

Component 4: Introduction to Information and Computer Science

Unit 4: Application and System Software

Lecture 3

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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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File System

- A file system is a way of organizing files and their data on a storage device
- An operating system includes a file system
 - OS serves as intermediary between file system and applications
 - Applications include software, OS utilities, etc.

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Files



- Files are blocks of program instructions or data stored on disk
- File types
 - Executable (machine code instructions)
 - Text file (collection of characters)
 - Special format
 - Particular to an application (e.g. Microsoft Word, Excel)
 - Format for storing images, videos, etc.
 - Format for archives

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File Names and Extensions

- Every file must have a name
 - Each OS has its own naming rules
 - May or may not be case-sensitive
- The file extension is the portion of the name after "."
 - Identifies the file type
 - Used to identify what you can do with the file
 - May not see the extension
- Examples
 - essay.doc
 - budget.xls
 - winzip.exe
 - photo1.jpg

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File Permissions

- Files have owners
- Files have permissions
 - Identify if the file can be read (opened)
 - Identify if the file can be written (saved)
 - Identify if the file is an executable program (a program that can be run)
- Permissions may vary by user
 - One user may only be able to read a file, another may be able to read and write
 - Important security measure

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File Size

- All files have a size
- Expressed in bytes (or KB or MB or GB)
- Size depends on the amount of data stored in the file
 - A long Word document will be larger than a short one
 - An HD video will be larger than a low resolution video
 - A high resolution image will be larger than a simple text file (unless the text file is really, really long)

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Organizing Groups of Files



- Most file systems provide ways to organize your files into “containers”
 - In Windows and Mac OS the containers are called folders
 - In Unix and Linux, the containers are called directories
 - Folders/directories contained within other folders/directories are called subfolders/subdirectories
- A flat file system has only one large directory or folder

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File Management Utilities

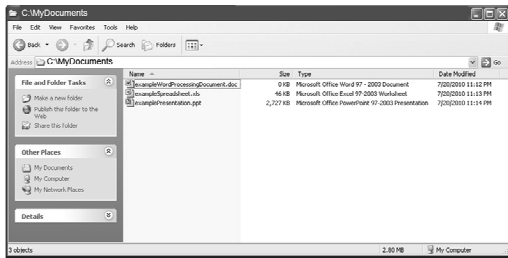
- Operating systems provide utilities for the user to manage files and folders/directories
 - Microsoft Windows Explorer
 - Mac OS X Finder
 - Typed commands in Unix
- Allow user to
 - View files and properties
 - Find files
 - Move files
 - Copy and paste files
 - Rename files
 - Create folders/directories

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Microsoft Windows File Explorer



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Mac OS X Finder



Mac OS X 10.5 Finder

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Dolphin File Manager KDE Windows for Linux



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Application File Utilities

- These file utilities are available within applications, too
- Facilitate opening and saving files



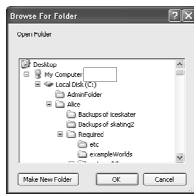
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File System Hierarchy

- File systems that are not flat have a hierarchy
 - A tree like structure that represents nested subfolders/subdirectories




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Other File Utilities

- Search 
- File compression/archiving utilities
 - Windows compression utilities
 - WinZip 
 - Stuffit
- Backup and restore utilities
- Security utilities 
- File transfer utilities

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File System Implementation

- Different types of file systems
 - Disk File System
 - Flash File System
 - Network File System
- The logical model (Explorer/Finder) is different from the physical model (hard disk)

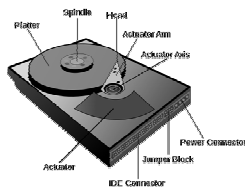
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Hard Disk Drive

- A hard disk drive contains a platter where data is stored
- The spindle holds one or more platters
- The platter spins and the arm moves so that the head is over the location on disk to be read/written



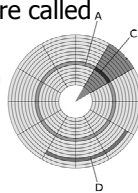
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Disk File Storage

- Files are stored physically in sectors (C) on the platter (usually 512 bytes)
- Sectors make up a track (A)
- Groups of adjacent sectors are called clusters (D)
- Each sector and track has an address



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Formatting Disk

- Disks must be formatted before they can be used
 - Separated into tracks and sectors
 - Given addresses
- Most disks come pre-formatted
- May need to reformat later

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File Systems



- Serve as an interface to the storage device (disk drive)
- Keep track of where files are located
 - File name and its address on disk
 - Kept in an index
- Optimize speed of storing and retrieving data
 - Uses clusters of sectors
 - Keeps track of free clusters
- Files may be stored in non-contiguous clusters
 - Called fragmented files
 - Can be slow to access

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File Systems, contd.

- What happens when a file is deleted?
 - File system removes file from index
 - Identifies clusters as free
- Can sometimes be recovered
 - Must do it quickly
- Can use file shredder utilities to overwrite clusters
- In healthcare, old disks must be safely disposed

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Disk File System Examples

- FAT (File Allocation Table)
 - Simple file system without file security
 - FAT12, FAT16, FAT32
 - Used in Microsoft OS before Windows NT
 - Used on flash cards today
- NTFS (NT File System)
 - Complex file system with file security
 - Used in Microsoft Windows starting with version NT

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File System Examples, Contd.

- HFS, HFS+, HFSX (Hierarchical File System)
 - Mac OS and Mac OS X
 - HFS was similar to FAT16
 - HFS+ and HFSX introduced file security
 - ext family, XFS
 - Linux
 - Provides file security and access control
- Note: one OS can support multiple file systems

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Putting It All Together

- The application or the user performs a file operation (open, close, read, write)
- The operating system translates that operation into one understood by the file system
- The file system finds the file and performs the operation. If any data is returned, it's sent to the OS.
- The OS returns any data to the application or user

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File Management Tips

- Use descriptive names for files and folders/directories
- Maintain proper file extensions
- Group similar files together
- Organize folders/directories in a proper hierarchy
- Delete or archive files you no longer need
- Defragment drive regularly
- Maintain enough free space (20%) on drive
- Back up!

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Summary

- Files store data/instructions in secondary storage
- OS provides file manager utilities
- The file system organizes and manages data stored on device

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