

# Component 4: Introduction to Information and Computer Science

## Unit 4: Application and System Software

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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 res 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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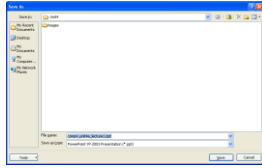
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## Application File Utilities

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



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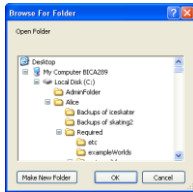
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## File System Hierarchy

- 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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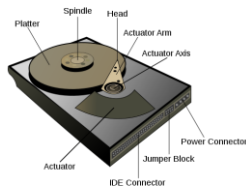
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# Hard Disk Drive

- 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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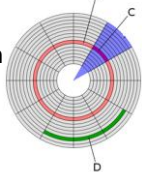
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# Disk File Storage

- 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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