Instructor Materials
Chapter 3: Computer Assembly

IT Essentials v6.0

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Chapter 3:
Computer Assembly

IT Essentials v6.0

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Chapter 3 - Sections & Objectives

- 3.1 Assemble the Computer
  - Build a Computer.
- 3.2 Boot the Computer
  - Explain how to verify BIOS and UEFI settings.
- 3.3 Upgrade and Configure a Computer
  - Explain how to upgrade components in a computer system to meet requirements.
- 3.4 Chapter Summary

3.1 Assemble the Computer

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Open the Case and Connect the Power Supply

- Open the Case
  - Prepare the workspace before opening the computer case.
  - There are also different methods for opening cases.
  - Consult the case's documentation to learn how to open a particular computer case.
- Install the Power Supply
  - Modern cases include a specific area for the power supply.
  - Consult the case and power supply's manuals for more information.
  - Secure the power supply to the case using the proper screws.
  - Make sure that all the screws are in place and tightened correctly.
  - Use a cable tie to secure all the cables out of the way.

Install the Motherboard

- Install the CPU, Heatsink and Fan Assembly
  - Install the CPU and the heat sink and fan assembly on the motherboard before the motherboard is placed in the computer case.
  - CPU and motherboard are highly sensitive to ESD.
  - Use the markings on the CPU and motherboard to properly align and install the CPU.
  - Thermal compounds help dissipating CPU heat and are strongly recommended.
  - Heat sinks and fans should also be properly aligned for correct installation.

Install the Motherboard (Cont.)

- Install RAM
  - RAM may be installed on the motherboard before the motherboard is installed in the computer case.
  - RAM is highly sensitive to ESD.
  - Use the documentation provided with the motherboard and RAM for more information on RAM installation.
  - RAM is designed to install in one specific direction. Make sure to check the markings before applying pressure.
- Install the Motherboard
  - When the CPU, heat sink, fan and RAM are installed on the motherboard, the motherboard can installed in the case.
  - Use proper plastic standoffs to securely install the motherboard in the case and avoid short circuits.
  - The I/O connectors on the back of the motherboard should be aligned with the openings in the I/O plate.

Install the Drives

- Install the Internal Drive
  - Internal drives are installed in empty hard drive bays found in the case.
  - The empty bay must match the drive's size.
  - Leave some space between the drives when installing multiple drives.
  - The drive's metal plate should face up to allow better heat dissipation.
- Install the Optical Drive
  - Commonly installed in 5.25 inch (13.34 cm.) drive bays
  - Optical drives are accessed from the front of the case.

Install the Adapter Cards

- Types of Adapter Cards
  - Examples of adapter cards include: video, Ethernet and wireless network, sound, TV tuner, video capture, external ports such as USB, FireWire, Thunderbolt.
  - PCI and PCIe are two common slots for adapter cards.
- Install a Wireless NIC
  - Commonly use PCI or PCIe expansion slots or USB connectors.
  - Locate an empty expansion slot and follow the manufacturer instructions for proper installation.
- Install a Video Adapter Card
  - Commonly uses PCI, AGP or PCIe expansion slots.
  - Many video cards require an external power supply.
  - Due to their cooling systems, modern video cards take more space inside the case. Be sure to plan for the extra space needed.

Install the Cables

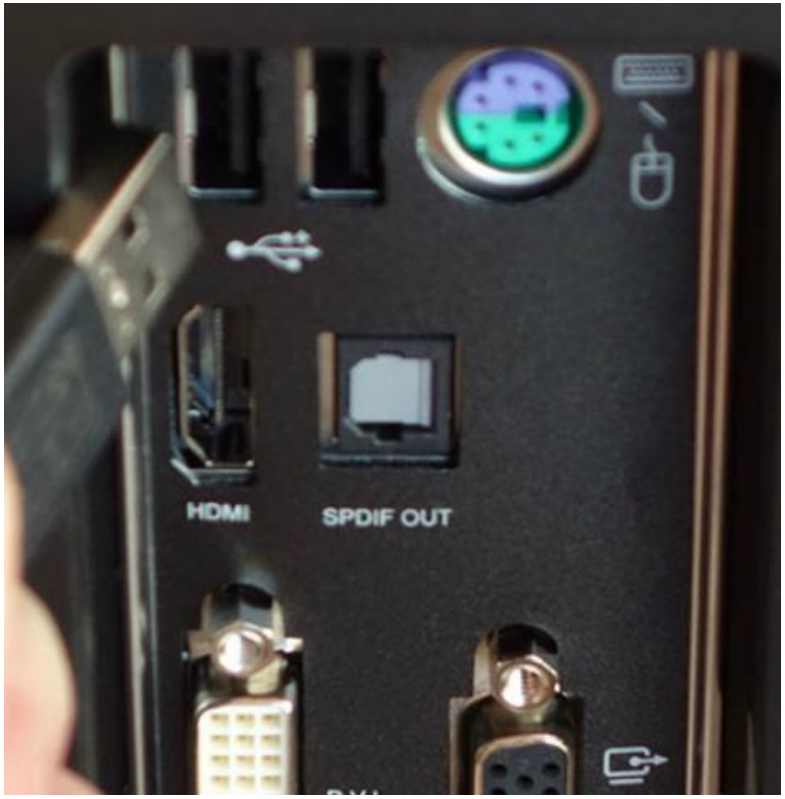
- Connect Power to Motherboard
  - Motherboards require power to operate.
  - Motherboards also relay power to components and adapter cards.
  - Refer to the motherboard and power supply documentation to ensure compatibility of power supply and motherboard connectors.
  - Modern motherboards require two power connectors for operation.
  - Align the proper connectors and press it down against the motherboard.
  - Remember: If it is difficult to plug in a cable or other part, something is wrong. Do not use more force.
- Connect Power to the Internal Drive and Case Fans
  - Some drives accept different power connectors for compatibility.
  - 4-pin Molex and 15-pin SATA are common hard drive connectors.
  - Align the proper connectors and gently press it against the other end.
  - Fans also need power and use 3-pin or 4-pin connectors.

Install the Cables (Cont.)

- Connect the Internal Data Cables
  - The internal and optical drives typically connect to the motherboard through SATA cables.
  - SATA are keyed to fit in only one direction. They also have locking tabs.
  - Locate the SATA socket on the motherboard, align the connector and press it gently to connect.
- Install the Front Panel Cables
  - Most of the case's front panel controls, ports and connectors also connect to the motherboard.
  - Front panel cables and connected are usually not keyed.
  - The front panel cables that must be connected to the motherboard include: power button, reset button, status LEDs and the speakers.

Install the Cables (Cont.)

- Reassemble the Case
  - Double-check cables and components to ensure that all are correctly installed.
  - Secure case cover screws.
  - Watch for small wires hanging off the case to avoid pinching them.
- Install the External Cables
  - The power cable should be the last cable to be connected.
  - External cables include: video cable, USB cables, network cable, speakers and microphones.



3.2 Boot the Computer

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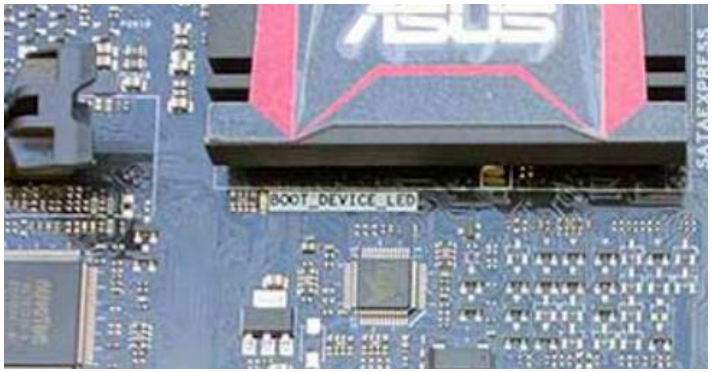
Boot the Computer

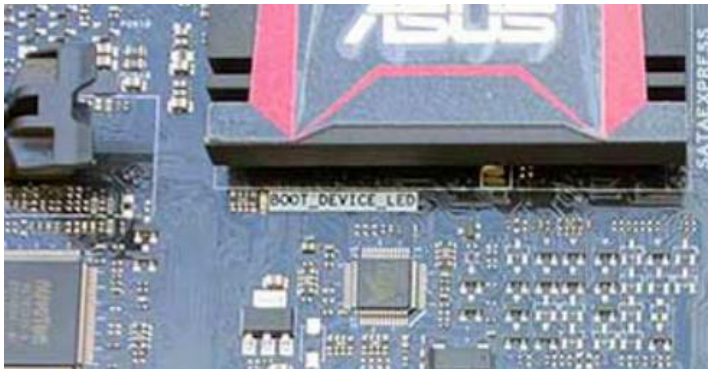
POST, BIOS, UEFI

- BIOS Beep Codes and Setup
  - As the computer boots, it checks its own critical components (POST).
  - The firmware (BIOS or UEFI) uses beep codes to indicate any errors.
  - Critical components include: video card(s), memory and I/O devices.
  - A POST card can be used to help debugging POST problems.
- BIOS and CMOS
  - BIOS is a firmware; all motherboards need a firmware to operate.
  - Some aspects of BIOS can be configured by the user.
  - BIOS settings are stored in CMOS to survive reboots.



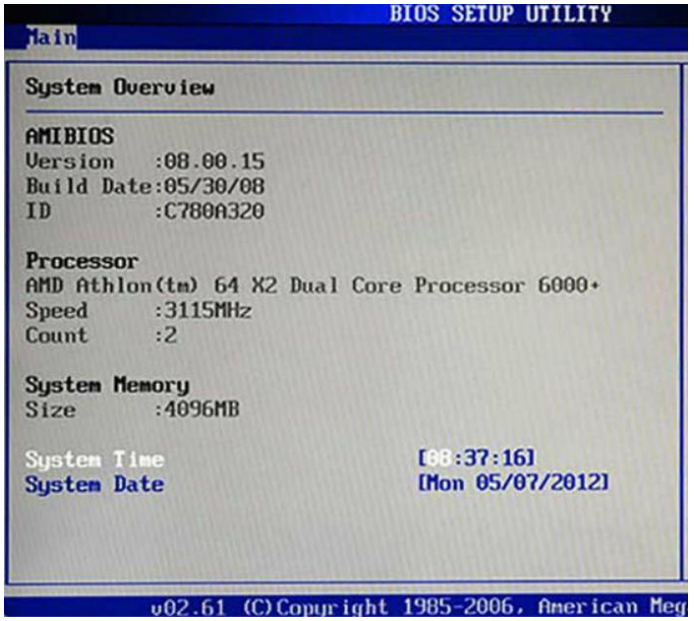
POST, BIOS, UEFI (Cont.)

- BIOS Setup Program
  - Allows the user to change BIOS settings.
  - Common reasons for changes in the BIOS are system optimizations and hardware changes.
  - Can be accessed by pressing the proper key or key combination during startup.
  - Refer to the motherboard documentation for details.
- UEFI Setup Program
  - UEFI is also a firmware.
  - Performs the same tasks performed by BIOS and more.
  - Designed to eventually make BIOS obsolete.
  - Can also be accessed by pressing the proper key or key combination during startup.
  - Refer to the motherboard documentation for details.



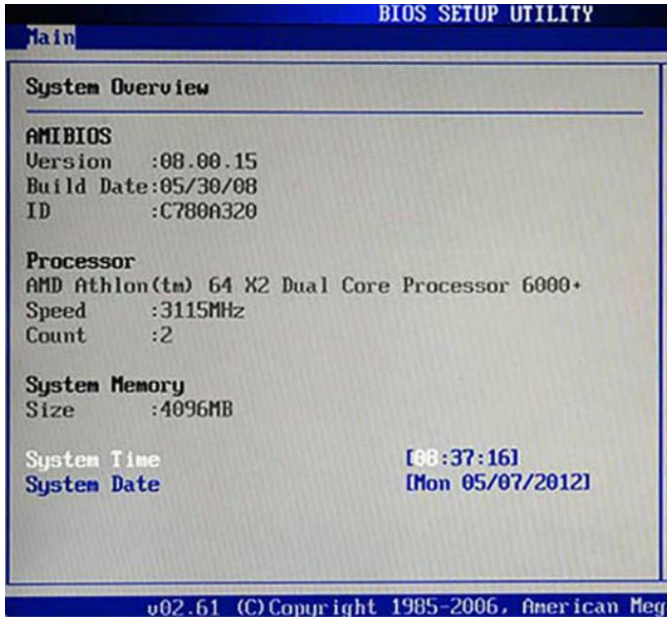
BIOS and UEFI Configuration

- BIOS Component Information
  - BIOS or UEFI can provide information about the installed hardware, including: CPU, RAM, hard drives and optical drives.
  - This information can be useful when troubleshooting.
- BIOS Configurations
  - Allows for customizing specific aspects of the computer hardware
  - The customizable variables and features are manufacturer specific.
  - BIOS settings typically have a direct impact on hardware; incorrect settings have an adverse effect.
  - Main BIOS configuration settings include: time and date, disable devices, boot order, clock speed, virtualization.



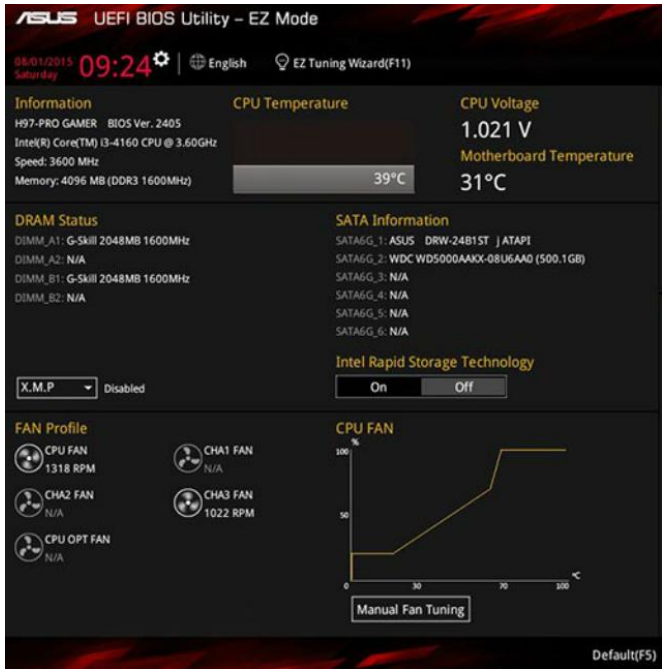
BIOS and UEFI Configuration (Cont.)

- BIOS Security Configuration
  - BIOS includes features to protect BIOS settings, data and recovery options.
  - Common BIOS security features include: BIOS passwords, Drive Encryption, LoJack, Trusted Platform Module and Secure Boot.
- BIOS Hardware Diagnostics and Monitoring
  - Useful for monitoring the activity of the motherboard and connected hardware.
  - Common BIOS hardware diagnostic features include: temperature (CPU, RAM and airflow), fan speeds, voltages, clock and bus speeds, intrusion detection and built-in diagnostics.



BIOS and UEFI Configuration (Cont.)

- UEFI EZ Mode
  - Newer computers replaced BIOS by UEFI firmware.
  - UEFI includes many new major features to address different BIOS shortcomings.
  - Among the changes introduced by UEFI is a new GUI.
  - EZ Mode provides an overview of basic system information.
- UEFI Advanced Mode
  - Advanced Mode includes more involved features including: Ai Tweaker, Advanced, Monitor and Boot.



3.3 Upgrade and Configure a Computer

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Motherboard and Related Components

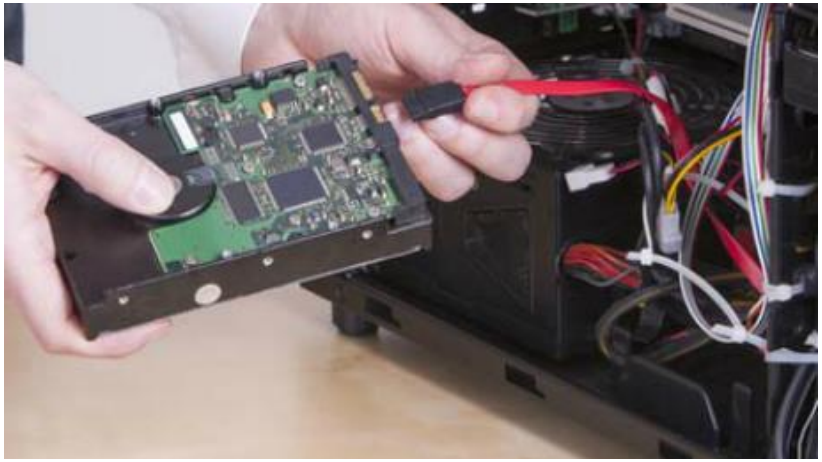
- Motherboard Component Upgrades
  - Motherboard upgrades typically lead to other components needing to be upgraded.
  - The new motherboard may also require a new case.
- Upgrade the Motherboard
  - Record the front panel wire locations if the case documentation is not available.
  - The power should be connected last.
  - Adapters may be needed.
- Upgrade the BIOS
  - Firmware updates bring fixes and new features.
  - BIOS and UEFI include tools to facilitate upgrades.
  - Modern firmware no longer requires ROM chip replacement
  - Consult the manufacturer's website to download firmware updates.

Motherboard and Related Components (Cont.)

- Upgrade CPU and Heat Sink and Fan Assembly
  - The new CPU will likely require a new heat sink and fan assembly.
  - The firmware tools can be used to monitor the temperature, fan speed and airflow.
- Upgrade RAM
  - When upgrading RAM, be sure to consider:
    - Type of RAM currently in use.
    - Are there available RAM slots?
    - RAM module installation scheme.
    - New RAM speed, latency, type, and voltage. Does it all match the existing RAM?

Storage Devices

- Upgrade Storage Devices
  - Ensure the motherboard supports the data transfer standards used by the new drive. (ATA, SATA, etc)
  - A new drive can provide:
    - More storage space
    - Increase read/write speed
    - Space for a second operating system
    - Increased the system swap file
    - Fault tolerance
    - Backup



Peripheral Devices

- Upgrade Input and Output Devices
  - Keyboards and mice upgrades can be done to address user disabilities, poor ergonomics or to accommodate a special task.
  - Monitor upgrades can provide better resolution, more screen area or better image quality.
  - Multiple monitors is considered to be a monitor upgrade.
  - New devices require new drivers; consult the manufacturer's website to download the latest driver version.
  - Signed drivers should be preferred.

3.4 Chapter Summary

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Summary

This chapter detailed the steps used to assemble a computer and to boot the system for the first time. These are some important points to remember:

- Computer cases come in a variety of sizes and configurations. Many of the computer components must match the form factor of the case.
- The CPU is installed on the motherboard with thermal compound and a heat sink and fan assembly.
- RAM is installed in RAM slots on the motherboard.
- Adapter cards are installed in PCI and PCIe expansion slots on the motherboard.
- Hard disk drives are installed in 3.5 in. (8.9 cm.) drive bays located inside the case.
- Optical drives are installed in 5.25 in. (13.34 cm.) drive bays that can be accessed from outside the case.
- Power supply cables are connected to all drives and the motherboard.
- Internal data cables transfer data between the motherboard and the drives.

Summary (Cont.)

- External cables connect peripheral devices to the computer.
- Beep codes signify hardware malfunctions.
- The BIOS setup program displays information about the computer components and allows the user to change system settings.
- Computer components require periodic upgrades and replacement parts.
- Additional hard drives can provide fault tolerance and the ability to install additional operating systems.