**NETWORKING & SYSTEM ADMINISTRATION LAB**

1. Introduction to Computer hardware: Physical identification of major components of a computer system such as mother board, RAM modules, daughter cards, bus slots, SMPS, internal storage devices,i nterfacing ports. Specifications of desktop and server class,computers. Installation of common operating systems for desktop and server use. (Students may be asked to formulate specification for computer to be used as Desktop, Web server)

**The motherboard**

The motherboard serves as a single platform to connect all of the parts of a computer together. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.



Features of Motherboard

A motherboard comes with following features −

* Motherboard varies greatly in supporting various types of components.
* Motherboard supports a single type of CPU and few types of memories.
* Video cards, hard disks, sound cards have to be compatible with the motherboard to function properly.
* Motherboards, cases, and power supplies must be compatible to work properly together.

Popular Manufacturers

Following are the popular manufacturers of the motherboard.

* Intel
* ASUS
* AOpen
* ABIT
* Biostar
* Gigabyte
* MSI

Description of Motherboard

The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU, whereas for memory, normally one or more slots are available. Motherboards provide ports to attach the floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply.

There is a peripheral card slot in front of the motherboard using which video cards, sound cards, and other expansion cards can be connected to the motherboard.

On the left side, motherboards carry a number of ports to connect the monitor, printer, mouse, keyboard, speaker, and network cables. Motherboards also provide USB ports, which allow compatible devices to be connected in plug-in/plug-out fashion. For example, pen drive, digital cameras, etc.

**Memory module**

Two types of DIMMs (dual in-line memory modules): a 168-pin SDRAM module (top) and a 184-pin DDR SDRAM module (bottom).

In computing, a memory module or RAM (random-access memory) stick is a printed circuit board on which memory integrated circuits are mounted.[1] Memory modules permit easy installation and replacement in electronic systems, especially computers such as personal computers, workstations, and servers. The first memory modules were proprietary designs that were specific to a model of computer from a specific manufacturer. Later, memory modules were standardized by organizations such as JEDEC and could be used in any system designed to use them.

Types of memory module include:

TransFlash Memory Module

SIMM, a single in-line memory module

DIMM, dual in-line memory module

Rambus memory modules are a subset of DIMMs, but are normally referred to as RIMMs

SO-DIMM, small outline DIMM, a smaller version of the DIMM, used in laptops

Distinguishing characteristics of computer memory modules include voltage, capacity, speed (i.e., bit rate), and form factor. For economic reasons, the large (main) memories found in personal computers, workstations, and non-handheld game-consoles (such as PlayStation and Xbox) normally consist of dynamic RAM (DRAM). Other parts of the computer, such as cache memories normally use static RAM (SRAM). Small amounts of SRAM are sometimes used in the same package as DRAM.[2] However, since SRAM has high leakage power and low density, die-stacked DRAM has recently been used for designing multi-megabyte sized processor caches.[3]

Physically, most DRAM is packaged in black epoxy resin.

General DRAM formats

A 256 x 4 Kibit 20-pin DIP DRAM on an early PC memory card, usually Industry Standard Architecture

Common DRAM packages. From top to bottom: DIP, SIPP, SIMM (30‑pin), SIMM (72‑pin), DIMM (168‑pin), DDR DIMM (184‑pin).

16 GiB DDR4-2666 288-pin 1.2 V UDIMMs

Dynamic random access memory is produced as integrated circuits (ICs) bonded and mounted into plastic packages with metal pins for connection to control signals and buses. In early use individual DRAM ICs were usually either installed directly to the motherboard or on ISA expansion cards; later they were assembled into multi-chip plug-in modules (DIMMs, SIMMs, etc.). Some standard module types are:

DRAM chip (Integrated Circuit or IC)

Dual in-line Package (DIP/DIL)

Zig-zag in-line package (ZIP)

DRAM (memory) modules

Single In-line Pin Package (SIPP)

Single In-line Memory Module (SIMM)

Dual In-line Memory Module (DIMM)

Rambus In-line Memory Module (RIMM), technically DIMMs but called RIMMs due to their proprietary slot.

Small outline DIMM (SO-DIMM), about half the size of regular DIMMs, are mostly used in notebooks, small footprint PCs (such as Mini-ITX motherboards), upgradable office printers and networking hardware like routers.

Small outline RIMM (SO-RIMM). Smaller version of the RIMM, used in laptops. Technically SO-DIMMs but called SO-RIMMs due to their proprietary slot.

Stacked vs. non-stacked RAM modules

Stacked RAM modules contain two or more RAM chips stacked on top of each other. This allows large modules to be manufactured using cheaper low density wafers. Stacked chip modules draw more power, and tend to run hotter than non-stacked modules. Stacked modules can be packaged using the older TSOP or the newer BGA style IC chips. Silicon dies connected with older wire bonding or newer TSV.

Several proposed stacked RAM approaches exist, with TSV and much wider interfaces, including Wide I/O, Wide I/O 2, Hybrid Memory Cube and High Bandwidth Memory.

Common DRAM modules

Common DRAM packages as illustrated to the right, from top to bottom (last three types are not present in the group picture, and the last type is available in a separate picture):

DIP 16-pin (DRAM chip, usually pre-fast page mode DRAM (FPRAM))

SIPP 30-pin (usually FPRAM)

SIMM 30-pin (usually FPRAM)

SIMM 72-pin (often extended data out DRAM (EDO DRAM) but FPRAM is not uncommon)

DIMM 168-pin (most SDRAM but some were extended data out DRAM (EDO DRAM))

DIMM 184-pin (DDR SDRAM)

RIMM 184-pin (RDRAM)

DIMM 240-pin (DDR2 SDRAM and DDR3 SDRAM)

DIMM 288-pin (DDR4 SDRAM)

Common SO-DIMM DRAM modules:

72-pin (32-bit)

144-pin (64-bit) used for SO-DIMM SDRAM

200-pin (72-bit) used for SO-DIMM DDR SDRAM and SO-DIMM DDR2 SDRAM

204-pin (64-bit) used for SO-DIMM DDR3 SDRAM

260-pin used for SO-DIMM DDR4 SDRAM

**Daughter card**

A daughtercard or daughterboard is a type of circuit board that gets added to an existing one. Its name is appropriate for its use, since it is connected to a “motherboard” or “main board.” The motherboard is the primary circuit board for a device. It is usually in the device as it is shipped from the factory. A daughtercard may be added later.

Daughtercards are common computer components that are joined to the motherboard using edge connectors.Daughtercards are common computer components that are joined to the motherboard using edge connectors.Some daughtercard designs are made so that engineers can add functionality to a device without requiring a lot more room inside its housing. These kinds of items are often called riser boards or risers. Some might also call them “mezzanine boards.”A daughtercard or daughterboard is a type of circuit board that gets added to an existing one.A daughtercard or daughterboard is a type of circuit board that gets added to an existing one.

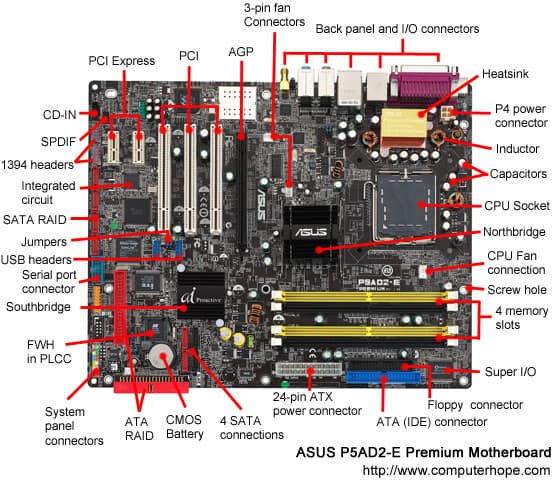
Daughtercards are different from some other types of additional circuit boards that tech enthusiasts call “expansion cards.” In expansion cards, the circuit board is often plugged in through a gap in the housing of a computer or device. These expansion boards help to give a device more functionality, often for additional sound play or for better visuals on a high-tech monitor or screen.In contrast to the way expansion boards are used, a daughtercard can be a more fundamental enhancement for a device. Adding a daughtercard often requires getting into the guts of a device. That’s why some users might hire a professional to install it. Companies that make an electronic device might offer a daughtercard as part of an essential upgrade that allows the product to be used in more various ways. With the rise of connective USB ports and other technology, it has become less necessary to upgrade devices with daughtercards or daughterboards. A lot of advanced use can be built into a wireless connection and “outsourced” to a remote server, rather than adding it physically into a desktop or laptop computer. However, some types of equipment might still get these kinds of additions as provided by the manufacturer. Computer and electronics makers choose the best ways of offering upgrades that they feel will match the needs and desires of their customer base. Since not a lot of laptop or computer users want to wrestle a daughtercard into an existing circuit board design, companies that sell to a consumer market will probably choose alternatives, or offer professional installation as a free service if they are offering a daughtercard as a way to upgrade a device.

**Bus Slot**

Alternatively referred to as a **bus slot** or **expansion port**, an **expansion slot** is connection or port located inside a computer on the motherboard or riser board that allows a computer hardware expansion card to be connected. For example, if you wanted to install a new video card in the computer, you’d purchase a video expansion card and install that card into the compatible expansion slot.

Many of the below expansion card slots are obsolete.You’re most likely only going to encounter AGP, PCI, and PCI Express when working with computers today. In the picture below is an example of what expansion slots may look like on a motherboard. In this picture, there are three different types of expansion slots:**PCI Express**, **PCI**, and **AGP**.

* **PCI** – Network card, SCSI, Sound card, Video card
* **PCI Express** – Video card
* **AGP** – Video card
* **ISA** – Network card, Sound card, Video card
* **AMR** – Modem, Sound card
* **CNR** – Modem, Network card, Sound card
* **EISA** – SCSI, Network card, Video card
* **VESA** – Video card



**PCI Express:**The best type of expansion slot to have in your PC is the PCI Express, also written as PCIe. Without boring you, the PCI Express type of expansion slot communicates with the motherboard, and therefore with the microprocessor, both quickly and efficiently.

**PCI:** The PCI slot is the most common form of internal expansion for a PC.[bs\_icon name=”glyphicon glyphicon-exclamation-sign”] Some PCs have a mixture of PCI and PCI Express slots. If so, go with PCI Express when you have that option.

**AGP:**This type of expansion slot was specifically designed to deal with graphics adapters. In fact, AGP stands for Accelerated Graphics Port. Older PCs may sport this expansion slot, but the best video cards use PCI Express.

**ISA:**The most ancient type of expansion slot is the ISA, which stands for (get this) Industry Standard Architecture. That’s because it never really had a name until another, better type of expansion slot came along. ISA slots hang around to be compatible with older expansion cards.

**Switched-Mode Power Supply**

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently.Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power, see AC adapter) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. A hypothetical ideal switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time (also known as duty cycles). In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply.

Switched-mode power supplies can also be substantially smaller and lighter than a linear supply because the transformer can be much smaller. This is because it operates on the switching frequency which ranges from several hundred kHz to several MHz in contrast to the 50-60Hz which is typical for the mains AC frequency. Despite the reduction in size, the power supply topology itself and the requirement for electromagnetic interference (EMI) suppression in commercial designs result in a usually much greater component count and corresponding circuit complexity.

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

**Internal Storage Devices**

Some storage devices are classed as 'internal' which means they are inside the computer case.Most computers have some form of internal storage. The most common type of internal storage is the hard disk.At the most basic level, internal storage is needed to hold the operating system so that the computer is able to access the input and output devices.It will also be used to store the applications software that you use and more than likely, the original copies of your data files.

Internal storage allows the data and applications to be loaded very rapidly into memory, ready for use. The data can be accessed much faster than data which is stored on an external storage device. This is because internal storage devices are connected directly to the motherboard and its data bus whereas external devices are connected through a hardware interface such as USB, which means they are considerably slower to access.Internal storage also means that if the computer is moved around, it will still retain its most commonly used data.

The main disadvantage of internal storage is that when the hard disk fails (and it will), all the data and applications may be lost.This can be avoided to some extent by using more than one hard disk within the machine. Each hard disk has a copy of all the data, so if one fails the other can carry on. This is called a RAID array. An alternative is to use external drives for backup

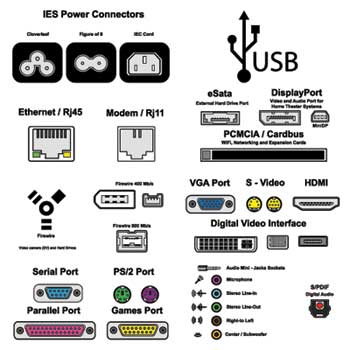
**Interfacing ports.**

A port is a physical docking point using which an external device can be connected to the computer. It can also be programmatic docking point through which information flows from a program to the computer or over the Internet.

## **Characteristics of Ports**

A port has the following characteristics −

* External devices are connected to a computer using cables and ports.
* Ports are slots on the motherboard into which a cable of external device is plugged in.
* Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.



Let us now discuss a few important types of ports −

## **Serial Port**

* Used for external modems and older computer mouse
* Two versions: 9 pin, 25 pin model
* Data travels at 115 kilobits per second

## **Parallel Port**

* Used for scanners and printers
* Also called printer port
* 25 pin model
* IEEE 1284-compliant Centronics port

## **PS/2 Port**

* Used for old computer keyboard and mouse
* Also called mouse port
* Most of the old computers provide two PS/2 port, each for the mouse and keyboard
* IEEE 1284-compliant Centronics port

## **Universal Serial Bus (or USB) Port**

* It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard, etc.
* It was introduced in 1997.
* Most of the computers provide two USB ports as minimum.
* Data travels at 12 megabits per seconds.
* USB compliant devices can get power from a USB port.

## **VGA Port**

* Connects monitor to a computer's video card.
* It has 15 holes.
* Similar to the serial port connector. However, serial port connector has pins, VGA port has holes.

## **Power Connector**

* Three-pronged plug.
* Connects to the computer's power cable that plugs into a power bar or wall socket.

## **Firewire Port**

* Transfers large amount of data at very fast speed.
* Connects camcorders and video equipment to the computer.
* Data travels at 400 to 800 megabits per seconds.
* Invented by Apple.
* It has three variants: 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector, and 9-Pin FireWire 800 connector.

## **Modem Port**

* Connects a PC's modem to the telephone network.

## **Ethernet Port**

* Connects to a network and high speed Internet.
* Connects the network cable to a computer.
* This port resides on an Ethernet Card.
* Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.

## **Game Port**

* Connect a joystick to a PC
* Now replaced by USB

## **Digital Video Interface, DVI port**

* Connects Flat panel LCD monitor to the computer's high-end video graphic cards.
* Very popular among video card manufacturers.

## **Sockets**

* Sockets connect the microphone and speakers to the sound card of the computer.

**Specifications of desktop and server class computers**

Many people mistakenly believe that a server is no different from a typical desktop computer. This couldn’t be further from the truth. While almost any computer that meets the minimum hardware requirements can run a server operating system that alone does not make a desktop computer a true server. Even if the desktop computer had similar processor speeds, memory and storage capacity compared to a server, it still isn’t a replacement for a real server. The technologies behind them are engineered for different purposes.

A desktop computer system typically runs a user-friendly operating system and desktop applications to facilitate desktop-oriented tasks. In contrast, a server manages all network resources. Servers are often dedicated (meaning it performs no other task besides server tasks). Because a server is engineered to manage, store, send and process data 24-hours a day it has to be more reliable than a desktop computer and offers a variety of features and hardware not typically used in the average desktop computer

**Installation of common operating systems for desktop and server use.**

# How to install the Microsoft Windows operating system

Each version of Microsoft Windows is installed on a computer using similar steps. While there are steps in the installation process that differ between versions of Windows, the following general steps and guidelines help you install Windows on your computer.

The steps below are for all recent versions of Windows, including [Windows 98](https://www.computerhope.com/jargon/w/win98.htm), [Windows ME](https://www.computerhope.com/jargon/w/winme.htm), [Windows 2000](https://www.computerhope.com/jargon/w/win2000.htm), [Windows XP](https://www.computerhope.com/jargon/w/winxp.htm), [Windows Vista](https://www.computerhope.com/jargon/v/vista.htm), [Windows 7](https://www.computerhope.com/jargon/w/windows7.htm), [Windows 8](https://www.computerhope.com/jargon/w/windows8.htm), [Windows 10](https://www.computerhope.com/jargon/w/windows-10.htm), and [Windows 11](https://www.computerhope.com/jargon/w/windows-11.htm). These steps even work for earlier versions (e.g., Windows 95) as long as you use the disc version. The floppy diskette version is similar, but it requires additional steps.

## Check hardware compatibility

Before installing or upgrading Windows on your computer, check the hardware in the computer to make sure it's compatible with that version of Windows. Microsoft provides a [Windows Compatible Products List](https://partner.microsoft.com/en-us/dashboard/hardware/search/cpl) for checking if the hardware in your computer is compatible with the chosen version of Windows.

If one or more pieces of [hardware](https://www.computerhope.com/jargon/h/hardware.htm) is not compatible with the chosen Windows version, we recommend replacing that hardware with compatible hardware or purchasing a new computer. Having compatible hardware in your computer helps ensure the Windows install or upgrade process is successful.

## Genuine Windows CD, DVD, or USB thumb drive

First, you need a genuine copy of the Microsoft Windows [operating system](https://www.computerhope.com/jargon/o/os.htm) installation [CD](https://www.computerhope.com/jargon/c/compactd.htm), [DVD](https://www.computerhope.com/jargon/d/dvd.htm), or [USB thumb drive](https://www.computerhope.com/jargon/j/jumpdriv.htm). A genuine Windows [product key](https://www.computerhope.com/jargon/c/cdkey.htm) is included with the installation disc, which is required to activate Windows after installation. If you have an [OEM](https://www.computerhope.com/jargon/o/oem.htm) (original equipment manufacturer) computer, the Windows product key is often on the back or side of the computer.

If you have an OEM computer (e.g., [Acer](https://www.computerhope.com/comp/acer.htm), [Dell](https://www.computerhope.com/comp/dell.htm), [HP](https://www.computerhope.com/comp/hp.htm), etc.), the computer will not have a genuine Windows CD, DVD, or USB thumb drive. Instead, you would reinstall Windows and the software using a [hidden partition](https://www.computerhope.com/jargon/h/hiddpart.htm) or a set of restore discs. The steps mentioned on this page would still work, but you'd need a copy of Windows. You can borrow a friend's Windows disc, as long as it's the same version of Windows that came with the computer and have a [product key](https://www.computerhope.com/jargon/c/cdkey.htm).

## Installing or upgrading Windows

To start the Windows install or upgrade process, you need to configure your computer to boot from a CD or DVD before booting to the hard drive. Changing the boot process forces the computer to look for the Windows installation disc before booting from the [hard drive](https://www.computerhope.com/jargon/h/harddriv.htm).

1. Open the CMOS setup.

* [How to enter the BIOS or CMOS setup.](https://www.computerhope.com/issues/ch000192.htm)

1. Change the computer's [boot order](https://www.computerhope.com/jargon/b/bootsequ.htm). Set the CD, DVD, or disc drive as the first boot device if you are trying to boot from a disc. Or, set the first boot device to your USB drive if you're trying to boot from a USB thumb drive. If the drive is not shown, keep the disc is inserted and reboot the computer. With the disc in the drive, BIOS should recognize and include it in the list.
2. Save the settings change and exit BIOS.

Once you have updated the boot order, you can begin the Windows installation process.

1. Place the Windows disc in the CD/DVD drive or USB thumb drive into the back of the computer.
2. Turn on or [restart the computer](https://www.computerhope.com/jargon/r/reboot.htm). As the computer starts up, it should detect the installation disc or drive and show a message similar to *Press any key to boot from CD*. Press any key on the keyboard to have the computer boot from the Windows disc or drive.
3. After the Windows install begins, there are several prompts that you need to answer. Select either **Yes** or the appropriate option to install Windows.
4. When asked which [partition](https://www.computerhope.com/jargon/p/partition.htm) to install Windows onto, select the main partition, usually the C: drive or one labeled "Unallocated partition". If upgrading Windows, select the existing installation of Windows on the hard drive.
5. You may be asked if you want to erase all contents on the hard drive, then install Windows. We recommend you choose this option, as it also formats the hard drive to allow the Windows operating system to be installed.
6. The computer may need to restart several times during the Windows install process. The restarts are normal and if prompted to restart, select the **Yes** option.
7. When the install process is nearly complete, the Windows configuration option screens are shown. On these screens, you may be asked to select the time zone you live in, your preferred language, and the account's name you use to access Windows. Select the appropriate options and enter the appropriate information on each configuration screen.

The Windows install process is completed when the computer prompts you to log in or when it loads into Windows.

## Final Windows and computer configuration

After Windows is installed on the computer, you need to install the [drivers](https://www.computerhope.com/jargon/d/driver.htm) and related software for the hardware in the computer. You can use the installation discs that came with the hardware or [download](https://www.computerhope.com/jargon/d/download.htm) the drivers from the hardware manufacturer's website.

* [How to install and update a computer driver.](https://www.computerhope.com/issues/ch000834.htm)

We strongly recommend you install the latest drivers for each piece of hardware.

To determine which hardware needs drivers to be installed, check the [Device Manager](https://www.computerhope.com/jargon/d/devicema.htm) and look for the [exclamation mark](https://www.computerhope.com/jargon/e/exclamation-mark.htm) "!" next to hardware devices. The exclamation point means drivers are needed for that device.

After installing the necessary hardware device drivers, install any software programs on the computer that you want to use.

Finally, download and install any available Windows updates. Updating Windows improves the operating system's performance, the hardware in the computer, and the software programs you use. It can also improve security by fixing potential security holes and flaws in Windows.

* [How to update a Microsoft Windows computer.](https://www.computerhope.com/issues/ch000545.htm)

## Long-term maintenance of Windows

Microsoft frequently releases new [updates](https://www.computerhope.com/jargon/u/update.htm) for Windows, so we recommend you check for and install available updates. Doing so helps keep Windows running better and keep your computer protected.

Also, periodically check for updated hardware device drivers from manufacturers' websites. Keeping hardware drivers updated helps the hardware devices in the computer run at peak performance and improves compatibility with other computer hardware and software.