768 MB Change	as
	Environment Vari		r Reporting					
						ок	Cancel Ap	ply

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

- Good no longer get "insufficient memory" error
- Bad performance is very slow when accessing VM
- **Solution** = more RAM

### **Virtual Memory**



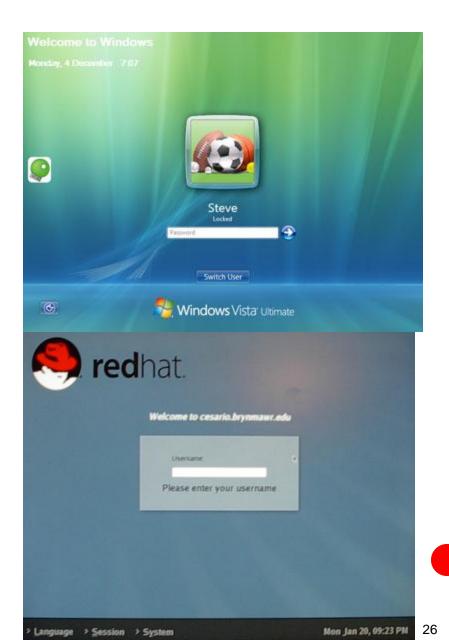
#### 2. Provides and Manages System Security

#### Single-user Operating Systems

- <u>minimal security</u>
- 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 =

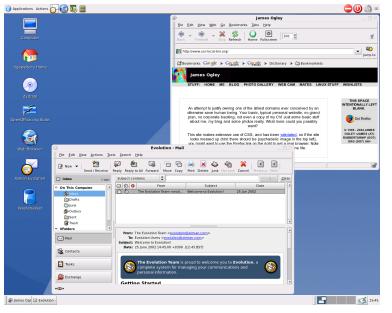
the interface between the user and the computer

#### Command Line Interface (CLI)

 Linux, UNIX, DOS, older OS's

#### Graphical User Interface (GUI)

<b>-</b>			/bin/bash			< 🗆 🗙
Fichier Se	ssions Option	ns Aide				
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[root@local total 31			THOTHEL			
drwxr-xr-x -rw-rr -rw-rr -rw-rr -rw-rr -rw-rr -rw-rr [root@local	2 frank 43 root 1 root 1 frank 1 frank 1 frank 1 frank 1 frank host MaJJ#	users root users users users users users	1024 Jun 2 4096 Det 2 2611 Jun 2 3589 Jun 2 4350 Jun 2 8222 Jun 2 355 Jun 2 3483 Jun 2	2 21:08 3 1999 3 1999 3 1999 3 1999 3 1999 3 1999	INSTALL Maj fr.symbols	ð.



# Command Line Interface DOS, UNIX, others

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

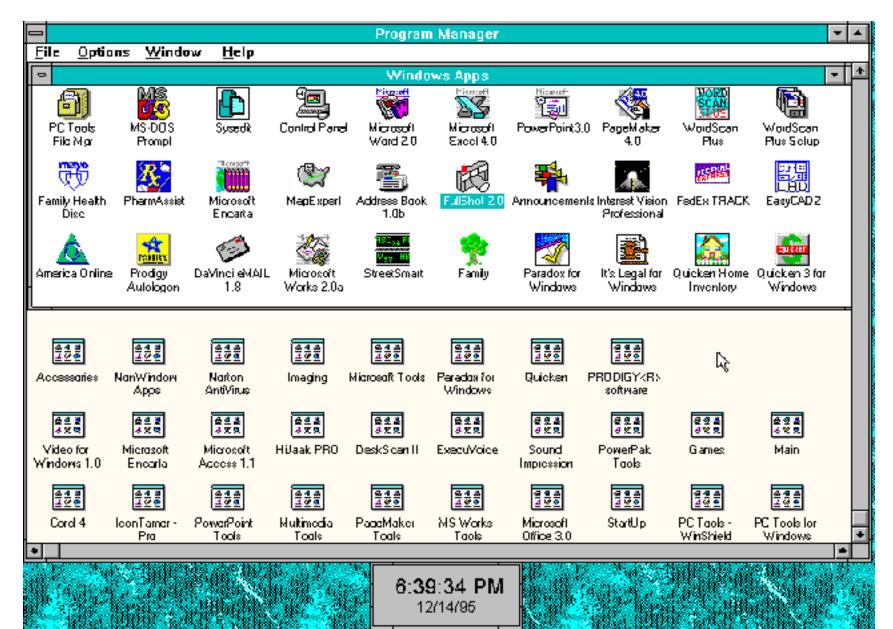
C:\>copy a:\myfolder\budget.xls c:\accounting\newbudget2005.xlx\_

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></dir>		I386		
10/10/2001	06:41 AM	<dir></dir>		BACKUP		
10/10/2001	06:41 AM	<dir></dir>		WINNT		
06/24/2004	12:53 PM		21	dv_trace.log		
03/15/2002	08:02 PM		9	CONFIG.SYS		
10/16/2001	11:58 AM	<dir></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></dir>		VPN304 -		
06/04/2001	08:04 AM		245,814	mping.exe		
10/10/2001	06:43 AM	<dir></dir>		DĪSCÕVER		
12/07/2001	11:14 AM	<dir></dir>		Cisco		
01/01/2002	06:33 PM	<dir></dir>		BDE		
11/19/2001	06:06 PM		9	AdobeWeb.log		
12/06/2001	10:11 PM	<dir></dir>		Windows Update	Setup	Files

### **DOS plus Windows 3.1**

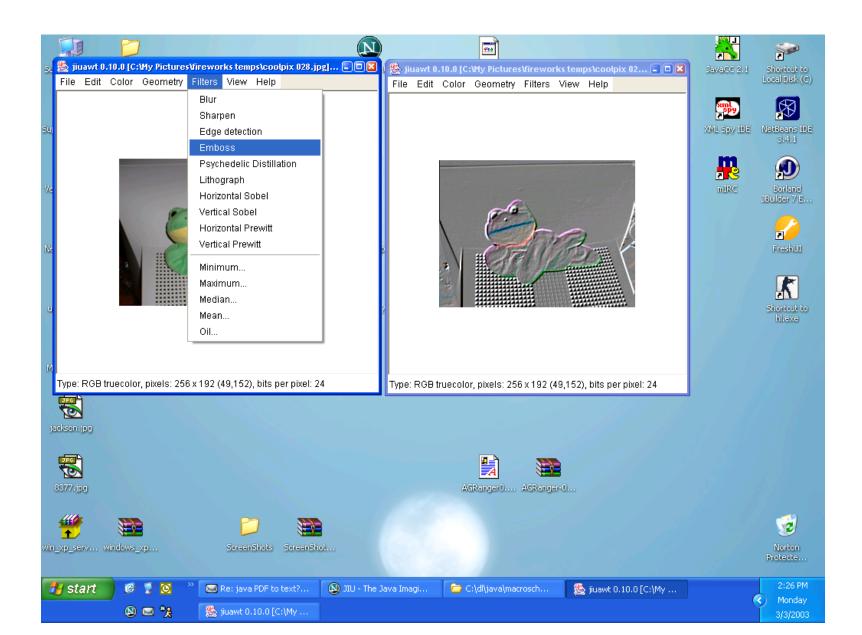


### Windows 95

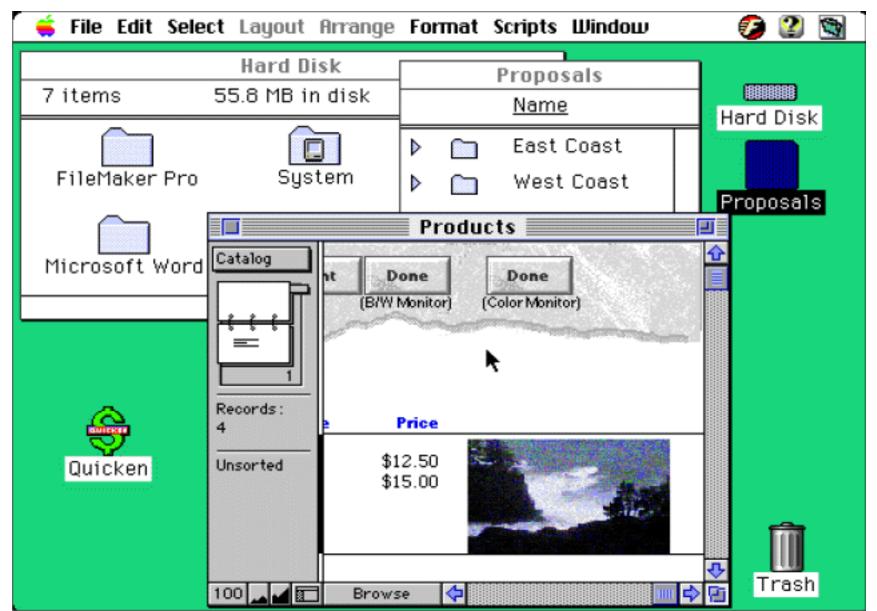
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Му	Compute	er Netscape						
		Navigator						
	etwork	My Briefcase		1				
		New Office Document						
	B	Open Office Document						
	<b>.</b>	<u>P</u> rograms	×					
		<u>D</u> ocuments	•		_			
	<b>.</b>	<u>S</u> ettings	•	Control Panel     Printers				
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WS,	200	<u>R</u> un						
indows95	9	Suspe <u>n</u> d						
Ň	9	Sh <u>u</u> t Down						
	Start							2:02 PM

30

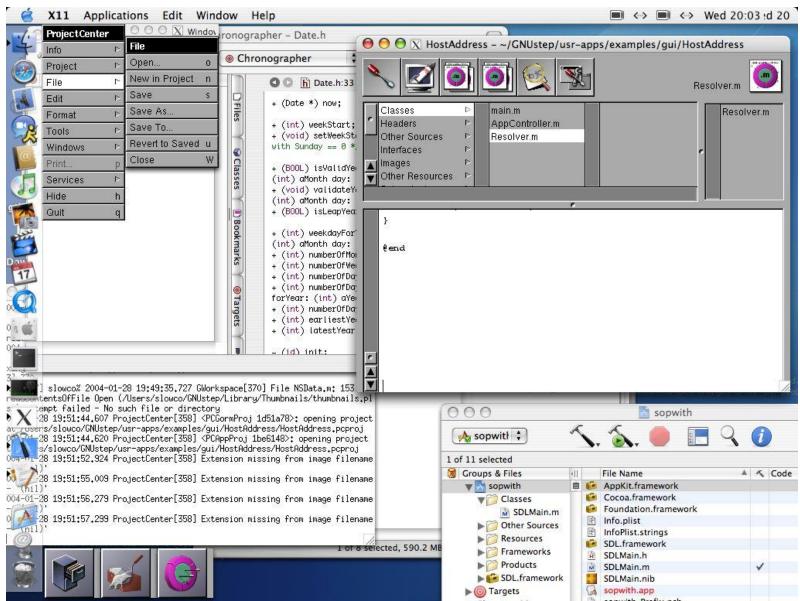
### Windows XP



### Macintosh

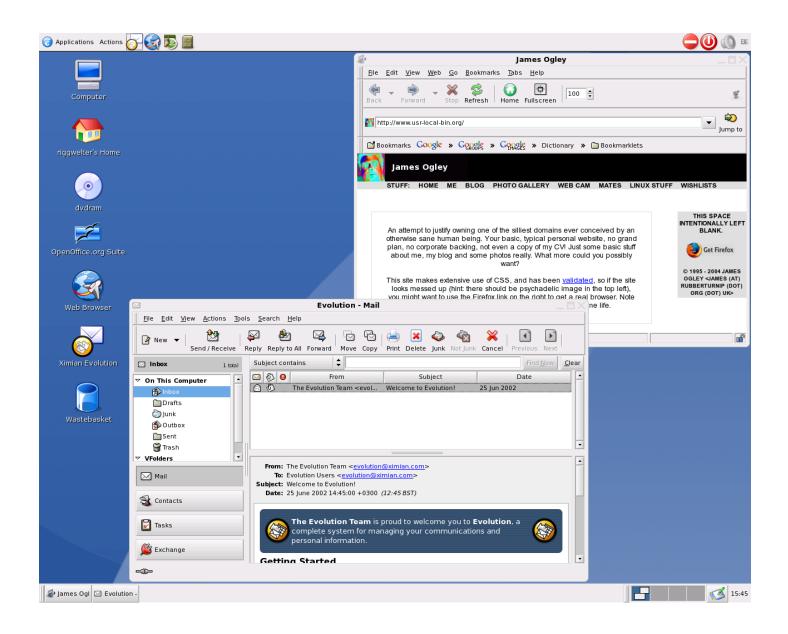


### Mac OS X



Rick Graziani graziani@cabrillo.edu

### **UNIX with X-Windows**



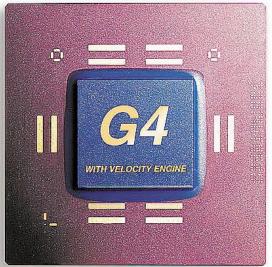
### **Microsoft Windows 8**



#### 4. Provides the Interface for Application Software

- Operating systems are <u>software</u>
- 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**

inte

1. The CPU

2. Other Hardware **Components** 

3. Operating System **Software** 

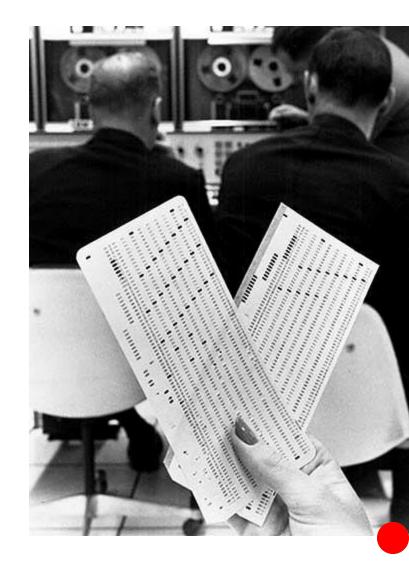
4. Application Software



Het Mensell Office (Prototoerverkingprogramma Vesie 2002

#### 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 <u>executing them without</u> <u>further interaction with the user</u>.



- 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

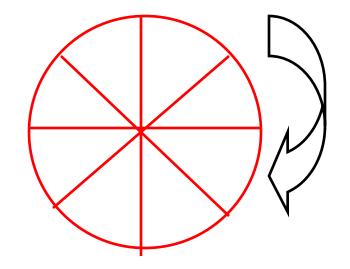


- Disadvantage to Batch Processing

   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



- Newer Operating Systems
- Used remote terminals and interactive processing
  - Computer must be fast enough to coordinate with the needs of the user.
- <u>Real-time processing</u> Computer must execute tasks under a deadline.
- **Time sharing** Provides service to multiple users at the same time.
  - Multiprogramming Time divided into intervals.
- <u>Multitasking</u> 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.

#### – <u>Scaling</u>

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

#### – <u>The Network (Internet)</u>

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

