OPERATING SYSTEM (OS) AND VIRTUAL MACHINE (VM)

EGCO103 INFORMATION TECHNOLOGY IN THE DAILY LIFE

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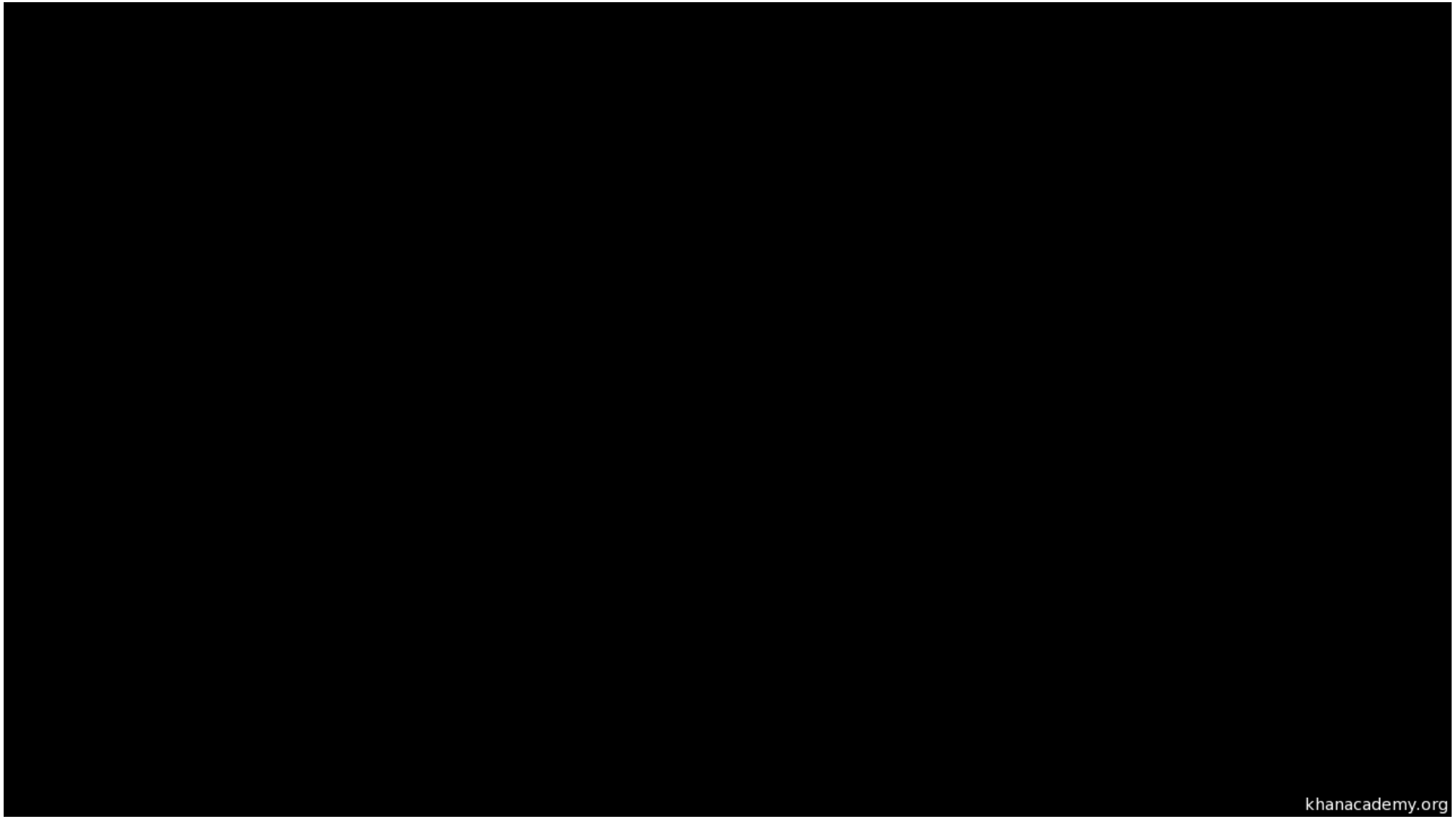
COVERED TOPICS

- Operating System (OS)
- File Management and Utility Programs
- Virtual Machine (VM)

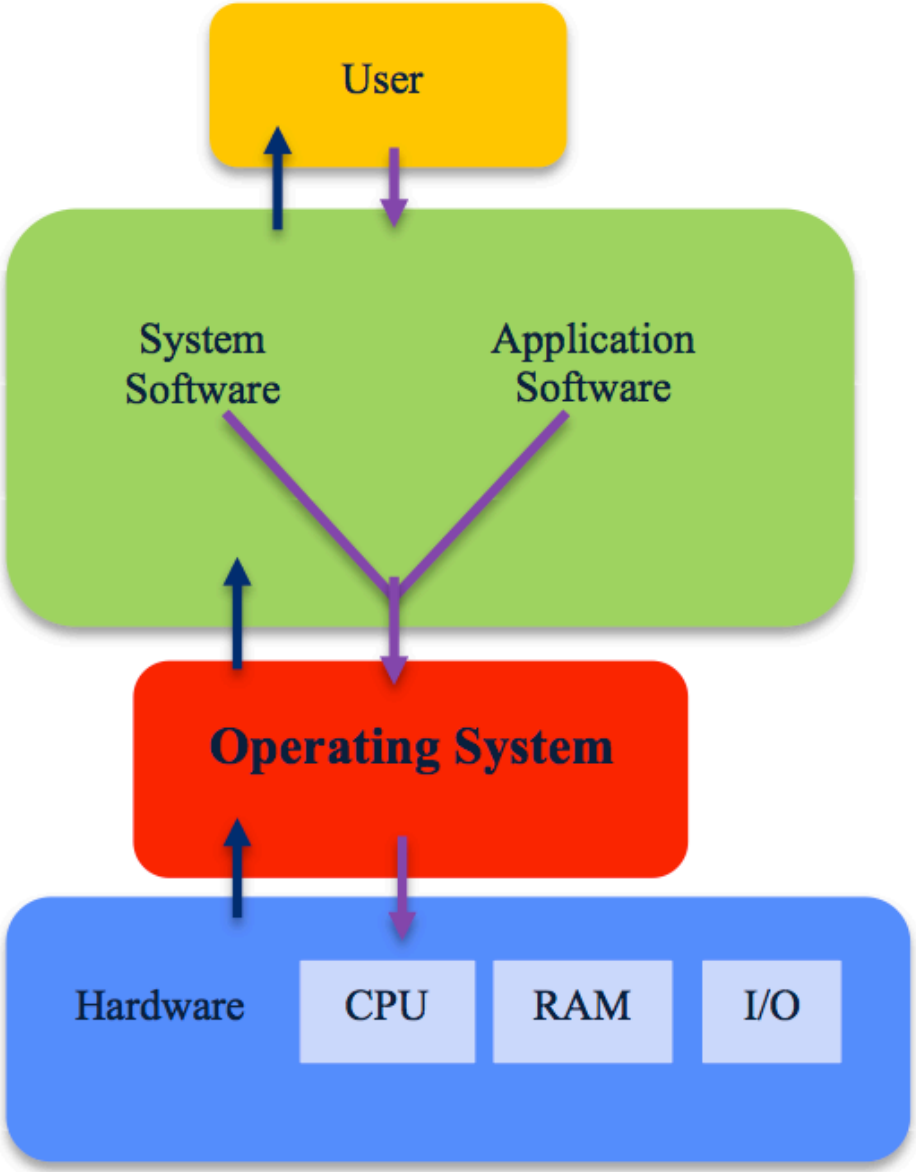
OPERATING SYSTEM (OS)

HARDWARE & SOFTWARE



* https://code.org and https://www.khanacademy.org

OPERATING SYSTEM (OS)



SYSTEM SOFTWARE BASICS

- Two basic types of software:
  - Application software is used to do everyday tasks at home and work
  - System software is set of programs that helps run the computer
    - Operating system is group of programs that controls how computer system functions
    - Utility programs are small programs that perform many general housekeeping tasks

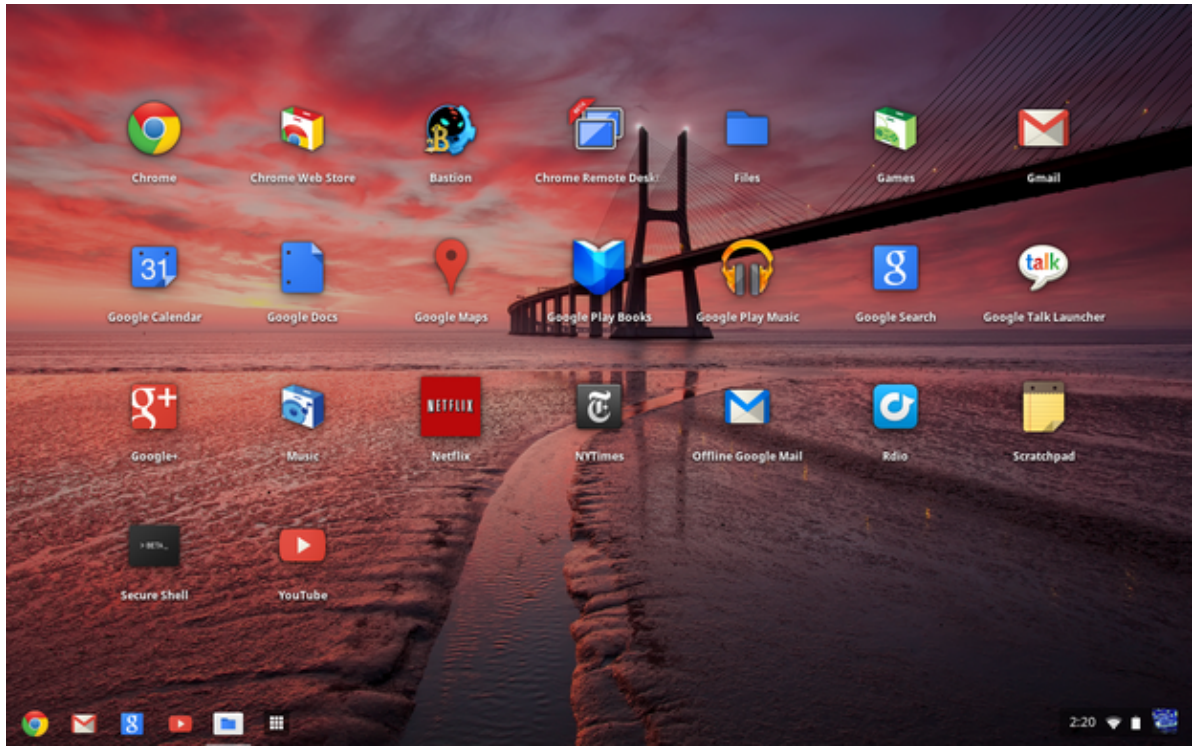
OPERATING SYSTEM (OS)

- OS for Personal Computer (PC)
  - Windows (…, 11, 10, Vista, or XP)
  - Mac OS (…, Sequoia 15.2, …)
  - Linux (Ubuntu, RedHat, Suse, CentOS, Fedora, and more.)
- OS for Mobile Devices
  - iOS
  - Android
- OS for Servers & Networks
  - Windows Server
  - Unix / Linux
- Other OS
  - Real Time OS, Car Engines, Medical Devices, Robot, etc.

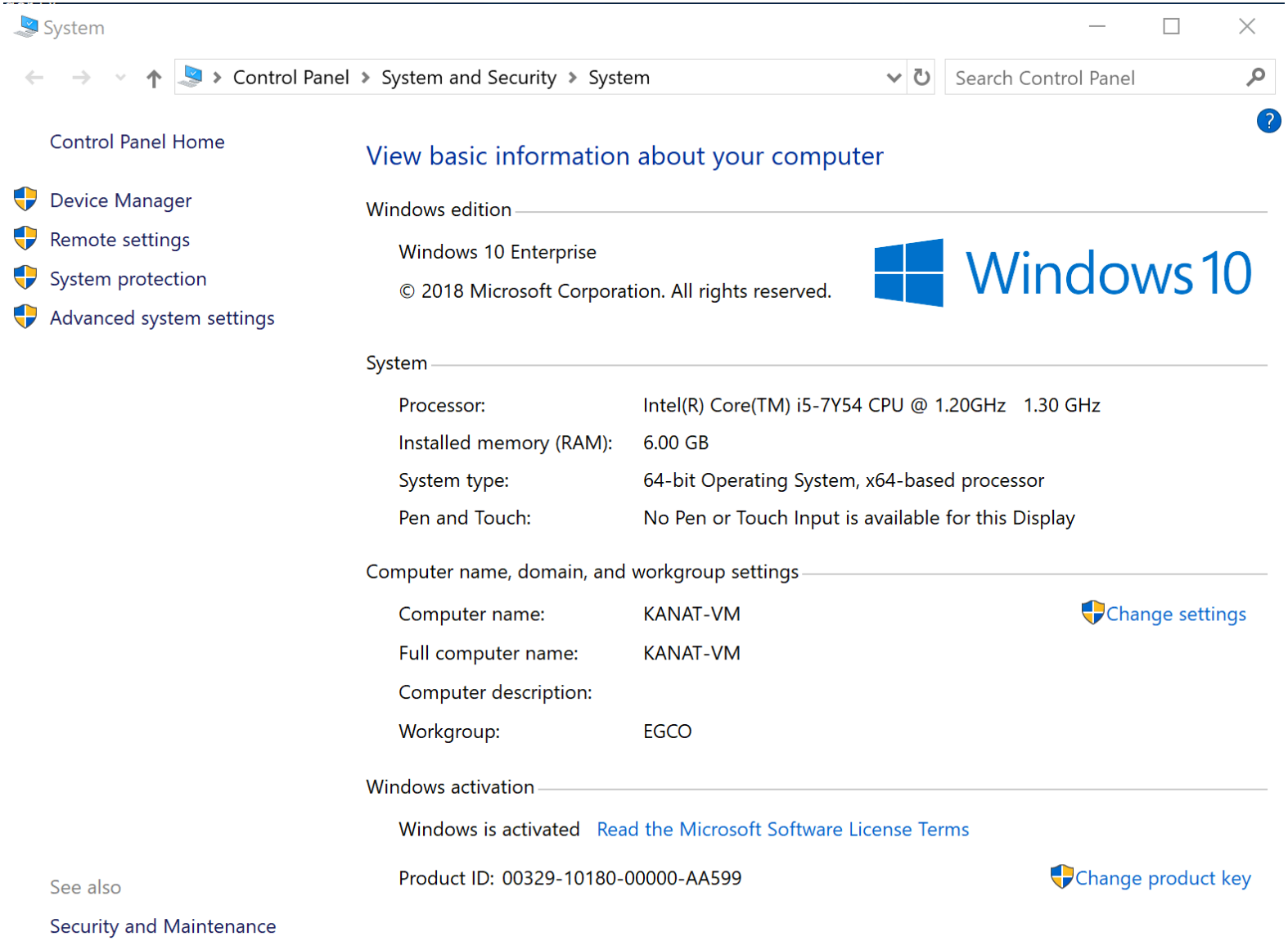
WEB-BASED OPERATING SYSTEMS

- Prototypes are being developed
- Still need a computer, operating system, and Web browser
- Enables users to access applications and content via the Web anywhere, on any machine and at any time
- Google is taking steps toward developing a complete Web-based operating system

CHROME OS AND CHROME BOOK



KNOW YOUR COMPUTER



UPGRADING YOUR OPERATING SYSTEM

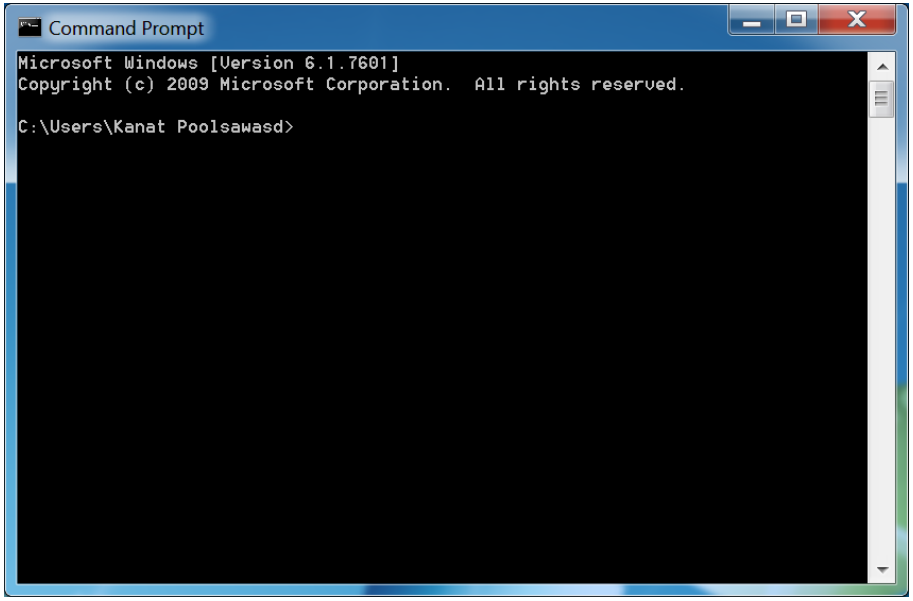
- Questions to ask before you upgrade:
  - Is current OS still supported?
  - Are there significant features in new version?
  - Will your hardware work with the new OS?
  - Is your software compatible with new OS?
- Back up all data files before starting upgrade.

WHAT THE OPERATING SYSTEM DOES ?

- Coordinates and directs the flow of data and information
  - Provides a user interface
  - Manages the processor, or CPU
  - Manages memory and storage
  - Manages hardware and peripheral devices
  - Provides means for software applications to work with the CPU

THE USER INTERFACE

- Enables user to interact with the computer
- Types of interfaces
- Command-driven interface
- Menu-driven interface
- Graphical user interface (GUI)



PROCESSOR MANAGEMENT

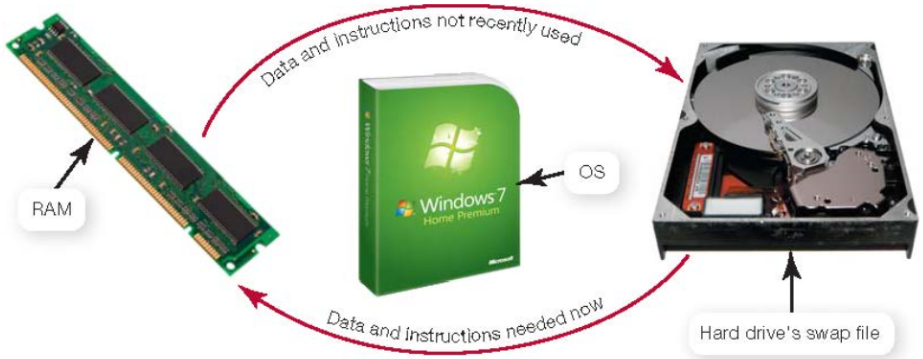
- CPU usually is asked to perform several tasks at once
- OS arranges for execution of all activities
- Assigns a slice of time to each activity
- Switches among processes millions of times a second
- Appears that everything is happening seamlessly

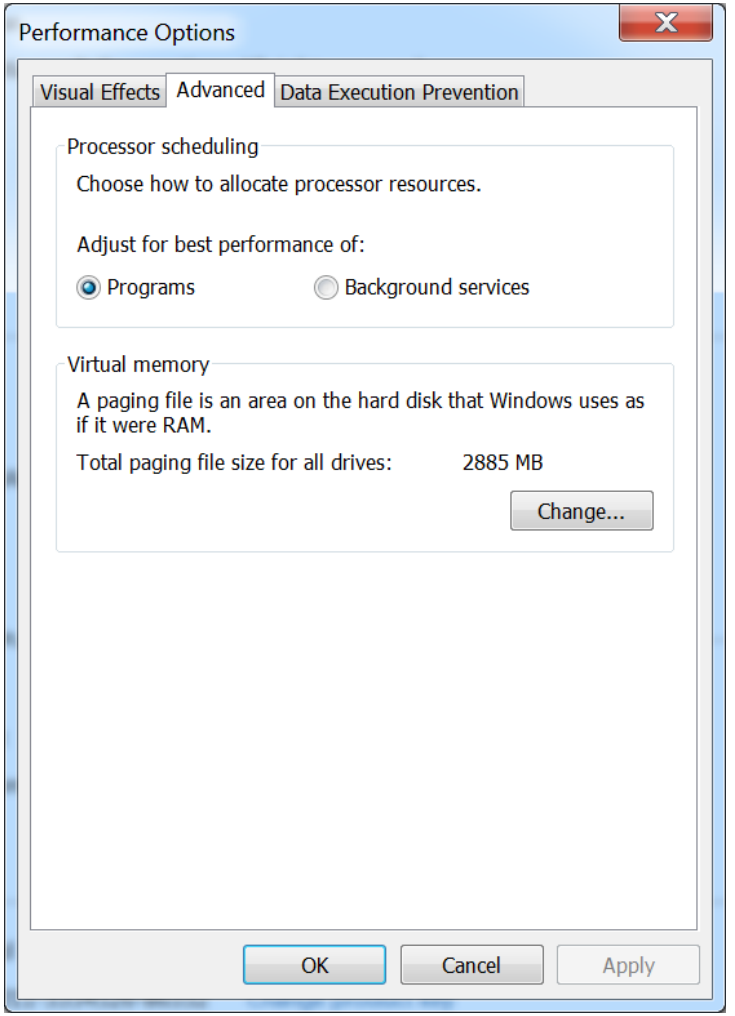
MEMORY AND STORAGE MANAGEMENT

- OS uses RAM as temporary storage area for instructions and data
- Processor accesses these instructions and data from RAM when it needs them
- OS is responsible for coordinating space allocation in RAM
- Clears item from RAM when processor no longer needs them

VIRTUAL MEMORY

- RAM has limited capacity
- When RAM is full, Instructions and data are stored on the hard drive





HARDWARE AND PERIPHERAL DEVICE MANAGEMENT

- Device Drivers
  - Facilitate communication between device and the operating system.
  - Translates device's commands into commands the operating system can understand.
- Plug and Play
  - Hardware and software standard.
  - Facilitates the installation of new hardware.

SOFTWARE APPLICATION COORDINATION

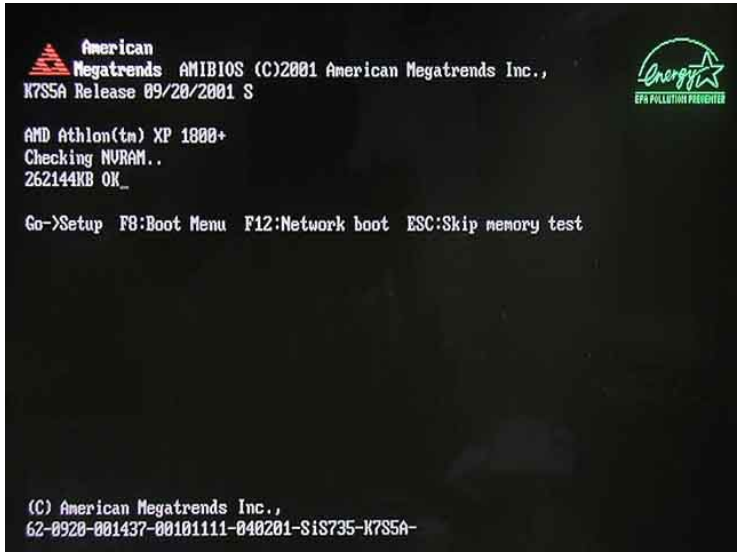
- For programs to work, they must contain code the CPU recognizes
- Application programming interface (API)
  - Blocks of code for similar procedures
  - Prevent redundancies in software code
  - Make it easier for software developers

THE BOOT PROCESS: STARTING THE COMPUTER

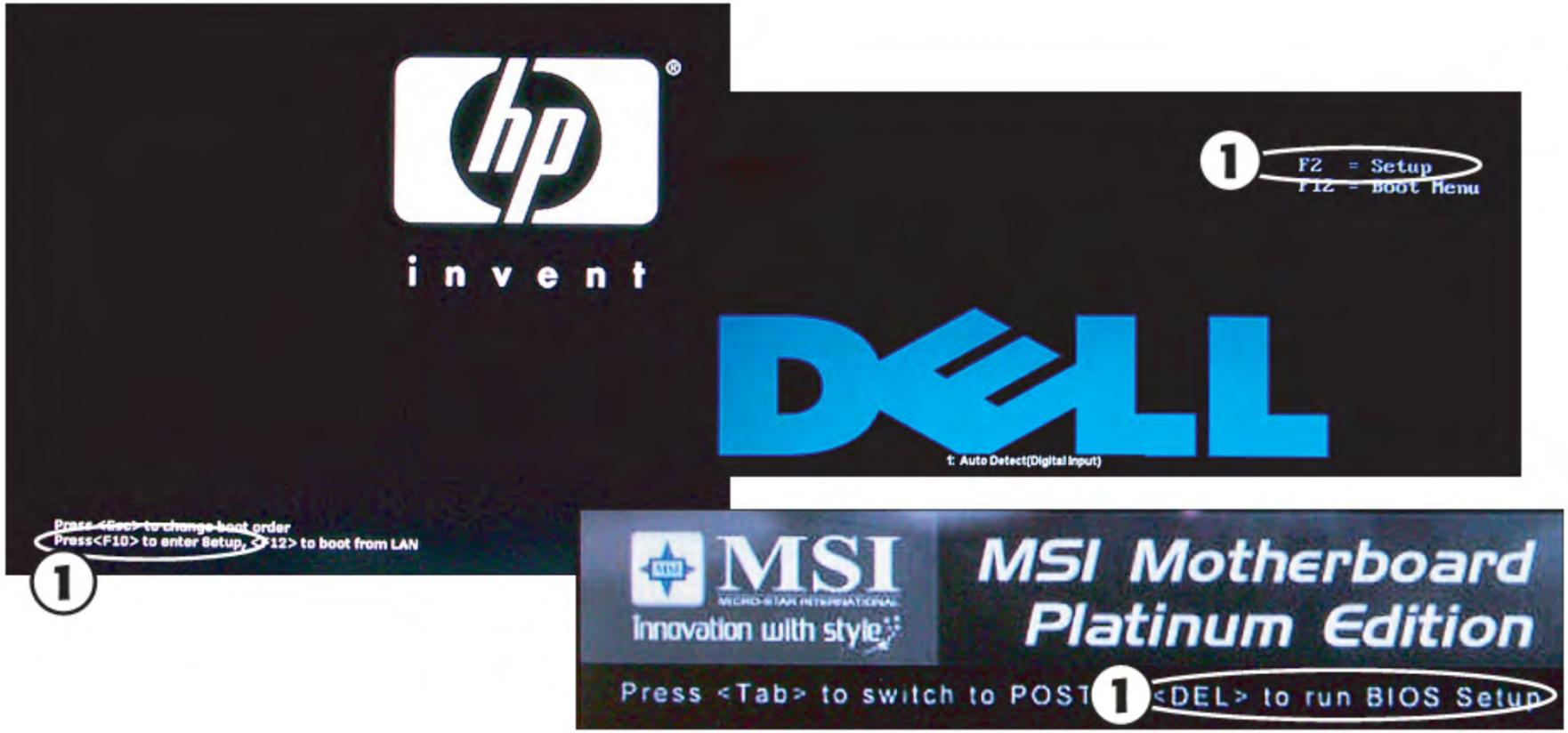
- The boot process loads the operating system into RAM
- Four basic steps:
  - BIOS is activated
  - A POST checks attached devices
  - The operating system is loaded into RAM
  - Configuration and customization settings are checked

BIOS (1)

- Basic Input/Output System (BIOS) and also known as the System BIOS, ROM BIOS or PC BIOS)
- Piece of software located inside the mainboard.
- Help detect components and start up the computer.
- POST (Power-On Self-Test)

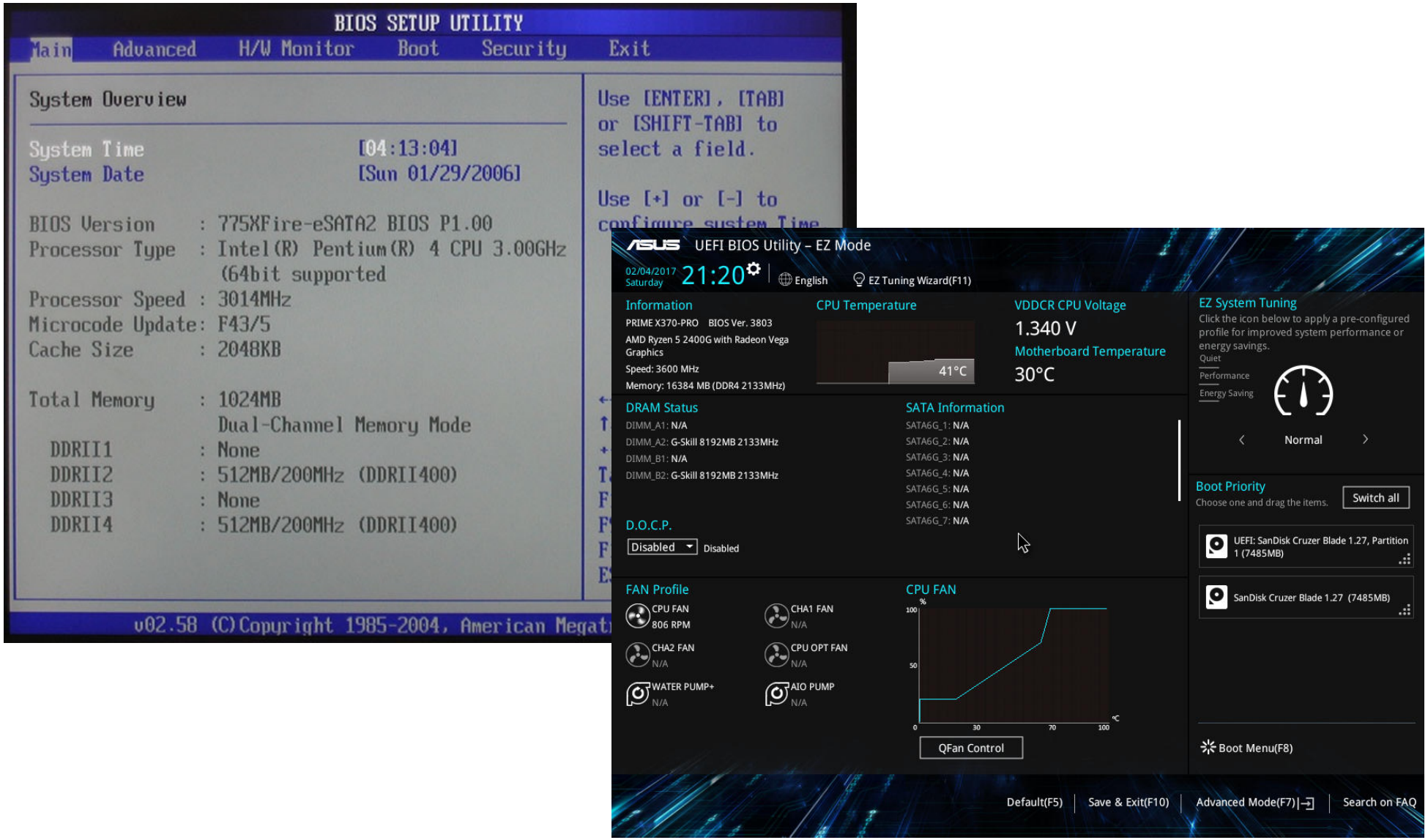


BIOS (2)



1 Keystroke to start the BIOS setup program

BIOS (3)


BIOS SETUP UTILITY
Main Advanced H/W Monitor Boot Security Exit
System Overview
System Time [04:13:04]
System Date [Sun 01/29/2006]
BIOS Version : 775XFire-eSATA2 BIOS P1.00
Processor Type : Intel(R) Pentium(R) 4 CPU 3.00GHz
(64bit supported
Processor Speed : 3014MHz
Microcode Update: F43/5
Cache Size : 2048KB
Total Memory : 1024MB
Dual-Channel Memory Mode
DDRII1 : None
DDRII2 : 512MB/200MHz (DDRII400)
DDRII3 : None
DDRII4 : 512MB/200MHz (DDRII400)
Use [ENTER], [TAB] or [SHIFT-TAB] to select a field.
Use [+] or [-] to
v02.58 (C)Copyright 1985-2004, American Megat
UEFI BIOS Utility – EZ Mode
02/04/2017 Saturday 21:20
English
EZ Tuning Wizard(F11)
Information
PRIME X370-PRO BIOS Ver. 3803
AMD Ryzen 5 2400G with Radeon Vega Graphics
Speed: 3600 MHz
Memory: 16384 MB (DDR4 2133MHz)
CPU Temperature
41°C
VDDCR CPU Voltage
1.340 V
Motherboard Temperature
30°C
DRAM Status
DIMM_A1: N/A
DIMM_A2: G-Skill 8192MB 2133MHz
DIMM_B1: N/A
DIMM_B2: G-Skill 8192MB 2133MHz
SATA Information
SATA6G_1: N/A
SATA6G_2: N/A
SATA6G_3: N/A
SATA6G_4: N/A
SATA6G_5: N/A
SATA6G_6: N/A
SATA6G_7: N/A
D.O.C.P.
Disabled
Disabled
FAN Profile
CPU FAN 806 RPM
CHA1 FAN N/A
CHA2 FAN N/A
CPU OPT FAN N/A
WATER PUMP+ N/A
AIO PUMP N/A
CPU FAN
QFan Control
EZ System Tuning
Click the icon below to apply a pre-configured profile for improved system performance or energy savings.
Quiet
Performance
Energy Saving
Normal
Boot Priority
Choose one and drag the items.
Switch all
UEFI: SanDisk Cruzer Blade 1.27, Partition 1 (7485MB)
SanDisk Cruzer Blade 1.27 (7485MB)
Boot Menu(F8)
Default(F5)
Save & Exit(F10)
Advanced Mode(F7)
Search on FAQ

WHEN WE NEED BIOS

- Boot your PC from CD / USB
- Select a boot sequence
  - CD -> HD -> USB
  - HD -> USB -> CD

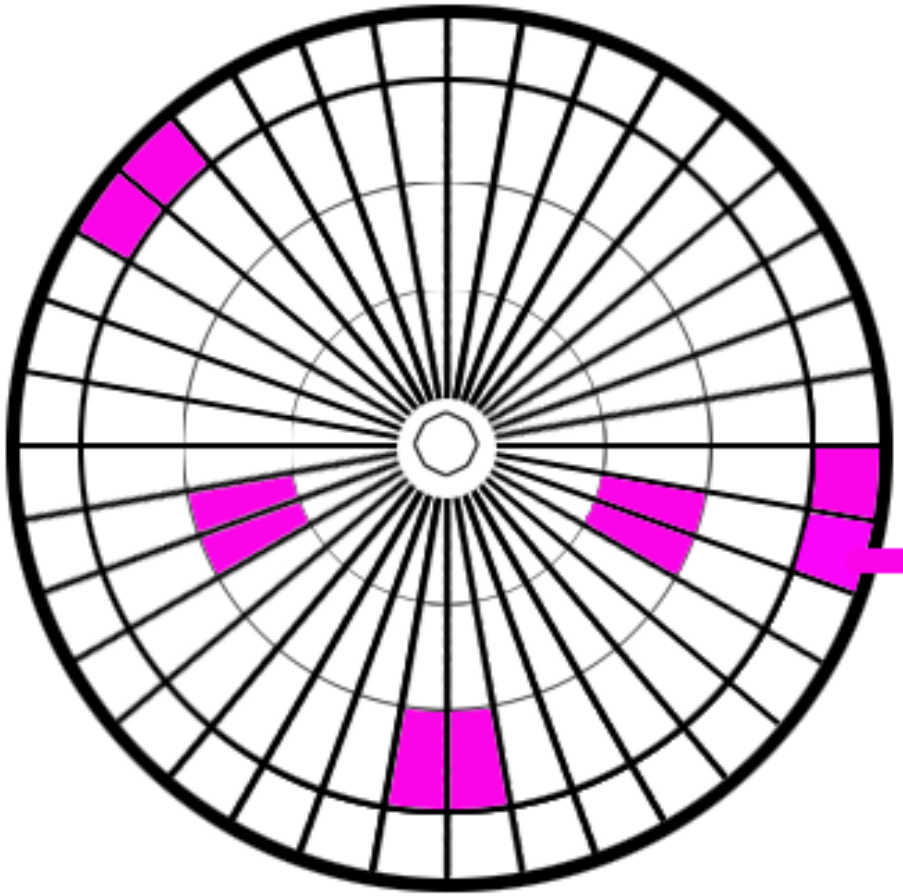
FILE MANAGEMENT & UTILITY PROGRAMS

FILE SYSTEM (1)

- If it's all 0/1 on the disk, how do we know where our file is ?
- File System is how OS tell where information are on the disk.
- Example: NTFS, EXT3, FAT16, FAT32

FILE SYSTEM (2)

A file as stored on a hard disk



A file is stored across a number of clusters

DIFFERENT TYPES OF FILE SYSTEM

- FAT (File Allocation Table), FAT16, and FAT32 in Windows. It's was designed by Microsoft. Starting with DOS.
- NTFS (New Technology File System) is the newer drive format. Starting with Windows NT 3.1, it is the default file system of the Windows NT family.
- exFAT (Extended File Allocation Table) was designed by Microsoft back in 2006 and was a part of the company's Windows CE 6.0 operating system.
- HFS (Hierarchical File System) or Mac OS Extended read/write on Mac only.
- APFS (Apple File System) is a new file system for macOS, iOS, and Apple devices.

WHAT IS THE DIFFERENCES ?

File system	Maximum filename length	Allowable characters in directory entries	Total Files	Max file size	Max volume size
FAT16	8.3 or 255 UTF-16 code units with Long File Name	Any byte except for values 0-31, 127 (DEL) and: " * / : < > ? \ | + , . ; = [] (lowcase a-z are stored as A-Z). With VFAT LFN any Unicode except NUL	65,460	4 GB	2 - 4 GB
FAT32			268,173, 300		2 - 16 TB
NTFS	255		2^{32}-1	16 TB	256 TB
HFS+	Very long			Very big	Very big

COMPATIBILITY

- FAT16, FAT32 can be read/write by all
- NTFS read/write on Windows, Read only for Mac
- APFS, HFS+ read/write on Mac only.

FORMATTING

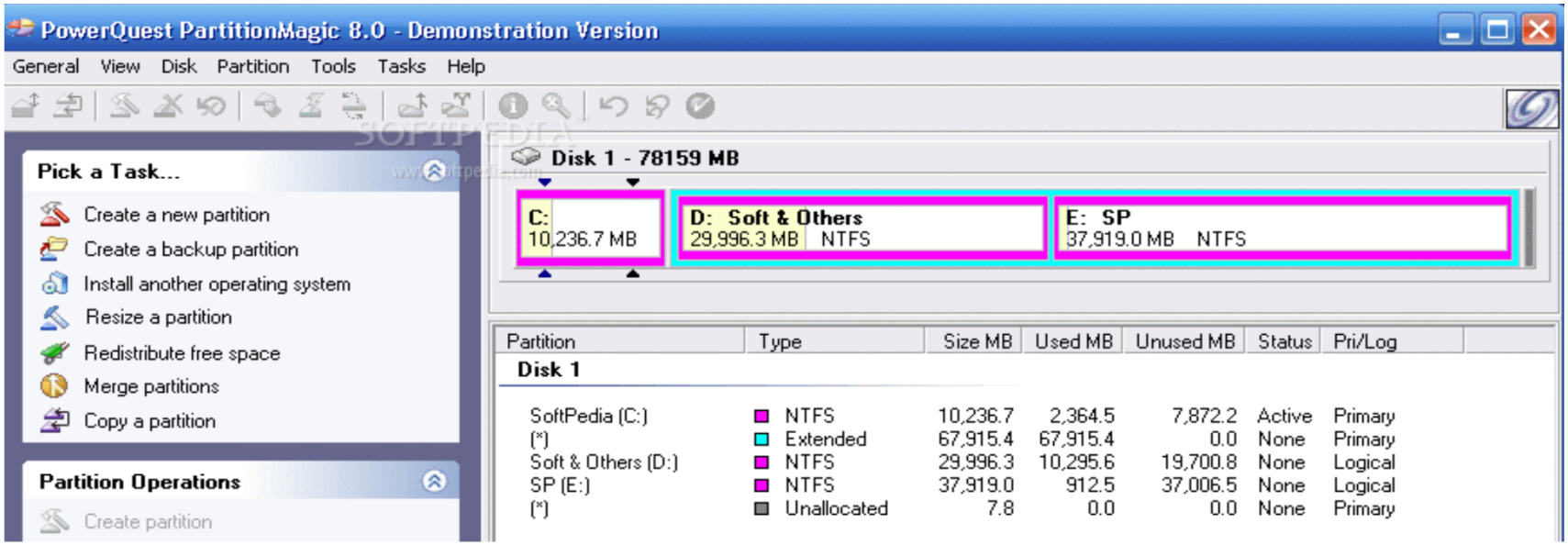
- Wipe all data from a hard disk/flash drive.
- Set file system.
- Try right click on a drive.
- Quick Format vs Normal Format
  - Quick = File directory system is destroyed.
  - Normal = Very Slow (Hours or Day) but check HD condition

PARTITIONING AND FILE SYSTEMS (1)

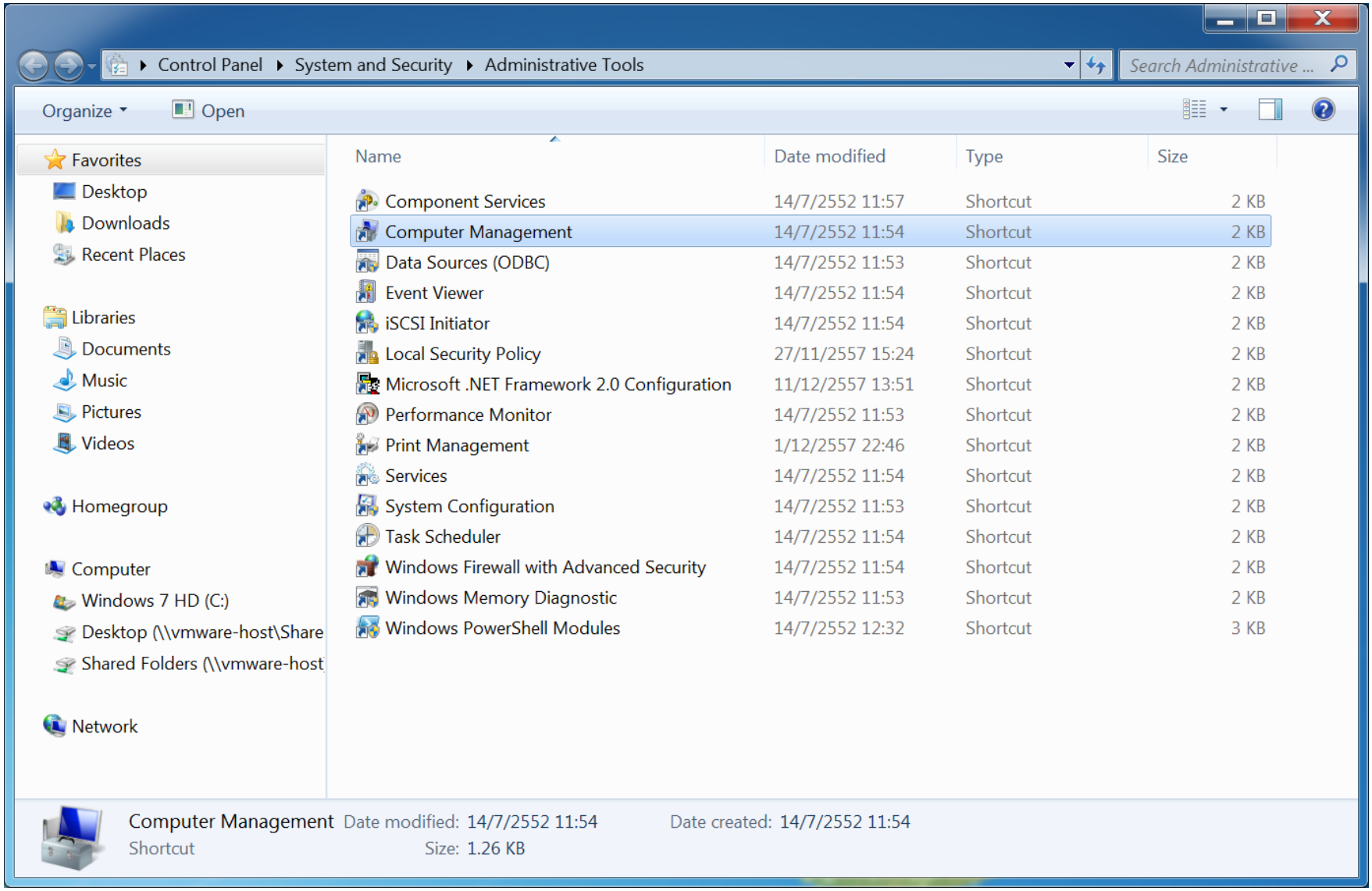
- Partitioning: Enables you to logically divide the physical capacity of a single drive into separate areas, called partitions or logical drives
- Used to:
  - Install more than one operating system.
  - Create a recovery partition.
  - Create a new logical drive for data.
  - Increase efficiency (smaller drives can use smaller cluster sizes)
- File system: Determines the cluster size, maximum drive size, and maximum file size
- FAT, FAT32, and NTFS

PARTITIONING AND FILE SYSTEMS (2)

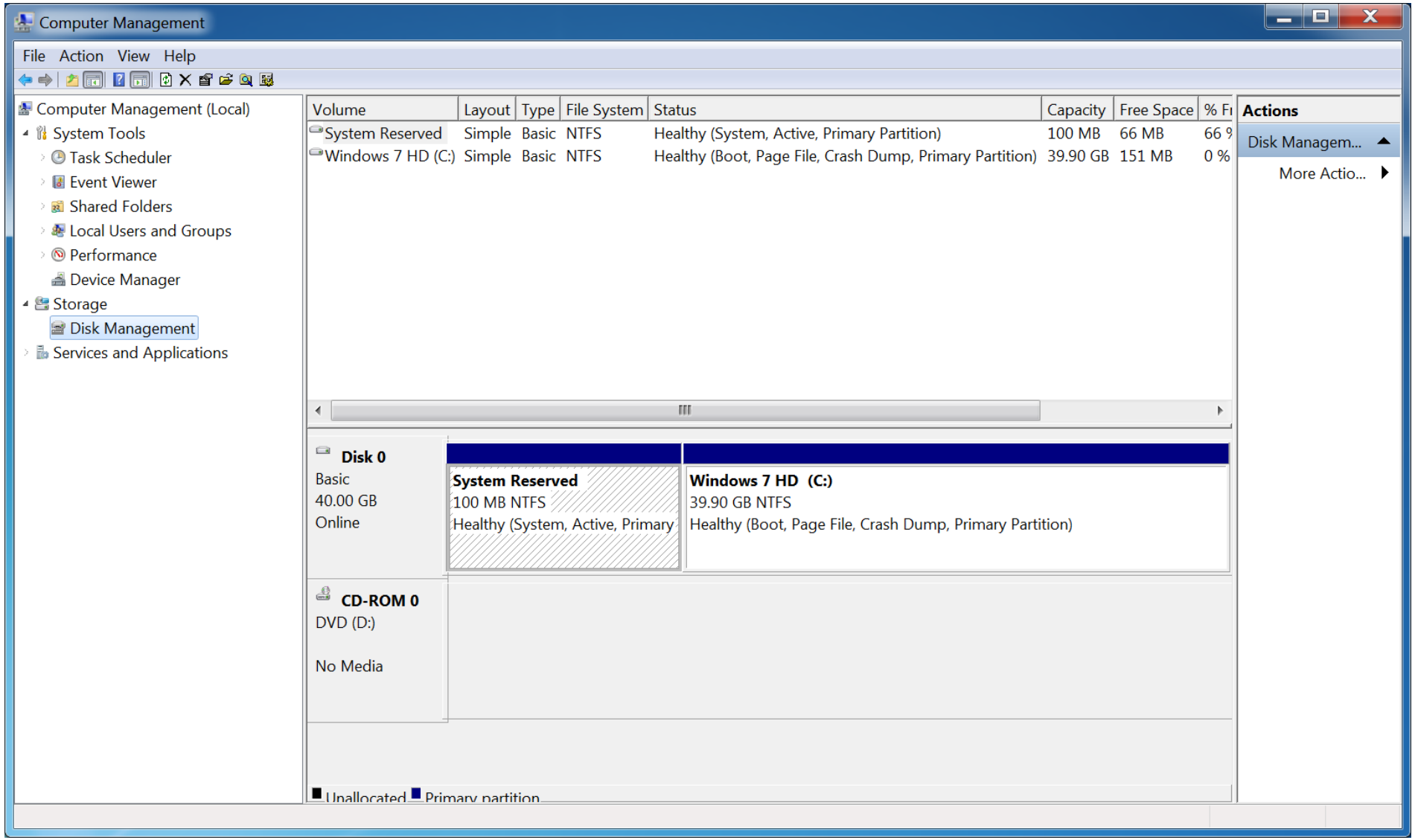
- Usually remove partition destroys ALL DATA.
- Windows has a tool for repartition that can shrink and expand without destroying data.
- Possible to use special software for repartitioning without losing data at all such as Partition Magic, GNU Parted, etc...



PARTITIONING AND FILE SYSTEMS (3)



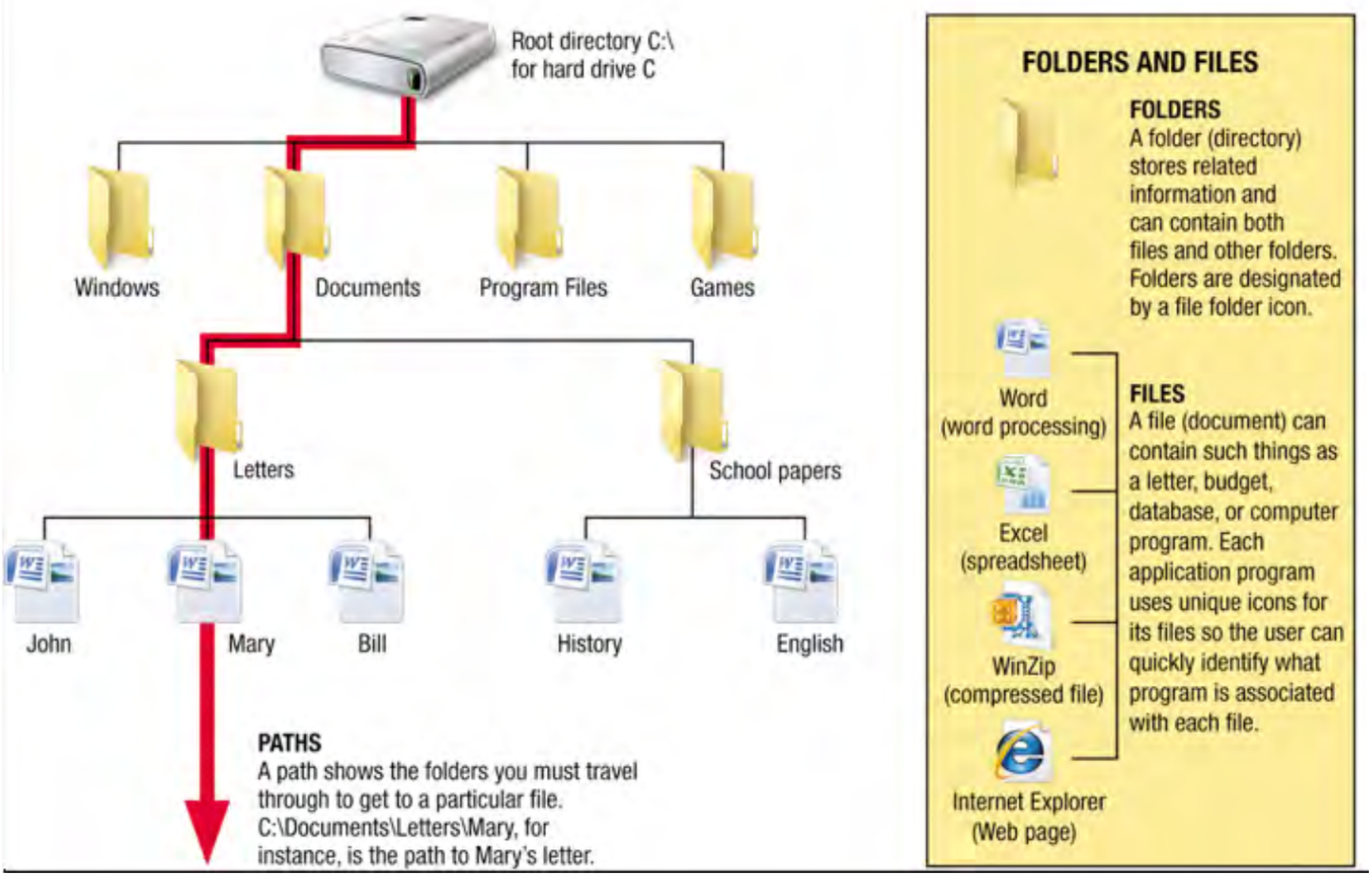
PARTITIONING AND FILE SYSTEMS (4)



WHY PARTITION ?

- Separate OS from data
  - OS on one partition and Data (Music, Word, etc) on another.
  - OS need certain free space for virtual memory.
- Have more than one OS on the same computer.

FILES AND DIRECTORIES



NAMING FILES

- File name is the name you assign to the file when you save it
  - First part is similar to your first name
- In Windows, an extension, or file type, follows the file name and a period or dot (.)
  - Similar to a last name, extension identifies the application needed to read the file

COMMON FILE NAME EXTENSIONS

Extension	Type of Document	Application
.doc	Word processing	Microsoft Word 2003
.docx	Word processing	Microsoft Word 2007 and 2010
.xlsx	Spreadsheet	Microsoft Excel 2007 and 2010
.accdb	Database	Microsoft Access 2007 and 2010
.pptx	PowerPoint presentation	Microsoft PowerPoint 2007 and 2010
.pdf	Portable Document Format	Adobe Acrobat or Adobe Reader
.rtf	Text (Rich Text Format)	Program that can read text
.txt	Text	Program that can read text
.htm /.html	Hyper Text Markup	Any program that can read HTML
.jpg	JPEG image	Programs capable of displaying
.zip	Compressed file	WinZip

FILE NAMING CONVENTIONS

- Each OS has own naming conventions
- Up to 255 characters
- Forbidden characters in Windows:

  " / \ * ? < > | :
- Mac file names may not use a colon (:), are case sensitive and do not need file extensions

FILE PATH

- Determine location of a file by its file path
- File path includes drive, folders, subfolders, the file name, and the extension
- Path separators include a backslash (\) for Windows, or slash (/) for Mac and Linux

WORKING WITH FILES

- File-management actions
  - Open
  - Copy
  - Move
  - Rename
  - Delete
    - Recycle Bin (Windows)
    - Trash (Mac)

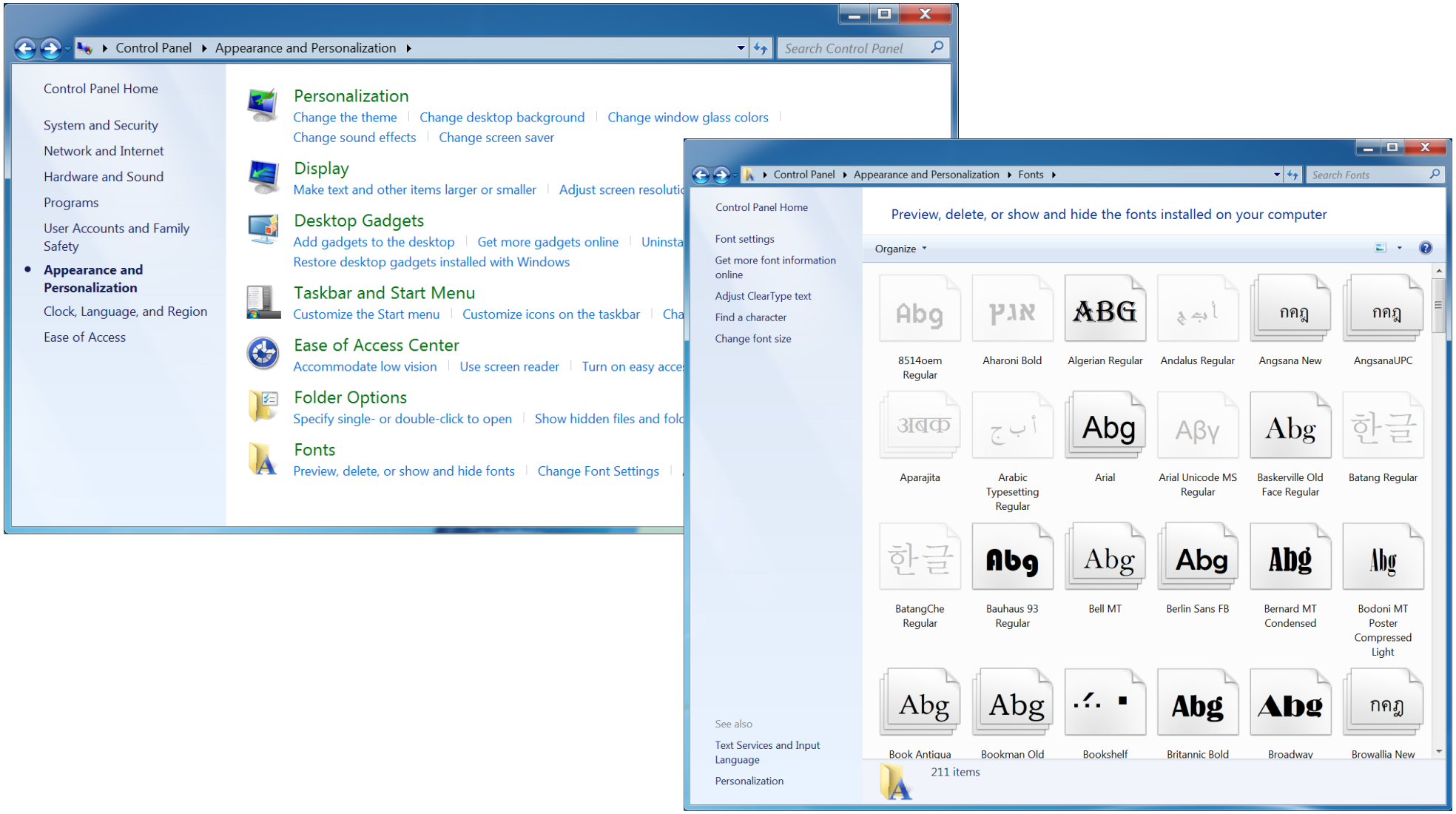
UTILITY PROGRAMS

- Small applications that perform special functions
- Some are incorporated into operating system
  - Firewall and file-compression utilities
- Stand-alone utility programs offer more features and require frequent updating
  - Antivirus and security programs

DISPLAY UTILITIES (1)

- Personalization has features to change the appearance of your desktop:
  - Background
  - Screen savers
  - Window colors
- Vast array of downloadable options are available on the Web.

DISPLAY UTILITIES (2)



THE PROGRAMS AND FEATURES UTILITY

- Installing a new program usually runs a wizard automatically that walks you through installation
- Delete programs by:
  - Selecting the program's own uninstall option
  - Windows uninstaller utility

FILE COMPRESSION UTILITIES

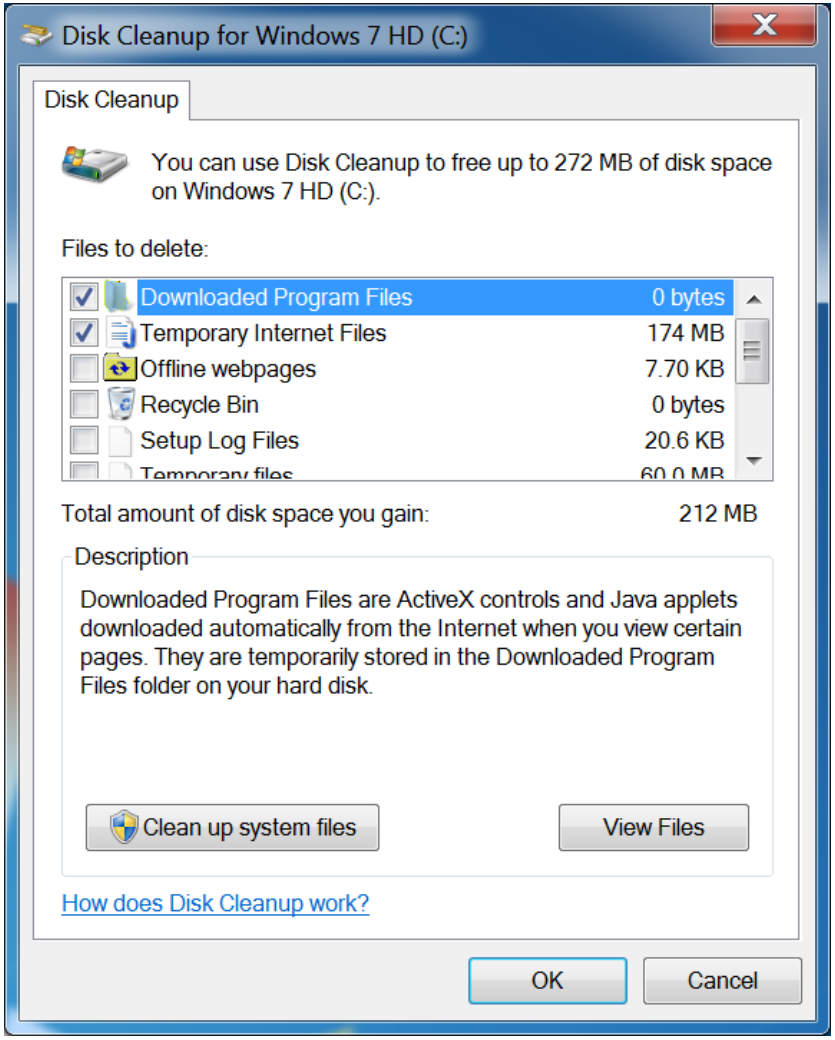
- Makes a large file more compact
- Easier and faster to send over Internet
- Windows has built-in file compression
- Take out redundancies
- Look for repeated patterns

the rain in Spain falls mainly on the plain

✞ r♦ in Sp♦ falls m♦ly on ✞ pl♦

SYSTEM MAINTENANCE UTILITIES (1)

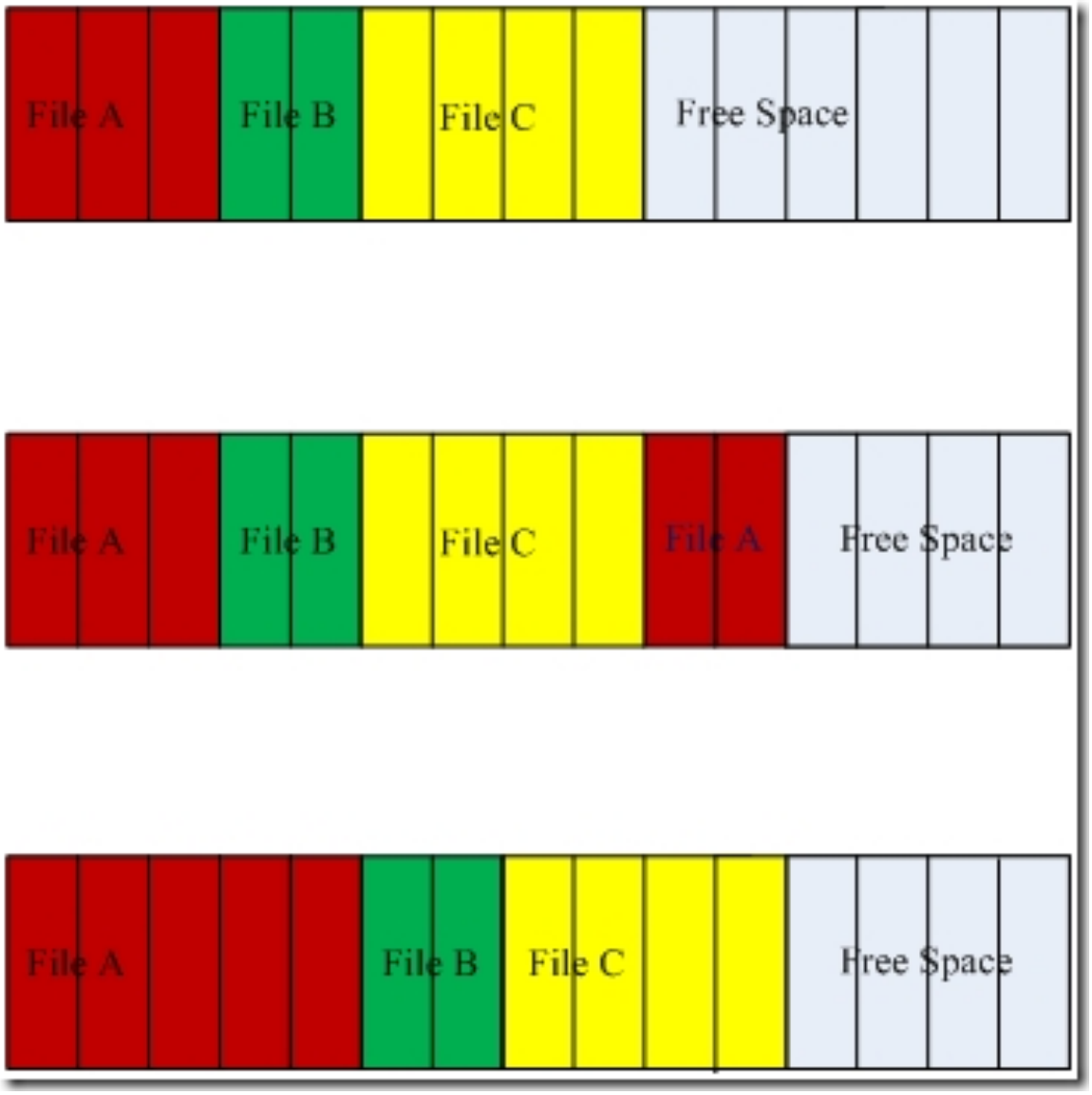
- Disk Cleanup removes unnecessary files
- Recycle Bin
- Temporary Internet files
- Offline Web pages
- If not deleted, these files can hinder efficient performance



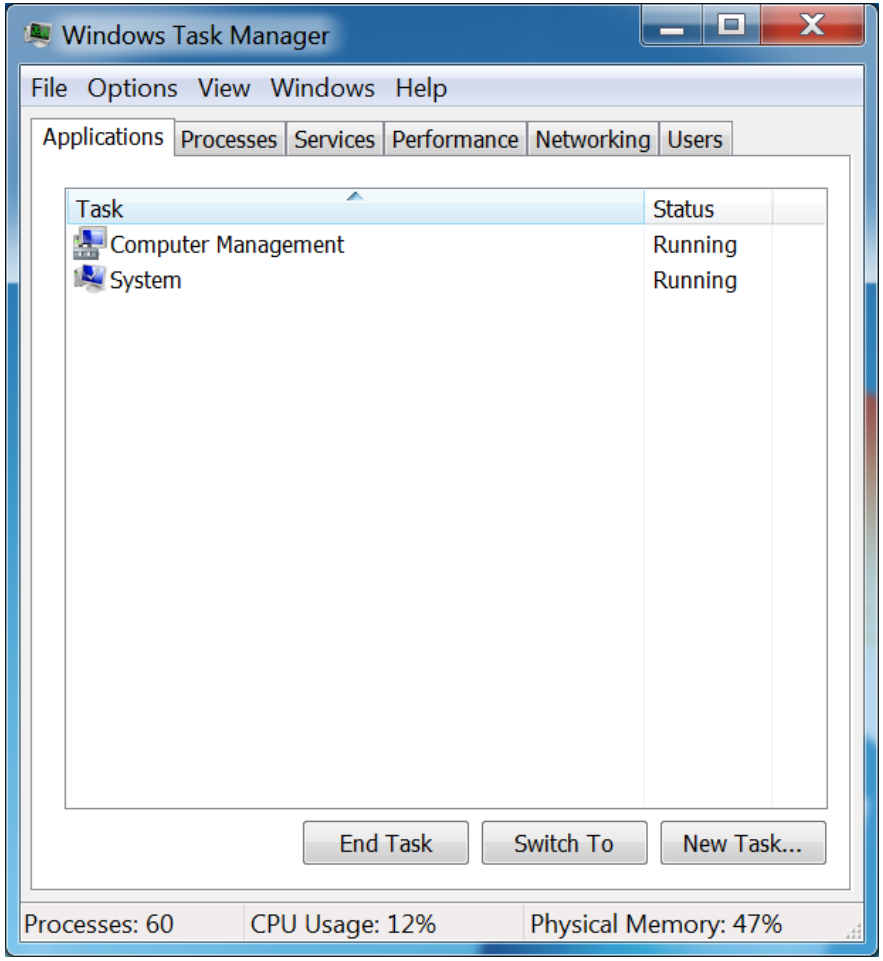
SYSTEM MAINTENANCE UTILITIES (2)

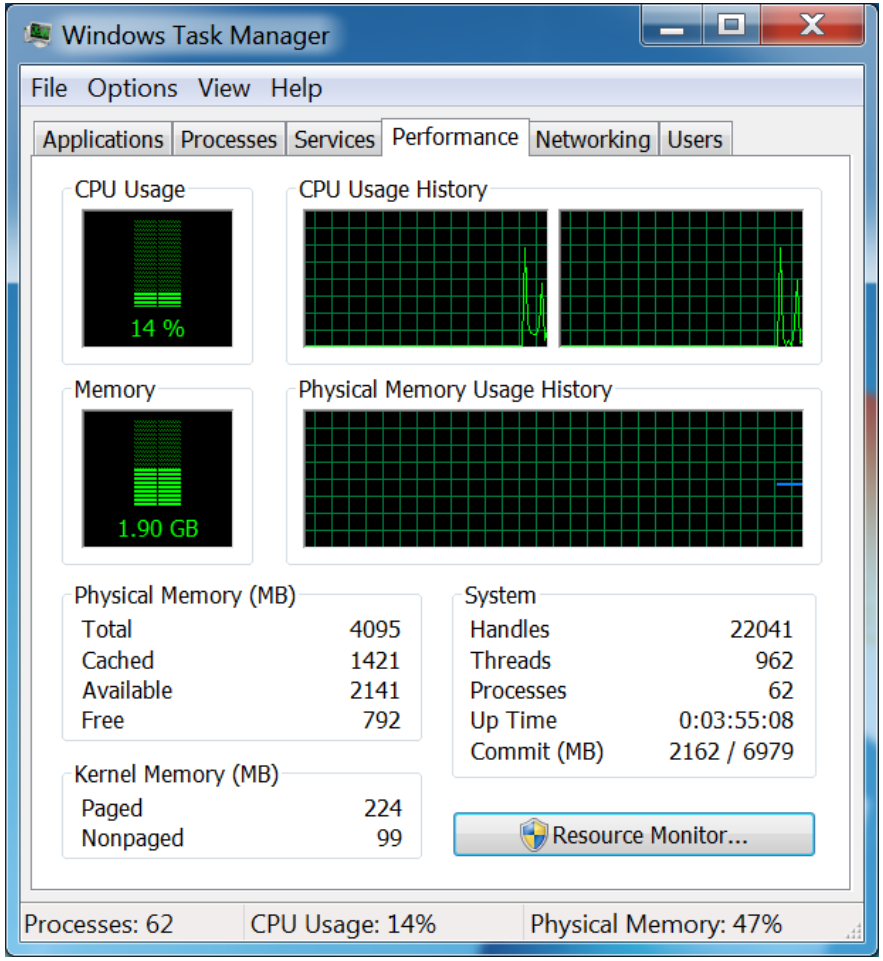
- Disk Defragmenter regroups related pieces of files on the hard disk
- Error-checking checks for lost files and fragments and physical errors on hard drive.
- Use Task Manager to check on program.
  that has stopped working or to exit nonresponsive programs.

SYSTEM MAINTENANCE UTILITIES (3)



TASK MANAGER UTILITY





SLEEP AND HIBERNATE

- Control Panel -> Power Options
- Sleep / suspend
  - Pause computer
  - Power out = lose everything
- Hibernate
  - Pause to hard disk.
  - Need space = memory.
  - Slower to start.
  - Safe from power out.

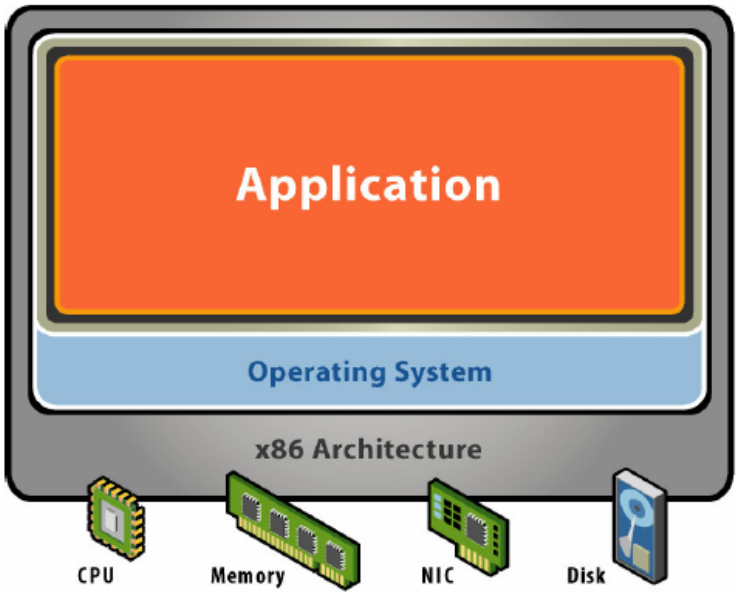
VIRTUAL MACHINE (VM)

VIRTUAL MACHINE (1)

- A virtual machine (VM) is an operating system OS or application environment that is installed on software which imitates dedicated hardware. The end user has the same experience on a virtual machine as they would have on dedicated hardware
- Key Players
  - VMWare
  - VirtualBox
  - Windows Virtual PC
  - QEMU

VIRTUAL MACHINE (2)

Starting Point: A Physical Machine



Physical Hardware

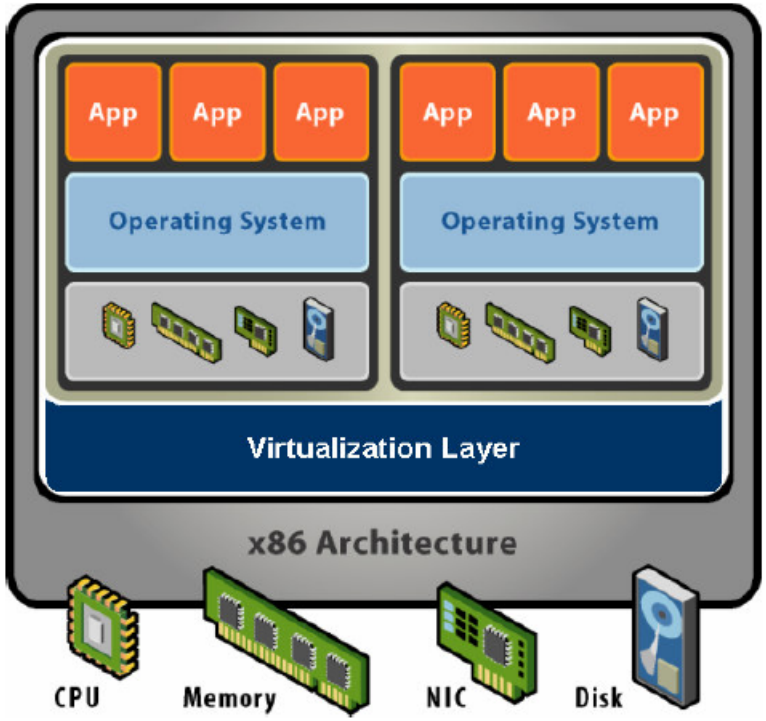
- Processors, memory, chipset, I/O bus and devices, etc.
- Physical resources often underutilized

Software

- Tightly coupled to hardware
- Single active OS image
- OS controls hardware

VIRTUAL MACHINE (3)

What is a Virtual Machine?



Hardware-Level Abstraction

- Virtual hardware: processors, memory, chipset, I/O devices, etc.
- Encapsulates all OS and application state

Virtualization Software

- Extra level of indirection decouples hardware and OS
- Multiplexes physical hardware across multiple “guest” VMs
- Strong isolation between VMs
- Manages physical resources, improves utilization

VIRTUAL MACHINE (4)

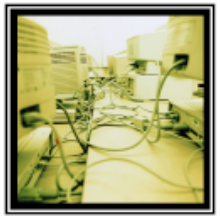
- Host Operating System:
  - The operating system actually running on the hardware
  - Together with virtualization layer, it simulates environment for …
- Guest Operating System:
  - The operating system running in the simulated environment
  - E.g., the one we are trying to debug

EXAMPLE: VIRTUALBOX

COMMON VIRTUALIZATION USES TODAY (1)

Test and Development – Rapidly provision test and development servers; store libraries of pre-configured test machines

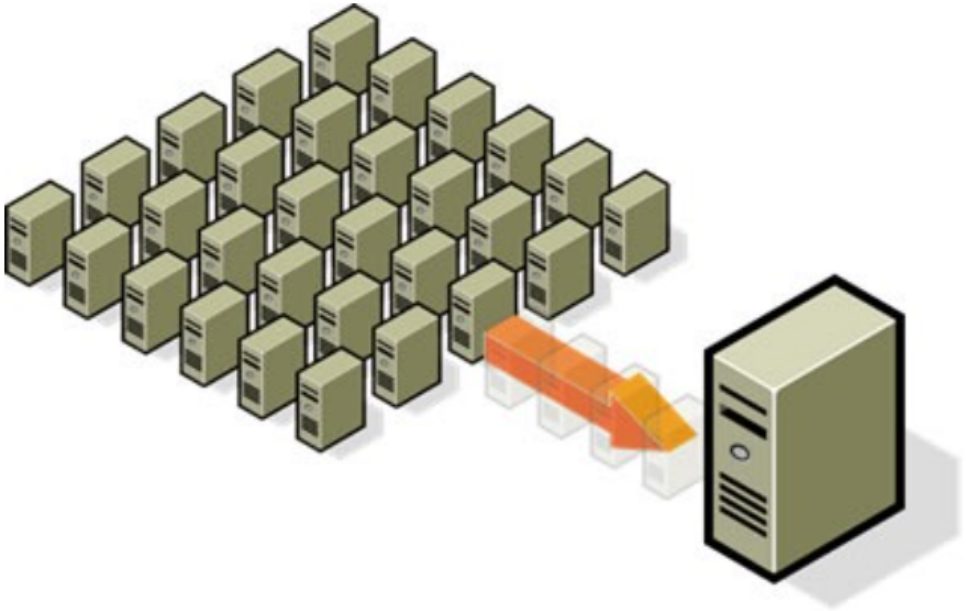
Business Continuity – Reduce cost and complexity by encapsulating entire systems into single files that can be replicated and restored onto any target server



Enterprise Desktop – Secure unmanaged PCs without compromising end-user autonomy by layering a security policy in software around desktop virtual machines

COMMON VIRTUALIZATION USES TODAY (2)

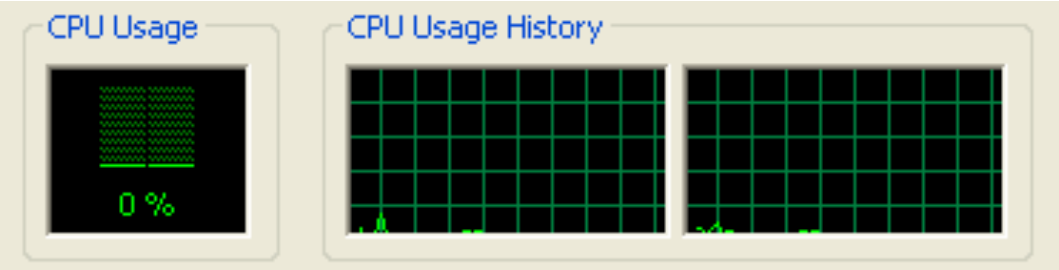
- Reduce costs by consolidating services onto the fewest number of physical machines



http://www.vmware.com/img/serverconsolidation.jpg

NON-VIRTUALIZED DATA CENTERS

- Too many servers for too little work



- High costs and infrastructure needs
- Maintenance
- Networking
- Floor space
- Cooling
- Power
- Disaster Recovery

DYNAMIC DATA CENTER

- Virtualization helps us break the “one service per server” model
- Consolidate many services into a fewer number of machines when workload is low, reducing costs
- Conversely, as demand for a particular service increases, we can shift more virtual machines to run that service
- We can build a data center with fewer total resources, since resources are used as needed instead of being dedicated to single services

VM WORKLOAD MULTIPLEXING