Module 1 – Server Overview (Understanding what Server Does)

Introduction

System administration matters because computers and networks matter. Computers are a lot more important than they were years ago. What happened?

Moreover, the widespread use of the Internet, intranets, and the move to a web centric world has redefined the way companies depend on computers. The Internet is a 24/7 operation, and sloppy operations can no longer be tolerated. Paper purchase orders can be processed daily, in batches, with no one the wiser. However, there is an expectation that the web-based system that does the process will be available all the time, from anywhere. Nightly maintenance windows have become an unheard-of luxury. That unreliable machine room power system that caused occasional but bearable problems now prevents sales from being recorded.

In this module, we pull together the various elements from the rest of the topics to provide an overview of how they can be used to deal with everyday situations or to answer common questions system administrators (SAs) and managers often have.

Learning Objectives

After studying this module, the learners will be able to:

- Discuss the different Server Roles
- Explain the Comparison between Physical Servers and Virtual Servers
- Discuss the different ways in selecting Server Hardware

Topic Outline
- Introducing Server Roles
- Selecting Server Hardware
- Form Factor
- Motherboard components

Key Concepts

- **Server –** is a computer or system that provides resources, data, services, or programs to other computers, known as clients, over a network. In theory, whenever computers share resources with client machines they are considered servers.
- **Drives –** A hard drive is the hardware component that stores all of your digital content. Your documents, pictures, music, videos, programs, application preferences, and operating system represent digital content stored on a hard drive. Hard drives can be external or internal.
- **Firmware –** In electronic systems and computing, firmware is a tangible electronic component with embedded software instructions, such as a BIOS. Typically, those software instructions are used to tell an electronic device how to operate.
- **Motherboard** - is a computer's central communications backbone connectivity point, through which all components and external peripherals connect.

member: *With today's computers, any computer on the network can provide services or request services depending on how the network is set up. A server is a computer that is meant to be a dedicated service provider, and a client is a computer that requests services.*

A network that is made up of dedicated servers and clients is known as a client/server network. A server-based network is the best network for sharing resources and data, while providing centralized network security for those resources and data.

If you have been using Windows XP, Windows Vista, or Windows 7, Windows 8 , 10 and 11 for a significant amount of time, you should realize that your computer is providing services and requesting services (although it is most likely requesting services more than it is providing services). When you access a web page over the Internet, access your email, access a data file on another computer, or access a printer that is connected to the network, you are requesting services.

While Windows servers are designed to provide a wide range of network services, Windows XP, Windows Vista, and Windows 7, Windows 8 , 10 and 11 can provide printer and file sharing and web pages (although you are limited by the number of concurrent connections, especially when compared to Windows servers, and are not optimized for multiuser access). Therefore, while these versions of Windows are designed as clients, they can also be utilized to provide services.

While computers with Windows Server 2003, Windows Server 2008 and Windows Server 2016 are designed to provide services, they can also request services from other computers. For example, they can access a web server locally or over the Internet, access a software repository, or print to a network printer.

Furthermore, when you are determining hardware and software needs, look at the role the computer needs to fill and the load the computer will be placed under. You can then start researching the hardware **(including the number of computers, number of processors, amount of RAM, and amount of disk storage**) and software requirements to reach those goals. Remember that you will also need to look at disaster recovery including the steps you will need to take if a server fails and you lose data.

Remember: *Don't forget to plan your server for growth. Most servers should be designed for three to five years of service. Be sure to envision what your landscape may look like three to five years from deployment of the server. This will help you avoid purchasing and reinstalling the server several months later. It should also be noted that the bare basic server leaves little room for growth.*

Introducing Server Roles

Remember: *Before selecting server hardware and software components, you must first understand what your server is supposed to do. First identify the server roles and network services that the server will need to provide. Then examine how many people will be accessing the server at one time to help determine the load the server needs to fulfill.*

A **server role** is a primary duty that a server performs. You should note that a server could have multiple roles. Some of the more common server roles include:

- File services
- Print services
- Web services
- Remote access
- Application servers
- Email server
- Database server
- Monitoring servers
- Threat management servers

A **file server** allows you to centrally locate files to be accessed by multiple people. Because the files are centrally located, it is easier for multiple users to access and find files (assuming they are organized well) and it is easier to back up these files. When using Microsoft Windows to provide file sharing, you will usually be using Server Message Block (SMB) to access Microsoft Shares or shared folders. Windows Servers can also provide NFS shares for Unix/Linux users.

Multiple users can access a centrally located printer using print services, which means that you may share an expensive heavy-duty, or fast, printer that supports advanced options such as color. Printers can be accessed as a **network printer** that is connected directly to the network or through a Microsoft Windows server (again using SMB).

Because the Internet has become more prevalent in today's business applications, so has the use of **web services**. Using a web server to provide web services means that users can access web pages using their browsers. These web services may be used to do research, provide leads for sales, allow customers to purchase goods and services, and provide customer support over the Internet.

Remote access is a service that supports multiple inbound requests in connecting to the server or network. It can provide terminal services so that multiple users can log on to a server remotely and access a desktop, start menu, and programs as if they were sitting in front of the server. On the other hand, remote access can also provide network access over the Internet using a virtual private network (VPN), which allows a user to be at home and yet have full access to their internal network resources such as email and data files.

Finally, the **application server** role provides an integrated environment for deploying and running server-based business applications. In other words, the server delivers networked applications. When you access a file from a shared folder, your PC does all of the work; in this case, the server will also do some of the processing.

When talking about servers and **server applications**, you may hear the terms front end and back end. In client/server applications, the client part of the program is often called the front end, and the server part is called the back end. The front end is the interface that is provided to a user or another program. It may be accessed via a web page or a customized application that runs on the client PC. The back end will often contain a database that is used to store, organize, query, and retrieve data.

One commonly used application server that is essential for most corporations is the **mail server.** The mail server is a server that stores and manages electronic messages (email) among users. If you are using Microsoft email products, you will be using Microsoft Exchange to act as your mail server, and you would most likely access the email using Microsoft Outlook or a web browser.

Two additional examples of application servers are sales tracking or inventory control applications. You would access this type of server on your company network by using a customized program or using your browser. You would then request information or input some data, which would then be retrieved from or sent to the back-end server running a database such as Microsoft SQL server.

The last two types of servers, **monitoring servers and threat management servers**, are not commonly known servers but are essential within any organization. Since many organizations have large or complex networks and multiple servers, you will most likely need one or more monitoring servers to help you monitor servers that provide the necessary services to your users and customers. With monitoring servers, you should use threat management servers to monitor your network and servers for intruders or other security breaches.

Progress Assessment (Server Roles)
1. Discuss further the main advantages of the listed Server Role :**File services, Print services, Web services, Remote access, Application servers and Email server,** Also Look for Disadvantages in using the said Roles.

Progress Assessment

Answer the Progress Assessment question on the Learning Management System.

Selecting Server Hardware

member: When choosing the server to use and the hardware components that make up the server, keep the following in mind. First, the server is designed to provide network services. Since a server is designed to be used by multiple users at the same time, the server is usually much more powerful than most client PCs.

Moreover, if the server fails or becomes inaccessible, the problem will affect multiple people. Therefore, you need to choose hardware that is less prone to failure than a normal client PC and that has some redundancy built in. You also need to plan so you know how to deal with these problems when they occur.

These are the primary subsystems that make up a server:

- Processor
- Memory
- Storage
- Network

If any of these fails, the entire system can fail. In addition, if any one of these is asked to do more than what it was designed for, it can cause a bottleneck that may affect performance of the entire system.

member: Even if you strive for 100% uptime, it is next to impossible to get it over a long enough period of time. However, by anticipating the type of failure that could occur; adding additional servers, components, or technology that will make the system more fault tolerant; and developing good plans so that you can react quickly when a failure occurs, you can alleviate much of this to reduce your chances of a failure and the impact that failure would have when it occurs. In addition, while you need to spend money to make a system more

If you've ever taken the case off of a computer, you've seen the one piece of equipment that ties everything together witch is called a motherboard. A motherboard allows all the parts of your computer to receive power and communicate with one another.

Motherboard

Motherboards have come a long way in the- last twenty years. The first m other boards held very few actual components. The first IBM PC motherboard had only a processor and card slots. Users plugged components like floppy drive controllers and memory into the slots.

Today, motherboards typically boast a wide variety of built-in features, and they directly affect a computer's capabilities and potential for upgrades.

In this article, we'll look at the general components of a motherboard. Then, we'll closely examine five points that dramatically affect what a computer can do.

- **Form Factor** - The shape and layout of a motherboard is called the form factor. The form factor affects where individual components go and the shape of the computer's case. There are several specific form factors that most PC motherboards use so that they can all fit in standard cases.

- **Sockets and CPUs** - a CPU socket or CPU slot contains one or more mechanical components providing mechanical and electrical connections between a microprocessor and a printed circuit board (PCB). This allows for placing and replacing the central processing unit (CPU) without soldering.

- **Chipsets** - a chipset is a set of electronic components in an integrated circuit known as a "Data Flow Management System" that manages the data flow between the processor, memory and peripherals. It is usually found on the motherboard.

  Chipsets are usually designed to work with a specific family of microprocessors. Because it controls communications between the processor and external devices, the chipset plays a crucial role in determining system performance.

- **Bus Speed –** A bus is simply a circuit that connects one part of the motherboard to another. The more data a bus can handle at one time, the faster it allows information to travel. The speed of the bus, measured in megahertz (MHz), refers to how much data can move across the bus simultaneously.

- **Memory and Other Features** - We've established that the speed of the processor itself controls how quickly a computer thinks. The speed of the chipset and busses controls how quickly it can communicate with other parts of the computer. The speed of the RAM connection directly controls how fast the computer can access instructions and data, and therefore has a big effect on system performance.
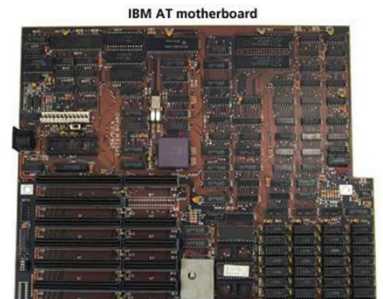
Form Factor

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As computers advanced, so have motherboards. Below is a listing of the various motherboard form factors and links to additional information about each of them.

*Today, the most common motherboard form factor for desktop computers is the **ATX form factor**.*

AT (Advanced Technology)

Commonly referred to as AT and full-size AT, the Full AT is a motherboard form factor introduced by IBM in August 1984, and was widely used in the 1980s. The Full AT is 12" wide x 13.8" deep and only fits into a full size AT tower case. Today, this form factor is rarely found or used and was replaced by ATX and Baby AT. Below is an example of an early IBM AT motherboard.

IBM AT motherboard

Baby AT

A replacement for the Full AT motherboard and sometimes referred to as BAT, the Baby AT is a motherboard form factor introduced by IBM in 1985. It is used with the 286, 386, 486, and Pentium computers up until the early 1990s.

The Baby AT is 8.57" wide x 13.04" deep, which is almost the same as the original IBM XT motherboard but with different screw hole positions to fit into AT-style case. The Baby AT is now considered obsolete and was replaced by ATX.
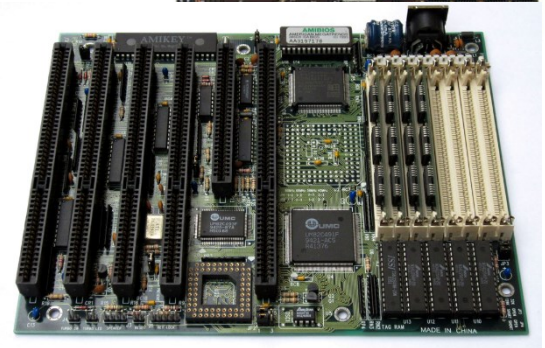
ATX (Advanced Technology eXtended)

Short for Advanced Technology eXtended, ATX is a specification used to outline motherboard configuration and dimensions to improve standardization. First released in July 1995 by Intel, ATX has since had many revisions. The first was version 2.01 in February 1997, then 2.03 in May 2000, 2.1 in June 2002, and 2.2 in February 2004.

ATX boards didn't hit the market in force until mid-1996, when they rapidly began replacing Baby-AT boards in new systems. The original ATX motherboard, often referred to as Standard ATX or Full-ATX, is 12" wide x 9.6" deep (305 x 244 mm). Its COM port, LPT port, PS/2, and USB are mounted directly on the motherboard. The image below is an example of the ATX form factor.

microATX

Sometimes called mATX, the microATX is a motherboard that is 9.6" wide x 9.6" deep and capable of being as small as 6.75" wide x 6.75" deep. This motherboard was first introduced by Intel in December 1997, and is a smaller motherboard that is used in an ATX or smaller computer case.

### BTX (Balanced Technology eXtended)

BTX is a motherboard form factor first announced by Intel on September 17, 2003 as a replacement for ATX. BTX was later revised to 1.0a, which was released in February 2004.

The BTX features a low profile, more efficient layout to facilitate cooling, a scalable board to accommodate different system sizes, and support for high-mass motherboard components. In September 2006, Intel announced that it was stopping all future development of BTX.

DTX

DTX is a form factor for motherboards. It is a variation of the ATX form factor that was originally developed by AMD in January 2007, designed for smaller computers like home theater PCs (media center computers).
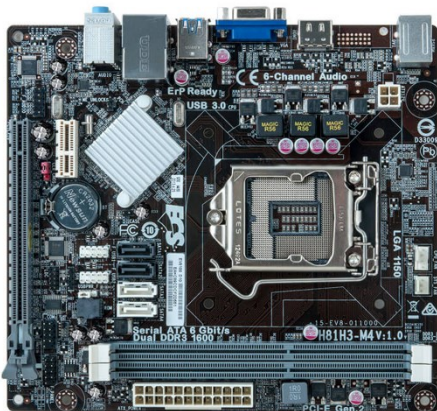
With physical dimensions of 8.0-inches by 9.6-inches, a DTX motherboard allowed for two expansion slots. A somewhat smaller version was also developed, called the Mini-DTX, having dimensions of 8.0-inches by 6.7-inches.

The DTX form factor provided a lower cost of manufacturing because it used fewer layers of printed circuit board wiring. It was intended to be an industry standard for small computers, like the Shuttle "SFF" design. DTX motherboards are backward compatible with the ATX form factor, fitting into the same size cases, and utilizing the same 24-pin power connector.

LPX (Low Profile eXtension)

is a motherboard form factor developed by Western Digital in 1987, that was used in the late 1980s and throughout the 1990s. An LPX motherboard is 9" wide x 13" deep, uses a riser card, and has different placement of the video, parallel, serial, and PS/2 ports compared to other motherboards.

As shown, this motherboard has one large brown slot for the riser card. Using a riser card allowed the expansion cards to be installed parallel to the motherboard, which is why the LP in LPX stands for "Low Profile." The low profile allowed computers using this motherboard to be much slimmer than computers using a Baby-AT motherboard.

The LPX motherboard was not the only motherboard to have a riser card. The NLX motherboard also has a riser card, but it actually plugged into the riser card versus having the riser card on the motherboard.
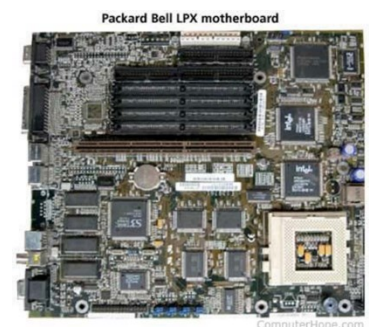
ITX (Information Technology eXtended)

Is a small motherboard form factor from VIA Technologies that was first introduced in November 2001 with the Mini-ITX. Later versions of ITX include the Nano-ITX released in March 2003, the Mobile-ITX released in March 2004, and the Pico-ITX released in April 2007.


With the compact configuration of ITX motherboards, they are often used in low-cost small setups found in cars, network devices, set-top boxes, and other small computers. Below is a picture and comparison of all of the ITX motherboards from VIA.

NLX (New Low Profile Extended)

NLX is a motherboard form factor originally developed by Intel and finalized in March 1997. The NLX motherboard was designed to replace the nonstandard LPX design and is 9" wide x 13.6" deep maximum to 8" x 10" deep minimum and included the below features.

- *The NLX form factor uses a riser board (backplane), which the motherboard plugs into instead of being on the motherboard. This allowed the motherboard to be removed from the computer without removing all expansion cards. It also supported motherboards that can be removed without using tools.*
- *Support for the Pentium II*
- *Support for AGP*
- *Support for USB.*
- *Support for DIMM.*
- Easier access to internal components.

NLX Motherboard

As shown in the picture, this motherboard is easy to identify by its gold backplane connection found at the side of the motherboard. The connector is found on the left side of the motherboard.
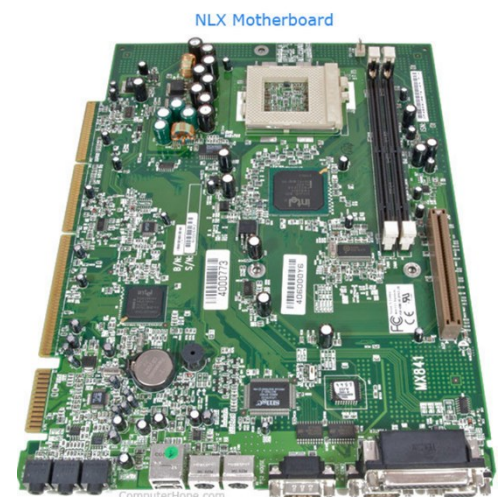
Motherboard components

A motherboard provides connectivity between the hardware components of a computer, like the processor (CPU), memory (RAM), hard drive, and video card. There are multiple types of motherboards, designed to fit different types and sizes of computers.

Each type of motherboard is designed to work with specific types of processors and memory, so they don't work with every processor and type of memory. However, hard drives are mostly universal and work with the majority of motherboards, regardless of the type or brand.

Below is a picture of the ASUS P5AD2-E motherboard with labels next to each of its major components. Clicking on the image directs you to a larger and more detailed version.

ASUS P5AD2-E Motherboard
ComputerHope.com
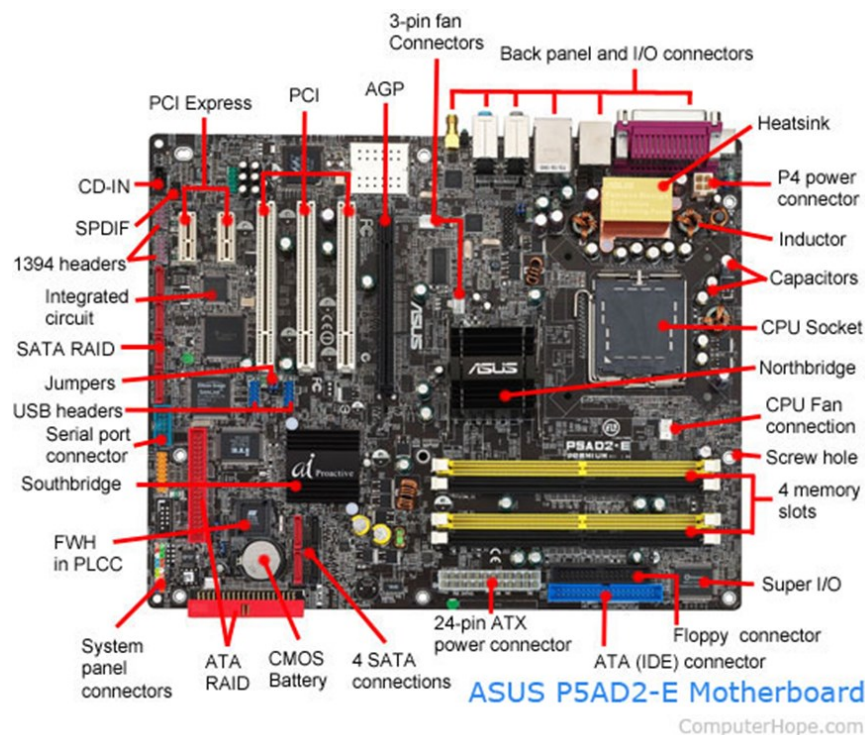
List of Components

1. Expansion slots (PCI Express, PCI, and AGP).
2. 3-pin case fan connectors.
3. Back panel connectors.
4. Heat sink.
5. 4-pin(P4)power connector.
6. CPU socket.
7. Northbridge.
8. Memory slot.
9. Super I/O.
10. Floppy connection.
11. ATA / IDE disk drive primary connection.
12. 24-pin ATX power supply connector.
13. Serial ATA connections.
14. Coin cell battery (CMOS backup battery).
15. System panel connectors.
16. FWH.

Expansion slot

Alternatively known as a **bus slot** or **expansion port**, an expansion slot is a connection or port inside a computer on the motherboard or riser card. It provides an installation point for a hardware expansion card to be connected.

Remember: 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.

list of expansion slots commonly found in a motherboard and the devices associated with those slots.

- **AGP** - Video card.
- **AMR** - Modem, sound card.
- **CNR** - Modem, network card, sound card.
- **EISA** - SCSI, network card, video card.
- **ISA** - Network card, sound card, video card.
- **PCI** - Network card, SCSI, sound card, video card.
- **PCI Express** - Video card, modem, sound card, network card.

Many of the above expansion card slots are **obsolete**. You're most likely only going to encounter AGP, PCI, and PCI Express when working with computers today.

How many expansion slots does my computer have?

Every computer motherboard is different, to determine how many expansion slots are on your computer motherboard identify the manufacturer and model of the motherboard. Once you've identified the model of motherboard, you can find complete information about the motherboard in its manual.

Adding additional expansion slots for older motherboards could be accomplished by using a riser board, which would add several ISA or PCI slots. Today, riser boards are rarely used with motherboards, as there is limited need for additional expansion slots with modern motherboards.

Why do computers have expansion slots?

Computers have expansion slots to give the user the ability to add new devices to their computer. For example, a computer gamer may upgrade their video card to get better performance in their games. An expansion slot allows them to remove the old video card and add a new video card without replacing the motherboard.

Progress Assessment (Expansion Slots)
How important are the expansion slots to a server type computer?
Enumerate/Discuss the importance of this slots.

Progress Assessment   Answer the Progress Assessment question on the Learning Management System.

AGP - accelerated graphics port

AGP is an advanced port designed for video cards and 3D accelerators. Developed by Intel and introduced in August 1997, AGP introduces a dedicated point-to-point channel that allows the graphics controller direct access to the system memory. Below is an illustration of what the AGP slot may look like on your motherboard.

The AGP channel is 32-bits wide and runs at 66 MHz, which is a total bandwidth of 266 MBps and much greater than the PCI bandwidth (**up to 133 MBps**). AGP also supports two optional faster modes, with a throughput of 533 MBps and 1.07 GBps. It also allows 3-D textures to be stored in main memory rather than video memory.

AGP is available in three different versions, the original AGP version mentioned above, AGP 2.0 that was introduced in May 1998, and AGP 3.0 (AGP 8x) that was introduced in November 2000. AGP 2.0 added 4x signaling and was capable of operating at 1.5V, and AGP 3.0 was capable of double the transfer speeds.

AMR - audio/modem riser
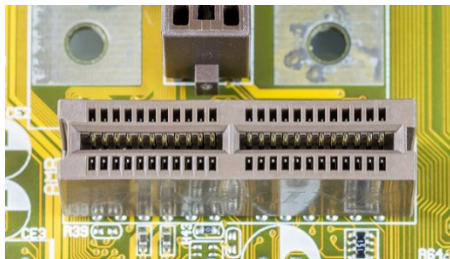
Released September 8, 1998, AMR, short for audio/modem riser, allows OEMs to make one card with the functionality of either a Modem or audio or both as one card. This specification allows for the motherboard to be manufactured at a lower cost and free up industry standard expansion slots in the system for other additional plug-in peripherals.

With modems and sound cards being integrated into the motherboard, more people using broadband, and better technologies like PCIe, AMR never gained mass adoption. Today, AMR is no longer found or used with any modern motherboard.

CNR - Communication and Network Rise

CNR is a specification that supports Audio, Modem, USB, and LAN interfaces of core logic chipsets. CNR slot technology was introduced by Intel on February 7, 2000. It was mainly developed by leading hardware and software developers who helped release the AMR (Audio Modem Riser) slot. The picture below is an example of a CNR slot, which is labeled as "CNR_SLOT" on this motherboard.

Today, this slot is no longer found on motherboards and was replaced with PCI only motherboards and motherboards with PCIe.

EISA - Extended Industry Standard Architecture

EISA or Extended ISA is a standard first announced in September 1988 for IBM compatible computers that competed with the MCA bus. The EISA bus is found on Intel 80386, 80486 and early Pentium computers and was designed by nine competitors. These competitors were AST Research, Compaq, Epson, Hewlett Packard, NEC, Olivetti, Tandy, WYSE, and Zenith Data Systems.

The EISA bus provided 32-bit slots at an 8.33 MHz cycle rate for use with 386DX or higher processors. EISA can also accommodate a 16-bit ISA card in the first row.

ISA - Industry Standard Architecture

ISA was introduced by IBM and headed by Mark Dean. ISA was originally an 8-bit computer bus that was later expanded to a 16-bit bus in 1984. When this bus was originally released, it was a proprietary bus, which allowed only IBM to create peripherals and the actual interface. However, in the early 1980s other manufacturers were creating the bus.

ISA Expansion Slot

In 1993, Intel and Microsoft introduced a PnP ISA bus that allowed the computer to automatically detect and setup computer ISA peripherals, such as a modem or sound card.

PCI - peripheral component interconnect

PCI was introduced by Intel in 1992. The PCI bus came in both 32-bit (133 MBps) and 64-bit versions and was used to attach hardware to a computer. Although commonly used in computers from the late 1990s to the early 2000s, PCI has since been replaced with PCI Express.

Revisions came in 1993 to version 2.0, and in 1995 to PCI 2.1, as an expansion to the ISA bus. Unlike ISA and other earlier expansion cards, PCI follows the PnP specification and therefore did not require any jumpers or dip switches.


How many PCI slots are on a motherboard?

The number of PCI slots depend on the manufacturer and model of the motherboard. Today, very few motherboards come with any PCI with the introduction of PCI-E. Those few motherboards that do come with PCI slots have between one and three PCI slots.

PCI Express

Originally known as 3rd Generation I/O (3GIO), PCI Express, or PCIe, was approved in July 2002 as a serial computer expansion bus standard. PCI Express was designed as a high-speed replacement for the aging PCI and AGP standards and is available in different formats.
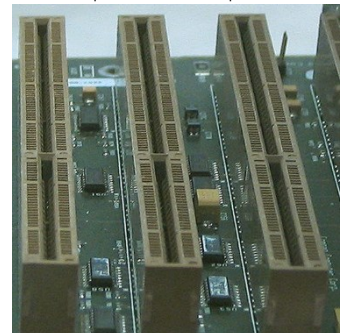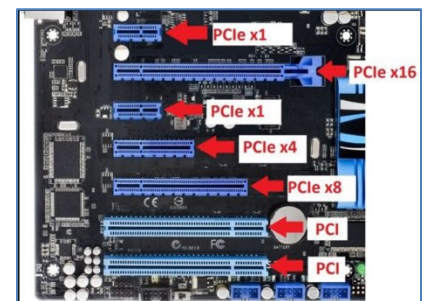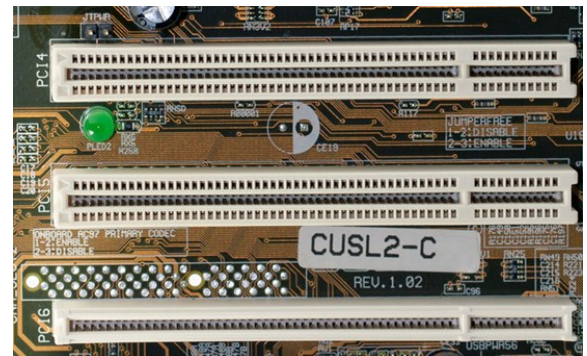
Back panel Connectors

The back panel is the portion of the motherboard that allows you to connect external devices, such as your monitor, speakers, keyboard, and mouse. As seen in the picture below, the back panel is on the edge of the motherboard. When installing the motherboard, the back panel is on the back side of the case and is inserted into the cases I/O plate.

Motherboard back panel and I/O connectors
ComputerHope.com

Heat sink

A heat sink is a device that incorporates a fan or another mechanism to reduce the temperature of a hardware component (e.g., processor). There are two heat sink types: active and passive. The picture is an example of a heat sink that has both active and passive cooling mechanisms.
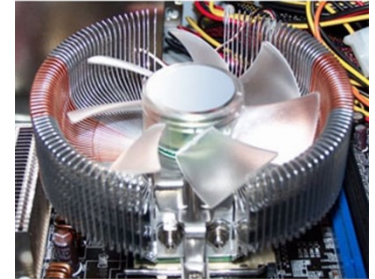
Active heat sink

Active heat sinks utilize the computer's power supply and may include a fan. Sometimes these types of heat sinks are referred to as an HSF, which is short for heat sink and fan. There are also liquid cooling systems, which have become popular in recent years.

Passive heat sink

Passive heat sinks are those that have no mechanical components. Consequently, they are 100% reliable. Passive heat sinks are made of an aluminum finned radiator that dissipates heat through convection. For passive heat sinks to work to their full capacity, there should be a steady airflow moving across the fins.

Heat spreaders

Heat spreaders are another type of passive heat sink used to help dissipate the heat produced by RAM modules.

P4 connector

The P4 connector is a 12V power supply cable used with motherboards that have an Intel Pentium 4 or later processor. Today, the connector is a standard power connector and is used with both Intel and AMD motherboards. As seen in the picture, the P4 cable has two black wires that serve as a ground, and two yellow ones that are +12VDC. All of these wires attach to a four pin connection on the motherboard.

If you purchase a new power supply with an 8-pin connector and your motherboard only needs a P4 connector, you can separate the 8-pin into two 4-pin sections.

CPU Socket

CPU socket or processor socket is a connection that allows a computer processor to connect to a motherboard. The picture shows an example of what a socket may look like on a motherboard. Although there were computers that used the slot processor, most computers today and in the past have used socket processors.

Why would I need to know the socket on my motherboard?

The processor socket helps determine what computer processors your computer motherboard is capable of accepting. *For example, a socket 1 processor is not compatible with a Socket 370 because of the pin layout and the technology differences used in each socket.*
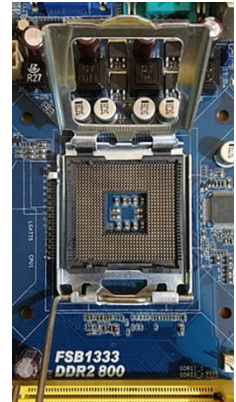
Northbridge

Alternatively referred to as the **PAC (PCI/AGP Controller)** and nb, the **Northbridge** is an integrated circuit responsible for communications between the CPU interface, AGP, and the memory. Unlike the southbridge, the northbridge is directly connected to these components. It acts as a "bridge" for the southbridge chip to communicate with the CPU, RAM, and graphics controller.

Today, the northbridge is a single-chip that is north of the PCI bus, however, early computers may have had up to three separate chips that made up the northbridge.

When the CPU needs data from RAM, a request is sent to the northbridge memory controller. After the request is received, the northbridge responds with how long the processor needs to wait to read memory over the front-side bus. Some newer motherboards have replaced the northbridge and the southbridge with IHA.

Memory slot

A **memory slot, memory socket, or RAM slot allows RAM** (computer memory) to be inserted into the computer. Most motherboards have two to four memory slots, which determine the type of RAM used with the computer. The most common RAM types are **SDRAM and DDR** for desktop computers and **SODIMM** for laptop computers, each having various types and speeds. The picture below is an example of what memory slots may look like inside a desktop computer. In this picture, there are three open and available slots for three memory sticks.
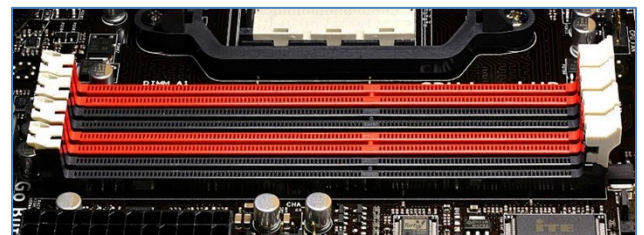
Remember: When buying a new computer or motherboard, pay close attention to the types of RAM the memory slots can accept. Make sure you know exactly the type of RAM to buy for your computer. It is also important to note how many available memory slots are available in your computer. It is not uncommon for computers to have all memory slots occupied. If all slots are full and you want to upgrade the computer memory, you need to remove some or all of the existing memory.

Progress Assessment (Memory Slot)
Why are the memory slots have different colors? And why is it important?

Progress Assessment

Answer the Progress Assessment question on the Learning Management System.

SIO – super input/output

SIO is an integrated circuit on a computer motherboard that handles the slower and less prominent input/output devices shown below. When the super input/output was first introduced in the late 1980s, it was found on an expansion card. Later, this chip was embedded into the motherboard and communicated over the ISA bus. As ISA began to no longer be used with computers, SIO communicated over the PCI bus. Today, super I/O communicates through the Southbridge and is still used with computers to support older legacy devices.

Computer devices handled by the super I/O

- Floppy disk controller
- Game port
- Infrared
- Intrusion detection
- Keyboard and mouse (non-USB)
- Parallel port
- RTC (Real-time clock)
- Serial port UART
- Temperature sensor and fan speed.

Some newer chipsets are combining the Southbridge and super I/O chips into a single chip and referring to this chip as the Super Southbridge chip. Some manufacturers, such as NVIDIA and SiS, have even combined the Northbridge, Southbridge, and super I/O into a single chip.

Floppy Channel

The **floppy channel, FDD header, or floppy connection** is where the floppy drive connects to the computer motherboard. In the picture below, is an example of a motherboard with two IDE connections and a floppy channel connector.

IDE - Integrated Drive Electronics

IDE is more commonly known as ATA or PATA (parallel ATA). It is a standard interface for IBM computers that was first developed by Western Digital and Compaq in 1986 for compatible hard drives and CD or DVD drives. IDE is different than SCSI and ESDI (Enhanced Small Disk Interface) because its controllers are on each drive, meaning the drive can connect directly to the motherboard or controller. IDE and its updated successor, EIDE (Enhanced IDE), are common drive interfaces found in IBM compatible computers. Below is a picture of the IDE connector on a hard drive, IDE cable, and the IDE channels on the motherboard.
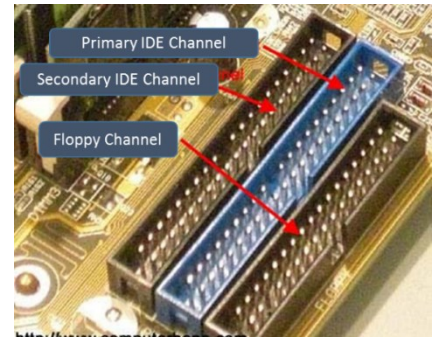
ATX style connector

An ATX style connector is a replacement for the older P8 and P9 AT style connector. It is one of the largest connectors inside a computer. It connects a power supply to an ATX style motherboard. As shown in the picture, the 20-pin cable is a multi-color cable and may be labeled as P1.
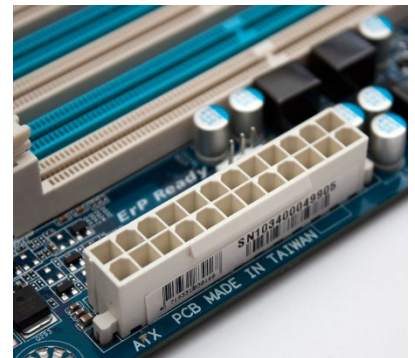
With the introduction of ATX-2, this cable is now a 24-pin cable and no longer a 20-pin cable.

SATA - serial AT attachment

SATA 1.0 was first released in August 2001 and is a replacement for the parallel ATA interface used in IBM compatible computers. SerialATA is capable of delivering 1.5 Gbps (approximately 187 MBps) of performance to each drive within a disk array. It is backward-compatible with ATA and ATAPI devices, and offers a thin, small cable solution, as seen in the "SATA Data Cable" picture. This cable helps makes cable routing easier and offers better airflow in the computer compared to the earlier ribbon cables used with ATA drives.

eSATA connection

SATA also supports external drives through External SATA more commonly known as eSATA. eSATA offers many more advantages compared to other solutions. *For example, it is hot-swappable, supports faster transfer speeds with no bottleneck issues like USB and FireWire, and supports disk drive technologies (e.g., S.M.A.R.T.).*

Progress Assessment (eSATA)
Site some disadvantage of eSATA?

Progress Assessment
Answer the Progress Assessment question on the Learning Management System.

CMOS - complementary metal-oxide semiconductor

Alternatively referred to as a RTC (real-time clock), NVRAM (non-volatile RAM) or CMOS RAM, CMOS is short for complementary metal-oxide semiconductor. CMOS is an onboard, battery powered semiconductor chip inside computers that stores information. This information ranges from the system time and date to system hardware settings for your computer.

How long does the CMOS battery last?
The standard lifetime of a CMOS battery is around 10 Years. However, this can vary depending on the use and environment where the computer resides.

System panel connector

Alternatively referred to as the fpanel or front panel connector, the system panel connector or system panel header controls a computer **power button, reset button, and LED's**. The System panel cables, as shown in the picture are two wire cables that are color-coded to help identify where they connect to the motherboard system panel connector. The black or white wire is the GND (ground) wire and the colored wire is the powered wire. The cables, colors, and connections vary depending on the computer case and motherboard you have, however, generally include the cables mentioned below.
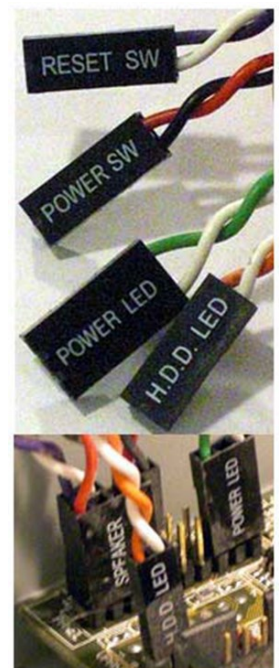
Types of system panel cables
- **HDD LED (IDE LED)** - The LED activity light for the hard drive. This indicator is the light that flashes as information is being written to and read from the hard drive.
- **PLED (Power LED)** - The LED power light, which indicates when the computer is on, off, or in Standby.
- **PWRSW (Power SW)** - Controls the power button that allows you to turn on and off the computer.
- **Reset SW** - Handles the reset button to restart the computer.
- **Speaker** - The internal speaker used to sound the beep noises you hear from your computer when it is booting.

The Central Processing Unit (CPU)

A central processing unit (CPU), also called a central processor, main processor or just processor, is the electronic circuitry within a computer that executes instructions that make up a computer program. The CPU performs basic arithmetic, logic, controlling, and input/output (I/O) operations specified by the instructions in the program. The computer industry used the term "central processing unit" as early as 1955. Traditionally, the term "CPU" refers to a processor, more specifically to its processing unit and control unit (CU), distinguishing these core elements of a computer from external components such as main memory and I/O circuitry.

The CPU is often called the "brain" of a computer, thanks to its direct plug connection to the motherboard, and communication with all of the computer's other components.

Random-access memory

Random-access memory is a form of computer memory that can be read and changed in any order, typically used to store working data and machine code.
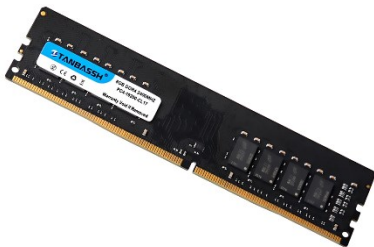
Random-access memory, or RAM, is an essential component in all devices, from PCs to smartphones to game consoles. Without RAM, doing just about anything on any system would be much, much slower. On the flip side, not having enough for the application or game you're trying to run can bring things to a crawl or even prevent them from running at all.

But what is RAM exactly? In a nutshell, it's a high-speed component that temporarily stores all the information a device needs both right now and imminently. Accessing data in RAM is insanely fast, unlike hard drives that are slower but provide long-term storage.

If this is all semantics and you just need to know how to install some RAM or want to find out how much RAM you need, we have guides for that, too.

Short-term memory

RAM is essentially a device's short-term memory. It temporarily stores (remembers) everything currently running on a device, like all OS-specific services and any web browser, image editor, or game you're playing.

RAM prevents the CPU from digging through the device's slower storage — like a hard drive or even a solid-state drive (SSD) — every time you request a new browser tab or load a new enemy to shoot. As fast as storage is when compared to drives of years gone by, they're still far slower than RAM.

Data that resides in RAM is readable from any capable component at almost the same speed. Because it has a hard-wired connection to the device, there's no real latency in cabling or connection.

RAM doesn't remember everything forever, however. It's a **"volatile"** technology, meaning that once it loses power, it forgets everything. That makes it perfect for handling the multitude of high-speed tasks that your device throws at it each day.

Hard drive

A hard disk drive (sometimes abbreviated as a hard drive, HD, or HDD) is a non-volatile data storage device. It is usually installed internally in a computer, attached directly to the disk controller of the computer's motherboard. It contains one or more platters, housed inside of an air-sealed casing. Data is written to the platters using a magnetic head, which moves rapidly over them as they spin.

Why does a computer need a hard drive?

A computer requires an operating system to allow users to interact with and use it. The operating system interprets keyboard and mouse movements and allows for the use of software, like an Internet browser, word processor, and video games. To install a computer operating system, a hard drive (or another storage device) is required. The storage device provides the storage medium where the operating system is installed and stored.

A hard drive is also required for the installation of any programs or other files you want to keep on your computer. When downloading files to your computer, they are permanently stored on your hard drive or another storage medium until they are moved or uninstalled.

Hard drives in modern computers

Modern computers often use an **SSD (solid-state drive)** as the primary storage device, instead of an HDD. HDDs are slower than SSDs when reading and writing data, but offer greater storage capacity for the price.

Although an HDD may still be used as a computer's primary storage, it's common for it to be installed as a secondary disk drive. For example, the primary SSD may contain the operating system and installed software, and a secondary HDD may be used to store documents, downloads, and audio or video files.

Remenber: New computer users may confuse RAM (memory) with their disk drive. Unlike an HDD or SSD, RAM is a "volatile" data storage device, meaning it can store data only when the computer is powered on. See our memory definition for a comparison between memory and disk storage.

Progress Assessment (HDD)
1. Can a computer work without a hard drive? Discuss your answer.
2. Enumerate the different storage sizes of hard drives? From smallest to largest.

Progress Assessment Answer the Progress Assessment question on the Learning Management System.

Although most hard drives are internal, there are also stand-alone devices called external hard drives or portable hard drives that backup data on computers and expand the available space. External drives are often stored in an enclosure that helps protect the drive and allows it to interface with the computer, usually over USB, eSATA, or FireWire. An excellent example of an external backup device that supports multiple hard drives is the Drobo.

Remember: HDD being replaced by SSD

SSDs (solid-state drives) have started to replace HDDs (hard disk drives) because of the distinct performance advantages they have over HDD, including faster access times and lower latency. While SSDs are becoming popular, HDDs continue to be used in many desktop computers largely due to the value per dollar that HDDs offer over SSDs. However, more and more laptops are beginning to utilize SSD over HDD, helping to improve the reliability and stability of laptops.

Chassis

Alternatively referred to as the case and sometimes referred to as the system unit or base unit. The chassis is the housing that helps protect and organize all the components that make up a desktop computer. The picture is an empty computer chassis.

Why do we need a computer case?

Most people overlook the computer case as only a box, but it does provide the below important features.

- **Structure** - The case is what holds everything together in a compact and organized fashion.
- **Protection** - Without the case, each of the sensitive components in the computer would be vulnerable to dirt, foreign objects, kids, animals, and electrical interference (EMI / RFI).
- **Cooling** - The case helps keep the air properly flowing over all components, which keeps everything cool and running properly.
- **Noise** - Many computers and components have fans that generate noise. Having those components in a confined case reduces the overall noise.
- **Aesthetics** - Although some may disagree, most people would rather look at the case instead of all the circuit boards, wires, and the computer components.

Types of computer cases

There are many different motherboard form factors used for computers today. Below is a list of the most popular type of cases. If you're building a computer, make sure you get a case that is compatible with your motherboard.

- Desktop
- Full-sized tower
- Slimline
- Mini-sized tower and tower