

COMPUTER BOOTING

For the computer to run it needs an OS, because the OS is the software that manages all the activities and devices attached to the computer. However, when the computer is off, the OS is not running, and is simply stored on the hard disk inside the computer. Therefore when a user presses the power button when the computer is off, the OS cannot get itself out of the hard drive since it is off. So how does the computer start up without the OS?

DEFINITION OF BOOTING

Booting is defined as the process of starting up a computer. Booting is also the process of loading the operating system (OS) from disk into working memory. Booting (also known as booting up) is the initial set of operations that a computer system performs when electrical power is switched on. The process begins when a computer that has been turned off is re-energized, and ends when the computer is ready to perform its normal operations.

Steps involved in the booting process

1. The power supply sends a signal to the components in the system unit.
2. The processor finds the ROM chip(s) that contain the BIOS (Basic input/output system).
3. The BIOS performs the POST (Power-On Self Test) which checks components such as the mouse, keyboard and adapter cards. A series of messages may display.
4. The results of the POST are compared with data in a CMOS chip.
5. The BIOS looks for system files on the Hard disk (C :)
6. The system files and the kernel of the Operating System load into RAM from the Hard Disk.
7. The OS loads configuration information and displays the welcome screen.
8. On start up, the OS may verify that the person attempting to use the computer is a legitimate user through use of a password.
9. After the user logs on, the desktop and icons are displayed on the screen.
10. Finally, the operating system also executes programs in the Startup folder, which contains a list of programs that open automatically when you boot the computer.

Power-On Self-Test (POST)

What does Power-On Self-Test (POST) mean?

A power-on self-test (POST) is a succession of built-in diagnostic tests performed when turning on a computer. This series of tests determines proper functioning of the following:

- 1) Random access memory (RAM)
- 2) Disk drives
- 3) Hard drives
- 4) Central processing unit (CPU)
- 5) All other hardware devices

How is POST executed?

- 1) The POST is run by a computer's basic input/output system (BIOS).
- 2) The initial tests, include reading configuration information stored in the **complementary metal-oxide-semiconductor (CMOS) chip**.
- 3) This information is then compared to hardware devices, such as the CPU, hard drive, disc drives and video card. Then, ROM BIOS assigns system resources as needed. These set up the environment required by the operating system (OS).

Basic Input/Output System (BIOS)

What does BIOS mean?

BIOS (basic input/output system) is the program a computer's microprocessor uses to get the computer system started after you turn it on. It also manages data flow between the computer's operating system and attached devices such as the hard disk, video adapter, keyboard, mouse, and printer.

BIOS is a program that is made accessible to the microprocessor on an erasable programmable read-only memory (**EPROM**) chip. When you turn on your computer, the microprocessor passes control to the BIOS program, which is always located at the same place on EPROM.

When BIOS boots up (starts up) your computer, it first determines whether all of the attachments are in place and operational and then it loads the operating system (or key parts of it) into your computer's random access memory (RAM) from your hard disk or diskette drive.

The four main functions of a Personal Computer's BIOS are:

- 1) **POST** - Test the computer hardware and make sure no errors exist before loading the operating system.
- 2) **Bootstrap Loader** - Locate the operating system. If a capable operating system is located, the BIOS will pass control to it.
- 3) **BIOS drivers** - Low level drivers that give the computer basic operational control over your computer's hardware.
- 4) **BIOS or CMOS Setup** - Configuration program that allows you to configure hardware settings including system settings such as computer passwords, time, and date.

CMOS

What is CMOS?

Complementary metal-oxide semiconductor, or CMOS, refers to a battery-powered memory chip in your computer that stores start-up information. Your computer's basic input/output system (BIOS) uses this information when starting your computer.

Information stored in CMOS may include:

- 1) Amount of memory,
- 2) types of disk drives,
- 3) keyboard, monitor,
- 4) current date and time
- 5) Port settings (parallel and serial)

What is the difference between BIOS and CMOS?

1) The BIOS is a computer chip on the motherboard. This chip contains a special program that helps the computer processor interact and control the other components in the computer.	1) The CMOS is also a computer chip on the motherboard. This is a type of memory chip which stores information about the computer components, as well as settings for those components.
2) These other components include disc drives, video cards, sound cards, network cards, floppy drives, USB ports, hard drives, and others.	2) In order to retain the information in the CMOS chip, a CMOS battery on the motherboard supplies constant power to that CMOS chip.
	3) If the battery is removed from the

<p>3) Without the BIOS, the processor would not know how to interact or interface with the computer components, and the computer would not be able to function.</p>	<p>motherboard or runs out of juice (e.g. a dead CMOS battery), the CMOS would lose the information stored in it.</p>
<p>4) The BIOS program on the BIOS chip reads information from the CMOS chip when the computer is starting up, during the boot up process.</p>	

SYSTEM SPECIFICATIONS:

What is a System Specification?

The term System (computer) specification or ‘spec’ is a list of the key components that make up the computer. It is provided by retailers to help buyers decide which PC and which combination of features, they need.

When reviewing a computer specification, the most important components to take account of are the **processor**, the amount of **RAM** and the size of the **hard drive** as these are central to the overall capability of the system. An example of a System of Personal Computer Specification is listed below.

- Intel or AMD Processor
- 2 GB SDRAM
- 160GB Hard Drive
- 48X Max CD/DVD Drive
- 17” Flat Screen Colour Monitor
- Integrated Graphics Card
- Microsoft Windows XP Pro

Detailed Explanations on Specifications:

Processors

The processor is the ‘brain’ of the computer and controls most of the work done. Two companies –Intel Incorporation and AMD Incorporation – manufacture most of today’s PC Processors and both offer a range that balances price and performance. Processors are generally defined by their speed – in megahertz (MHz) or in gigahertz (GHZ) – and this relates to the number of operations they can perform per second. The higher the value, the faster the PC will perform and the more expensive it generally is.

Memory (RAM)

The main working memory in a computer is called random access memory or RAM. The processor uses this memory to run programs. RAM is measured in megabytes (MB) or gigabytes (GB). Most modern computers use DDR3 RAM.

- A minimum of 2024MB (2GB) of RAM is recommended for general purpose PCs and is also sufficient for PCs running multimedia applications i.e. those on which digital music, digital video or high-end graphics are being created or edited.

Storage – The Hard Drive

The hard drive is a central storage area for the programs being run and the documents or folders created. The hard drive is the computer's primary storage area. It stores the applications and programs that run on the PC, as well as any work created by users. From a school's perspective, the capacity of the hard drive, measured in gigabytes (GB) is a key criterion and should be given due consideration when reviewing PC specifications.

- A hard drive capacity of at least 80GB is recommended for general purpose PCs.
- A hard drive capacity of 200GB or more is recommended if working with multimedia applications where large graphics and digital audio/video files are being created and stored.

Monitors

The older CRTs have been largely replaced by TFT flat-screens. A 15" TFT has the same viewing area as the older 17" CRT

- Average entry-level PCs usually come with a 17" Flat-screen and this is adequate for most general purpose applications.
- Larger 19" flat screens are available and may be appropriate if video editing and advanced graphics work is being carried out.
- Teachers of students with special needs may want to consider using larger monitors with their students.

CD/DVD Drives

CD-R/W and DVD-R/RW drives are standard on PCs and allow the information on a compact disc (either data or audio) to be read and written to by the PC. It is defined by its speed (i.e. 48x or 48 speed). DVD drives can read both CDs and DVDs. These allow you to copy to blank CDs. 52X DVD-RWs are standard on higher performance computers.

Graphics Card

These cards are installed inside a PC and are responsible for determining the quality of the audio and visuals (graphics and video) output by the computer. They hold their own memory in MB), which is why they add to a computer's capability.

- An integrated graphics card with 256MB of memory is recommended for general purpose PCs.
- Computers running high-end applications generally require a separate 25MB graphics card

Sound cards

A sound card generally comes as standard in most PCs purchased today. If students intend to work extensively with digital music, the school should consider getting a high-end sound card as this will create a greater depths, complexity and realism of sound.

Speakers and headphones

Most computers come with either built-in or external speakers. Schools may also consider buying headphones to control sound levels within a classroom or computer room.

Network Interface Card (NIC)

A network Interface Card allows a computer to be connected to a network. It is recommended that all PCs be purchased with a suitable Network Interface Card (NIC). A 10/100/1000 Mbps (Mega bits per second) card is the standard network card today. Few school networks currently operate at speeds higher than 100Mbps.

Operating Systems (OS)

PCs are generally purchased with an operating system pre-installed. It is worth checking that your existing software will still work with the operating system of any new systems being purchased. At present, Microsoft's newer OS is Windows 10. However when ordering computers schools need to specify a base operating system. The choice of base operating system should be made along with their choice of operating system license. Linux is an open source free operating system which is not widely used by schools at present moment, though it may be suitable for schools that are aware of its capabilities.

Factors to Consider before Purchasing a Computer

Consider the following points when purchasing PCs

1. What is the intended use of the PC and will the chosen specification fulfill these aims?
2. Is the PC compatible with existing computer equipment and software?
3. Nature of the school e.g. a school for the deaf would need some hardware for the deaf.
4. Ergonomics and safety provisions for the hardware e.g. comfort, safety, efficiency etc
5. Cost of hardware components given the available school budget like installation, initial hardware cost and maintenance plus repair.
6. After sale services provision such as free maintenance, warrants/guarantees for a period of time like one year.
7. Source of hardware given the school foundation body and virtues
8. School and government policy governing procurement laws and procedures.
9. Data/information security provisions/concerns

10. Computer hard disk capacity
11. Memory (RAM) capacity
12. Processor speed of the PC.
13. Compatibility with the existing infrastructure in the school
14. Provision for future growth and development (upgradeability)
15. Past experience of working state of the nature of the computer.
16. Reputation of the supplier
17. Environmental concerns
18. Technical advice and support
19. Space for storage
20. Consider the internal Network Interface Card
21. Consider Resolution for high Graphics
22. Will added peripherals be required such as headphones, optical mice etc.

SOFTWARE INSTALLATION

Software Installation (or **setup**) of a computer program is the act of making the program ready for execution. Because the process varies for each program and each computer, programs (including operating systems) often come with an *installer*.

What is an Installer?

An **installation program or installer** is a computer program that installs files, such as applications, drivers, or other software, onto a computer. Some installers are specifically made to install the files they contain; other installers are general-purpose and work by reading the contents of the software package to be installed.

Types of Software Installations

Attended installation

This is an installation process which usually needs a user who attends it to make choices, such as accepting or declining an end-

user license agreement (EULA), specifying preferences such as the installation location, supplying passwords or assisting in product activation

Silent installation

This is an installation which does not display messages or windows during its progress. The reason behind a silent installation may be convenience. Malware is almost always installed silently.

Unattended installation

This is an installation which is performed without user interaction during its progress or with no user present at all. One of the reasons to use this approach is to automate the installation of a large number of systems. An unattended installation either does not require the user to supply anything or has received all necessary input prior to the start of installation.

Headless installation

Installation performed without using a computer monitor connected. In attended forms of headless installation, another machine connects to the target machine (for instance, via a local area network) and takes over the display output.

Scheduled or automated installation

This is an installation process that runs on a preset time or when a predefined condition transpires, as opposed to an installation process that starts explicitly on a user's command. For instance, a system administrator willing to install a later version of a computer program that is being used can schedule that installation to occur when that program is not running. An operating system may automatically install a device driver for a device that the user connects. Malware may also be installed automatically.

Clean installation

A clean installation of an operating system is an installation in which the target disk partition is erased before installation. This is in the absence of any interfering elements such as old versions of the computer program being installed or leftovers from a previous installation.

Network installation

Network installation, shortened **netinstall**, is an installation of a program from a shared network resource that may be done by installing a minimal system before proceeding to download further packages over the network. This may simply be a copy of the original media by software publishers that offer site licenses for institutional customers, may provide a version intended for installation over a network.

Installing System Software

Things You'll Need

1. A computer
2. A disk with an operating system
3. Some basic knowledge
4. A working second PC just in case something goes wrong helps

Procedure

1. Decide what you would like to do. Are you going to reinstall your operating system because of problems, upgrading your current version, or are you installing an operating system on a new computer? Make sure that you have the new operating system install program.
2. Back up your data. If you are reinstalling your operating system, it is likely that you will need to wipe the disk. Back up your data before doing so, as everything on the disk will be destroyed.

3. Boot up. Turn on your computer and quickly enter the boot menu. The owner's manual for your computer or motherboard should have instructions on how to do this. It will show on the screen for a brief moment too. Select the drive that contains the setup disk (and be sure you have inserted it). Save the setting and exit.
4. Start the installation. It may take the install program a few minutes to load, this is normal. Once it has loaded, follow the onscreen instructions. If you are installing a new operating system on a new computer or reinstalling due to a problem, wipe the disk. Be sure you have saved everything that you would like to save before starting this process.
5. Sit back and relax. The installer may ask you for some information while it's installing, but for the most part, just waiting is okay. Near the end of the installation, the installer will ask you for last-minute information, like your name, the name of the computer, sign in name, password, time zone, etc..
6. Enter the product ID. If you are installing a consumer operating system like Windows, it will probably require you to enter a product ID. Look at the back of the CD case for the product ID or, indeed, on the case of the computer if the computer came with a version of Windows.
7. Reboot. Once you reboot, the computer will finalize everything and log you in. At this point, you may need to install drivers. Insert any disks that came with your computer or its parts that are NOT an operating system, and allow the drivers to be installed (if necessary).
8. Allow updates. This is especially important in Windows. Allow the computer to seek updates and install them. Look for a "top 10 things to do" list for that operating system.
9. Install antivirus software. If you are using Windows without antivirus software while on the web, you are extremely vulnerable to all kinds of malicious programs. Before you do anything, even installing Firefox, install antivirus.

Warnings

1. Be sure to back up everything before you do this, unless you are upgrading. However, it is wise to back up while upgrading, too.
2. If you are installing Windows and you go online, be sure to install antivirus software before you do so.
3. If you are moving from Windows to Linux, and don't know what you're doing with Linux, perhaps a full install isn't right. If your computer is new enough to boot to a USB device, install Linux to a flash drive. Otherwise, just boot from CD to use it.
4. Windows will be unable to read Linux partitions.

Installing application software

After configuring the computer completely, and working well with an operating system, application programs can now be installed. The steps followed are:

1. Insert the application CD-ROM into the CD-ROM driver. In most cases, it will start automatically.
2. Follow the instructions on the screen until the end, filling your name or that of the organization, product keys where applicable and restarting the computer.
3. In other instances, you have to open the CD-ROM and browse for the SETUP.EXE or Install program. Double click on it and the installation wizard will start. Follow the instructions as above.

SOFTWARE UPDATING AND UPGRADING

SOFTWARE UPGRADE

A Software Upgrade is to replace a product with a new version of the same product.

Why Upgrade?

- 1) Bring systems up to date
- 2) Improve its characteristics

- 3) Support industry regulatory requirements
- 4) Access emerging technologies
- 5) Meet demands of changing markets
- 6) Receive product support
- 7) Improves computers performance
- 8) Install new features not available in previous version
- 9) Better product stability
- 10) Avoid risks of discontinuity
- 11) Fix current bugs
- 12) Improved security

SOFTWARE UPDATE

A software update is a free download for software that provides fixes for features that are not working well. It adds minor software enhancements and compatibility. It includes driver updates that improve operation of hardware or peripherals or adds support for new models.

Why Update Software?

- 1) Add new features
- 2) Remove outdated features
- 3) Update drivers
- 4) Fix security holes (security vulnerabilities)
- 5) Better functionality
- 6) Delivering bug fixes

Uninstalling software

You can uninstall a program from your computer if you no longer use it or if you want to free up space on your hard disk. You can use Programs and Features to uninstall programs or to change the program's configuration by adding or removing certain options.

1. Open Programs and Features by clicking the Start button, clicking Control Panel, clicking Programs, and then clicking Programs and Features.

2. Select a program, and then click Uninstall.

Some programs include the option to change or repair the program in addition to uninstalling it. But many simply offer the option to uninstall.

To change a program, click **Change or Repair**. If you are prompted for an administrator password or confirmation, type the password or provide confirmation.

Why Uninstall Software

There are several reasons why you may want to uninstall software from your computer.

1. It could be that the software is no longer being used and is unnecessary.
2. It conflicts with other programs.
3. It's not functioning as expected.
4. You just want to free up some space on your computer's hard drive.

COMPUTER TROUBLESHOOTING

Troubleshooting is the process of identifying and fixing computer problems. Computer troubleshooting may involve hardware or software and can sometimes involve both at the same time. The basic process of troubleshooting is to check the most general possible problems first, and then gradually check for more specific problems.

Even with the most updated software and hardware, occasionally computers can malfunction.

In order to solve a problem, you must figure out which part of

the system is malfunctioning. You will need to check each component of the computer, unless it is obvious where the problem is coming from. Isolating the problem will help you solve the problem quickly.

Backing up your important computer files to another source will ensure that if your problem cannot be corrected, you will still have a safe copy of your information.

BASIC TROUBLESHOOTING STEPS

1. Close open programs and windows you are not currently using.
2. Make sure all of your power cords are connected properly.
3. Try to repeat the sequence of commands you performed before the problem occurred. See if this causes the same response by your computer.
4. Press the F1 key to access the Help window. You can search for a solution to your problem once the Help window appears.
5. If there is an error message, record the full message for future reference.
6. Restart your computer to see if it clears the problem. To restart your computer, open the start window and select the Restart button instead of the Log Off button.
7. If restarting the computer does not clear the problem, shut down the computer and then start it back up again.

COMMON TECHNOLOGY ISSUES

Below we describe some of the most commonly encountered technology issues and possible solutions to correcting the problem.

Common Solutions for Technology Issues

A. Issue: The printer is not working.

1. Check if the printer is turned on. If not, turn it on and try again.
2. Check if the printer has paper. If not, put paper in the paper tray and try printing again.
3. Check if the printer has a paper jam. If so, remove the paper, close the printer, and try printing again.
4. Ensure that all printer cables are properly connected.
5. Turn off the printer and turn it on again.
6. Check to see if a new printer driver is needed. Do this by going to the manufacturer's website to search for your printer model and checking for any updated driver. Seek assistance from your system administrator before installing any drivers.
7. Check your printer's print queue by looking for the printer icon in the system tray and double-clicking it. The print queue shows you the status of each job as well as the general status of your printer.
8. Ensure that 'Use Printer Offline' isn't checked. Sometimes, printing while your printer is turned off can cause Windows to set your printer to work offline, and that can stall jobs sent later.

B. Issue: The computer is frozen. A program is not responding.

1. Push the Ctrl, Alt, and Delete keys at the same time. Then, start the Task Manager, highlight the program's name, and hit the End Task button.
2. Perform a hard reboot by simply pressing the on/off button to turn off the computer manually. This action should only be done as a last resort if you have an unresponsive program or critical error. This process could cause data loss or corruption.
3. Once the computer is responding again, run a virus check.

C. Issue: The mouse is not working correctly.

1. Check if the mouse is securely plugged into the computer. If not, plug it in completely.
2. Check to see if the cord has been damaged. If so, the mouse may need replacing.
3. If you are using a cordless mouse, try pushing the connection button on the underside of the mouse to reestablish a connection.
4. Clean the mouse, especially on the bottom.

D. Issue: The keyboard is not working.

1. Make sure the keyboard is connected to the computer. If not, connect it to the computer.
2. If you are using a wireless keyboard, try changing the batteries.
3. If one of the keys on your keyboard gets stuck, turn the computer off and clean with a damp cloth.
4. Use the mouse to restart the computer.

E. Issue: New hardware or software is working incorrectly.

1. Verify your computer meets the requirements of the program or utility.
2. Uninstall and install the program.
3. There could be a conflict with another installed program and you should contact your system administrator

F. Issue: The computer is slow.

1. **Restart** your computer.
2. Verify that there is at least 200-500 MB of free hard drive space. To do so, select Start and click on My Computer or Computer. Then highlight the local C drive by clicking on it once. Select the Properties button at the top left-hand corner of the window; this will display a window showing how much free and used space you have.

3. **Empty your recycle bin** by right-clicking on the Recycle Bin icon (usually on the desktop), then selecting Empty Recycle Bin.
4. Check your **mail files**. Remove any large attachments and delete unused mail.
5. Images and videos take up a lot of space, so consider moving those to an **external drive**.
6. **Remove temporary files** from the Internet. To do so:
 - a) Click Start button | My Computer or Computer.
 - b) Click Open Control Panel at the top of the window.
 - c) Click Network | Internet | Internet Options.
 - d) Select the General tab and click Delete under Browsing History.
9. Perform a **disk cleanup**. To do so:
 - a) Click Start button | My Computer or Computer.
 - b) Highlight the local C drive by clicking on it once.
 - c) Select the properties button at the top left of the window.
 - d) Go to the General tab and select Disk Cleanup.
 - e) Once the Disk Cleanup finishes running, click on Clean up System Files; this will delete any unnecessary system-related files from your local disk.
10. Information in **computer files changes often**, resulting in gaps or spaces within the file. This takes up more space on the computer and can cause the computer to slow down. To reclaim these gaps in space, run **disk defragmentation**. To do so:
 - a) Click Start | My Computer or Computer.
 - b) Highlight the local C drive by clicking on it once.
 - c) Select the properties button at the top left of the window.
 - d) Go to the Tools tab and select Run Defragmentation.
9. **Old or unused programs that aren't being used** may still have components running behind the scenes

when you start your computer, which can slow down the system. You can prevent these programs from running when you start your computer by removing unused shortcuts and turning off unused program services.

10. **Remove unused shortcuts from Windows startup**

a) Click Start button | Select All Programs | Click Startup

b) Right-click the shortcuts that you do not use and click delete

11. **Disable unused program services**

a. Click Start button | Control Panel | Administrative Tools | Services

b. For each program/service that you are **certain** that you do not need, click on the Service to highlight it, click the Stop link to stop the service from running, then double-click the service, choose Startup Type of Disabled, and click OK.

12. **Run a virus scan** to remove potential viruses that can slow down your computer.

E. Issue: The browser's homepage suddenly changed.

1. This is a common symptom that a virus or browser hijacker may have infected the computer.

2. Try re-setting the home page to the default:

a. In Internet Explorer:

i. On the Tools menu, click Internet Options.

ii. Click the General tab.

iii. In the Address box, type the Web address you want for your home page.

iv. Click OK.

b. In Mozilla Firefox:

i. Open the web site you want to set as your home page.

- ii. Click the icon to the left of the web address and drag it to the Home button.
 - iii. Click Yes.
3. If the home page still reverts back to the “new” page, do an Internet search using keywords that include the name of the “new” homepage and the word “virus.” If there is a virus, this search may reveal more information on the virus and how it can be safely removed.
4. Run a virus scan.

F. Non-system disk error when the computer system is switched on

1. Eject the disk from the drive press any key on the keyboard to enable the boot process to continue
2. Restart the computer
3. Check hardware connection
4. Reformat the hard disk

G. Low disk space and computer is slow

1. Fix this by deleting some files using disk cleaner utility
2. Close some files which are open and would occupy the RAM
3. Back up and delete unnecessary files from computer
4. Use of cloud computing
5. Increase the RAM
6. Defragmenting the hard disk
7. File compression
8. Run anti-virus to scan the device
9. Increase/slave/add new HDD

H. Access denied when a user wants to access a particular file

1. Exit or stop programs that are running and could be blocking the users’ tasks from running
2. Install and run the anti-virus

3. Adjust users' settings to allow access
4. Provide password
5. Adjust windows firewall and allow access

I. Out of memory

1. Exit or stop programs that are running and could be blocking the user's tasks from running
2. Install or upgrade the RAM by buying another chip and fixing it on the memory slot of the mother board and restarting the computer to implement the upgrade.
3. Run a virus scan
4. Restart the system

J. Device not ready

1. Disable particular disk drive from the device manager
2. Give it time to activate
3. Re-install drivers if they are not working properly.
4. Check and change power connection points e.g. USB
5. Restart the device
6. Re-install the Operating system
7. Scan for viruses/malware
8. Uninstall and or deactivate software blocking the hardware from working such as Deep Freeze.
9. Change ports where applicable
10. Disable and enable the device.