Computer Software

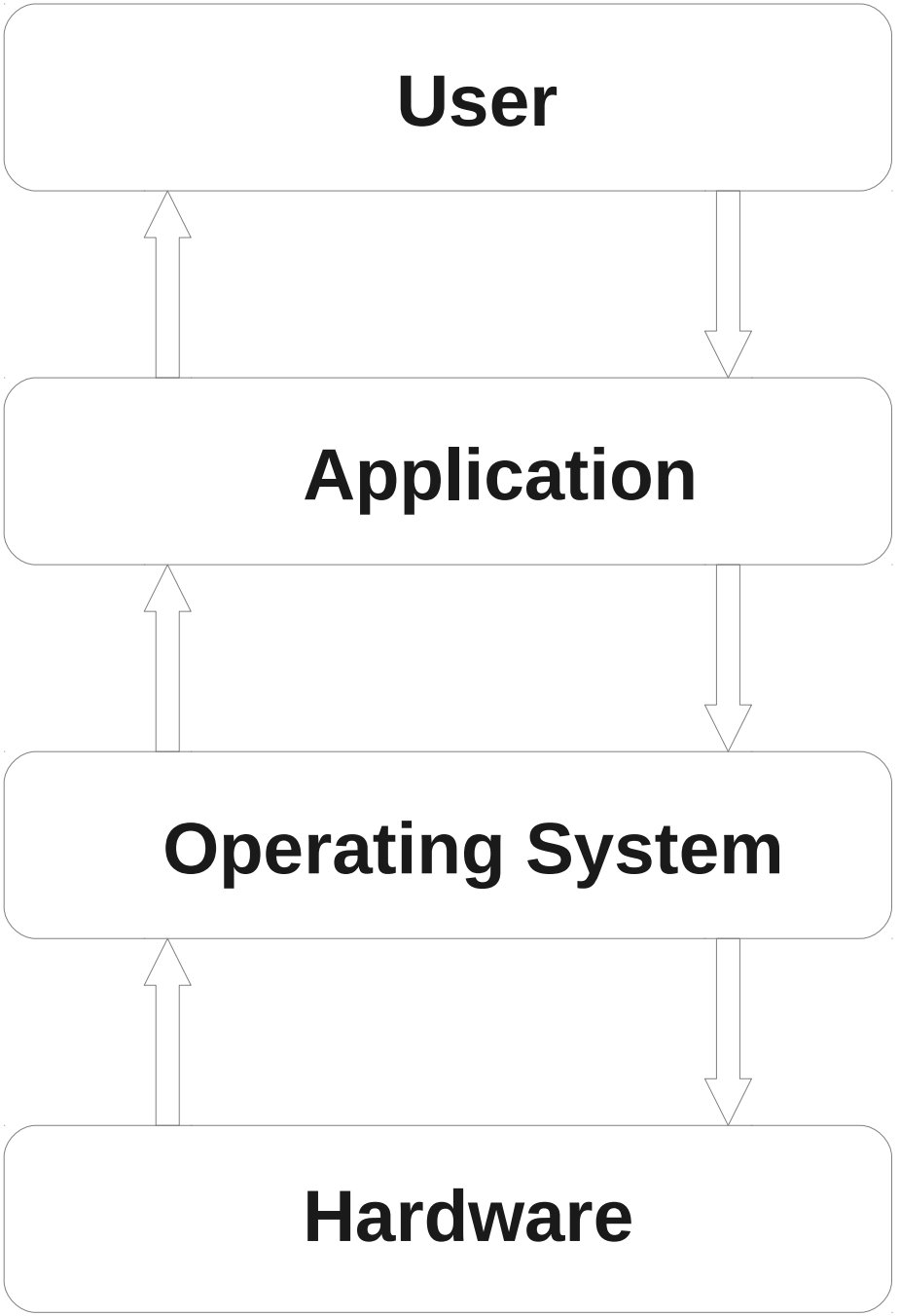
- Computer software and its need.
- Types of Software
  - System Software
    - Operating Systems
    - Programming software
  - Application Software
    - Office Suites
    - Graphics software
    - Browsers
    - Other application software

Computer Software

- Computer software – a collection of computer programs and related data that provide the instructions for telling a computer what to do and how to do it.
- Distinct from Computer Hardware, which encompasses the physical interconnections and devices required to store and execute – or run – the software.

Computer Software

- At the lowest level software consists of machine language instructions specific to an individual processor.
  - Machine language consists of groups of binary values signifying processor instructions that change the state of a computer from its preceding state.
- Software is usually written in a higher level language closer to humans -- and converted to machine code -- or using assembly language – a mnemonic representation of machine language using natural language alphabet.



Types of Software

- Computer software can be divided into two major categories:
  - System Software
  - Application Software
- The distinction is arbitrary and often blurred.
  - Sometimes System Software is further divided into
    - System Software
    - Programming software

System Software

- Designed to operate the computer hardware.
- Provides platform for running application software.
- Basic system software are:
  - BIOS and device firmware
  - The Operating System
  - Utility software
  - Programming Software

Firmware

- A fixed usually small program that controls electronic devices.
- No strict boundary between firmware and software.
- Firmware involved at a very low level that the hardware would be non functional without its help.
- Software could be changed without replacing the hardware.

Firmware

- Many firmware in a typical PC, at multiple levels.
- Lower level firmware considered as hardware by higher level firmware.
- Low level firmware – in a ROM.
- Higher level firmware – in flash memory.
- BIOS is the most common firmware people come in direct contact.

BIOS

- Basic Input/Output System.
- Also known as System BIOS or ROM BIOS.
- Software built into the PC.
- First code run by the PC when powered on.
- BIOS initializes and identifies system hardware devices.
- Then locates boot loader on a peripheral device and executes it, giving it control of the PC.
- Known as booting – short for bootstrapping.

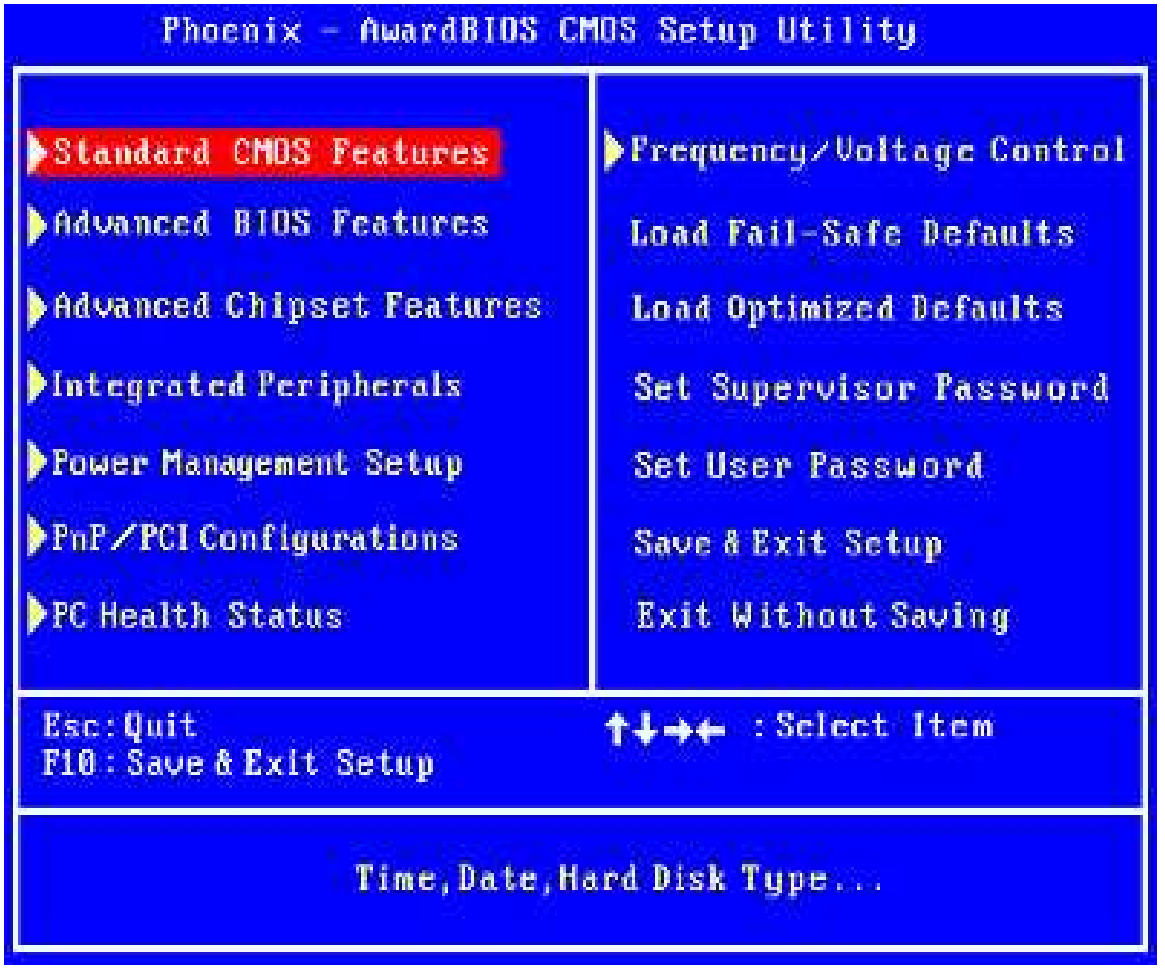
BIOS

- First appeared in CP/M in 1975.
- BIOS is limited to a 16-bit processor mode and 1 MB of addressable space.
- Most BIOS firmware is stored on EEPROM or flash memory devices.
- Rewriting the contents of BIOS is known as flashing.
- Flashing the BIOS is done to fix software problems, add support to newer hardware or to recover from a damaged BIOS.

BIOS

- There can be many BIOS firmware chips in a computer.
- Motherboard BIOS contains code to the basic hardware needed to bootstrap the system – keyboard and storage.
- Plug in adapter cards like video, network cards etc have their own BIOS – complementing or replacing the system BIOS code for that component.
- Needed because BIOS is limited and cannot handle sophisticated tasks.

BIOS



Advanced Configuration and Power Interface (ACPI)

- A specification providing an open standard for device configuration and power management by the operating system.
- Defines a platform independent interface for hardware discovery, configuration, power management and monitoring.
- Originally developed by Intel, Microsoft and Toshiba and later joined by HP and Phoenix.
- All modern BIOS firmware provides support for ACPI.

ACPI

- Operating System-directed configuration and Power Management (OSPM) – a system implementing ACPI.
- Power management under the control of the operating system instead of the BIOS.
- Defines various power states for the system.

ACPI

- Global Power States
  - G0 (S0) : Working
  - G1 : Sleep with four states from S1 to S4
  - G2 (S5): Soft Off. Some components remain powered so the computer can wake from input from the keyboard, modem, LAN or USB device.
  - G3 : Mechanical Off. All components switched off and system can be dis-assembled – the real time clock will usually be running off its own battery

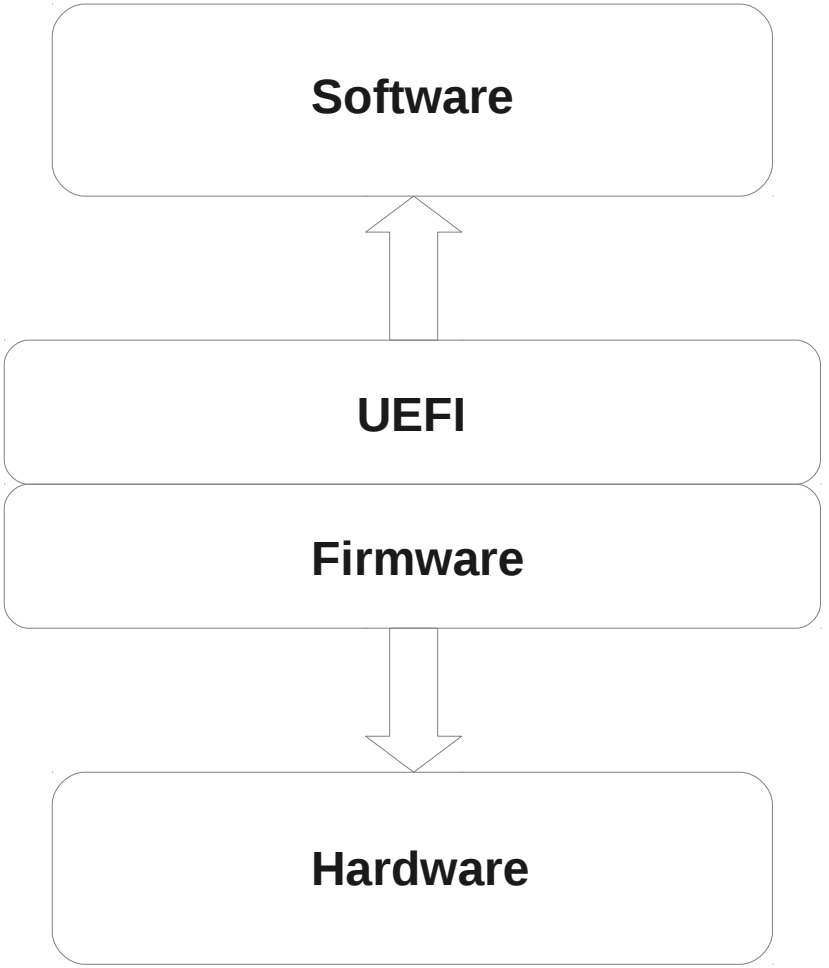
ACPI

- Sleep States
  - S1 : All processor caches are flushed and the CPU stops executing instructions but power is maintained to the CPU and RAM.
  - S2: CPU powered off.
  - S3: Standby, Sleep or Suspend to RAM, RAM is powered.
  - S4: Hibernation or Suspend to Disk. Content of RAM is saved to non-volatile memory such as a hard drive and is powered down.

United Extensible Firmware Interface (UEFI)

- A specification that defines a software interface between and Operating system and platform firmware.
- A replacement for the older BIOS interface.
- Developed by the United UFI forum.
- Not restricted to any specific processor architecture and can run on top of or instead of the older BIOS.
- Can be 32 or 64 bit and can boot corresponding Operating systems.

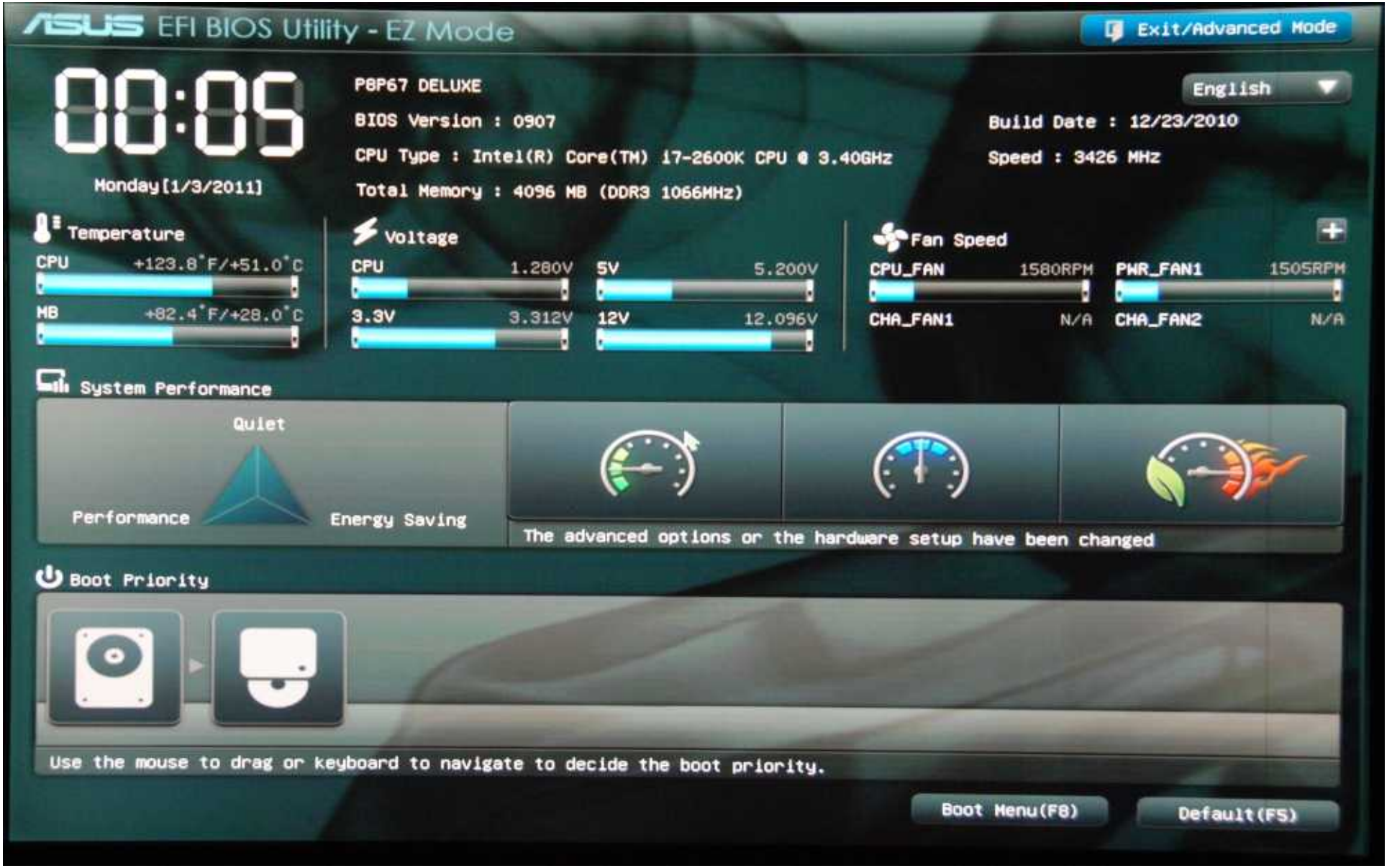
UEFI



UEFI

- Advantages
  - Ability to boot from large disks (over 2 TiB)
  - Faster Boot-up
  - CPU independent architecture
  - CPU independent drivers
  - Flexible pre-OS environment, including networking
  - Modular design
- Enhancements to BIOS like ACPI which does not depend on a 16-bit runtime are also present.

UEFI



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