# Module 2

Bus Systems, Motherboards, and BIOS

# Objectives

1. PC Hardware (Part 1):
   A. Differentiate between different bus structures
   B. 1.3 Differentiate between motherboard components, their purposes, and properties
   C. 1.2 Configure and apply BIOS settings

# BUS STRUCTURES

# Bus Structures

1. Computer components are incredibly complex
2. All parts must communicate in a fast and efficient manner
3. If not the speed and capabilities are lost

4. **Bus** – the channel or path between the components in a computer

# Typical Bus Structures

A typical computer has two key buses:

A. System Bus

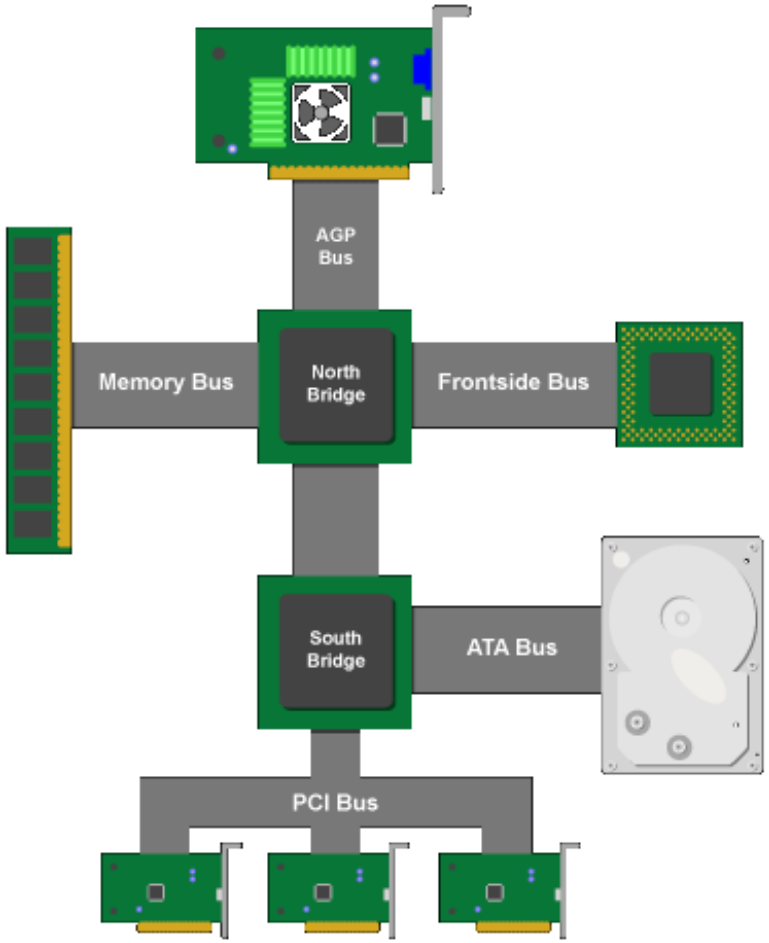
B. Shared Bus

1. The **System Bus, Local Bus**, or **Frontside Bus** – connects the microprocessor (central processing unit) and the system memory

# Typical Bus Structures

2. The **Shared Bus** – connects additional components (ISA, EISA, PCI, USB, Firewire, and PCI-e) together through a **bridge:**
   A. Part of the computer's chipset
   B. Acts as a traffic cop, integrating the data from the other buses to the system bus
   C. Lets multiple devices access the same path to the CPU and system memory

# Typical Bus Structures




This illustration shows how the various buses connect to the CPU”

1. Northbridge controls the CPU, Memory, and AGP
2. Southbridge controls everything else

# Buses Types

Every bus has three components:

| Bus Type | Description |
|---|---|
| **1. Address bus** | A uni-directional pathway, which means that information can only flow one way. |
| **2. Data bus** | A bi-directional pathway for data flow, which means that information can flow in two directions. |
| **3. Control bus** | Carries the control and timing signals needed to coordinate the activities of the entire computer. |

# ISA Bus

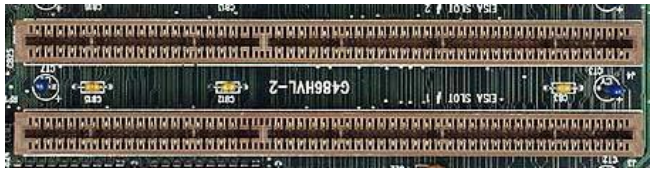
**Industry Standard Architecture**

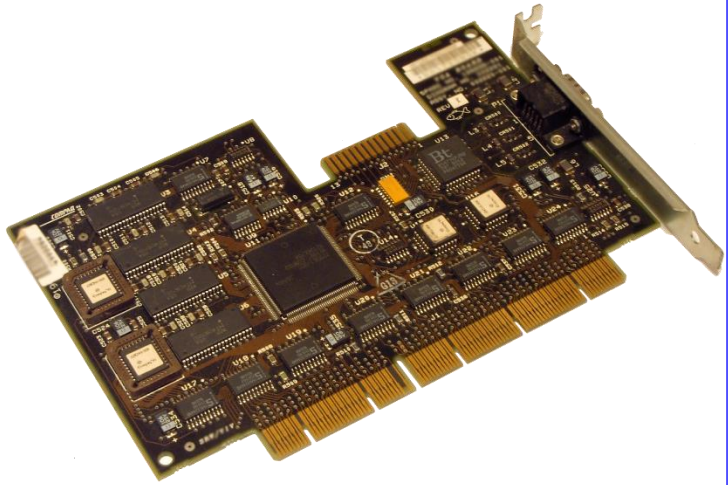
1. Still be found in some newer computers
2. Largely unchanged since it was expanded to 16 bits in 1984
3. Became a bottleneck to performance and was augmented with additional high-speed buses
4. Persists because of the enormous base of existing peripherals

# EISA Bus

## Extended Industry Standard Architecture

1. Extends the ISA bus to 32 bits
2. Allows more than one CPU to share the bus
3. Bus mastering support enhanced to provide access to 4 GB of memory
4. EISA can accept older ISA cards
5. Better suited to bandwidth-intensive tasks (such as disk access and networking)
6. Most cards were either SCSI or network cards



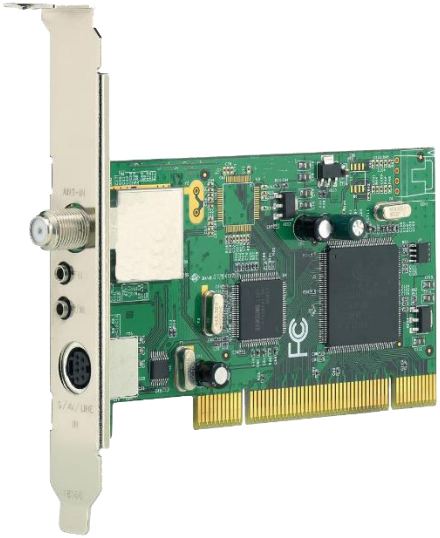


# PCI Bus

**Peripheral Component Interconnect**

1. Intel introduced in early 1993
2. A hybrid between ISA and VL-Bus
3. Provides direct access to system memory for connected devices
4. Uses a bridge to connect to the front side bus and CPU
5. Is capable of higher performance while eliminating the potential for interference with the CPU

# PCI Bus



1. Can bus connect up to five external components
2. Can have more than one PCI bus on the same computer
3. PCI bridge regulates the speed of the bus independently of the CPU's speed (half the CPU speed)
4. Provides a higher degree of reliability
5. Ensures that PCI-hardware manufacturers know exactly what to design for

# AGP Bus

**Accelerated Graphic Bus**

1. 32 bits wide (same as PCI)
2. Runs at full System bus speed
3. Doubles the bandwidth of the port
4. Does not share bandwidth with other devices

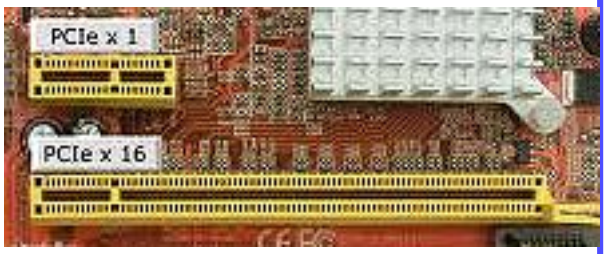
# AGP Bus

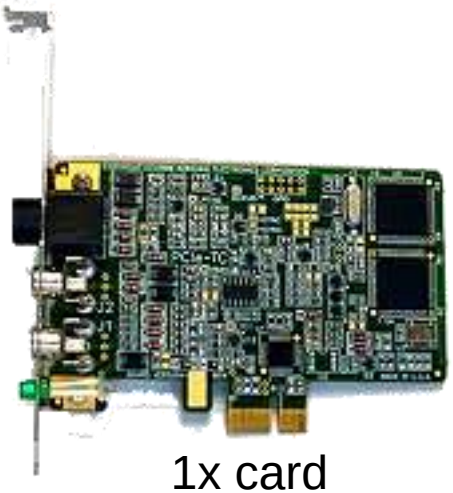
1. Base speed is 66MHz
2. 2X mode doubles the speed of the bus
3. Can also get AGP at 4x and 8x speeds
4. 8x expansion slot has a clock speed of 533MHz
5. Uses special signaling to allow twice as much data to be sent over the port at the same clock speed

# PCI Express

## PCI Express

1. Created to replace AGP and PCI
2. Backwards compatible with PCI
3. Has 1x, 4x, 8x, 16x slots
4. Multiplier indicates maximum transfer rate
5. Full duplex serial I/O architecture
6. 133MHZ 64 bit
7. Has the highest transfer speed of any expansion slot



1x card

# THE MOTHERBOARD

# Motherboards

1. Everything in the system plugs into it
2. Everything is controlled by it
3. Depends on it to communicate with other devices on the system
4. Is the largest printed circuit boards
5. Every device has one
6. Houses the CPU, the controller circuitry, the bus, RAM, expansion slots for additional boards, and ports for external devices
7. Determines capabilities and limitations of the system

# Main Components on a Motherboard

1. System clock
2. CPU
3. Chip set
4. RAM
5. ROM BIOS
6. CMOS configuration chip and its battery
7. System bus with expansion slots
8. Ports directly on the board
9. Power supply connections

# The System Clock

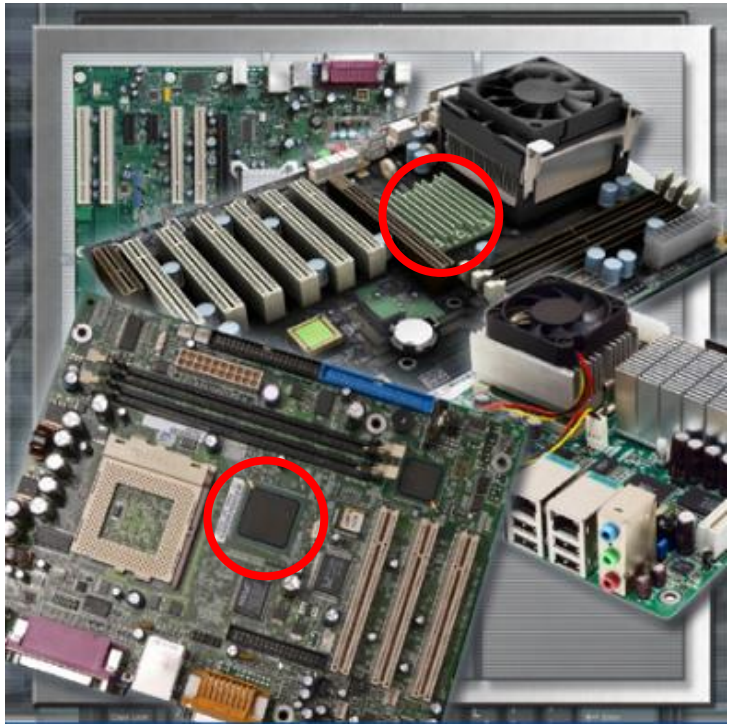
1. Keeps the beat for motherboard activities
2. Frequency is measured in Hertz (Hz)
3. Determines the speed of the CPU

# The Chip Set

1. Determines how system hardware interacts with the CPU and other components
2. Determines system performance
3. Determines system limitations
4. Establishes how much memory can be added to a motherboard
5. Determines the type of connectors on the motherboard

# The Chip Set

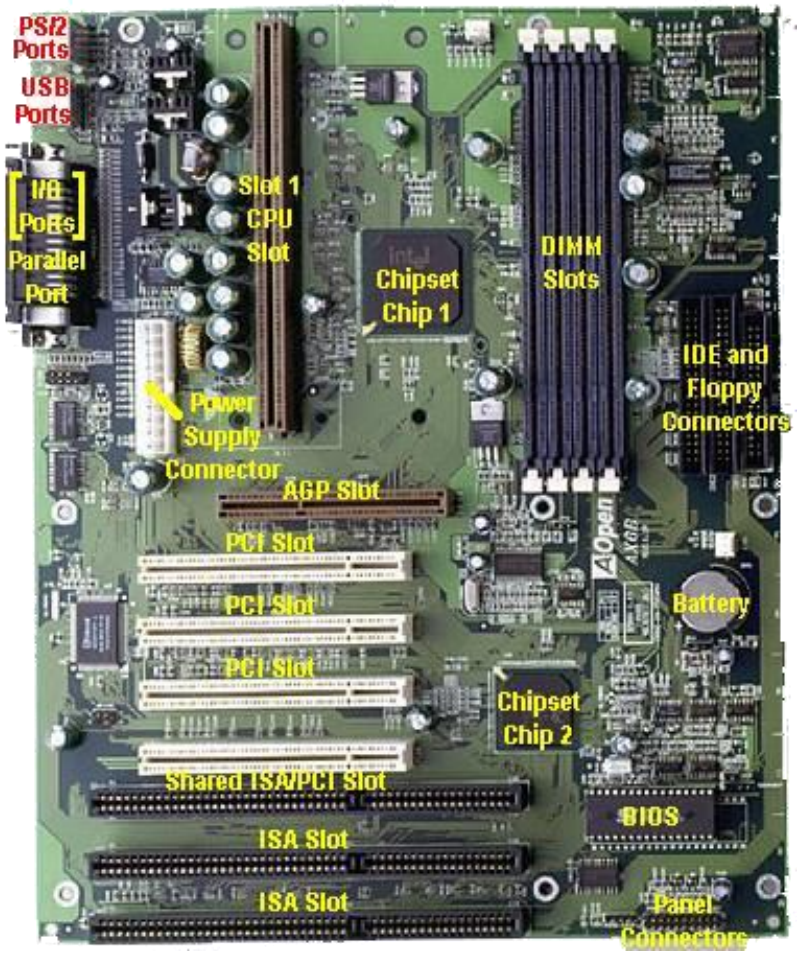
Most chip sets are divided into two distinct components: **Northbridge** and **Southbridge**



# The Chip Set

1. **Northbridge** controls:
   A. Access to the RAM
   B. Access to AGP video card
   C. Access to the CPU
   D. The speed the CPU can communicate
2. **Southbridge** controls:
   A. Communication between the CPU and the expansion ports (hard drives, sound card, USB ports, and other I/O ports)

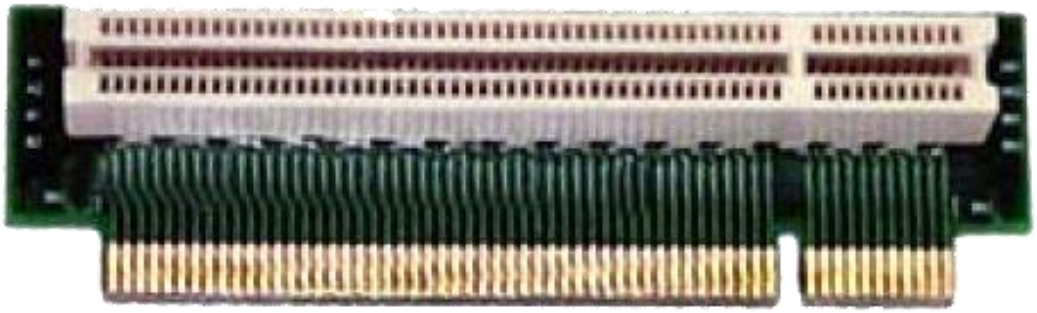
# Expansion Slots



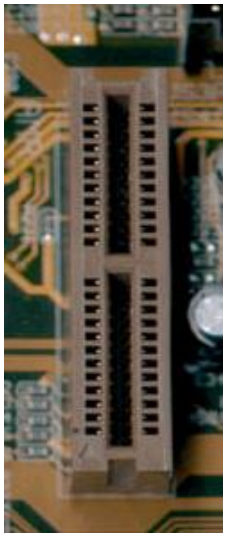

1. Accept printed circuit boards
2. Common expansion slots:
   A. Peripheral Component Interconnect (PCI )
   B. Accelerated Graphics Port (AGP)
   C. Peripheral Component Interconnect Express (PCIe)

# Riser Cards

1. Used to physically extends a slot so a chip or card can be plugged in
2. Cards reside parallel with the motherboard
3. Used in low-profile and space-saving cases



# Other Slots

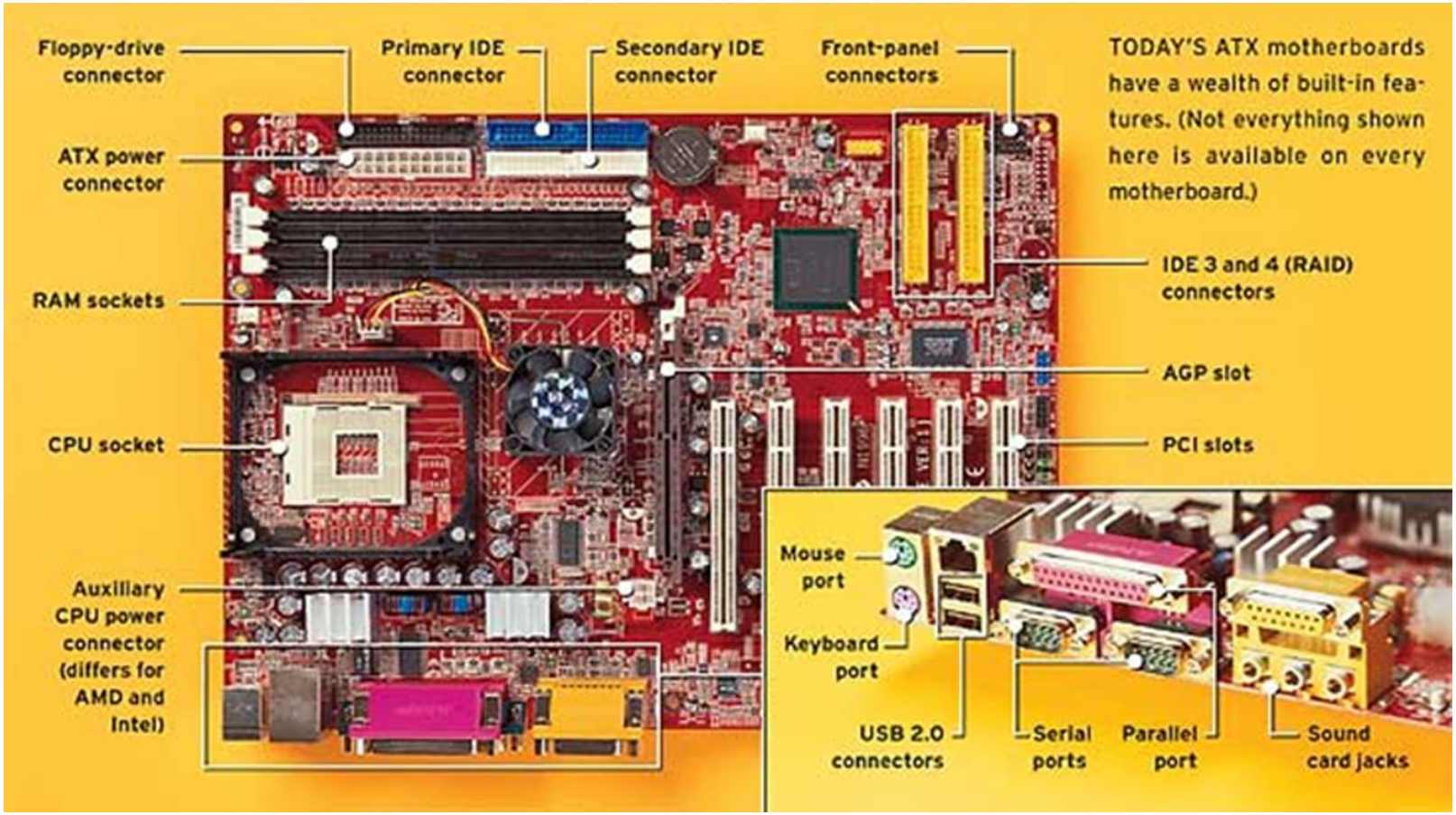


AMR

CNR

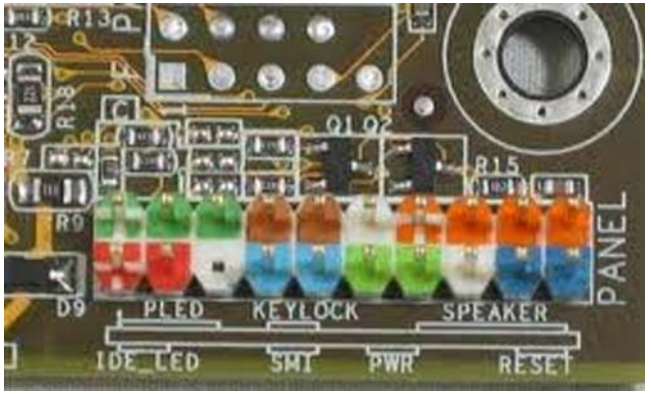
1. **Audio/Modem Riser** (AMR)
2. Evolved into the **Communications and Networking Riser** (CNR)
   A. Added LAN and home networking functions
   B. A 30-pin interface
   C. Accommodates two formats making various audio/modem and audio/network combinations possible

# Identify the Motherboard Components

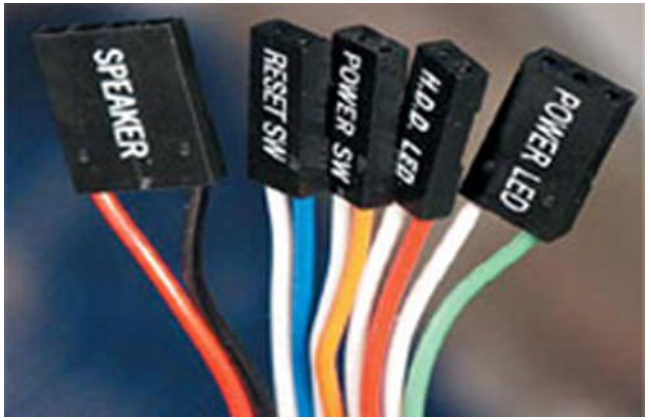


# Front Panel Connectors

1. Attach to the motherboard with pins
2. Are always grouped together but may be in a different order or configuration
3. The power LED may be either a 2 or 3 pin connector
4. Can buy adaptors to change the configuration
5. The Reset jumper MUST be attached in order for the computer to start
6. May also see:
   A. USB
   B. Firewire
   C. Audio



Front Panel Connector Group



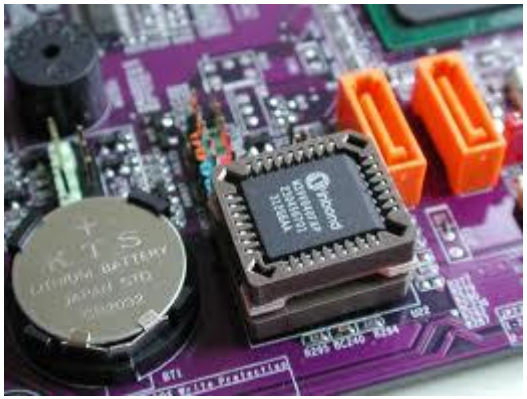
Front Panel Connectors

# BIOS

# BIOS

**Basic Input/Output System**

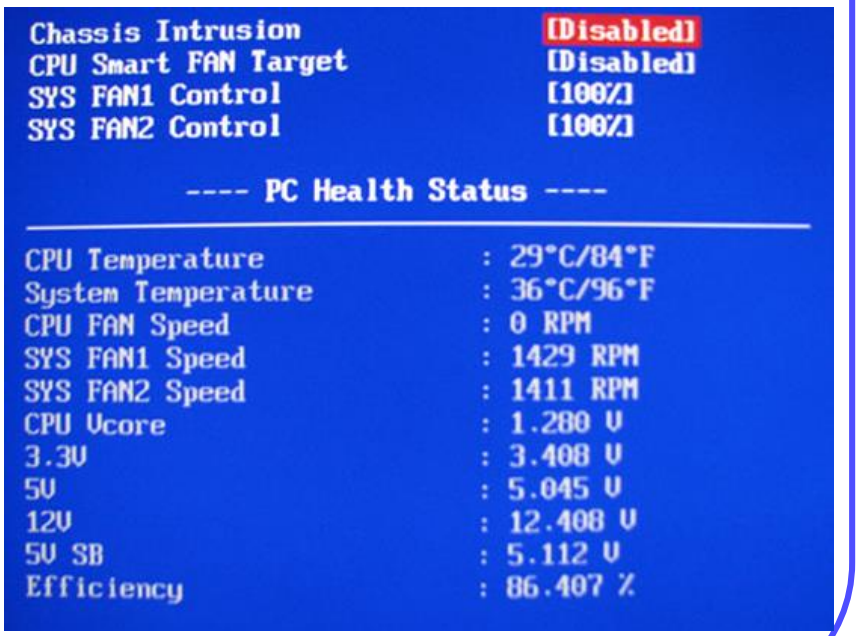
1. Also known as the system BIOS or ROM BIOS
2. Holds the firmware of the motherboard
3. The fundamental purposes is to initialize and test the system hardware components and load the operating system
4. Is the first software run when powered on
5. Provides a consistent way for applications and operating systems to interact with the keyboard, display, and other input/output devices



BIOS and Battery

# BIOS

1. Contains some built-in diagnostics like the Power On Self Test (POST)
2. Built-in monitoring tools:
   A. Temperature
   B. Fan speeds
   C. Intrusion detection
   D. Voltages
   E. Clock
   F. Bus speeds



# BIOS

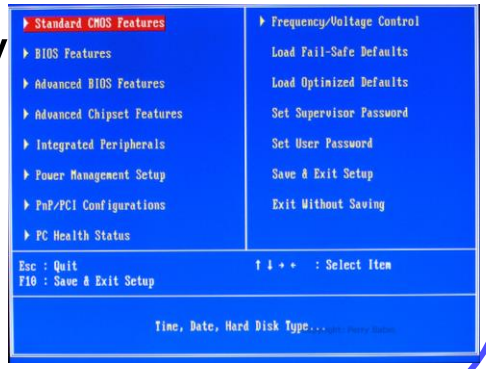
1. Can be accessed at system power-up by a particular key sequence (usually Delete or F2)
2. User can configure hardware options using the keyboard and video display
3. Software is stored on a non-volatile ROM chip on the motherboard
4. Specifically designed to work with each particular model of computer
5. Interfaces with devices of the system

# BIOS

1. Also know as ROM BIOS or **Firmware**
2. Supports different feature sets depending on the manufacturer of the chip
3. Can be upgraded by using a process called **flashing**
4. Contents is stored on an EEPROM chip so that the contents can be rewritten without removing the chip from the motherboard
5. Allows BIOS software to be easily upgraded to add new features or fix bugs

# BIOS and CMOS

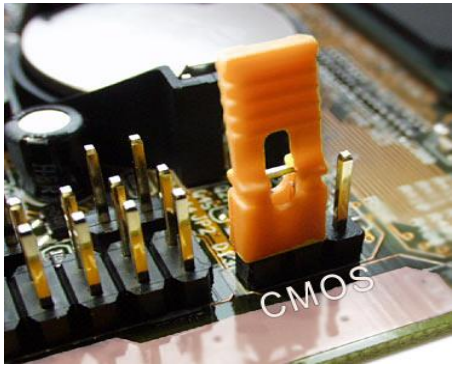
1. Uses a battery-backed **Complementary Metal–Oxide Semiconductor** (CMOS) chip to held BIOS settings
2. Has a menu-based user interface to make changes to these settings
3. A user can:
   A. Configure hardware
   B. Set the system clock/time
   C. Enable or disable system components
   D. Virtualization support
   E. Voltage parameters for CPUs and memory
   F. Set the boot sequence
   G. Control fans
   H. Set various password

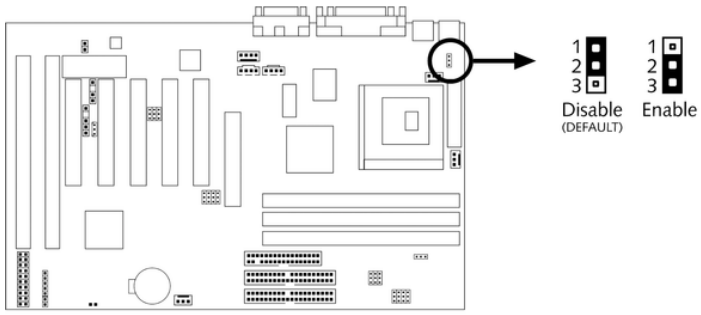


# BIOS

Can be manually reset back to the factory defaults by:

1. Removing the battery for a few seconds
2. Moving the reset jumper to Enable, then start the computer



# BIOS

As of 2011, the BIOS is being replaced by the more complex **Extensible Firmware Interface** (EFI) or the **Unified Extensible Firmware Interface** (UEFI)

1. Specification that defines a software interface between the operating system and components
2. Replaces the BIOS firmware interface
3. Initially made for the Itanium architecture, now available for x86 and 64x platforms
4. Provides legacy support for BIOS services
5. Can support remote diagnostics and repair of computers, even without an operating system

# Protecting Documentation and Configuration Settings

1. Keep well-labeled, written record of:
   A. All changes you make to CMOS
   B. Records of hardware and software installed
   C. Network settings
2. Keep documentation up to date and in a safe place
3. Document before you flash or replace the BIOS chip

# Summary

In the module we discussed:

1. Common types of buses and how they operate
2. Motherboard components and their function
3. BIOS and CMOS function