Component 4: Introduction to Information and Computer Science

Unit 4: Application and System Software

Unit 4 Objectives

a. Define application vs. system software.
b. Give examples of application software and the elements that comprise them, focusing on healthcare systems.
➡c. Describe the functions of system software (OS), including file organization (file types, downloading, zipped files).
➡d. List different types/brands of Operating Systems.
e. Explain the purpose and usage of file systems.

System Software

- Consists of programs that control/maintain operations of computer
- Two types
  - Operating Systems
  - Utility Programs

Operating System (OS)

- A set of programs that coordinate all activities of hardware resources
- It's the layer between the hardware and application software
- It's unique to each individual computer hardware system

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Example

Suppose you want to print a document from a word processor
- Start the word processor
  - You click on the icon for the word processor
  - The OS starts the program
- Open the document
  - You select the document to open
  - The word processor requests that the OS find the document on the hard disk
  - The OS finds it and sends it back to the word processor
  - The word processor displays the document
- Print the document
  - You select print
  - The word processor tells the OS to print the document
  - The OS sends the document to the printer
  - The printer prints it

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Functions of an OS

- Interfacing with users
- Booting the computer
- Configuring devices
- Managing processes
- Managing resources
- Managing memory
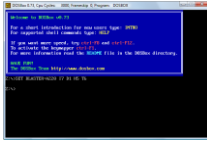- Managing files
- Providing security

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Interfacing with Users

- Command line
- GUI

- Examples
  - DOS
  - Unix
  - Linux (without windowing)
- Examples
  - Microsoft Windows
  - Mac OS and Mac OS X
  - KDE (Linux windowing)

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Booting the Computer

- First task when you turn on computer
- Starts the BIOS (Basic Input/Output System) stored in ROM
- The BIOS starts the OS
  - The "kernel" is started and runs the entire time your computer is powered on
  - Other utility programs are started later as needed
  - Detects devices and ensures they are configured properly
- Other applications are launched
  - Determined by startup scripts

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Configuring Devices

- Devices are components that are connected to the computer
  - Printer, scanner, etc.
- OS configures devices
  - Device drivers are small programs used by the OS to communicate with the device
  - The are unique to the OS (and version) and hardware
  - Need new device drivers when
    - Device driver is corrupted or overwritten
    - Upgrade computer
    - Upgrade device
    - Upgrade OS

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Managing Processes

- Processes are programs that are running
- Most PCs have operating systems that are single user/multitasking
  - One user
  - Multiple programs/processes running at once
- The OS has to manage which process is active (foreground process) and which are not (background processes)

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Managing Resources

- There are many resources in a computer
  - CPU
  - Memory
  - Devices
  - Disk storage
  - Network
- The operating system controls which process controls which resource
- It implements a scheduler for the processes so that each process gets a share of CPU time
  - Gives the illusion that multiple programs are running at the same time
- It controls how devices are shared among processes
- It provides access to memory, disk storage and the network

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Processes View

- Every OS provides a way to view running processes and the resources they use
  - Microsoft Windows has Task Manager
  - Mac OS has Activity Monitor/Process Viewer
  - "top" command in Unix/Linux

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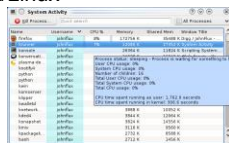
Managing Memory

- The OS manages memory
  - How it's accessed/addressed
  - Retrieving/storing data from/into memory
- Modern OS use virtual memory to give the illusion of more memory
  - Virtual memory is larger than physical memory
  - OS manages mapping virtual memory to physical memory
  - Uses hard disk space ("swap space") for the part of virtual memory not currently loaded into physical memory (RAM)
  - "Swapping" is when instructions/data in "swap space" are loaded into RAM and some other instructions/data previously in RAM are saved in the "swap space"

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Managing Files

- Files are all the documents on your computer
  - Are organized into folders/directories
- The OS controls how these files are stored in secondary storage (hard disk drive) by using a file system
- The file system provides an interface to the user for viewing and manipulating files
  - View file lists and folders/directories
  - Provides functions like copy, rename, move, delete, etc.
- The file system provides access to files/folders for application software

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Providing Security

- The Operating System provides some security
  - All processes related to OS run in system mode
  - Users can be defined as having different levels of access to the computer
  - Can be configured to update automatically
  - Can include integrated firewall
- Still need standalone security applications
  - Anti-viral, anti-spyware, anti-malware

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Utility Programs

- Software that performs a system maintenance task
  - Backing up files, diagnosing system problems, searching for a file, compressing files, etc.
  - Can provide accessibility features
- Can be included in OS or added as a stand-alone program

Types of OS

- For personal computers
- For servers
- For hand-held devices
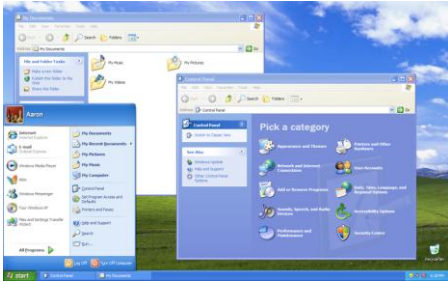- For embedded computers

OS for PCs

- DOS
- Microsoft Windows
  - Microsoft Windows 1.0 through 2000
  - Windows NT
  - Microsoft Windows XP
  - Microsoft Windows Vista
  - Microsoft Windows 7
- Mac OS
  - Classic Mac OS – Mac OS 9
  - Mac Os X 10.1 – 10.4
  - Mac OS X 10.4.4 (Tiger Intel)
  - Mac OS X 10.5 (Leopard)
  - Mac OS X 10.6 (Snow Leopard)

Microsoft Windows XP

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Mac OS X 10.6

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Windows vs. Mac OS X

- Strengths of Windows:
  - Most applications available for Windows
  - Large variety of hardware that run Windows
  - Great support for devices
- Weaknesses of Windows:
  - Reliability
  - Security

- Strengths of Mac OS X:
  - Easy to use
  - Reliable
  - Secure
- Weaknesses of Mac OS X:
  - Limited software availability

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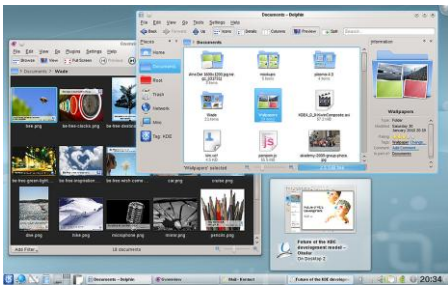Version 1.0/Fall 2010   21

OS for PCs and Servers

- Unix
  - Developed in 1969
  - Used for mainframes
  - Many different variations available
- Linux
  - Open source version of Unix created by Linus Torvalds in 1991

Linux
(KDE 4 Windowing Environment)

Unix

OS for Servers

- Mac OS X Server
- Microsoft Windows Server
  - Versions 2000, 2003, 2008, 2008 R2
  - Windows HPC Server 2008
- Windows Small Business Server
- Windows Essential Small Business Server
- Windows Home Server
- Unix/Linux

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OS for Handheld Devices

- Palm OS
- Microsoft Windows Mobile OS/Phone 7
- iPhone iOS 4
- Blackberry OS
- Android OS

Android OS

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OS for Embedded Systems

- Embedded systems need their own OS
- Some are proprietary and developed for that system alone
- Some are commercially available and customizable
  - "Windows XP for Embedded Systems" version of XP (known as XPe) is made up of components
  - An implementation of XPe installs only the components of the OS that are necessary
    - Decreases the size of the OS
    - Increases the OS's security
- XPe was superseded by Windows Embedded Standard 2009, the current version
- XPe is not available for PCs as it is licensed to original equipment manufacturers (OEMs) who develop the embedded systems

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Embedded OS Example

- The SonoSite, Inc. hand-carried ultrasound device runs with Windows Embedded CE
  - Is handheld
  - Easy to use
  - Boots in less than 15 seconds
  - Provides instant images at an accident site or hospital setting
  - Allows for USB support

Microsoft Web site, SonoSite Inc. M-Turbo Portable Ultrasound: Embedded medical Devices, Online: http://www.microsoft.com/windowsembedded/en-us/about/casestudies/m-turbo.mspx, 2010.

Summary

- Operating Systems control the functions of computers
- They act as an intermediary between the hardware and the software
- They also provides a way for the user to interact with the computer
- Many different versions and brands of OS