

Tech Training: Computer Components

Hardware forms the foundation of any technology device. Adding an Operating System allows the user to interact with the hardware. Installing Applications gives the user tools with which to create documents. Basic computer components include:

- Power supply
- Motherboard
- BIOS
- Processor
- Memory (RAM)
- Storage (optical and magnetic)
- Audio sub-system
- Video sub-system
- Operating System

Power Supply

Electrical power at the wall plate is 120 volts AC (alternating current). This amount of power, necessary for running air conditioners and refrigerators, would damage delicate computer hardware. The power supply converts 120 volts down to 12, 5, and 3.3 volts necessary for various computer components. It also converts AC to DC (direct current used in batteries).

Power supplies provide power to the motherboard, fans, and drives via various connectors.



Motherboard

The main circuit board provides an anchor/connection mechanism for the various hardware components necessary for a computer to operate. This includes internal components like RAM, video card, and processor as well as external components like keyboard, mouse, and printer. Using traces cut into the board, the motherboard also provides a discrete route for electric current to move from component to component.



More info:

- Intro: <https://www.youtube.com/watch?v=nQIB5qcl3R8>
- Printed Circuit Boards: <https://www.youtube.com/watch?v=H9pGbLJknDk>
- Chipset: <https://www.youtube.com/watch?v=8gfA3H5XTAE>

BIOS

The Basic Input Output System is programming stored in the CMOS (complementary metal-oxide semiconductor) chip which assists the processor in locating the hardware components it needs for the computer to operate. The CMOS chip is powered by a small battery. After finding all hardware, the last instruction in BIOS is to locate and load an Operating System.

More info:

- Intro: <https://www.youtube.com/watch?v=zIYkol851dU>



Heat Sink

Electrons flowing through metal create heat. Chips on a motherboard create heat; large chips more heat than smaller chips. Mounting a heat sink on top of a chip facilitates the transfer of heat from the chip into the air.

More info:

- Heatsinks: <https://www.youtube.com/watch?v=tX2VKEesUiE>
- CPU Cooling: <https://www.youtube.com/watch?v=7vG16oN-kys>



Processor

The Central Processing Unit is the brain of the computer. It performs calculations and sends instructions to the other hardware components. Processors use power and generate heat. They are protected from overheating by mounting a Heat Sink to the face of the processor. Thermal Compound assists in heat transfer. A fan is then added to facilitate air movement.

More info:

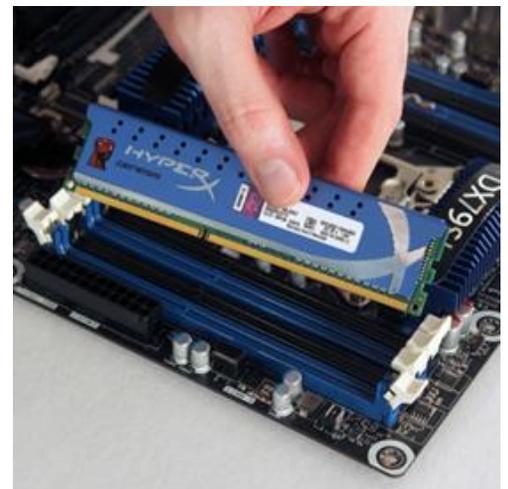
- i3, i5, i7: <https://www.youtube.com/watch?v=GLSPub4ydiM>
- Multiple Core: <https://www.youtube.com/watch?v=S3I5WNHbnJ0>

Memory

Random Access Memory (RAM) allows the processor temporarily store data used in the multitude of calculations required to operate a computer. RAM sticks mount into RAM Slots and pass current via gold contacts. Data stored in RAM expires when the computer is powered down.

More info:

<http://4040.taylor.edu/tutorials/techtraining/videos/ramintro.mp4>



Storage

Data that must be stored permanently (documents, OS and program files, etc.) are written to optical and/or magnetic storage devices.

Optical drives (CD, DVD, Blu-Ray) burn 1s and 0s into the face of the disk. Magnetic drives (hard disks) detect and store polarity (plus or minus) and convert them to 1s and 0s. Data stored on a drive is permanent.

More info:

- Intro: <http://4040.taylor.edu/tutorials/techtraining/videos/harddiskintro.mp4>
- SSD: <https://www.youtube.com/watch?v=YQEjGKYXiw8>
- Deleted Files: <https://www.youtube.com/watch?v=T87iyGiXb7o>
- DVD Disk: <https://www.youtube.com/watch?v=xCAuE7Gg-Bs>

Audio

Audio is handled by a dedicated audio chip on the motherboard or an expansion card. The chip is connected to the audio input/output jacks on the back of the computer. The image shows an audio input/output assembly prior to installation on the motherboard.

When connecting audio, generally:

- Red = microphone input (mono)
- Green = front speaker output (stereo)
- Blue = line in input (mono)
- Orange = subwoofer output (mono)
- Black = rear speaker output (stereo)
- Grey = side speaker output (stereo)



Video

Video is handled by a dedicated video chip on the motherboard or an expansion card. Some video cards can drive multiple monitors. Video card can generate excessive amounts of heat requiring a heat sink, and often, a fan.

The large image shows a dedicated video expansion card with the following connectors:

- VGA (blue)
- HDMI (black)
- DVI (white)



HP computers use their proprietary DisplayPort connection (small image) and is common at Taylor. The clipped corner helps distinguish it from HDMI.

More info:

- GPUs: <https://www.youtube.com/watch?v=1kypaBjJ-pg>
- Connections: <https://www.youtube.com/watch?v=f38sotYHqtA>
- LCD Monitor: <https://www.youtube.com/watch?v=jiejNAUwcQ8&list=PLA33BC8305BA0F871>

Networking

- TPC/IP: https://www.youtube.com/watch?v=PpsEaqJV_A0
- Internet Infrastructure: <https://www.youtube.com/watch?v=n71TUnTNdw8>

Operating System

An Operating System is a collection of files which include all the programming required to control hardware, launch programs, save documents, etc. It is the OS which allows a user to move a mouse and see the pointer move on the monitor. It also detects mouse clicks and keyboard strokes.

Drivers for each piece of hardware must be installed and available to the operating system. Drivers act as interpreters allowing the OS to communicate with the hardware.

More info:

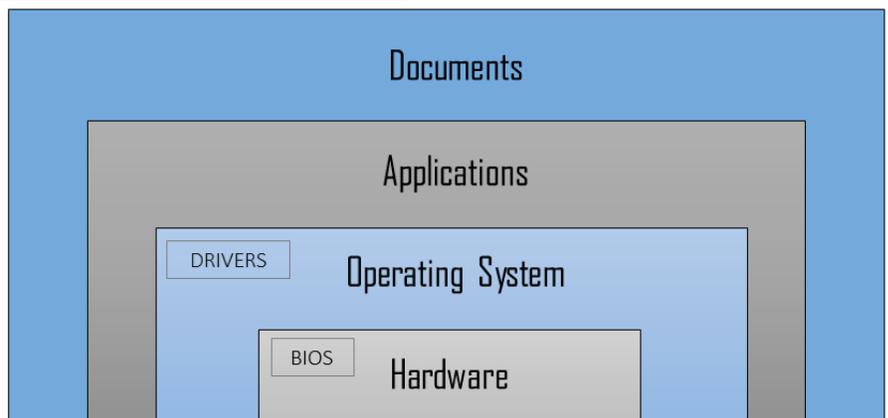
- What is an OS: <https://www.youtube.com/watch?v=pVzRTmdd9j0>
- Windows Registry: <https://www.youtube.com/watch?v=E6ROLfd8RFo>
- Anti-Malware: https://www.youtube.com/watch?v=67-5bzc_GKE

Boot Up Process

Hardware forms the foundation. Once powered on, the processor reads instructions from the BIOS chip which helps it locate the hardware it will use. The last BIOS instruction tells the processor where to search for an operating system (usually, a hard disk)

The hard disk sends to the processor the system files (programming or code)

necessary to run the operating system. The processor stores code in RAM for the duration of the session. Loading an operating system on top of the hardware, with applicable drivers, allows the user to interact with and control the hardware.



Installing and launching an application on top of the OS opens a blank window used to display, create, and edit documents. Creating documents on top of the application completes the process and allows the user to permanently store, share, email, and print information.

A word about User Profiles and Policies

User profiles contain the documents and settings for each user. This includes printers. Profiles are managed by the OS and stored on the local hard disk. This is generally true of personally-owned as well as Taylor-owned computers, although faculty/staff documents on Taylor-owned computers are located on an IT server (Document Redirection is an advanced topic).

Manually installing printers for every client logging into TLC computers would be time consuming and inconvenient. For this reason, IT assigns an Active Directory Policy to all TLC computers covering the installation of TLC printers. On log in, the computer checks in with AD which verifies the client's credentials/permissions, approves log on, and then sends an instruction to install TLC printers (currently TLCPrinter1C and TLC3).

Occasionally, printer installation fails, and TLC printers do not appear as a print option. A log off/on would re-run the Policy and might solve the problem, but manually adding printers for the client is usually quicker and more convenient.