

Component 4: Introduction to Information and Computer Science

Unit 4: Application and System Software Lecture 2

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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.

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2

System Software

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

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3

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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4

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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5

Functions of an OS

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

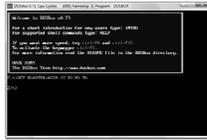
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6

Interfacing with Users

- Command line



- Examples
 - DOS
 - Unix
 - Linux (without windowing)

- GUI



- Examples
 - Microsoft Windows
 - Mac OS and Mac OS X
 - KDE (Linux windowing)

Note: we will describe the different operating systems in detail later in the lecture.

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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
 - They 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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Version 2.0/Spring 2011

10

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

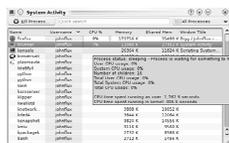
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11

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



Process Name	PID	PPID	Parent	Working Set	Private Bytes	Virtual Bytes	Page Faults	Page Faults/sec	Page Faults/KB	Page Faults/MB	Page Faults/GB	Page Faults/TB	Page Faults/PB	Page Faults/EB	Page Faults/EB
System	0	0	System	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc	1	0	System	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper	2	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper2	3	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper3	4	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper4	5	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper5	6	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
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smc_helper7	8	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper8	9	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
smc_helper9	10	1	smc	4K	4K	4K	0	0	0	0	0	0	0	0	0
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12

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 larger than physical memory
 - OS maps 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"

Component 4/Unit 4-2 Health IT Workforce Curriculum 13
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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

Component 4/Unit 4-2 Health IT Workforce Curriculum 14
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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

Component 4/Unit 4-2 Health IT Workforce Curriculum 15
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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

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16

Types of OS

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

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17

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)

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18

Microsoft Windows XP



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19

Mac OS X 10.6



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20

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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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

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22

Linux (KDE 4 Windowing Environment)



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23

Unix

```
root@kali:~# cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
games:x:5:12:games:/usr/games:/usr/sbin/nologin
uucp:x:6:5:uucp:/usr/lib/uucp:/usr/sbin/nologin
cron:x:18:18:cron:/var/spool/cron/root:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uux:x:10:10:uux:/usr/lib/uucp:/usr/sbin/nologin
operator:x:11:11:operator:/root:/usr/sbin/nologin
man:x:12:12:man:/usr/share/man:/usr/sbin/nologin
linda:x:13:13:linda:/home/linda:/bin/bash
postfix:x:82:82:Postfix Mail Service:/var/spool/postfix:/usr/sbin/nologin
root@kali:~#
```

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Version 2.0/Spring 2011

24

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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25

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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26

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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Version 2.0/Spring 2011

27

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.sonosite.com/windows/embeddedwin-us/about/casestudies/m_turbo.msp, 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
