A+ Unit Two: Hardware Basics

Student Name		Member of Team		Team Lead		AM/PM

A+ Test	Essentials 701		2.2 Explain motherboard components, types and features
			
			• I/O interfaces
			  ○ Sound
			  ○ Video
			  ○ USB 2.1 and 2.0
			  ○ Serial
			  ○ IEEE 1394 / Firewire
			  ○ Parallel
			  ○ NIC
			  ○ Modem
			  ○ PS/2
			
			4.2 Categorize network cables and connectors and their implementations
			
			• Connectors
			  ○ RJ45
			  ○ RJ11			

A+ Certification Objectives Covered						

Turn in for this unit	**Time Allotted**	**9 Days**	
Labs	Team Lead Check Off	Points	Teacher Check Off
2.1: Locating Power Supple		10	
2.2: Accessing the BIOS		10	
2.3: Observing the Boot Process		10	

2.4: Identify Ports and Cables		10	
2.5: Internal Components		10	
2.6: Label the Motherboard		10	
2.7: Label the jumper blocks		10	
2.8: Identifying the Components of the Lab Computer		10	
Lab reports, 1 per lab per group (total 8)		80	

Unit Project (one per group)

✓ Customer Overview	
✓ List of current needs	
✓ List of future needs	
✓ List of questions asked of customer	
✓ Written (at least 2 full page, double spaced) proposal that describes, in clear English, your solution.)	
✓ Diagram of computer components	
✓ Worksheet from lab	
✓ Printout of spreadsheet showing complete cost of ALL computers and hardware and software	

Computer Hardware Basics

Computers, Servers, and Networking

Sno Isle Skills Center

Hardware and Software work together

Hardware is used to:

- ✓ _____ data
- ✓ _____ data
- ✓ _____ data
- ✓ _____ data

Software is used to:

- ✓ Control the _____
- ✓ _____ to the user
- ✓ _____ the hardware*

What does a computer "need" to work?

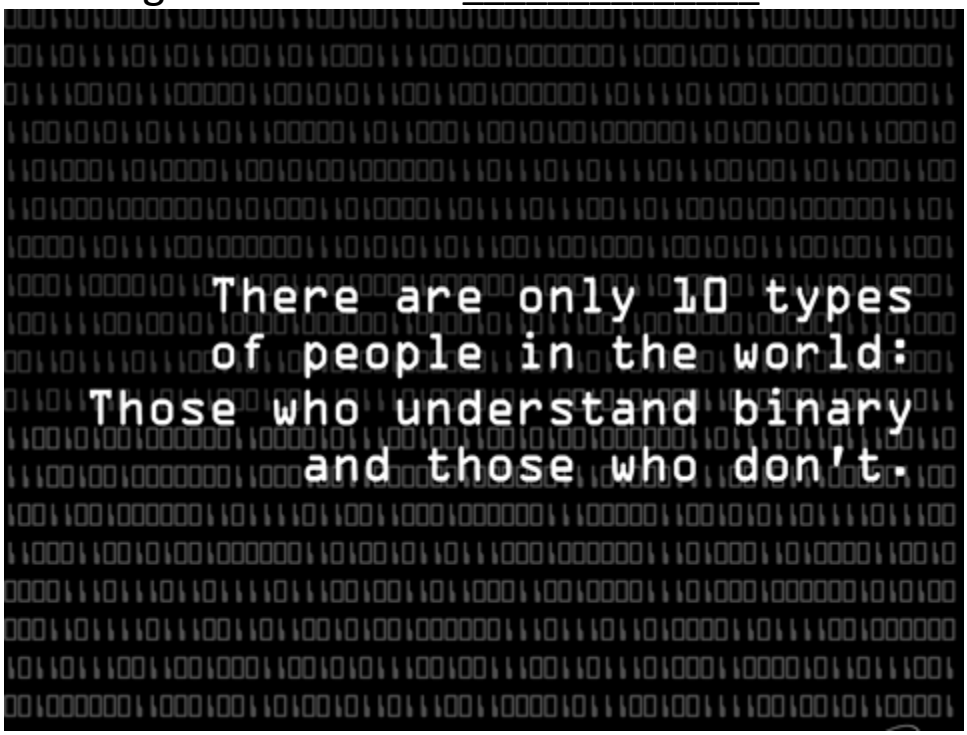
- ✓ A method for the processor (CPU) to _____ with the device.
- ✓ The combination of the _____, the _____, and the _____ is called a BUS.
- ✓ Software to instruct and control the device.
- ✓ We _____ with the hardware through software
- ✓ Electricity to power the device.

No _____, no game

Binary

- ✓ At the machine level, hardware and software "talk" to each other in _____.
- ✓ Binary is a _____ 2 system of number and consists only of the characters 0 and 1.
- ✓ Binary is based on "_____" and "_____" states
- ✓ On=_____

- ✓ Off=_____
- ✓ Charged above 50%=_____
- ✓ Charged below 50%=_____



What is a computer?

- ✓ A computer is a collection of _____ that is supported by _____.
- ✓ Hardware-_____ components that you can see, feel, touch, and _____ at your brother.
- ✓ Software-A set of _____ that make the _____ "do stuff"
- ✓ _____ —Software that is semi-_____ and lives on a chip inside the computer.*

Major Hardware Components

- ✓ CPU
- ✓ Hard Drive
  - ○ _____

- _____
- _____
- _____
- _____
- _____

✓ Optical Drive

- _____
- _____

✓ Output devices
✓ Monitor
✓ Input devices

- _____
- _____
- _____
- _____
- _____

✓ Power Supply
✓ _____ drive (not much any more)
✓ RAM
✓ Motherboard
✓ Chipset
✓ Expansion cards

- _____
- _____
- _____
- Etc.

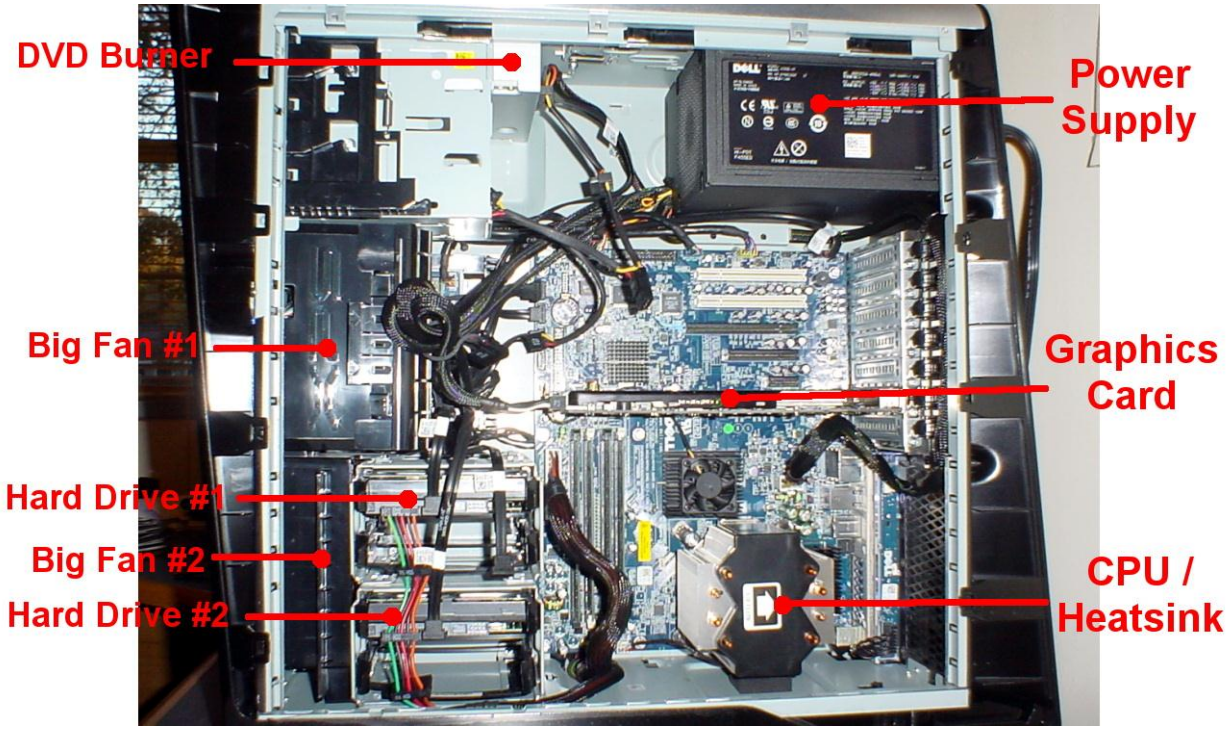
✓ Cables*

Hardware Inside Computer

✓ _____ board
✓ _____ (maybe), hard drive, CD/DVD ROM

- ✓ _____ Supply
- ✓ _____ Boards (_____ cards)
- ✓ Cables*

Computer Guts



System Board

- ✓ Aka Mainboard, motherboard
- ✓ Contains
  - CPU
  - _____ set
  - RAM
  - _____ and _____ Battery
  - _____ chip
  - Connections

- Expansion slots*

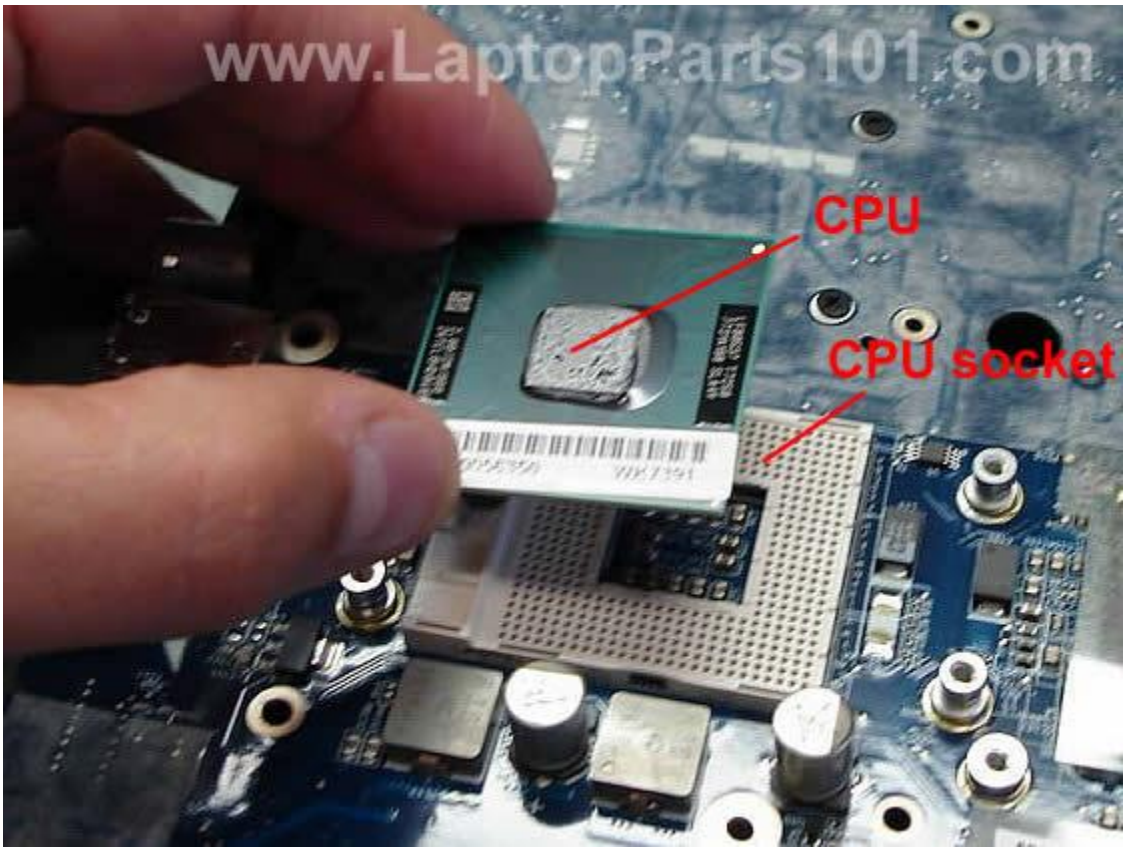
System Board Components

- ✓ Traces—the tiny fine _____ you see on the motherboard. Enable _____ and _____ to travel along the board.
- ✓ BUS—_____ of communication that includes the method and the protocol used to _____.
- ✓ _____ 1s and 0s travel down the lines of a _____.*
- ✓ System _____ —A _____ that times activities of chips. Makes sure things happen at the right time.
- ✓ _____ slots—Holds expansion cards such as _____, video cards, etc.

CPU

- ✓ Microprocessor—chip inside of computer that executes _____ commands
- ✓ Often works with a _____ set
- ✓ Microchips that do some of the _____ -level processing to free up _____ for high level
- ✓ Also act as go _____ to allow hardware to get access to _____ power.
- ✓ Some older machines also have a _____ (or slot for one) to speed up certain math functions.*

CPU



Data Stored on System Board

- ✓ Important software is stored _____ on the motherboard
- ✓ _____ Chips
- ✓ Setting physical _____ switches
- ✓ _____ tells the computer how to start up before the OS starts.
- ✓ One type of ROM is the _____ chip. Has programming necessary to start the computer.*

Updating Firmware

- ✓ Flashing the BIOS
- ✓ Can only flash _____ ROM

- _____ (Electronically Erasable Programmable Read Only Memory)
- _____ (Erasable Programmable Read Only Memory)

✓ Must use ONLY a flash program for your particular _____ version or bad things happen.

CMOS (complementary metal oxide semi-conductor)

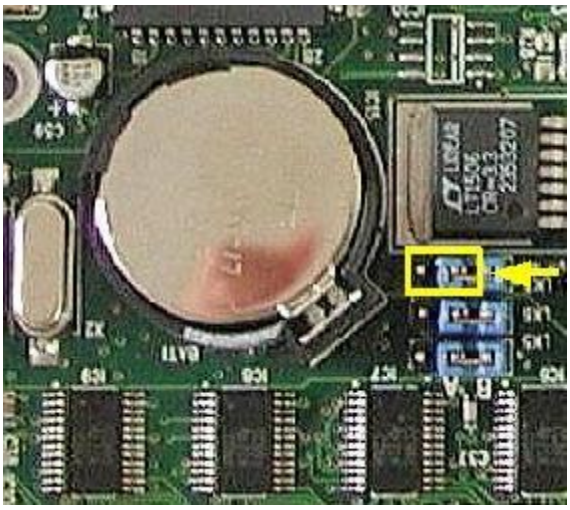
✓ Is a CMOS volatile or non-volatile? _____
✓ Volatile—it requires a _____ to keep the data in the chip.
✓ Holds _____ setup information.
✓ Other information is stored by physically setting jumpers or _____ switches on the board.*

Software

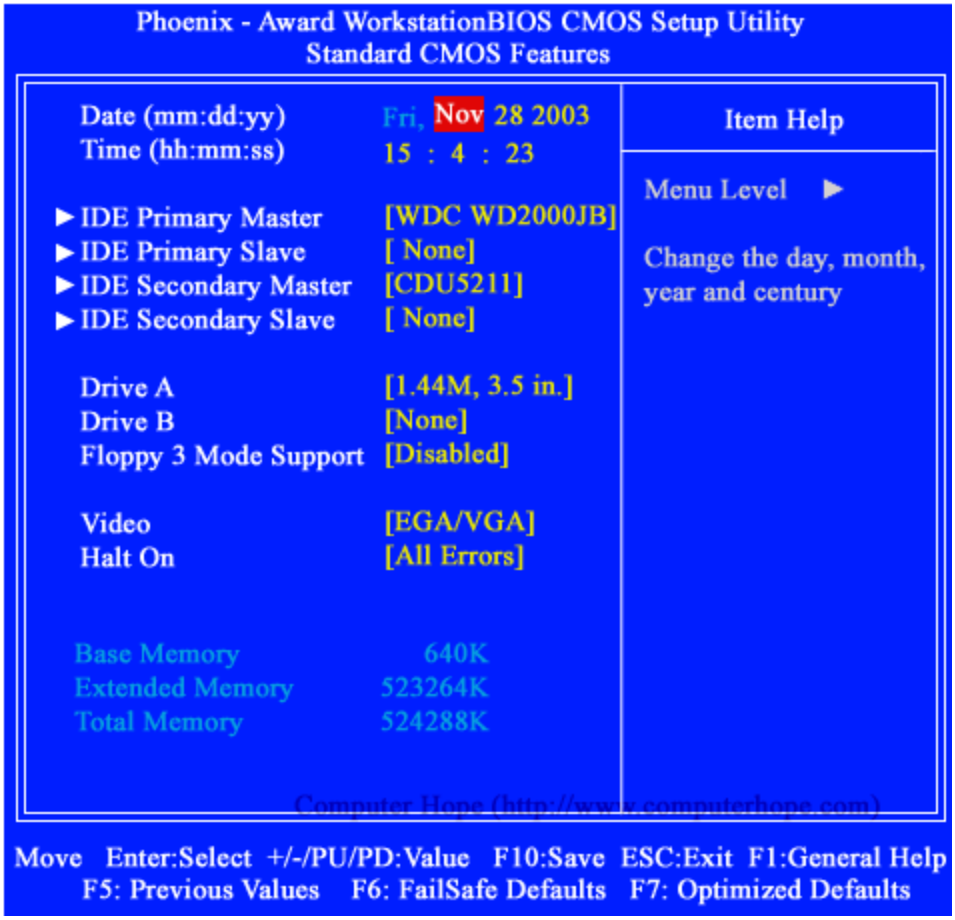
Three types of software

✓ _____ (BIOS)
✓ _____ System
✓ _____
✓ Now we could also add _____ —virtual pc software that you can use to emulate other operating systems on.*

BIOS settings are stored in CMOS



BIOS



Basic Input Output System

- ✓ Starts up the computer and _____ some of the hardware
- ✓ By _____ some HW it frees up the OS to control other stuff.

Review

1. All data and commands travel through the CPU. T/F
2. What are the four major operations of the CPU?
    a. _____
    b. _____
    c. _____
    d. _____
3. This is also known as the mainboard.

4. Hard drives are considered:

5. RAM is considered:

CPU and Chipset

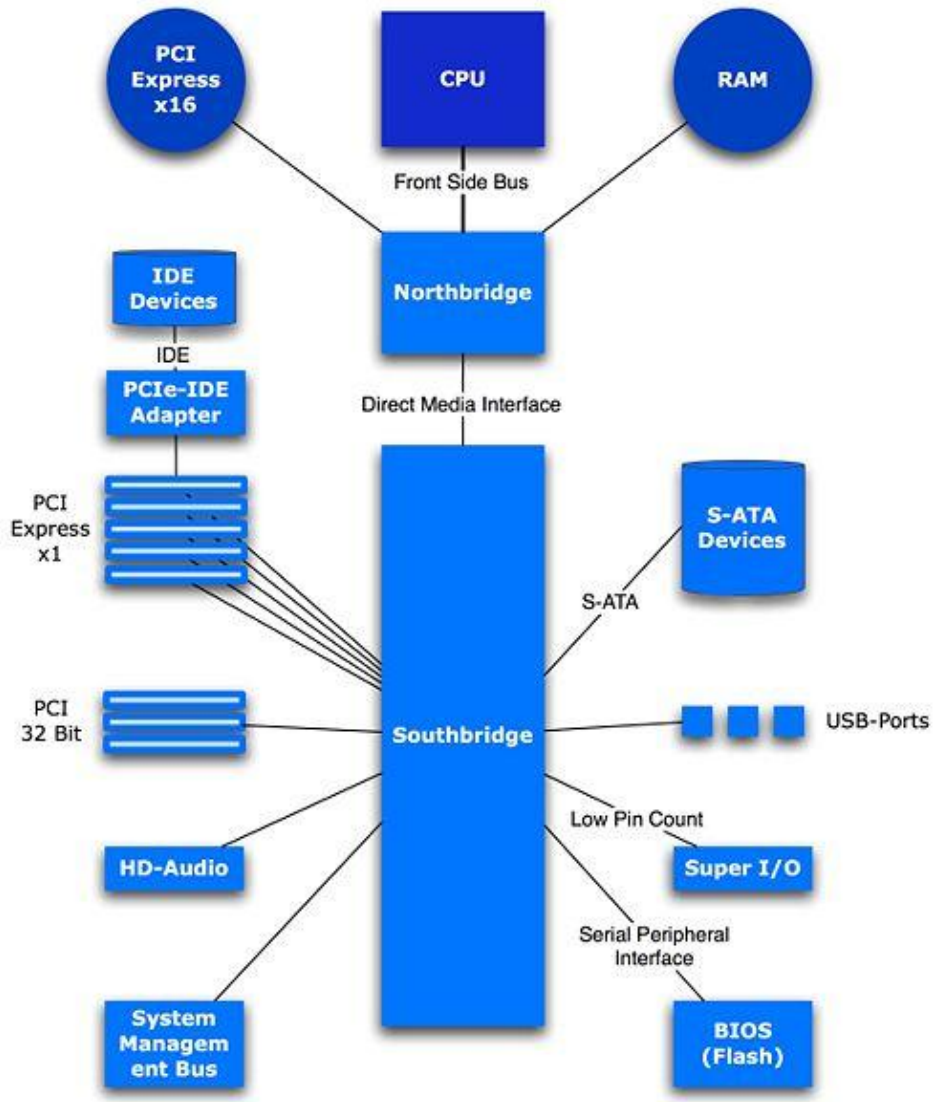
- ✓ The "_____" of the computer
- ✓ The CPU is the _____ Processing Unit
- ✓ Most major _____ takes place on the CPU
- ✓ The _____ is a group of microchips on the motherboard that is responsible for co-processing, including

- _____
- _____
- _____ between CPU and other hardware

✓ Your CPU comes _____ of your motherboard, but your chipset is _____ on.

✓ You CPU must be able to work with a board's _____.

CPU & Chipset



Chipset

- ✓ Northbridge and southbridge are the _____ on the motherboard
- ✓ Northbridge
  - Intel aka _____ controller
  - Handles _____ between CPU and
    - _____
    - _____
    - _____ Express
    - _____

Southbridge

- ✓ Southbridge
- ✓ Aka _____ /_____ controller hub (ICH) or Fusion Controller Hub (FCH) in AMD
- ✓ Handles all I/O functions such as
  - PCI bus. The PCI bus support includes the traditional PCI specification, but may also include support for _____ and _____.
  - _____ bus (legacy)
  - _____ bus. The SPI bus is a simple serial bus mostly used for firmware (e.g., BIOS) flash storage access.
  - _____. The SMBus is used to communicate with other devices on the motherboard (e.g., system temperature sensors, fan controllers).

- ✓ _____ controller--The DMA controller allows devices direct access to main memory without needing help from the CPU.
- ✓ Interrupt controllers--The interrupt controller provides a _____ for attached devices to get attention from the CPU.
- ✓ _____ storage controllers such as PATA and/or SATA
- ✓ _____ -_____ clock. The real time clock provides a persistent time account.
- ✓ Power management (APM and ACPI). The _____ or _____ functions provide methods and signaling to allow the computer to sleep or shut down to save power.
- ✓ _____ BIOS memory. The system CMOS, assisted by battery supplemental power, creates a limited non-volatile storage area for system configuration data.
- ✓ AC'97 or Intel High Definition _____ sound interface.

The CPU

- ✓ Stores _____ in storage devices
- ✓ _____ calculations
- ✓ _____ data
- ✓ _____ results

CPU Comparisons

	AMD	Intel
Power consumption		More efficient (one of Intel's strengths)
Price range (2012)	Lower	
Cooling factor	Tend to heat up under heavy use, but supposed to be improved with Bulldozer Gen2 CPUs	
Performance speed	Generally considered faster under same use due to shorter "pipeline". Same throughput for lower rating.	
Gaming and multimedia		Ivy Bridge is supposed to be faster.
Price to Performance ratio		

How it all works together

✓You _____ click a program icon

- ✓ The program (_____ set) is transferred from the hard _____ to RAM
- ✓ The _____ loads the program from RAM
- ✓ The _____ is processed
- ✓ Depending on the program this keeps _____ over and over again while you're using it.*

Review

1. What are the three components of the full computer system?
   a. _____
   b. _____
   c. _____
2. How does software differ from firmware?

3. What five functions does the computer perform using a combination of hardware and software?
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
4. What is a CPU?

Input/Output Hardware

Input

- ✓ _____
- ✓ _____
- ✓ _____
- ✓ Bar code _____
- ✓ _____ Device
- ✓ Wacom _____
- ✓ _____
- ✓ _____

Output

- ✓ _____
- ✓ _____
- ✓ _____

Types of Storage

- ✓ Primary =_____
- ✓ Secondary=_____ _____

Temporary (Primary) Storage

- ✓ _____ that is volatile.
- ✓ Faster than _____ storage (hard drives, floppies)
- ✓ Includes
  - _____
  - _____ (older, single inline memory modules)
  - _____ (dual inline memory modules
  - _____ (rambus inline memory modules)

- _____ memory
- _____ (cache on a stick)*

✓ Permanent (non-volatile) storage
- _____ drive
- _____ drive (legacy)
- _____ drives (aka jump drives) (1GB-128GB)
- _____ /CDRW
- DVD/_____ *

Storage Devices

✓ Hard Drive
- _____
- _____ State

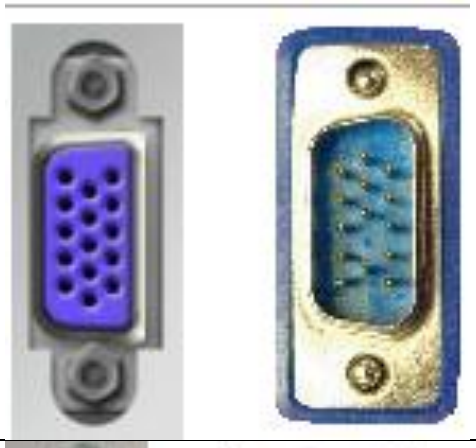
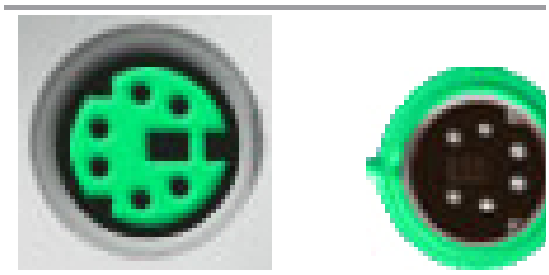
✓ Floppy Drive
✓ _____ Drive
✓ CD
✓ DVD
✓ Blu-Ray
✓ _____ Drive
✓ _____ Cards

Power Supply

✓ _____ system—Power supply connects to the mother board. Components use the power from the _____ *

External Ports (LABEL)

Color (standard) Male or Female	Name(s) of Port and connector	Number of Pins	Picture
			
			
			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			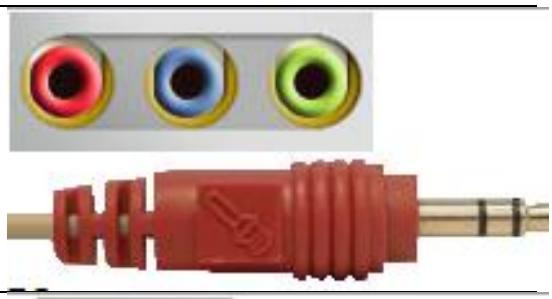
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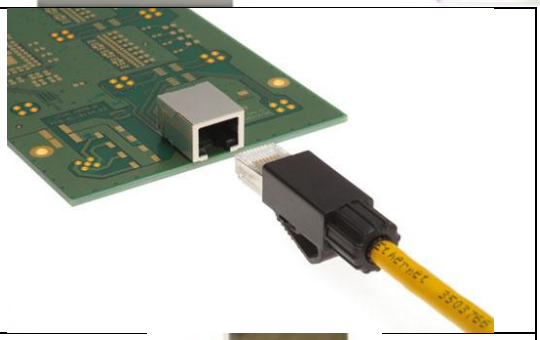
			
			

Lab 2-1 Locate the Power Supply

ACTIVITY

Locate the power supply in your lab computer. Answer the questions below.

Lab should take 20 minutes.

WHAT YOU NEED FOR LAB

1. Computer
2. Power supply

Questions

1. What is the wattage rating of your PSU?	
2. How many molex devices can you add to your PSU?	
3. How many fans can you connect to your PSU?	
4. Is there a floppy connector?	
5. Is there a built in SATA connector?	
6. If you need to replace this power supply, which would you choose and why? (Find one on Tiger Direct or Newegg.	

Lab 2-2 Access the BIOS

ACTIVITY

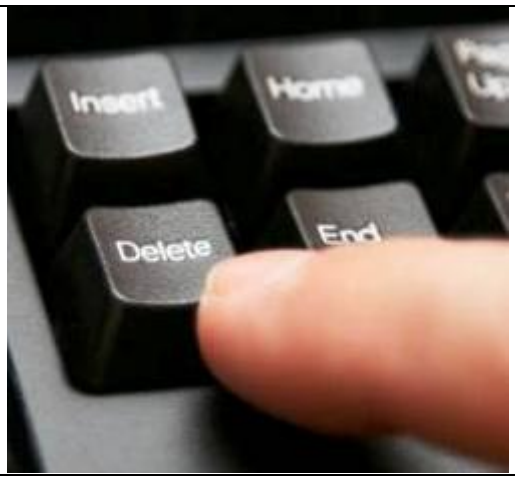
You are going to use your lab computer to access the BIOS and make some changes to the settings.

Lab should take 20 minutes.

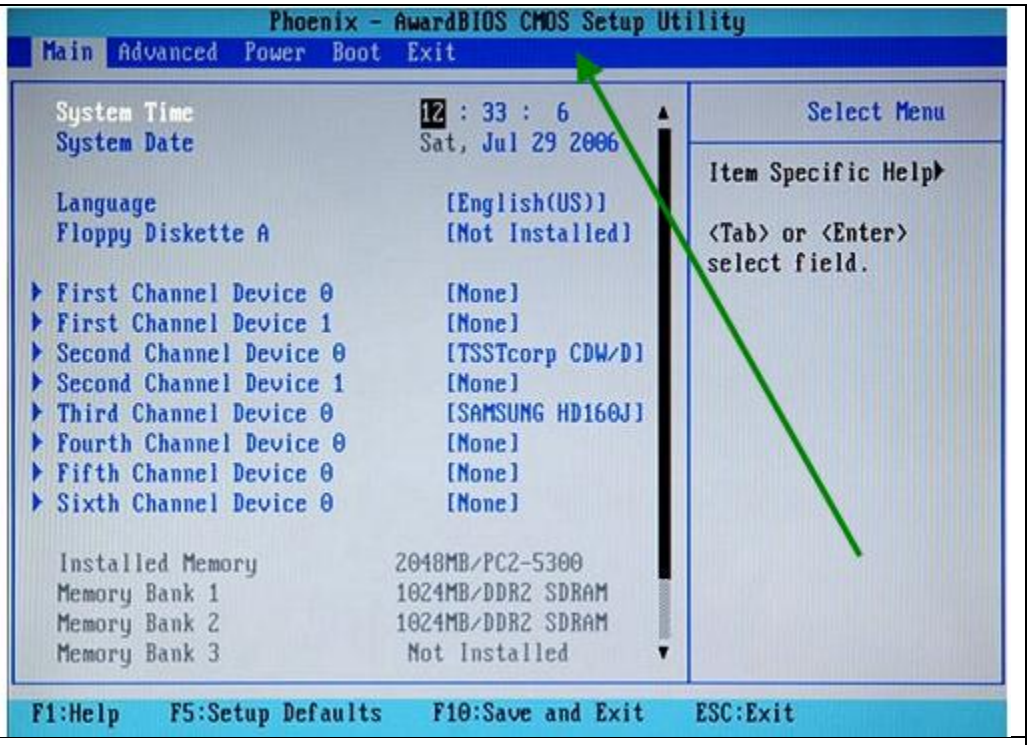
WHAT YOU NEED FOR LAB

1. Computer with internet.

DIRECTIONS

1. Restart your computer and watch the screen to learn which key to hit to access the BIOS or CMOS settings. 2. When you get into the BIOS look around to see what version of BIOS you have.	

3. Now start looking around your BIOS and answer the questions below.



Answer the questions

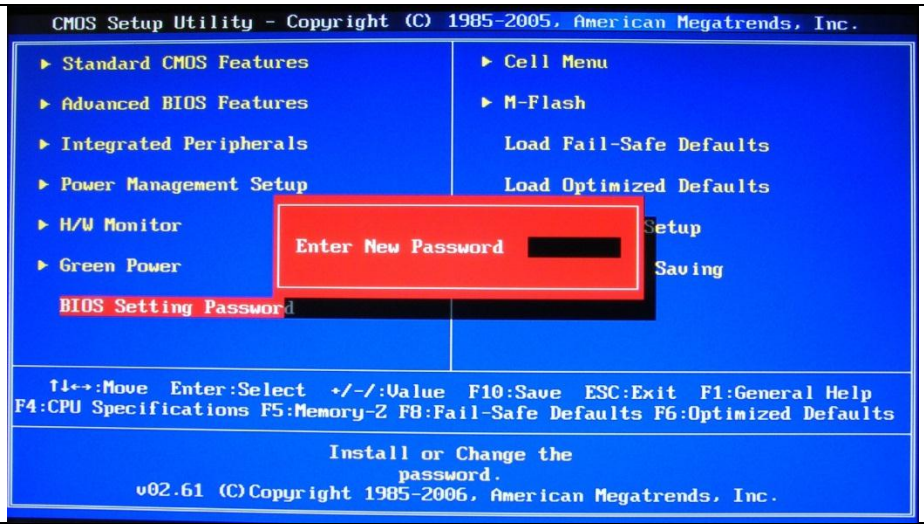
1. What is the frequency of your CPU?

2. What is the boot order sequence of devices?

3. What type of hard drive do you have installed?

4. Where would you set a BIOS password?

5. Does this BIOS allow you to overclock the processor? (Don't understand, look it up!)

4. Work with a neighbor and have him set a BIOS password on YOUR machine and you set one on his or hers. DO NOT TELL HIM OR HER THE PASSWORD!	
5. Using the DMI on the motherboard, which is the identifier on the board that tells you what the board is, look up a manual for this board and learn how to reset the BIOS password.	Don't know how: http://pcnineoneone.com/howto/moboid1/ shows you were to find identifiers on the motherboard.
6. Reset the BIOS password	
7. Restart and log in.	

Lab 2-3 Observing the Boot Process and Hardware Components

1. Reboot your lab computer. Carefully watch your computer screen during the boot process (press Pause if necessary), and record which CPU is used by your home or lab computer. If you do not see anything, hit F2 to get into the BIOS and turn off “Quiet Boot”. (You’ll have to search for it.)

2. Who is the BIOS vendor and what version of the BIOS are you using?

3. As the computer boots, memory is counted. Observe the memory count and record the amount of memory detected. What number system is used to count this memory?

Why do you see differences?

4. Look at the back (or the front if the ports are located there) of your home or lab computer and make a drawing. Label on the drawing the purpose of each port and connection you see. If you are not sure what the purpose of the port is, label the port “unknown port.” In later chapters, the purposes of these unknown ports will become clear.

Lab 2-4 Identifying Ports and Cables

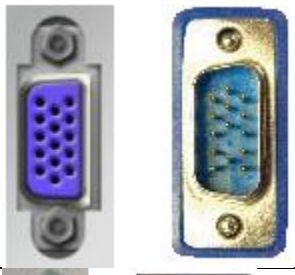
ACTIVITY

Turn your computer around so you can see the ports on the back. You are going to identify the ports on the back. For the ones you do NOT have, look them up online.

WHAT YOU NEED FOR LAB

1. Lab computer
2. Computer with Internet access.

Port	Common Name	Devices that attach	Old/Current Technology
			
			

			
			
			
			
	Pink Blue Green	Pink Blue Green	
		How many wires?	
		How many wires?	
			

		How many pins?	

Lab 2-5 Internal Components

ACTIVITY

Find compatible processors for your motherboard.

Lab should take 20 minutes.

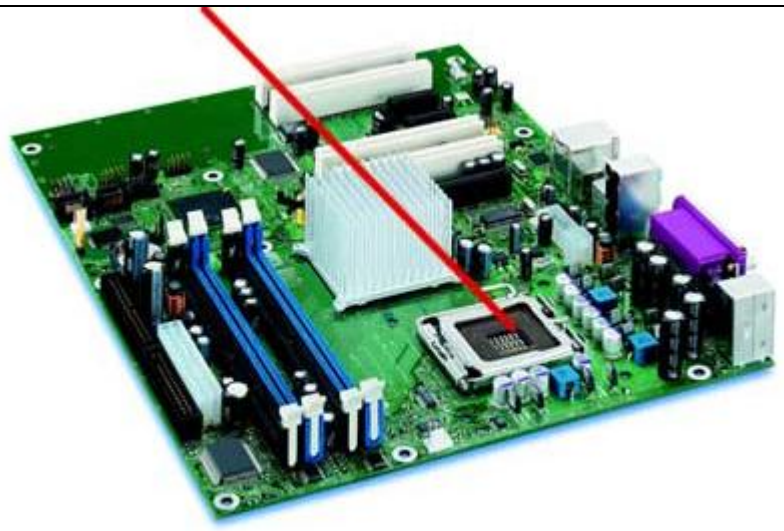
WHAT YOU NEED FOR LAB

1. Lab computer
2. Internet
3. Brains (don't eat them, we are not zombies)

DIRECTIONS

1. Imagine tomorrow you come in and your computer won't start at all. You check all the cables, swap things in and out, and finally determine your CPU died overnight. 2. Determine which motherboard you are using. You should have done that in lab. 3. First you need to figure out what SOCKET TYPE your processor is. Write that down.	What kind of processor is in there now?

4. Go online and find which processors will work with this motherboard.
5. Locate a place to purchase the processors you find (find at least three).



Answer the questions below:

1. What is the brand of motherboard you have?
2. What is the model number?
3. Which processor is in there now?
4. What is the form factor of this processor?
5. Which of the three processors you found is the cheapest?
6. Price?
7. Which of the processors is the fastest?
8. Speed?
9. Say you also wanted to buy RAM for this computer, what kind works with this motherboard?

Draw your processor below and label it.

Lab 2-6 Label the Motherboard

ACTIVITY

1. Turn off and unplug your computer workstation.
2. Check out a set of tools and a grounding strap from your teacher.
3. Attach the grounding strap and ensure your workstation is free of clutter.
4. Open up the computer.

In the space provided on the back/next page, make a *complete* diagram of your lab workstation's system board. In your diagram, label each of the components depicted in Figure 3-1, and describe each component's function. (*See www.howstuffworks.com for information on the components on a motherboard.)*

Label on your motherboard:

1. CPU
2. North bridge
3. South bridge
4. SATA connectors
5. IDE connector
6. Floppy connector
7. RAM
8. Battery
9. Capacitors
10. Resistors
11. PCI slots
12. PCI-e slots
13. AGP (if applicable)
14. AMR (if applicable)
15. P1
16. P4
17. CPU Fan connector
18. System panel connector block

Lab 2-7 Label the Jumper Blocks

Labeling the jumper blocks

Find your manual for your motherboard online and locate the jumper block for your power switch, HDD light, etc. Draw that block and label it below.

Draw your system panel connector jumper block here and label what each one does

Label the following:

a. HDD LED
b. Power LED
c. Power switch
d. Reset Switch
e. Speaker
f. Any other items

Review Questions

Circle True or False.

1. The mouse and keyboard ports are always located directly next to the CPU socket **True / False**
2. AT-style system boards require two power connectors from the power supply. **True / False**
3. Different system boards can use different types of memory. **True / False**
4. Most CPUs are bolted to the system board to prevent them from slipping off and causing the entire PC to crash. True / False

5. Describe the role of a voltage regulator.

6. Compare the role of a chip set to that of the CPU.

Lab 2-8 Diagramming Your Lab Computer

ACTIVITY

Now that you have diagrammed your computer, it's time to take it apart and inventory parts. You're going to get some anti-static bags, your grounding strap, and you're going to take apart your entire computer. Yes, everything comes off. After you write down what everything is (that you can determine), put it ALL back together.

Lab should take 40 minutes. If you do not have 40 minutes, move onto the project and come back to this one.

WHAT YOU NEED FOR LAB

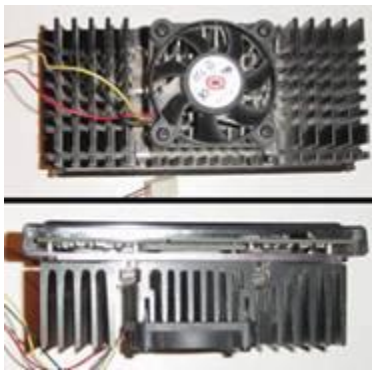
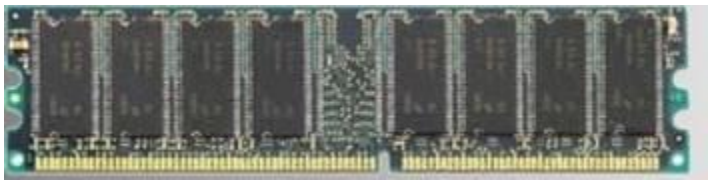
1. Lab computer
2. Toolkit
3. Grounding strap
4. Anti-static bags

DIRECTIONS

1. Get out your tools.
    a. One toolkit
    b. One grounding strap
2. Get your computer
3. Turn it on to ensure it is working. Never mind what OS is on it, we'll be changing that.
4. Shut it down.
5. You're going to inventory the brand and model of each of the following.
    a. Case
    b. Motherboard
    c. RAM
    d. Processor/heatsink
    e. Hard drive
    f. DVD burner
6. Make sure your area is clean.
7. Take out your tools.
8. Connect one end of your grounding strap to an unpainted surface on your computer. Connect the other end to you (your wrist). ***Any time you open your computer, you must be grounded.***
9. Locate the screws on the back of your case. You will unscrew the screws that are *farthest* from the power cord. Remove those screws and set aside. Do not lose them, please.
10. Remove your cover and set it out of your way above you or below, but NOT on the floor.

Label your computer with your name and we will lock them away after each class period.	
Video Card 	**Brand**
	Model
Sound Card	**Brand**

 On this card you can see it is an Abit AU10 sound card.	
	Model
Network Card 	**Brand**
	Model
CD ROM 	**Brand**
	Model
Hard Drive 	**Brand**
	Model

Motherboard 	**Brand** **Model**
Processor  	**Brand** **Model**
Memory (RAM) 	**Brand** **Model**
Other (draw picture)	**Brand** **Model**
Other (draw picture)	**Model**

	Brand

Once you have completed this lab, make sure the computer is running perfectly and go onto your project!

Unit Project

Your company has been hired to build 30 computers for Public School Number Nine. Your job is to:

2. Write a customer overview…description of your client.
3. Determine the needs of your customer.
    b. Current needs
    c. Future needs
4. Define the jargon for the client.
5. Design a student system that will fulfill the needs of students.
6. Design a teacher system that will meet the needs of the teachers.
7. Price out the components of each system.
8. Give a proposal bid for 28 student stations and 2 teacher stations as well as any additional components/peripherals needed. Be sure to include:

    1. All components on each system

        i. Case

        ii. Motherboard

        iii. Processor

        iv. Fans

        v. RAM

        vi. Hard drive

        vii. CD/DVD ROM Burner

        viii. Mouse

        ix. Keyboard

        x. Monitor

    a. Additional hardware needed
    b. Software needed

i. Operating system

ii. Applications

Task One:

- Write a customer overview. Who is your customer?
- Create a list of words that must be defined in order for the customer to understand the proposal (jargon)

Task Two: Develop a list of questions that must be answered before you can begin fulfilling the customer order. When you have developed this list, show it to me and in exchange I will give you the information from the customer.

Task Three: Develop a list of current customer needs.

Task Four: Develop a list of future customer needs.

Task Five: Research components and start "building" the system.

Task Six: Print or draw a picture of the systems you have created.

Task Seven: Create a spreadsheet of complete costs of the entire system

Task Eight: Write up a CLEAR proposal that includes ALL of the tasks above, but written in paragraph form. It should be at LEAST two full pages long, 12 point font (max), double spaced, spelling checked.

Student System

Device	Price	Company	Website
Case			
Power Supply			
CPU speed			
Motherboard			
Processor type			
Installed RAM			
RAM speed and type			
Sound card			
Video card			
Hard Drive			
CD/DVD Burner			
Mouse			
Keyboard			
Modem or network card			
Slots on motherboard			
Power supply			
Floppy drive			
Operating system installed			
Installed software packages			
Other Hardware Needed			

Teacher System

Device	Price	Company	Website
Case			
Power Supply			
CPU speed			
Motherboard			
Processor type			
Installed RAM			
RAM speed and type			
Sound card			
Video card			
Hard Drive			
CD/DVD RW			
Mouse			
Keyboard			
Modem or network card			
Slots on motherboard			
Power supply			
Floppy drive			
Operating system installed			
Installed software packages			
Other Hardware Needed			

2. What is the price difference between the two machines?

2. Why is the one cheaper than the other?

3. How does the student station meet the needs of the students?

4. What are some benefits of buying a pre-assembled system?

5. What are some benefits of building a system yourself?