# Information Communication Technologies

# Lecture 6. Resource Sharing

Kassymova Aizhan Bakhytzhanovna
PhD, Associate professor
a.kassymova@satbayev.university

# Agenda

1 Resource Sharing

2 Virtual Memory

3 File and Printer Sharing

4 File Systems

5 File Organization

6 File Allocation Table and NT File System

# Resource Sharing

- **Multitasking** is sharing the processor so that several tasks appear to execute simultaneously on a single CPU.
- Resources like memory, files, and printers can be shared.
- *Memory*
  - Processes shares the available memory on a computer
  - System juggles memory pages between RAM and disk if there is no sufficient RAM
  - This scheme is *Virtual Memory.*

# Relocation

- Executable programs written in binary machine code contains instructions and data whose storage locations are indicated by memory addresses.
- Any memory location that contains an address is specially marked in a binary file.
- When a user runs the program
  - OS allocates memory for it and loads into the allocated memory area.
  - OS updates all the memory references so that they point to the correct locations.

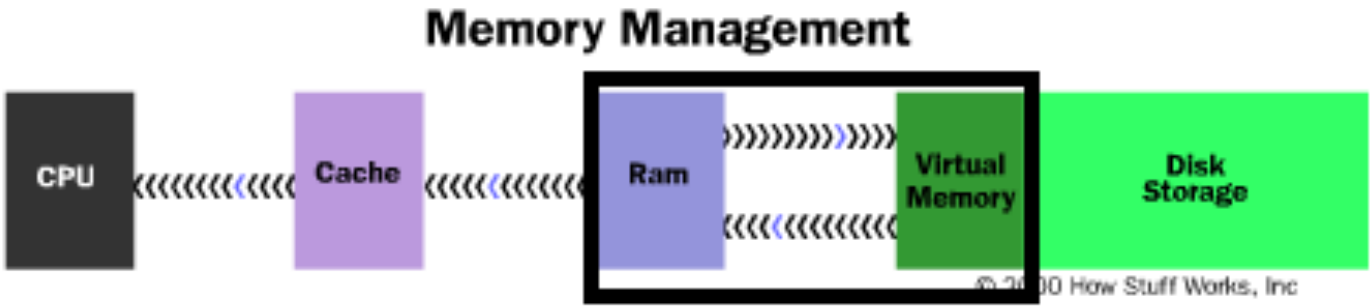
# Relocation (continued)

- Advantages :
  - Simple to implement
  - Does not require any change in the hardware
- Disadvantages:
  - Memory allocated to program should be contiguous
  - Size of running program is limited to the amount of physical memory installed on the machine

# Virtual Memory

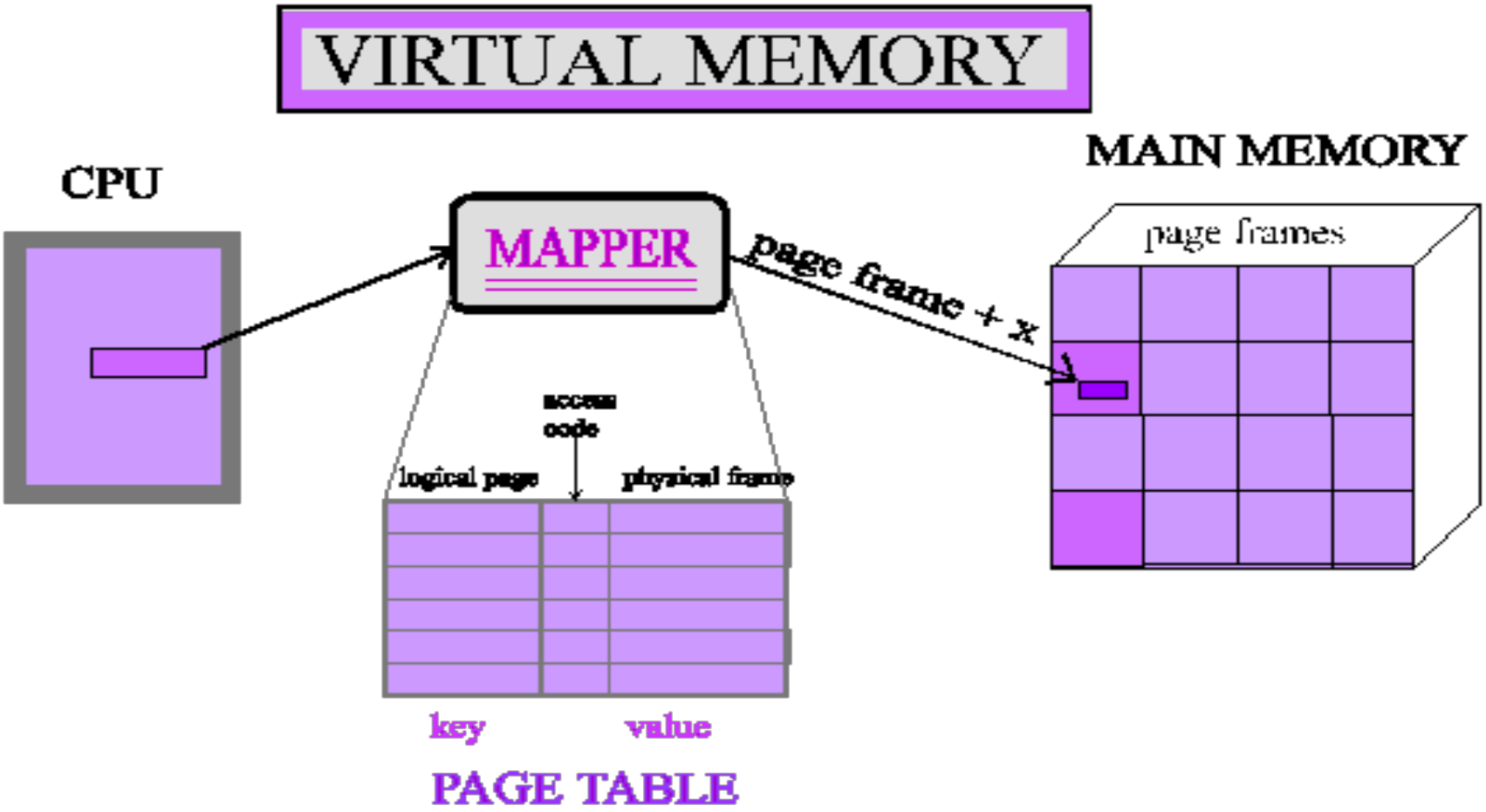
- Typical PC has 512MB memory or more.
- Some memory are assigned to the OS and the remainder for user programs.
- The kernel allocates memory and keeps track of the memory spaces used by each program.
- To increase program flexibility, *virtual memory* scheme is used by Windows and Linux.

- VM combines your computer RAM with temporary space on your hard disc.

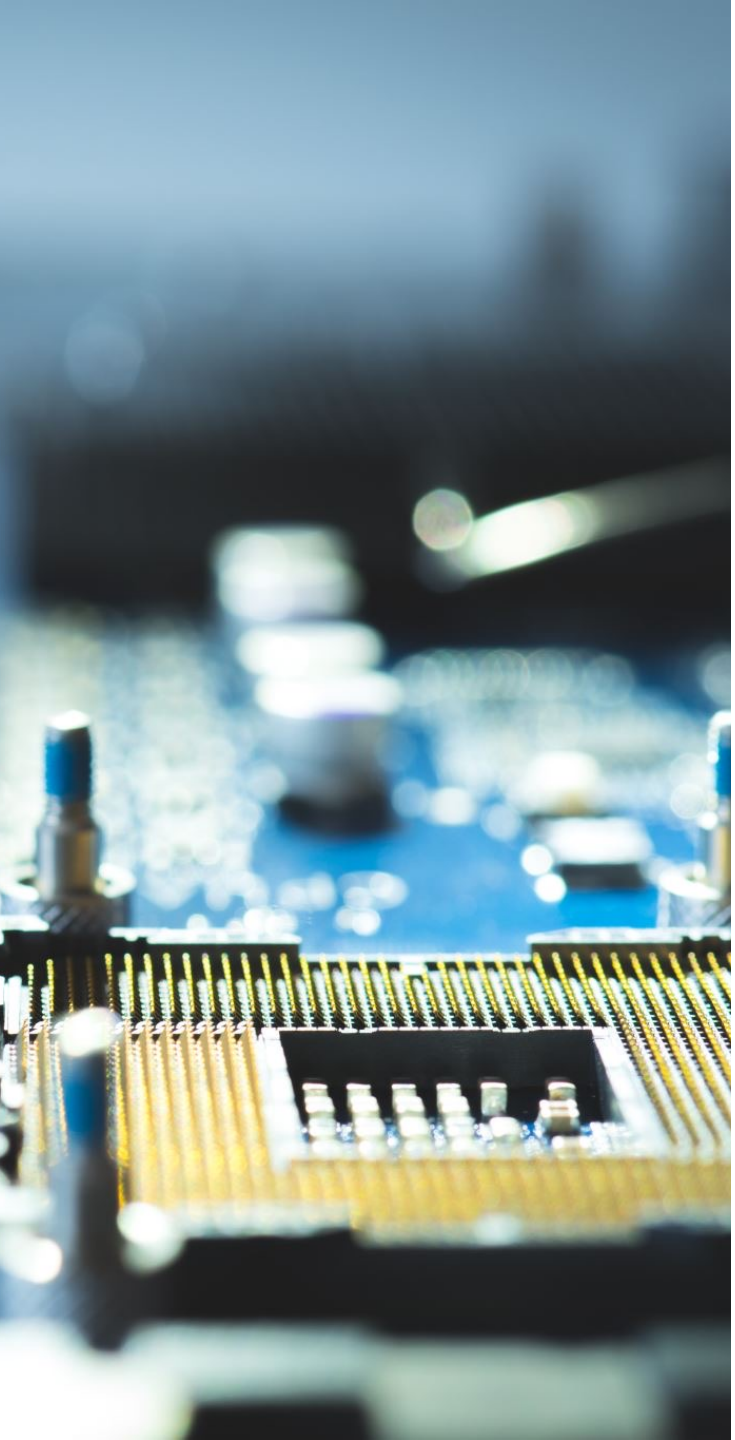


# Virtual Memory(continued)

- Using the virtual memory scheme, a small amount of RAM is required for a program to run, and the rest of the program's address space is kept on the disk.
- In a system that uses virtual memory, every program runs in its own private address space.
- Virtual address space can be larger than processor's physical memory.

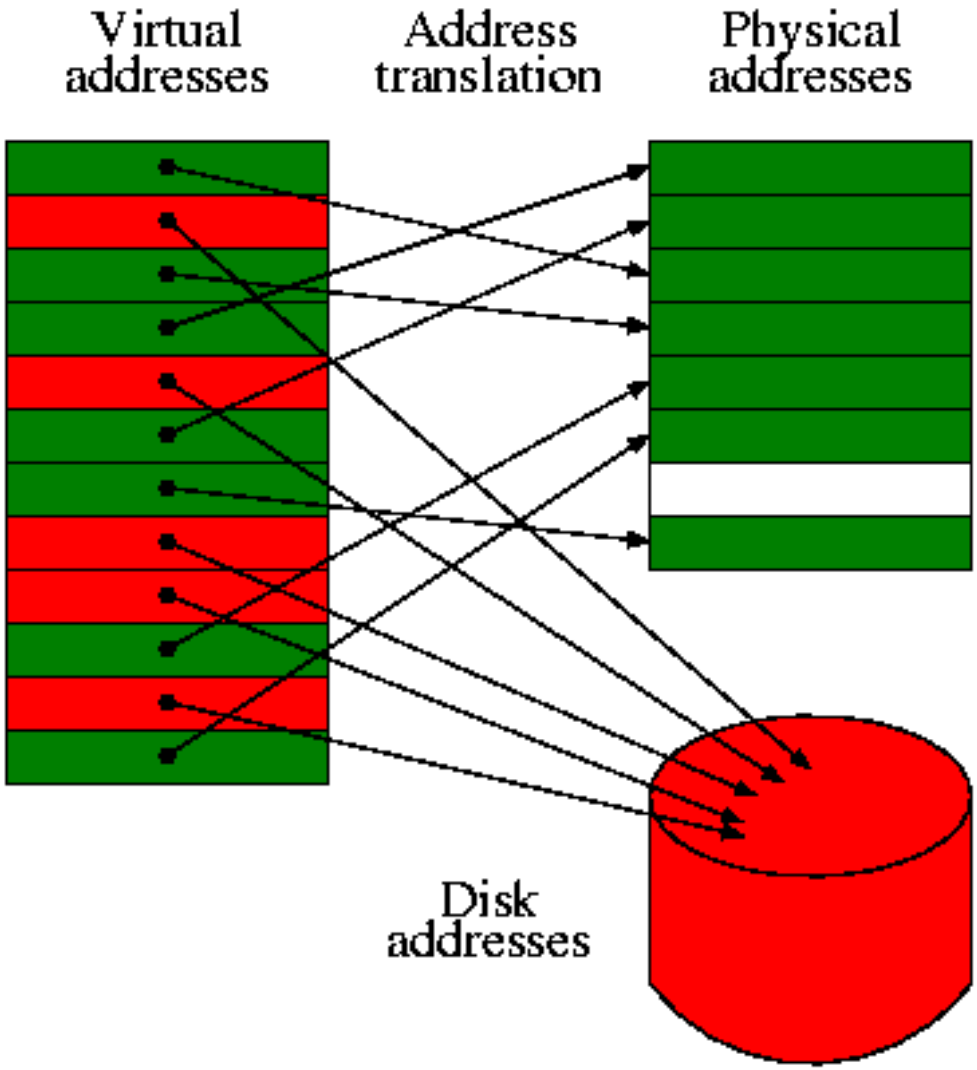


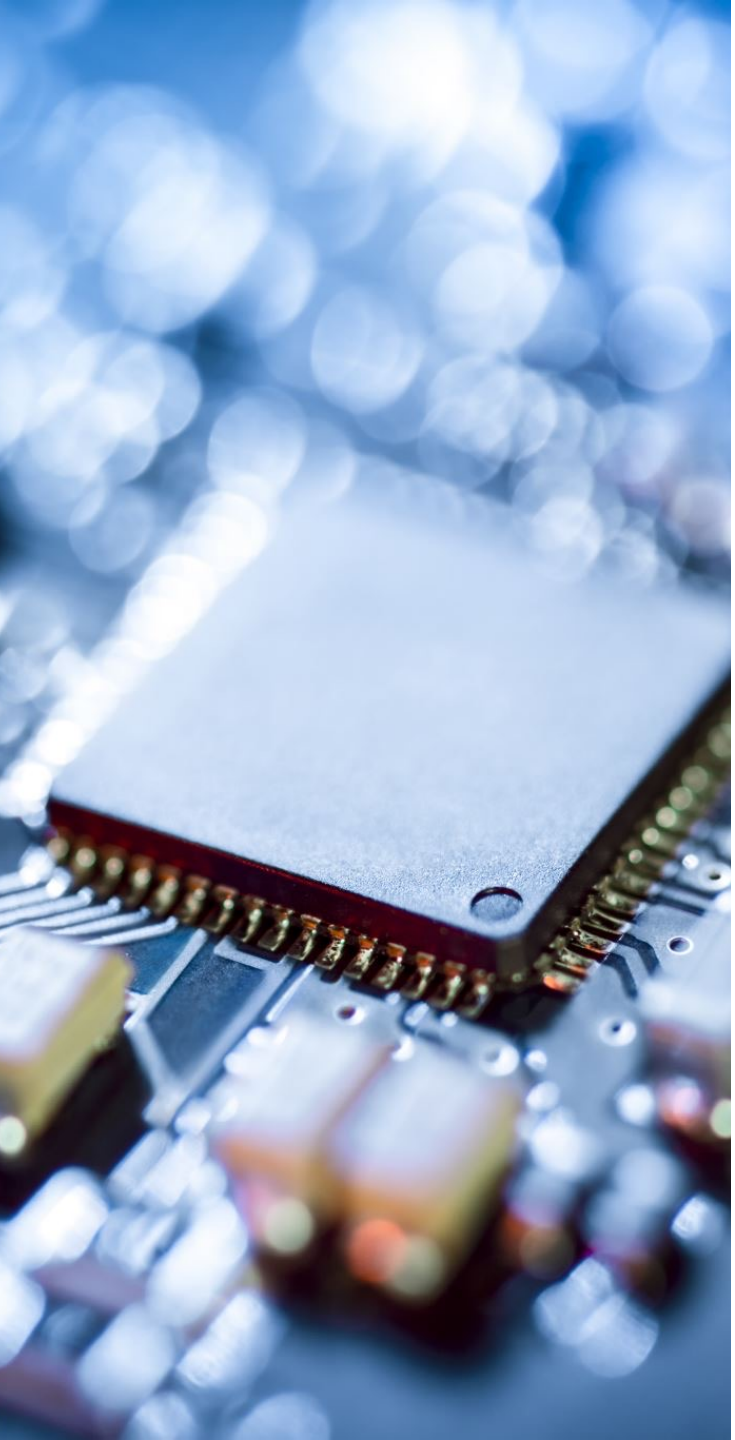

In virtual memory scheme, memory is divided into **pages**, the smallest unit of memory allocated for a program.



# Virtual Memory (continued)

- A processor works in two modes, real and virtual modes.
- In real mode, addresses refer to the physical locations in RAM. Only the kernel runs in real mode.
- In virtual mode, a ***page table*** provides a mapping between each physical address and virtual address.
- For every physical location in RAM, there is an entry in the page table.

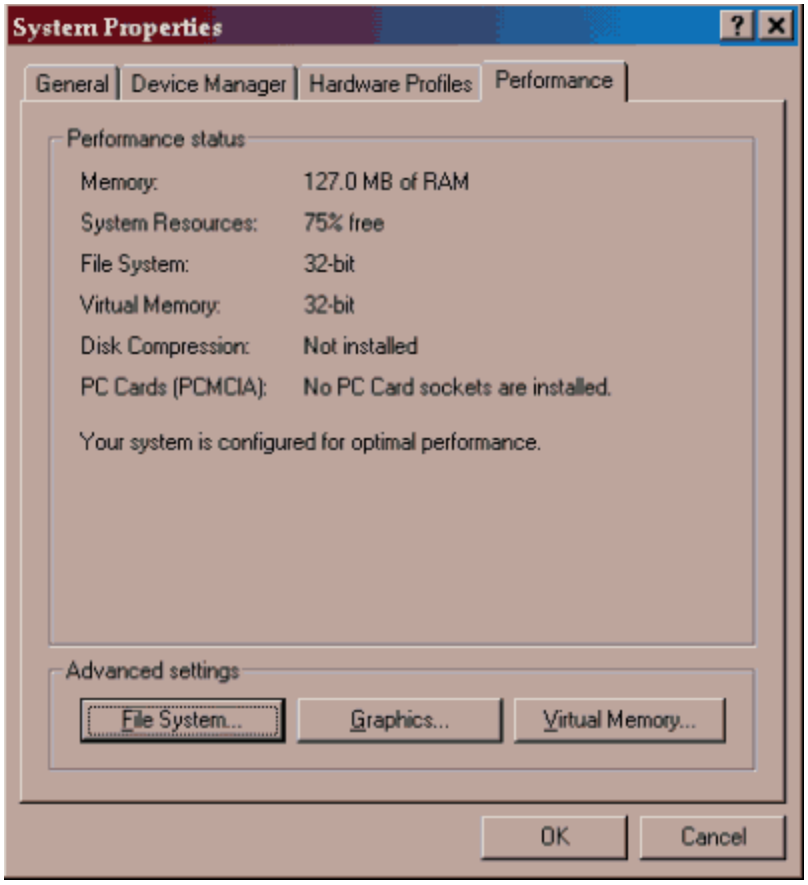

Virtual addresses
Address translation
Physical addresses
Disk addresses

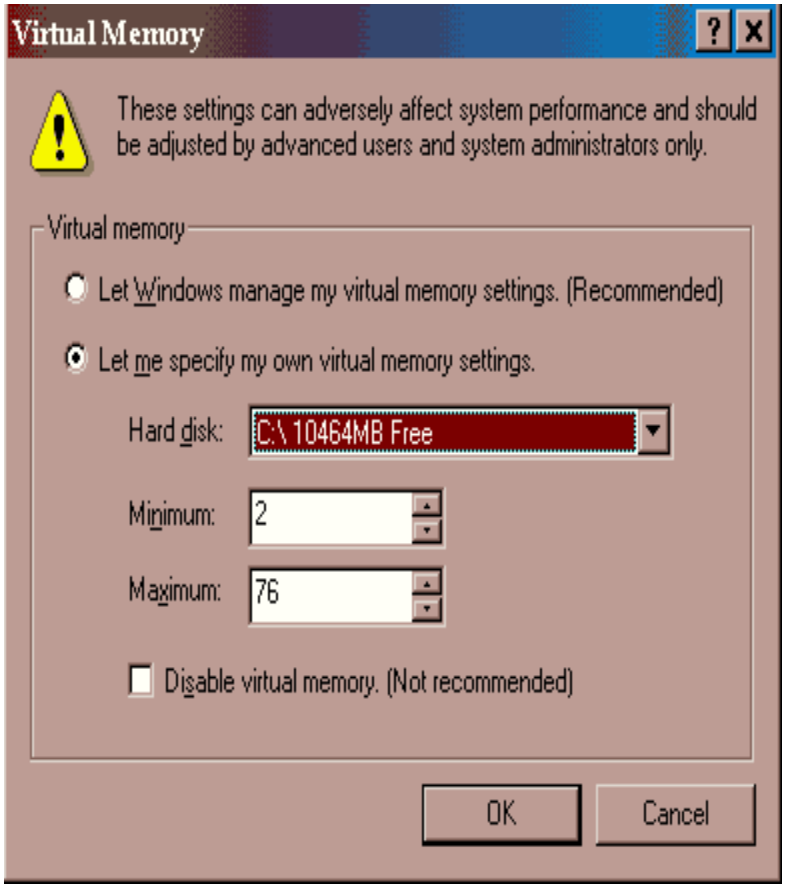


# Virtual Memory (continued)

- Advantages:
  - The program does not need to be loaded contiguously into RAM.
  - The program does not need to be loaded completely into RAM.
  - The program does not need to start at a specific physical address.
- Disadvantages:
  - Can slow access to data because it is stored on the hard drive which is slower than RAM.
  - Keeps the hard disk busy, delaying access to other files

# Virtual Memory (continued)




- www.howstuffworks.com/virtual-memory1.htm

# Resource Sharing

# Resource Sharing:  Files

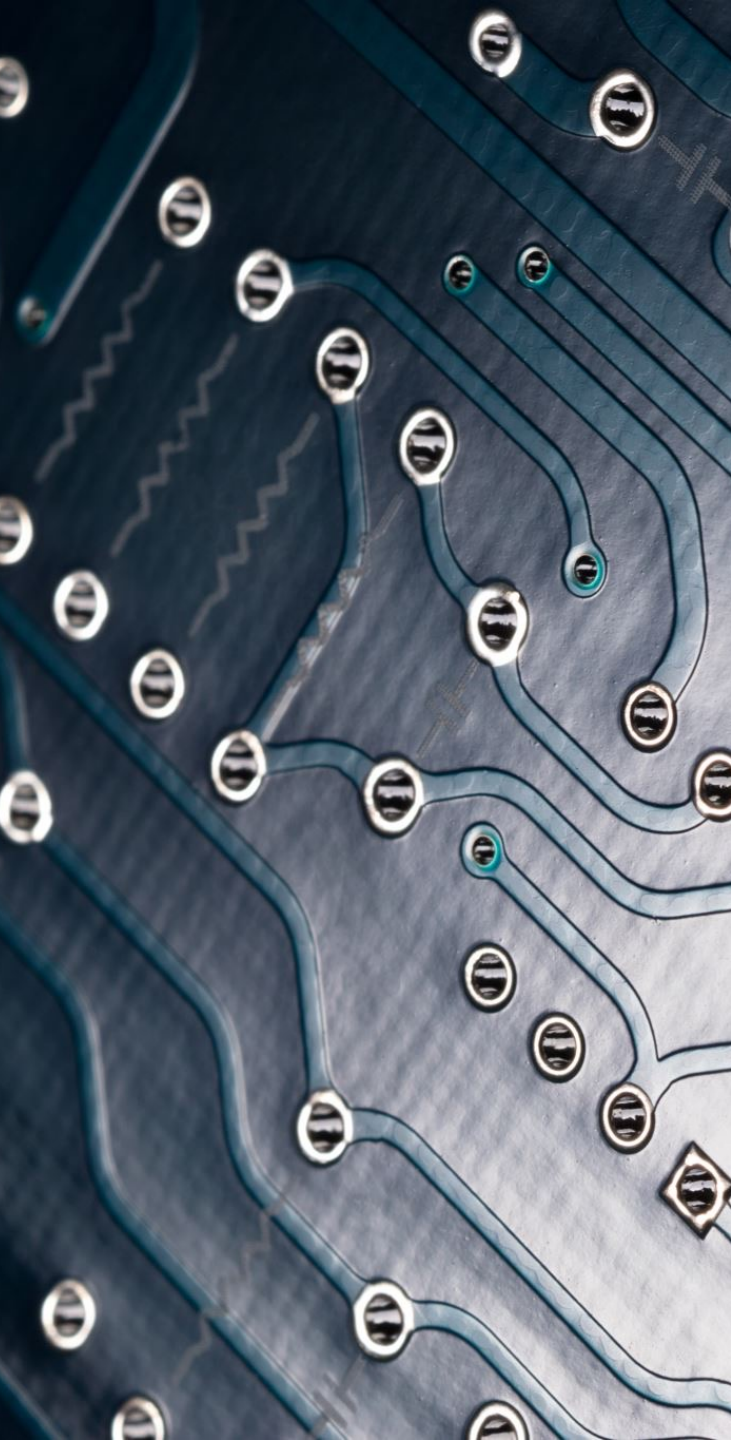
- Files are shared between applications and users in a networking environment.
- OS defines a set of permissions for files to prevent unauthorized access to files.
- Permissions include:
  - ***Read access***: allows user to read a file
  - ***Write access***: allows user to modify or delete a file
  - ***Execute access***: allows user to perform special operations such as viewing the contents of a directory or executing a program

# Resource Sharing - Printers

- Can be shared among applications, users, and machines
- Files to be printed are sent to a ***print server***, which maintains a list of files to be printed
- Server processes one print request at a time
- Print requests are stored on a disk in a process called *spooling.*
- Spooling allows the process issuing the print to continue with other processes.
- If a printer is connected to a network, print requests from other machines on the same network can be processed.


# Resource Sharing: Monitor, Keyboard, and Mouse

- Monitor, keyboard, and mouse are shared when many tasks are running at the same time.
- This function is a part of the OS known as Window System .
- Tasks are not displayed on the monitor directly.
- Each task has one or more windows associated with it for reading and writing data through the windows.
- Window System controls task's window display.
- User can change the arrangement of window by resizing, minimizing, or maximizing the window.



# File Systems

- One of the main things computers are used for is storing and retrieving information.
- A file is a named collection of data existing on a storage medium.
- Filename is a unique set of letters and numbers that identifies a file and describes the file contents.

# File Systems (continued)

- Four kinds of entities:
  - Files, folders, drives, and shortcuts
- File extensions indicate the category to which the file belongs, preceded with a dot.
- The maximum number of characters that a file name can have is different for different operating systems.
- Wildcards are used to represent unknown group of characters in the filename and the extension.

  - For example, “newfile*” means all the files whose name begin with “newfile” followed by whatever characters in the file name including extensions.

# File Systems (continued)

- Files can be of two types
  - An executable file containing program instructions that tell a computer how to perform a specific task.
  - Data file containing words, numbers, or pictures that can be viewed, edited, saved, sent, or printed.

# File Systems (continued)

- Filename extensions fall into 2 categories:
  - Generic filename extension:  indicates the general type of data contained in a file, which can be opened with several software packages (e.g. .txt)
  - Application-specific filename extension:  associated with specific application software and the application used to create the file (e.g. .doc, .ppt)
- Other type of files are essential for software and hardware operations (e.g. .bat, .sys .cfg, .dll).

# File Organization

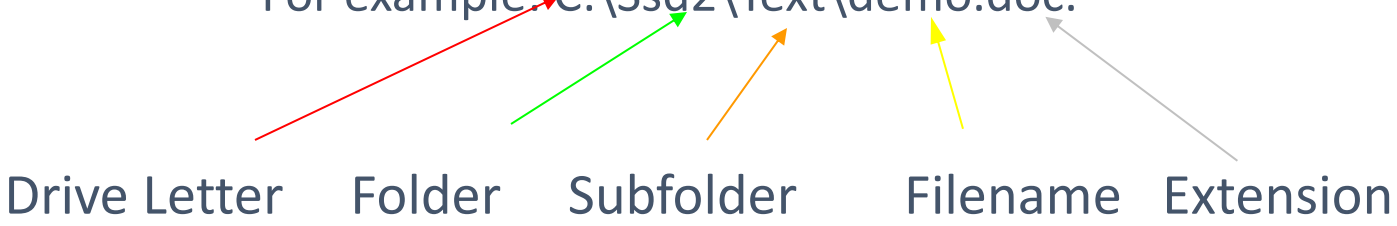
- File manager utility software helps us locate, rename, move, copy, and delete files (e.g. Internet Explorer).
- Device Letters are identifications for storage devices such as the floppy disk drive, the hard disk drive, and CD-ROM or DVD drives.
- Operating system maintains list of all the files in a "directory" for each disk.
- A ***directory*** contains all the information about the file including the filename, filename extension, date and time the file was created, and the file size.

# File Organization (continued)

- ***Main directory***: root directory that contains useful list of all the files within the directory.
- ***Folders***: organization of files into smaller groups to facilitate searching for the file.

# File Organization (continued)

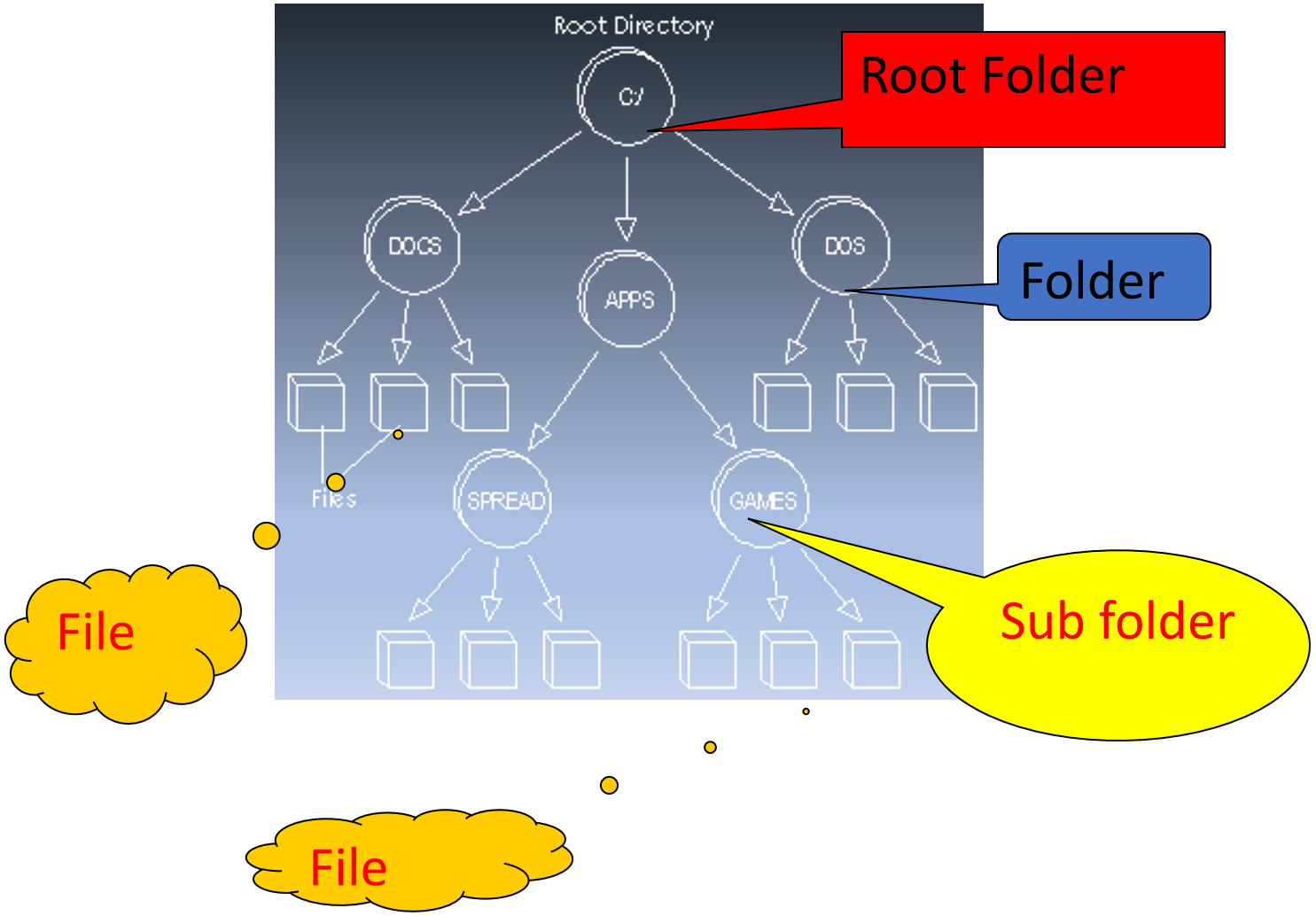
- File specification, also called a path, includes the drive letter, folder, Filename and an Extension that identifies a file.
- For example: C:\Ssd2\Text\demo.doc.




- Names of folders are differentiated from drive letters and files separated by the backslash symbol "****" (Dos & Windows).

# Hierarchical File System

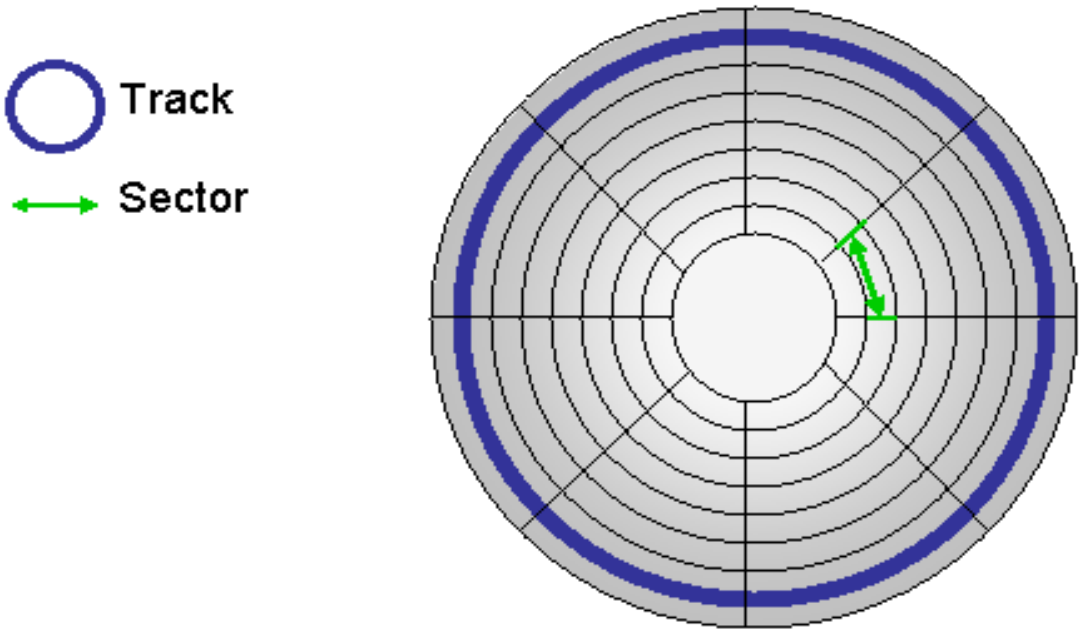
- Represents a *tree structure* in which directories have files and subdirectories beneath them.



# File Allocation Table

- Hard disks are divided into tracks and sectors.
- Each sector contains 512 bytes.
- Small files occupy fraction of sectors, the remaining sectors are called ***Slack Space.***
- Large files of ten million bytes require thousands of sectors spread across multiple tracks.

# File allocation table (continued)



# File Allocation Table (continued)

- Sectors are grouped into clusters.
- Each cluster contains 4,8,16,32,64 adjacent sectors.
- Cluster size depends on drive capacity.
- File Allocation Table (FAT)
  - Contains an entry for every cluster on the disk.
  - FAT gives each cluster the number of the next cluster for that file
- All clusters in a file are chained together.

# File Allocation Table (continued)

- All the clusters can be found when the first cluster is known.
- FAT16
  - Uses 16 bit per entry
  - Allows up to 65,536 clusters
  - Allows drives up to 2 GB
- FAT 32
  - Uses 32 bits per entry
  - Supports drives up to 2 terabytes

# NT File System (continued)

- NTFS (New Technology File System) is an improvement to the FAT file systems used in Windows 2000/NT/XP/Vista/7.
- No limit to the sector size
- Cluster size is variable depending on the size of the logical drives.
- Cluster size is automatically determined by the NTFS Format utility, providing a level of flexibility not available in FAT16 or FAT32.
- More efficient allocation of disk space

# NT File System (continued)

- Recoverability:  maintains consistency of data using journaling, keeping a log of each I/O operation.
- If the system fails, the file directory structure can be recovered based on the history of the I/O operations performed on the file system.
- Includes Encrypted Files System (EFS), which enables data to be encrypted as it is saved to disk.
- Supports data access control and ownership privileges to restrict unauthorized access to data in a multi-user environment

# END of Lecture 6