

Computer Hardware Basics

Computers, Servers, and Networking

Sno Isle Skills Center

Hardware and Software work together

- Hardware is used to:
 - Input data
 - Process data
 - Output data
 - Store data
- Software is used to:
 - Control the hardware
 - Communicate to the user
 - Manage the hardware*

What does a computer “need” to work?

- A method for the processor (CPU) to communicate with the device.
 - The combination of the protocol, the pathway, and the instructions is called a BUS.
- Software to instruct and control the device.
 - We interact with the hardware through software
- Electricity to power the device.
 - No juice, no game

There are only 10 types
of people in the world:
Those who understand binary
and those who don't.

What is a computer?

- A computer is a collection of hardware that is supported by software.
- Hardware-Physical components that you can see, feel, touch, and throw at your brother.
- Software-A set of instructions that make the hardware “do stuff”
- Firmware—Software that is semi-permanent and lives on a chip inside the computer.*

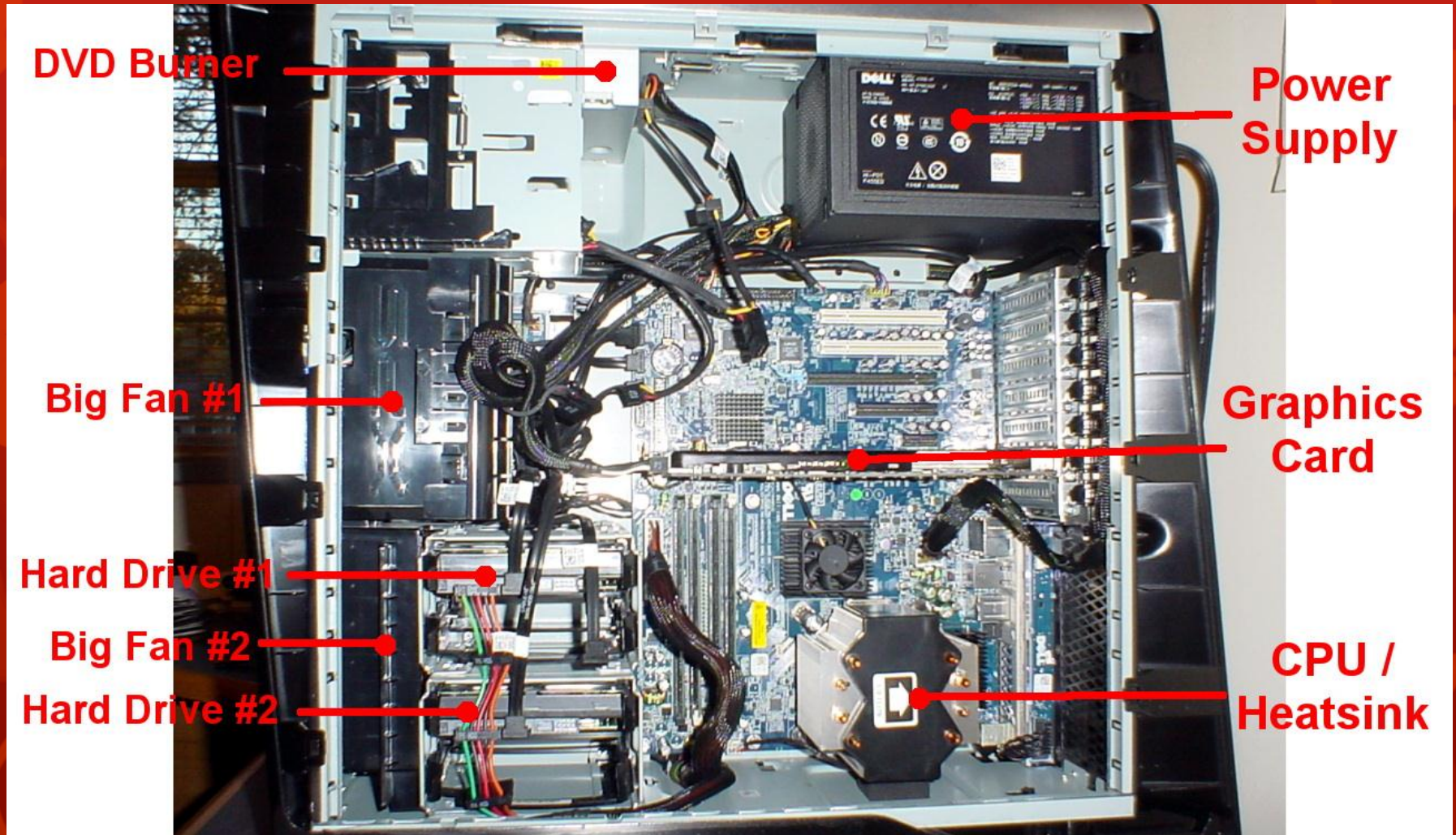
Major Hardware Components

- CPU
- Hard Drive
 - SSD
 - HDD
 - SATA
 - PATA
 - SCSI
- Optical Drive
 - CD/DVD
 - Bluray
- Monitor
- Input device
 - Mouse
 - Keyboard
 - Stylus
 - Finger
 - Eyes
- Power Supply
- Floppy drive (not much any more)
- RAM
- Motherboard
- Chipset
- Expansion cards
 - Network
 - Video
 - Joystick
 - Etc.
- Cables*

Hardware Inside Computer

- System board
- Floppy (maybe), hard drive, CD/DVD ROM
- Power Supply
- Circuit Boards (expansion cards)
- Cables*

Computer Guts



System Board

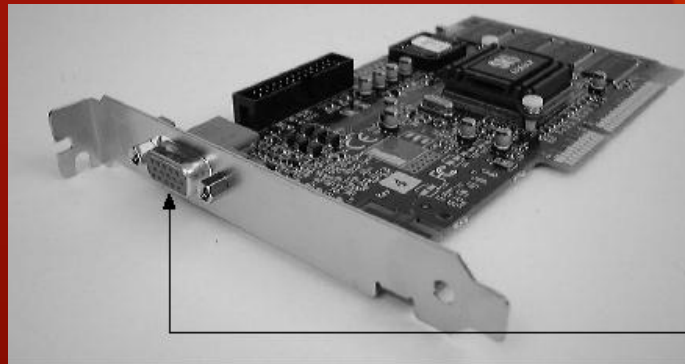
- Aka Mainboard, motherboard
- Contains
 - CPU
 - Chip set
 - RAM
 - CMOS and CMOS Battery
 - BIOS chip
 - Connections
 - Expansion slots*

System Board Components

- Traces—the tiny fine lines you see on the motherboard. Enable data and power to travel along the board.
- BUS—Pathway of communication that includes the method and the protocol used to communicate.
- Binary 1s and 0s travel down the lines of a bus.*

System Board Comp. Cont

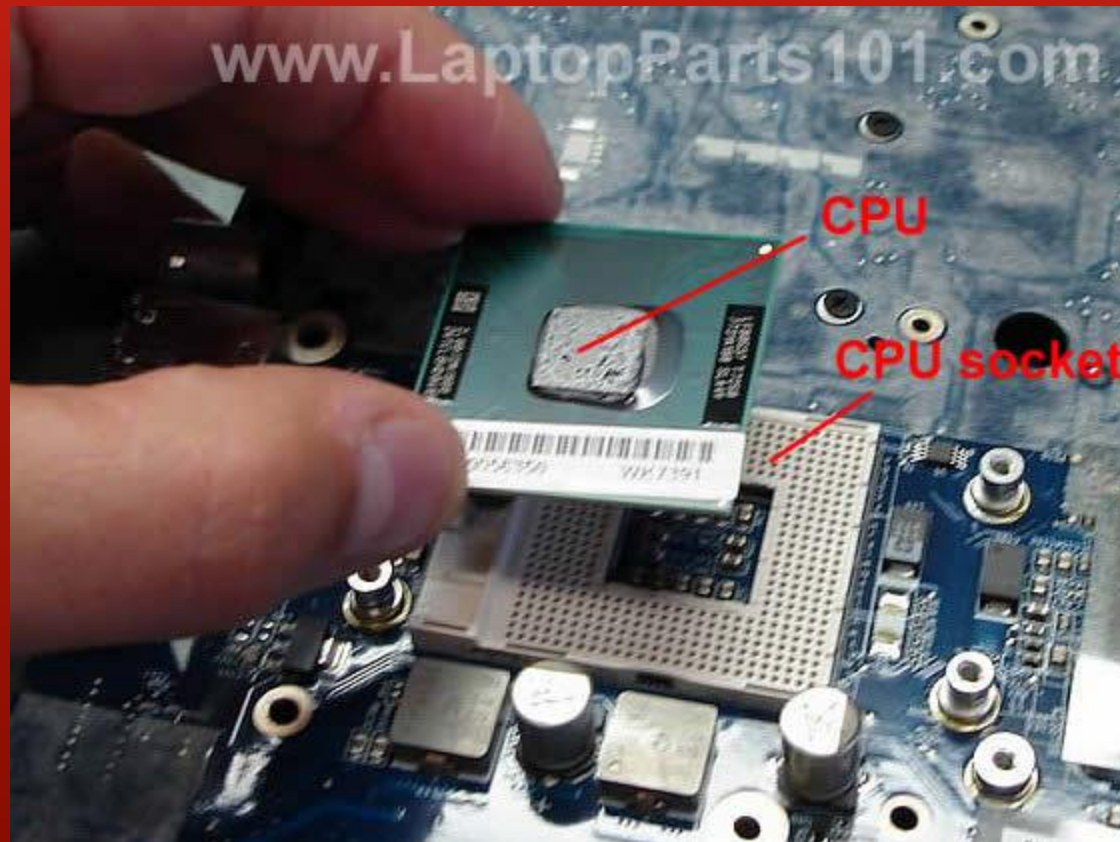
- System Clock—A crystal that times activities of chips. Makes sure things happen at the right time.
- Expansion slots—Holds expansion cards such as modems, video cards, etc.



CPU

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

CPU



Data Stored on System Board

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

Updating Firmware

- Flashing the BIOS
- Can only flash FLASH ROM
 - EEPROM (Electrically Erasable Programmable Read Only Memory)
 - EPROM (Erasable Programmable Read Only Memory)
- Must use ONLY a flash program for your particular BIOS version or bad things happen.

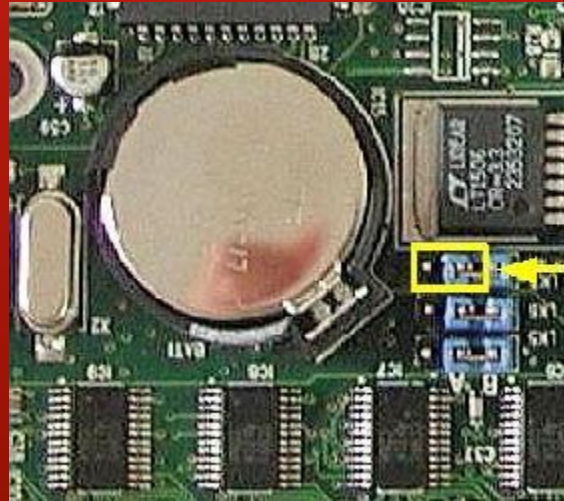
Software

- Three types of software
 - Firmware (BIOS)
 - Operating System
 - Applications
- Now we could also add VMWare—virtual pc software that you can use to emulate other operating systems on.*

CMOS (complementary metal oxide semi-conductor)

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

CMOS battery and jumper



BIOS settings are stored in CMOS

Phoenix - Award WorkstationBIOS CMOS Setup Utility
Standard CMOS Features

		Item Help
Date (mm:dd:yy)	Fri, Nov 28 2003	
Time (hh:mm:ss)	15 : 4 : 23	
▶ IDE Primary Master	[WDC WD2000JB]	Menu Level ▶
▶ IDE Primary Slave	[None]	
▶ IDE Secondary Master	[CDU5211]	Change the day, month, year and century
▶ IDE Secondary Slave	[None]	
Drive A	[1.44M, 3.5 in.]	
Drive B	[None]	
Floppy 3 Mode Support	[Disabled]	
Video	[EGA/VGA]	
Halt On	[All Errors]	
Base Memory	640K	
Extended Memory	523264K	
Total Memory	524288K	

Computer Hope (<http://www.computerhope.com>)

Move Enter:Select +/-/PU/PD:Value F10:Save ESC:Exit F1:General Help
F5: Previous Values F6: FailSafe Defaults F7: Optimized Defaults

BIOS

- Basic Input Output System
- Starts up the computer and controls some of the hardware
- By controlling some HW it frees up the OS to control other stuff.

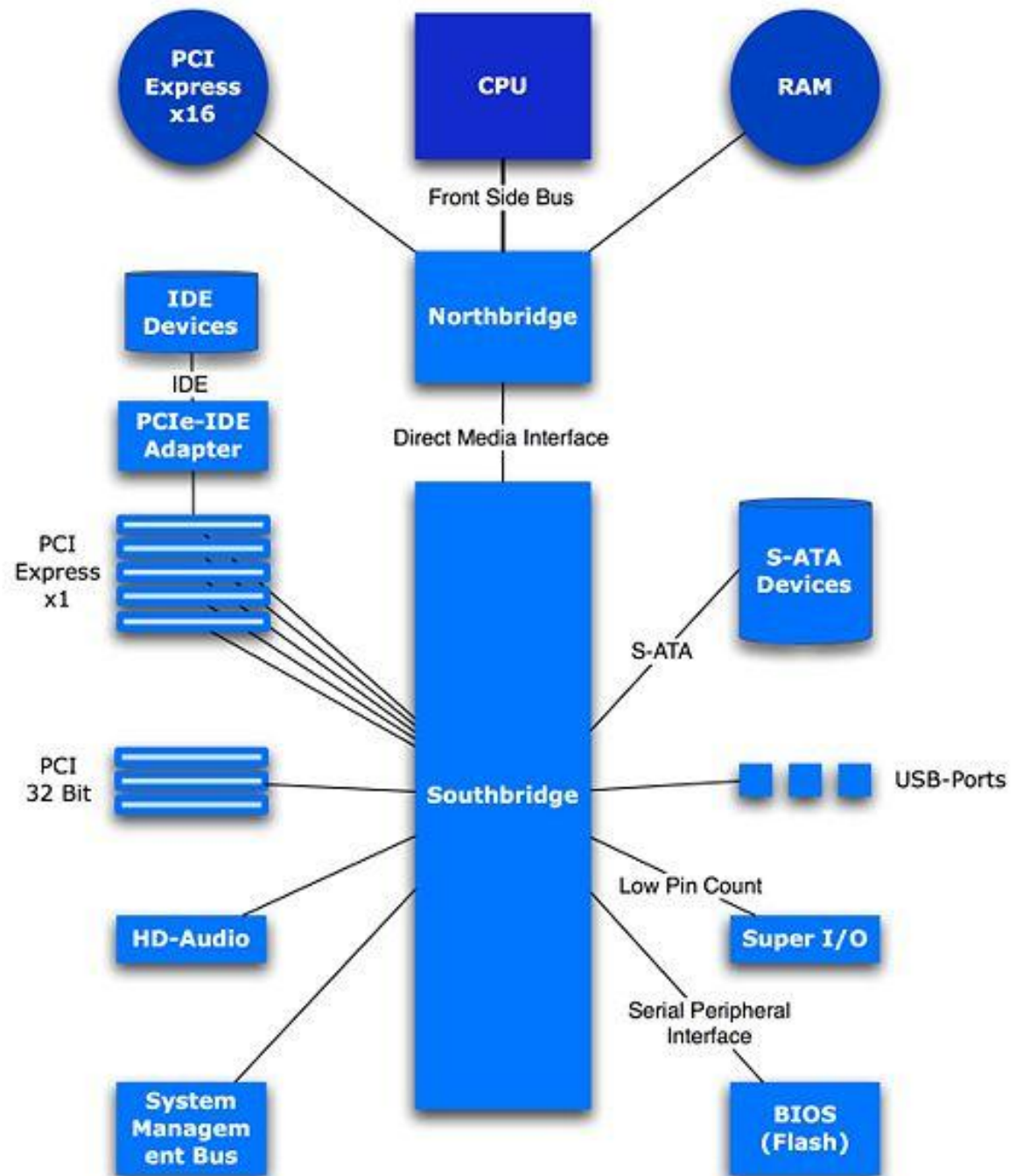
Review Three

- All data and commands travel through the CPU.
- What are the four major operations of the CPU?
- This is also known as the mainboard.
- Hard drives are considered:
- RAM is considered:

CPU and Chipset

- The “brains” of the computer
- The CPU is the Central Processing Unit
- Most major processing takes place on the CPU
- The Chipset is a group of microchips on the motherboard that is responsible for co-processing, including
 - Timing
 - Coordination
 - Communication between CPU and other hardware
- Your CPU comes separate of your motherboard, but your chipset is soldered on.
- You CPU must be able to work with a board’s chipset.

CPU & Chipset



Chipset

- Northbridge and southbridge are the chipset on the motherboard
- Northbridge
 - Intel aka memory controller
 - Handles communication between CPU and
 - RAM
 - AGP
 - PCI Express
 - Southbridge

Southbridge

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

Southbridge cont

- **DMA controller**--The DMA controller allows devices direct access to main memory without needing help from the CPU.
- **Interrupt controllers**--The interrupt controller provides a mechanism for attached devices to get attention from the CPU.
- **Mass storage controllers** such as PATA and/or SATA
- **Real-time clock.** The real time clock provides a persistent time account.
- **Power management** (APM and ACPI). The APM or ACPI functions provide methods and signaling to allow the computer to sleep or shut down to save power.
- **Nonvolatile 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 Audio sound interface.

The CPU



- Stores data in storage devices
- Performs calculations
- Processes data
- Outputs results

CPU Comparisons

	AMD	Intel
Power consumption	Less efficient	More efficient (one of Intel's strengths)
Price range (2012)	Lower	Higher
Cooling factor	Tend to heat up under heavy use, but supposed to be improved with Bulldozer Gen2 CPUs	Tends to run cooler, longer
Performance speed	Generally considered faster under same use due to shorter "pipeline". Same throughput for lower rating.	Really edging forward with Ivy Bridge processors
Gaming and multimedia	Clocking is faster, so multimedia output is faster	Ivy Bridge is supposed to be faster.
Price to Performance ratio	Low:High	High:High

How it all works together

- You double click a program icon
- The program (instruction set) is transferred from the hard disk to RAM
- The CPU loads the program from RAM
- The data is processed
- Depending on the program this keeps happening over and over again while you're using it.*

Review

- What are the three components of the full computer system?
- How does software differ from firmware?
- What five functions does the computer perform using a combination of hardware and software?
- What is a CPU?

Input/Output Hardware

- Input
 - Keyboard
 - Mouse
 - Scanner
 - Bar code reader
 - Bluetooth Device
 - Wacom Tablet
 - Finger
 - Eyeball
- Output
 - Printer
 - Monitor
 - Audio

Input/Output devices generally connect to the printer through ports usually found on the back of the case.

Types of Storage

- Primary
 - Temporary
- Secondary
 - Semi-permanent

Temporary (Primary) Storage

- Storage that is volatile.
- Faster than permanent storage (hard drives, floppies)
- Includes
 - RAM
 - SIMMs (older, single inline memory modules)
 - DIMMs (dual inline memory modules)
 - RIMMs (rambus inline memory modules)
 - Cache memory
 - COAST (cache on a stick)*

Permanent (secondary) Storage

- Permanent (non-volatile) storage
- Hard drive
- Floppy drive (legacy)
- Pen drives (aka jump drives) (1GB-128GB)
- CDR/CDRW
- DVD/BluRay*

Storage Devices

- Hard Drive
 - Regular
 - Solid State
- Floppy Drive
- Optical Drive
 - CD
 - DVD
 - Blu-Ray
- Flash Drive
- SD Cards



Power Supply

- Electrical system—Power supply connects to the mother board. Components use the power from the PSU*



External Ports

- PS/2
 - Mouse (old)
 - Keyboard (old)
- USB
- Parallel
 - Printer (old)
- Video
 - VGA
 - DVI
 - HDMI
- Sound
- E-SATA
- Serial
- Firewire
- Network
 - RJ45
- Modem
 - RJ11
- Thunderbolt

What is this?



Serial Port

What is this?



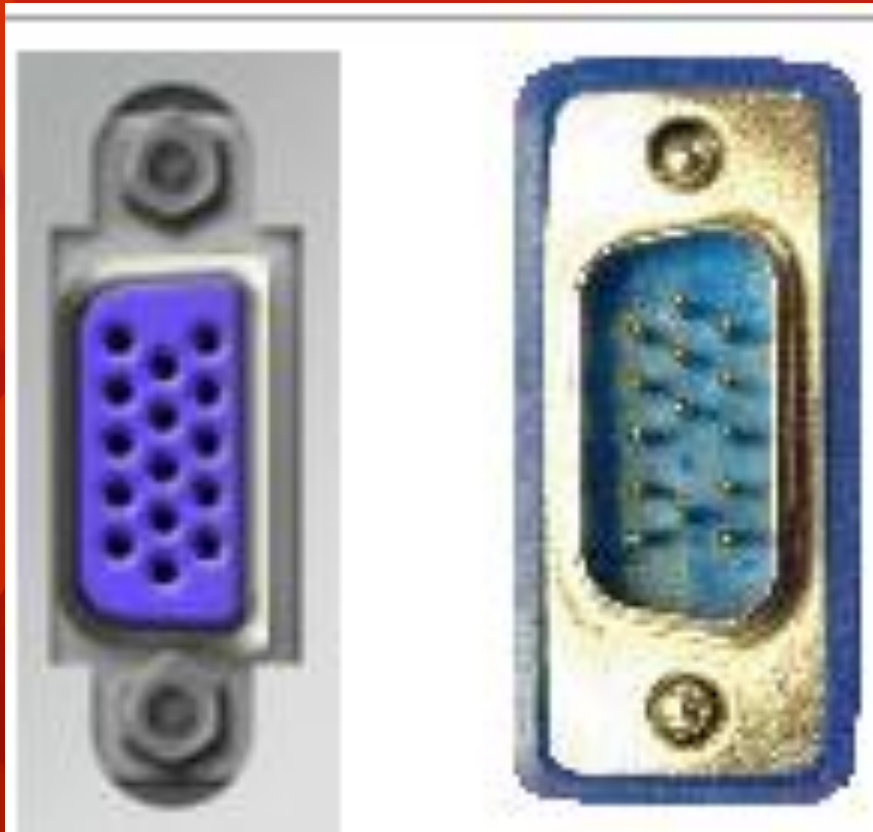
○ Parallel Port

What is this?



○ Joystick
Port

What is this?



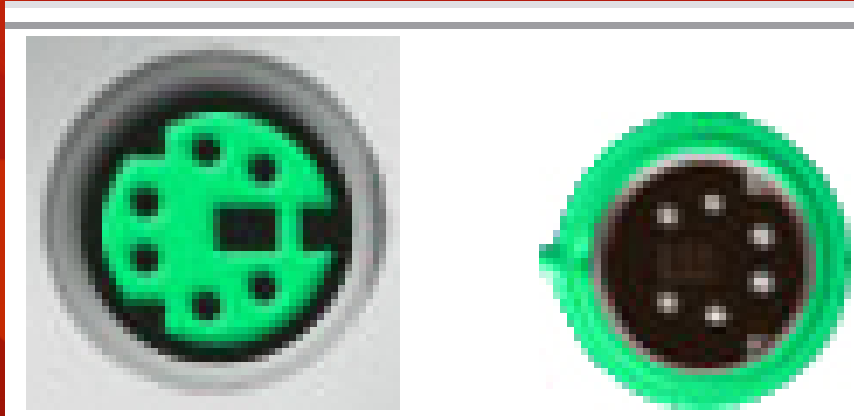
○ VGA

What is this?



○ DVI

What is this?



○ PS/2

○ Keyboard
or mouse?

What is this?



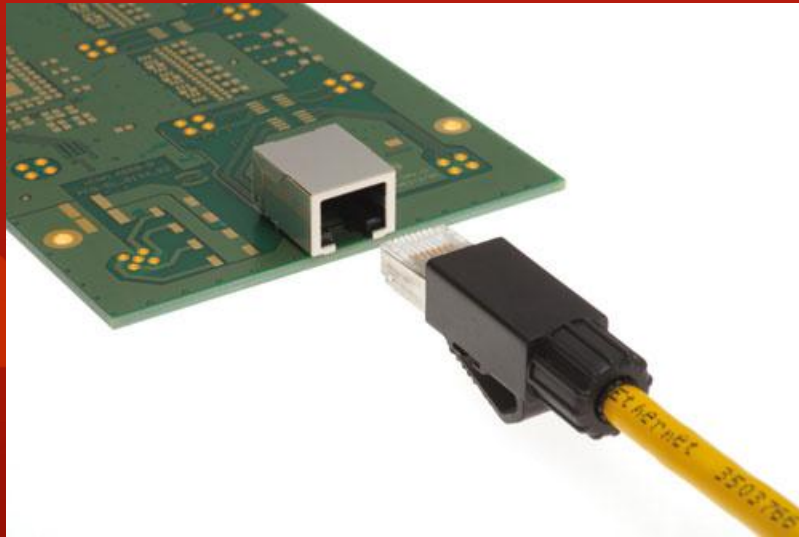
- Audio
 - Red
 - Blue
 - Green

What is this?



- RJ11
- AKA:
- How many wires:

What is this?



- RJ45

- AKA:

- How many wires:



this?

○ USB A

What is this?



○ IEEE/1394

○ AKA

What is this?



○ Thunderbolt
port