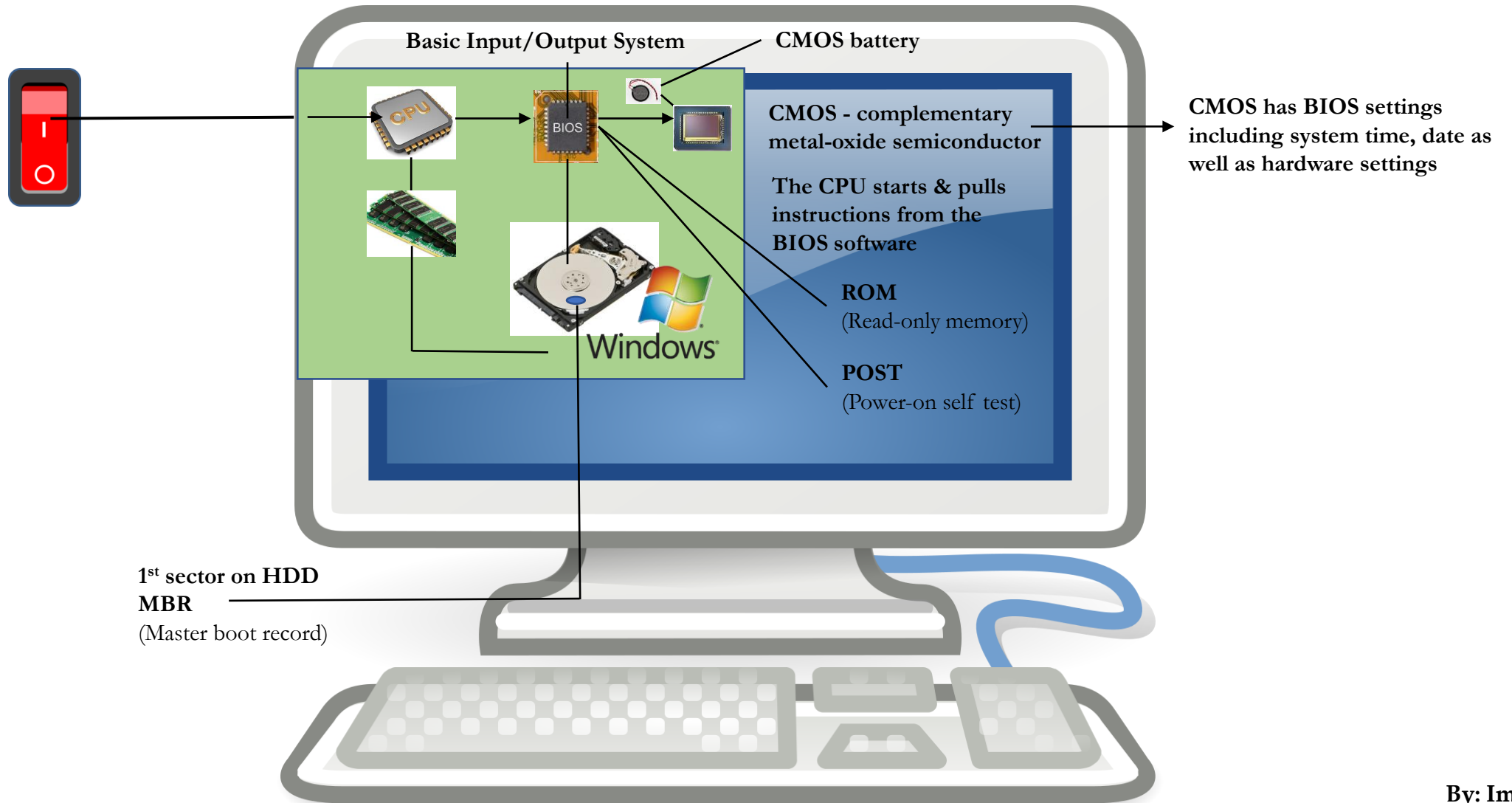


Welcome to Section 4

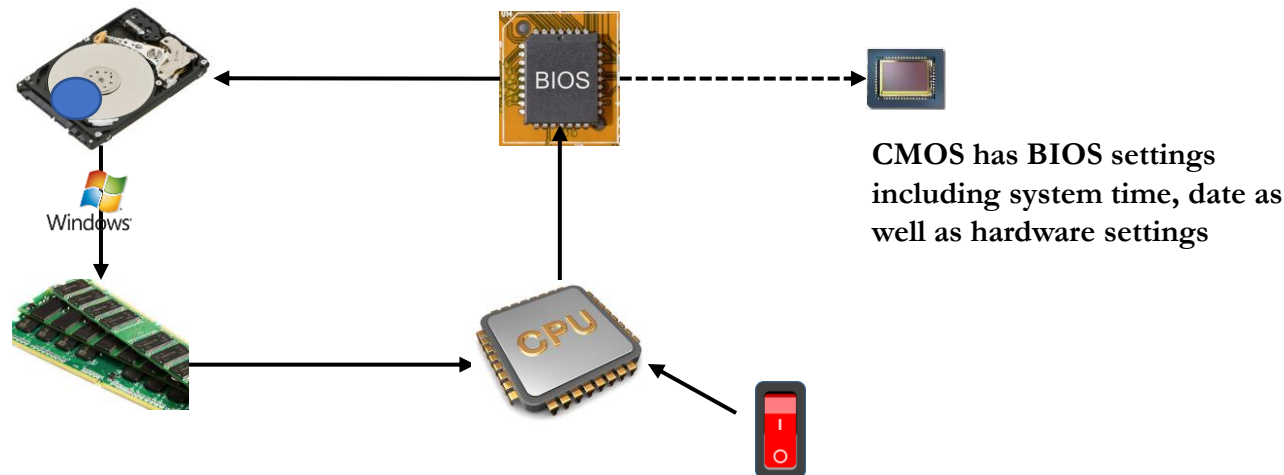
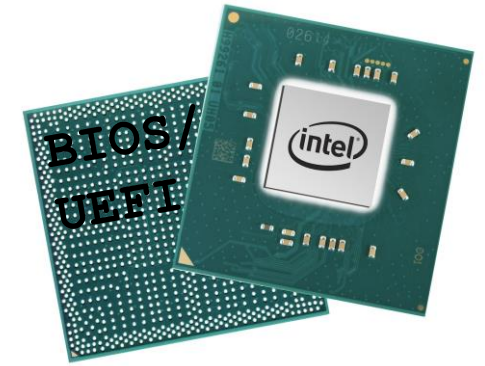
Computer Operating System

Computer Boot Process



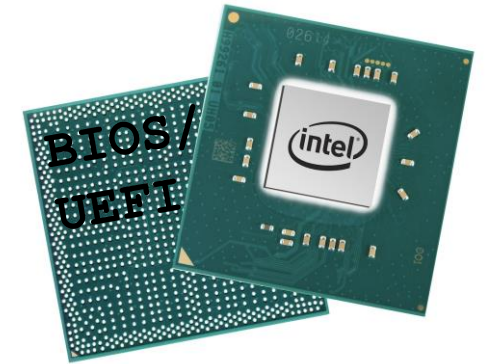
UEFI

- UEFI stands for “Unified Extensible Firmware Interface”
- Every computer comes with a chip which has a low-level software that instruct the computer how to boot
- One of that software is BIOS (Basic Input/Output System). The BIOS loads when your computer starts up, and the BIOS is responsible for waking up your computer’s hardware components, ensures they’re functioning properly, and then runs the bootloader that boots the OS.



UEFI

- Now recently that BIOS software is being replaced by UEFI software
 - UEFI has more modern solution such as:
 - Supporting larger hard drives
 - Faster boot times
 - More security features
 - Better graphics
 - Mouse cursors
- You cannot upgrade from BIOS to UEFI. You will have to buy the newer hardware that comes pre-installed with it.



Types of Operating Systems

- An operating system is a program that controls the execution of applications and acts as an interface between the user of a computer and the computer hardware
- In operating system there is one program always running (usually called the kernel), with all else being application programs

Types of OS

- **Batch Operating System:**
 - In this type of system, there is no direct interaction between user and the computer (e.g. In this type of OS, every user prepares his or her job on an offline device like a punch card and submit it to the computer operator. *Not used any more*)
- **Time sharing operating System:**
 - Allows multiple users to share the computer resources (Windows/Linux servers)
- **Distributed operating System:**
 - Manages a group of different computers and make appear to be a single computer

Types of Operating Systems

- **Network operating system:**
 - Computers running in different operating system can participate in common network (e.g. OS for switches, routers, firewall etc.)
- **Real time operating system:**
 - A real-time operating system is an operating system intended to serve real-time applications that process data as it comes in, typically without buffer delays. This OS is also considered as embedded OS which is a very small OS designed to perform certain specific tasks (e.g. Smart phones, smart TVs, kiosks, smart watch, ATM, digital camera etc.)

Functions of Operating Systems

- **Security**

The operating system uses password protection to protect user data. It also prevents unauthorized access to your computer system and its programs

- **Control over system performance**

Monitors overall system health to help improve performance

- **Job accounting**

OS keeps track of time and resources used by various tasks and users, this information can be used to track resource usage for a particular user or group of user

- **Error detecting aids**

OS constantly monitors the system to detect errors and avoid the malfunctioning of computer system. It also keep the system failure logs for troubleshooting purposes.

Functions of Operating Systems

- **Coordination between other software and users**

OS also coordinate and assign interpreters, compilers, assemblers and other software to the various users of the computer systems

- **Memory Management**

The OS manages the RAM or primary memory. RAM is a fast storage and it can be accessed directly by the CPU. The OS keeps tracks of primary memory, i.e., which bytes of memory are used by which user program. The memory addresses that have already been allocated and the memory addresses of the memory that has not yet been used

- **Processor Management**

In a multi programming environment, the OS decides the order in which processes have access to the processor and this function of OS is called process scheduling. OS keeps tracks of the status of processes, the program which perform this task is known as traffic controller. Allocates the CPU that is processor to a process. De-allocates processor when a process is no more required

Functions of Operating Systems

- **Device Management**

OS manages device communication via their respective drivers. It keeps tracks of all devices connected to system and decides which process gets access to a certain device and for how long

- **File Management**

A file system is organized into directories for efficient or easy navigation and usage. These directories may contain other directories and other files. An OS keeps track of where information is stored, user access settings and status of every file or directory.

Building an Operating System

- In order to build an operating system from scratch you will need learn programming language
- Coding of a typical OS is done in C and C++ (Object oriented programming language)
- The UNIX operating system's development started in 1969, and its code was rewritten in C in 1972
- Oracle database development started in 1977, and its code was rewritten from assembly to C in 1983. It became one of the most popular databases in the world
- In 1985 Windows 1.0 was released. Although Windows source code is not publicly available, it's been stated that its kernel is mostly written in C.

GUI vs. CLI Operating Systems

- GUI = Graphical user interface
- CLI = Command line interface

| CLI | GUI |
|---|--|
| Interaction is by typing commands | Interaction with devices is by graphics and visual components and icons |
| Commands need to be memorized | Visual indicators and icons are easy to understand |
| Use a lot less memory to store programs | Use large amount of memory due to graphics |
| Use of keyboard for commands makes CLI quicker | Use of mouse for interaction makes it slow |
| Only keyboard is used | Mouse and keyboard is used |
| Command line interface does not change, remains same over time | Structure and design can change with updates |
| With a CLI, users have all the control over the file system and operating system, and the tasks become simple. You can create a script that contains a few lines of command and it will do the work for you | Although GUI's can create shortcuts, they do not readily support scripting or automation. For common tasks, a user must repeat each action within the GUI manually |

CLI vs. GUI Operating Systems

- CLI OS
 - Unix (Solaris, AIX or HP-UX)
 - Linux (Redhat, CentOS, Ubuntu, Fedora)
- GUI OS
 - Windows
 - MacOS

File Systems Management

- File system is how files/data is stored or organized in computer
- Without a file system, data placed in a storage medium would be one large body of data with no way to tell where one piece of data stops and the next begins
- Example of a closet

Cluttered closet



OS File Systems Management



OS File Systems Management

- Applications files = Program files, /etc
 - Executable files = Windows, /usr/bin
 - User accounts = users, /home/username
 - Temporary files = temp, /tmp
-
- There are many different types of filesystems. In general improvements have been made to filesystems with new releases of operating systems, and each new filesystem has been given a different name:
 - e.g. NTFS, FAT, ext3, ext4, XFS etc.