

Dr.SNS RAJALAKHMI COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

DEPARTMENT OF COMPUTER APPLICATIONS (PG)

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Prepared by : Ms.S.Lalitha

UNIT III

Memory and Storage:

What is Computer memory?

Memory is an essential part of the computer system because a computer cannot process any task without it. Memory is used to store data and instructions for performing specific tasks on the computer system. The computer memory is typically a storage space that is capable of storing and fetching data.

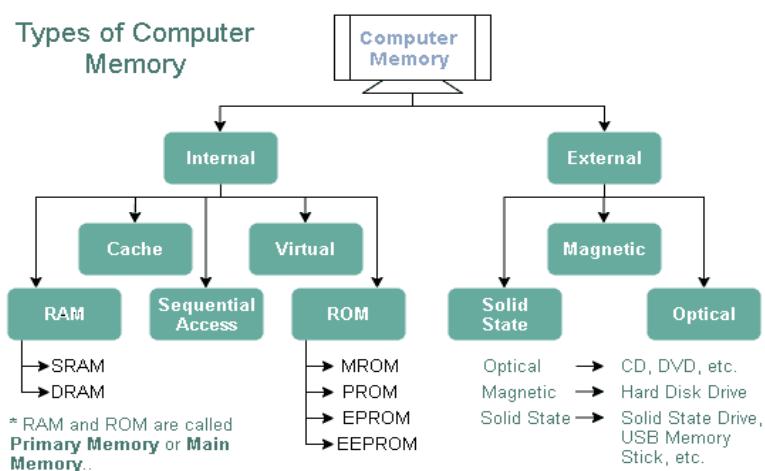
Memory is a set of several memory cells known as the building blocks of memory. Each memory cell has a unique index number or identification number known as the unique address of that specific memory cell. The CPU is responsible for selecting memory cells to read or write data.

The performance of the computer system depends on the memory and CPU. CPU cannot store programs or a large set of data permanently. They are only capable of storing basic instructions required to operate the computer. Therefore, it is mandatory to have the memory to run a computer system properly.

Types of Computer Memory

There are basically two types of computer memory:

- Internal Memory
- External Memory



- **Primary memory** includes ROM and RAM, and is located close to the CPU on the computer motherboard, enabling the CPU to read data from primary memory very quickly indeed. It is used to store data that the CPU needs imminently so that it does not have to wait for it to be delivered.
- **Secondary memory** by contrast, is usually physically located within a separate storage device, such as a hard disk drive or solid state drive (SSD), which is connected to the computer system either directly or over a network. The cost per gigabyte of secondary memory is much lower, but the read and write speeds are significantly slower.

Primary Memory Types: RAM and ROM

There are two key types of primary memory:

1. RAM, or random access memory
2. ROM, or read-only memory

1) RAM Computer Memory

The acronym RAM stems from the fact that data stored in random access memory can be accessed – as the name suggests – in any random order. Or, put another way, any random bit of data can be accessed just as quickly as any other bit.

The most important things to understand about RAM are that RAM memory is very fast, it can be written to as well as read, it is volatile (so all data stored in RAM memory is lost when it loses power) and, finally, it is very expensive compared to all types of secondary memory in terms of cost per gigabyte. It is because of the relative high cost of RAM compared to secondary memory types that most computer systems use both primary and secondary memory.

Data that is required for imminent processing is moved to RAM where it can be accessed and modified very quickly, so that the CPU is not kept waiting. When the data is no longer required it is shunted out to slower but cheaper secondary memory, and the RAM space that has been freed up is filled with the next chunk of data that is about to be used.

Types of RAM

- **DRAM:** DRAM stands for Dynamic RAM, and it is the most common type of RAM used in computers. The oldest type is known as single data rate (SDR) DRAM, but newer computers use faster dual data rate (DDR) DRAM. DDR comes in several versions including DDR2 , DDR3, and DDR4, which offer better performance and are more energy efficient than DDR. However different versions are incompatible, so it is

not possible to mix DDR2 with DDR3 DRAM in a computer system. DRAM consists of a transistor and a capacitor in each cell.

- **SRAM:** SRAM stands for Static RAM, and it is a particular type of RAM which is faster than DRAM, but more expensive and bulkier, having six transistors in each cell. For those reasons SRAM is generally only used as a data cache within a CPU itself or as RAM in very high-end server systems. A small SRAM cache of the most imminently-needed data can result in significant speed improvements in a system

2) ROM Computer Memory

ROM stands for read-only memory, and the name stems from the fact that while data can be read from this type of computer memory, data cannot normally be written to it. It is a very fast type of computer memory which is usually installed close to the CPU on the motherboard.

ROM is a type of non-volatile memory, which means that the data stored in ROM persists in the memory even when it receives no power – for example when the computer is turned off. In that sense it is similar to secondary memory, which is used for long term storage.

When a computer is turned on, the CPU can begin reading information stored in ROM without the need for drivers or other complex software to help it communicate. The ROM usually contains “bootstrap code” which is the basic set of instructions a computer needs to carry out to become aware of the operating system stored in secondary memory, and to load parts of the operating system into primary memory so that it can start up and become ready to use.

Types of ROM

ROM is available in several different types, including PROM, EPROM, and EEPROM.

- **PROM** PROM stands for Programmable Read-Only Memory, and it is different from true ROM in that while a ROM is programmed (i.e. has data written to it) during the

manufacturing process, a PROM is manufactured in an empty state and then programmed later using a PROM programmer or burner.

- **EPROM** EPROM stands for Erasable Programmable Read-Only Memory, and as the name suggests, data stored in an EPROM can be erased and the EPROM reprogrammed. Erasing an EPROM involves removing it from the computer and exposing it to ultraviolet light before re-burning it.
- **EEPROM** EEPROM stands for Electrically Erasable Programmable Read-Only Memory, and the distinction between EPROM and EEPROM is that the latter can be erased and written to by the computer system it is installed in. In that sense EEPROM is not strictly read-only. However in many cases the write process is slow, so it is normally only done to update program code such as firmware or BIOS code on an occasional basis

Confusingly, NAND flash memory (such as that found in USB memory sticks and solid state disk drives) is a type of EEPROM, but NAND flash is considered to be secondary memory.

Secondary Memory Types

Secondary memory comprises many different storage media which can be directly attached to a computer system. These include:

- hard disk drives
- solid state drives (SSDs)
- Optical (CD or DVD) drives
- Tape drives

Secondary memory also includes:

- Storage arrays including 3D NAND flash arrays connected over a storage area network (SAN)

- Storage devices which may be connected over a conventional network (known as network attached storage, or NAS)

Arguably cloud storage can also be called secondary memory.

Differences between RAM and ROM

ROM:

- Non-volatile
- Fast to read
- Usually used in small quantities
- Cannot be written to quickly
- Used to store boot instructions or firmware
- Relatively expensive per megabyte stored compared to RAM

RAM:

- Volatile
- Fast to read and write
- Used as system memory to store data (including program code) that the CPU needs to process imminently
- Relatively cheap per megabyte stored compared to ROM, but relatively expensive compared to secondary memory

Differences between RAM and ROM are :

• RAM

1. Random Access Memory
2. Volatile (*maintains its data while the device is powered*)
3. Stores information temporary
4. Requires flow of electricity to retain data
5. Large size with higher capacity
6. Used for both read and write
7. Costlier
8. Very fast but uses a lot of power
9. Used in CPU cache, primary memory

• ROM

1. Read only Memory
2. Non-Volatile (*does not lose content when power is lost*)
3. Stores information permanently
4. Does not require flow of electricity to retain data
5. Small size with less capacity
6. Used only for reading
7. Cheaper than RAM
8. Fast and uses very little power
9. Used in firmware, microcontrollers

Magnetic tapes uses:

- Magnetic tapes are used in most organizations to save data files.
- Magnetic tapes use a read-write mechanism.
- The read-write mechanism defines writing data on or reading data from a magnetic tape.

- The tapes sequentially save the data manner.
- In this sequential processing, the device should start searching at the starting and check each record until the desired information is available.

Usage of Hard disk:

Here are the top 5 uses for an external drive.

1. Storage
2. Backups
3. Digital editing
4. Data sharing
5. Gaming

That's right, you can use an external hard drive for so much more than storage. Let's review each one of these items in detail.

1. Storage

EXTERNAL HARD DRIVES ARE MAINLY USED FOR STORAGE

Every computer – whether it's a tower desktop or laptop – is equipped with an internal hard drive. The hard drive is where all your permanent computer data is stored. Whenever you save a file, photo, or software to your computer, it's stored in your hard drive.

Most hard drives have storage space between 250GB and 1TB. That's more than enough for the casual PC user, but if you've had your computer for a long time or if you're using your computer as a workstation, you'll probably need more hard drive space than 500GB. When you run out of space on your hard drive, you won't be able to save any additional data to your computer – no more photos, no more software, no more word processing documents.

You'll run into problems when your computer is running on low storage space. When your computer CPU is performing tasks, it creates "temporary" files that are often saved on your hard drive. If your hard drive is too full, then your CPU won't have as much space to store these temporary files, and it won't be able to process things as quickly. You'll have slowdown when you're playing games, streaming movies, running programs, or even just browsing the web. For that reason, it's always best to keep [as much free space on your hard drive as possible](#).

Most people use an external hard drive for that very reason. Unlike an internal drive, which is nestled firmly inside your computer, an external hard drive is a device that you plug into a computer port. An external hard drive gives you more storage space to keep your data.

When you store data on an external hard drive, you can only access it when the hard drive is plugged into your computer. You can use an external hard drive to store files that you don't access very frequently. These might be:

- Old photos or videos
- Records and archival data
- Completed projects/portfolios

When you store your older documents on an external hard drive, you'll be able to maintain a higher amount of free space on your hard drive, so you can keep adding new files and ensure your computer is running as fast as possible.

HOW TO FREE UP SPACE ON YOUR HARD DRIVE

In addition to using an external hard drive, you can free up space on your hard drive by using the Storage Sense utility on Windows 10 computers. Storage Sense automatically finds and deletes temporary files from your computer. To turn on Storage Sense:

- Press the Windows key
- Click the Settings icon
- Click System
- Click the Storage tab

PORTABLE EXTERNAL DRIVES FOR TRAVEL

If you're traveling, you can get a portable external hard drive to store all the photos and videos you take while you're on vacation. You could easily store all your photos and videos on your laptop or phone, but if you take a massive number of photos, that could quickly eat up your hard drive space. Use an external hard drive to store your new photos while you travel.

2. Backups

One of the most important things you can do to protect your computer data is to back up your hard drive. A backup is just a second copy of your hard drive that you'll have available in case something happens to your computer.

Moisture, drops, and computer viruses can cause catastrophic damage to your computer that can destroy your hard drive. You could also lose all your computer data if your computer gets stolen. That's why it's important to have a backup stored on an external hard drive. That way, when you

get a new computer, you'll be able to transfer the data from your backup onto your new hard drive – you're up and running, good as new.

3. Editing

An external hard drive is an absolute necessity for digital editing. What is digital editing?

- Video editing
- Photo editing
- Digital illustration
- 3D rendering
- Audio editing
- Advanced simulations

These are some of the most intensive tasks that your computer can do because they require massive computations and data processing. While your CPU and GPU do most of the work, an external hard drive is a crucial aspect, too.

RAID PROCESSING

RAID stands for “redundant array of independent disks.” Basically, you connect two or more hard drives and they act as a single hard drive. You can set up RAID so that your data is being stored on multiple hard drives - so if one drive crashes, you'll still have the data on the other hard drives.

When you're doing high-octane processing, there's a greater chance your hard drive may crash. A crashed hard drive could cause you to lose all the new data that's not yet saved. One of the best ways to prevent this from happening is to do RAID processing when you're doing intensive tasks. If you're new to digital editing, do some research on how to set up a RAID array.

EXTERNAL SCRATCH DISK

A scratch disk is any hard drive that a computer program saves data on. Most computers only have a single hard drive, so that's the designated scratch disk for computer programs. If you're doing digital editing, it might be beneficial for you to select an external hard drive as the scratch disk for your editing software.

Your computer hard drive is probably going to be full of software and personal files, and if you're doing editing that's going to spawn a large number of temporary files, you might run out of space on your hard disk. Plug in an external hard drive instead and set it as the scratch disk for

your editing program (typically you'll set the scratch disk in-app). An external hard will have more free space for editing.

4. Data sharing

An external hard drive is a great way to transfer a large amount of data. The most popular ways to transfer data are by flash drive, email, or cloud storage. Unfortunately, these methods aren't ideal for sending/receiving more than a few files. If you're trying to transfer many gigabytes of data, you'll find these transfer methods are slow and inconvenient. Cloud storage can handle a larger quantity of data, but upload and download times may be long.

5. Gaming

Modern PC games are absolutely massive in scope and graphical detail which means they take up a lot more space on your hard drive. If you're a hardcore PC gamer and your hard drive is getting overstuffed with games, get an external hard drive to store them. Remember that your computer won't perform as quickly if you're running low on free space. An external hard drive could significantly boost your gaming performance.

	CD	DVD
Stands for	Compact Disc	Digital Versatile Disc
Purpose	CDs are made with the purpose of holding audio files as well as program files.	DVDs are made with the purpose of holding video files, movies, substantial amount of programs, etc.
Media type	Optical disc	Optical disc
Encoding	Various	Various
Capacity	Typically up to 700 MiB (up to 80 minutes audio)	DVD can range from 4.7 GB to 17.08 GB.
Read mechanism	780 nm wavelength (infrared and red edge) semiconductor laser, 1200 Kib/s (1×)	650 nm laser, 10.5 Mbit/s (1×)
Write mechanism	1200 Kib/s (1×)	10.5 Mbit/s (1×)
Types	CD-R, CD-RW, CD-Text, CD + Graphics, CD + Extended Graphics, Super Audio CD, CD-MIDI, CD-ROM, Video CD, Super Video CD, Photo CD, CD-I, Enhanced CD, VinylDisc and Bootable CD.	DVD-RW, DVD+RW, DVD-RAM and Blu-Ray.
Developed by:	Philips, Sony	Philips, Sony, Toshiba, and Panasonic

Video memory:

What is VRAM?

VRAM (video RAM) refers to any type of random access memory (RAM) specifically used to store image data for a computer display. VRAM's purpose is to ensure the even and smooth execution of graphics display. It is most important in applications that display complex image textures or render polygon-based three-dimensional (3D) structures. People commonly use VRAM for applications such as video games or 3D graphic design programs.

All types of VRAM are special arrangements of dynamic RAM ([DRAM](#)). VRAM is a buffer between the computer processor and the display and is often called the frame buffer. When images are to be sent to the display, they are first read by the processor as data from some form of main (non-video) RAM and then written to VRAM.

From VRAM, the data is sent as a digital signal via a digital video interface or high-definition multimedia interface, or [HDMI](#), video port to a modern, flat-screen LED (light-emitting diode) display. If the display is an older cathode ray tube model, or if the modern display is connected by an older VGA (video graphics array) connector to the video card, the video signal is first converted by a [RAM digital-to-analog converter](#) into analog signals that are sent to the display.

VRAM usage

The only significant difference between VRAM and system RAM is the speed and the ability to mimic dual-port functionality common in older forms of specialized VRAM.

For applications that rely on complex data processing functions, the amount of VRAM on a system's graphics card is not nearly as important as the amount of system RAM. A modern business workstation can easily get by without a graphics card, often using a chip on the motherboard that shares system RAM for video display.

For gaming, users generally need:

- 2 GB for 720p
- 4 GB for 1080p
- 6 GB to 8 GB for 1440p
- 8 GB to 12 GB for 2160p, or 4K

For video editing, users typically need:

- 8 GB for 720p to 1080p files
- 16 GB for 4K files
- 32 GB for editing all types of files
- 64 GB for professional or commercial users who want to edit 8K files

Physical memory

- Physical memory refers to the actual RAM of the system, which usually takes the form of cards (DIMMs) attached onto the motherboard. Also called primary memory, it is the only storage type directly accessible to the CPU and holds the instructions of programs to execute. Physical memory is linearly addressable; memory addresses increase in a linear fashion and each byte is directly addressable.
- Logical Memory (Virtual memory) adds a layer of abstraction over the physical memory, and offers many benefits such as the ability to maintain separate address spaces (per process perhaps), and the ability to use physical memory as a large cache for the physical disk which makes memory appear limitless (upto $2^{(\text{bus width})}$) from the program/programmers perspective.

Once the memory is purchased, locate the memory slots on the computer motherboard. If no memory slots are available on the computer, one or more memory modules must be removed before the memory can be installed.



Each slot on a motherboard that supports a DIMM is a bank; therefore the computer works if one memory module is purchased.

Examine the memory module before installing it into the computer. At the bottom of the memory module, you should notice one or more notches at the bottom of the card. These notches look like those shown in the picture below.

Crucial DDR DIMM



Make sure that the notches match up with the memory slot you are installing the memory into. These notches allow the memory to be installed only in one direction. If the memory is incompatible, it will not physically match with the slot.

After verifying the notches and direction, the memory needs to be installed, move each memory slot tab out or away from the memory module. These tabs will snap into place as the memory module is installed.

Once these tabs are moved out, gently and firmly push the memory module into the slot. As the memory module is being pushed, the two tabs should snap and hold the memory module into place.

After the memory is installed in the computer, plug the computer back in, and turn it back on. As the computer is booting, the memory should be automatically detected and set up. If you have any difficulties with the memory detected or set up, enter the BIOS setup, and verify the memory is correctly detected by the system.

RIMM memory installation steps

What makes RIMM memory modules different from DIMM memory modules is the C-RIMM memory module. This module allows the computer to have a continuous flow of data. When installing a new RIMM, remove the C-RIMM. This module is a small circuit board and has only a few or no chips on it.

When the C-RIMM module is removed, and the two tabs are in the outward position, push the RIMM memory module to a vertical or 90-degree angle. As the memory module is being pushed, the two tabs should snap and hold the memory module into place.

SIMM memory installation steps

30 and 72-pin SIMM memory modules must occupy a bank. Computers that use 72-pin SIMMs have two sockets as one bank. Therefore, two memory modules of equal value must be installed in pairs, unless instructed otherwise by the computer or motherboard manufacturer.

The installation of most SIMM memory is the same. The memory is placed into the slot at a 75-degree angle and while still in the memory slot, moved to a vertical (90-degree) angle. As the memory module is moved to a vertical position, it should snap into place. When installed, ensure that both sides of the memory module are snapped into place. If a memory module is not installed properly, it could cause damage to the computer.

We recommend the larger memory modules be installed in the lowest available banks. For example, if the computer has two 4 MB memory modules and you're installing two 32 MB memory modules, place the 32 MB memory modules either in banks 0 and 1, or 1 and 2.

Set memory in BIOS

Once the memory appears is installed into the computer, test it. Put the case back on the computer. Connect the keyboard, monitor, and power to the computer. Turn on the computer.

As the computer is booting, enter the BIOS setup, verify that the memory is detected, and if necessary, adjust the settings to match your memory specifications. When verification and configuration is complete, save the settings, exit BIOS, and reboot the computer.

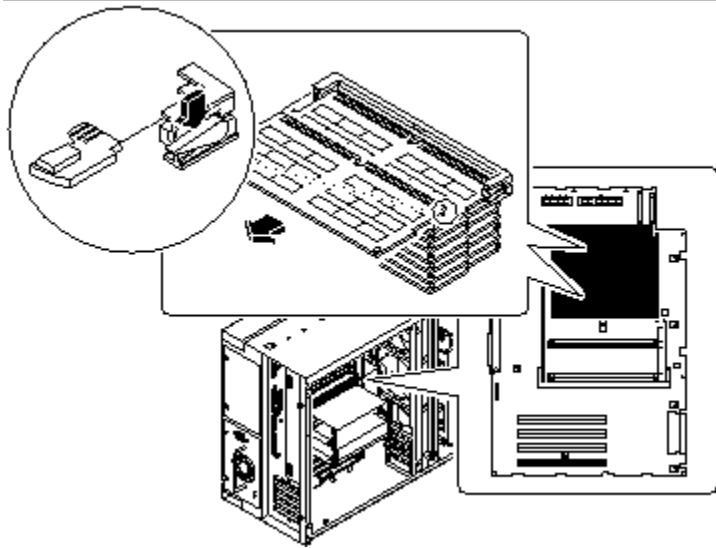
How to Remove a Memory Module

What to Do

1. Locate the DIMM module you want to remove on the main logic board.

See ["About Memory"](#).

2. Push the ejection lever away from the memory module and eject it from the socket.



3. Grasp the top corners of the memory module and pull it out of its socket.

Place the module on an antistatic mat.

Removing and replacing a memory module

- The memory modules are sensitive to electrostatic-discharge (ESD). Take precautions to avoid damage from static electricity. When you remove or replace this part, you must follow recommended procedures for handling ESD-sensitive devices.
- No tools are required to complete this task. Do not remove or loosen any screws when you complete these procedures.

[Figure 1](#) shows the location of the CPU and the DIMM slots within the node canister. [Figure 1](#). Location of the CPU and DIMM slots



- A CPU processor has six memory channels, which are labeled A-F.
- Each memory channel has 2 DIMM slots, numbered 0-1. For example, DIMM slots A0 and A1 are in memory channel A.
- On the system board, the DIMM slots are labeled according to their memory channel and slot.
- You do not have to replace all of the memory modules at the same time. However, when you install memory modules, be sure that you follow the configurations that are described in the following table.

To ensure proper cooling and a steady flow of air from the fan modules in each node canister, “blank” DIMMs must be inserted in any slot that does not contain a memory module.

If a node error 510 is logged (error code 1022 in the system log), the sense data includes the following information, which you can also use to determine which DIMMs need to be replaced.

- Detected memory size in MB.
- Expected memory size in MB.

- A list with one entry per DIMM slot, show the size of the DIMM in GB for each slot.

Procedure

Identifying failed DIMMs

1. If you are replacing failed DIMMs, use the service assistant or the **System Event Log** in the management GUI to obtain the sense data. This data shows the detected and expected memory sizes and the size of the DIMM in each slot.
2. Identify the column in the memory configuration table that contains the expected configuration. To do so, match the expected memory size from the error sense data to the column that has the same node canister total memory.
3. Compare the size of the DIMM reported in each slot in the error data with the expected DIMM size for the slot index and node canister total memory size that is shown in the memory configuration table. For each mismatch, the DIMM must be replaced with the size of DIMM that is indicated in the table. See the “Replaceable units” topic in the Reference section for the correct FRU part number for each size of DIMM.

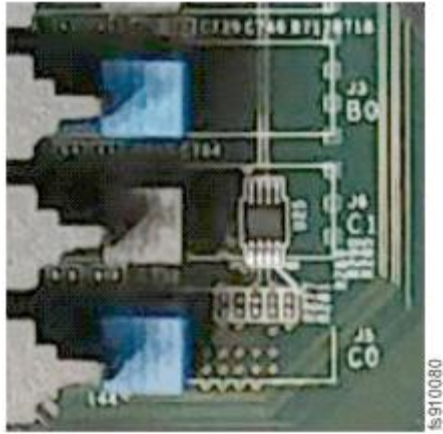
Removing the node canister

4. Follow [Procedure: Powering off a node canister](#) to verify that the hosts will not lose access to data in volumes.
5. Remove the node canister, as described in [Reseating a node canister in the control enclosure](#), and place it on a flat, level surface.

Removing the DIMM

6. Remove the cover, as described in [Removing and replacing the cover of a node canister](#).
7. Locate the appropriate DIMM slot.

As [Figure 2](#) shows, the DIMM locations are identified on the system board.



6. Press the locking tabs on the side of the DIMM to eject it.
7. Lift the DIMM up and out of the slot.
8. If you have other tasks to complete inside the control enclosure, do those tasks now.
9. Touch the static-protective package that contains the new DIMM to any unpainted metal surface on the node canister. Remove the DIMM from the package.
10. Turn the DIMM so that the DIMM keys align correctly with the connector on the main board.
11. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector, as shown in [Figure 3](#).



11. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector.

12. Repeat steps [11](#) through [14](#) until all the new or replacement DIMMs are installed.
13. Install the cover, as described in [Removing and replacing the cover of a node canister](#).
14. Reinsert the node canister, as described in [Reseating a node canister in the control enclosure](#).

If the canister does not begin to power up, check that the canister is fully inserted into the enclosure.

15. When the node is active again, go to the management GUI and look for any unfixed events that are related to the DIMMs.

What is virtual memory?

Virtual memory is a method that computers use to manage storage space to keep systems running quickly and efficiently. Using the technique, [operating systems](#) can transfer data between different types of storage, such as random access memory (RAM), also known as main memory, and hard drive or solid-state disk storage. At any particular time, the computer only needs enough active memory to support active processes. The system can move those that are dormant into virtual memory until needed.

A virtual memory system has many advantages, including:

- Allowing users to operate multiple applications at the same time or applications that are larger than the main memory

- Freeing applications from having to compete for shared memory space and allowing multiple applications to run at the same time
- Allowing core processes to share memory between libraries, which consists of written code that provides the foundation for a program's operations
- Improving security by isolating and segmenting where the computer stores information
- Improving efficiency and speed by allowing more processes to sit in virtual memory
- Lowering the cost of computer systems as you find the right amount of main memory and virtual memory
- Increasing the amount of memory available by working outside the limits of a computer's physical main memory space
- Optimizing central processing unit (CPU) usage

Virtual memory is a built-in component of most modern desktop computers. It's part of a computer's CPU and is a more cost-effective method for managing memory than expanding its physical memory storage system. Some specialized computers might not rely on virtual memory because it could cause inconsistencies in how the [computer processes](#) information and runs tasks.

Storage devices:

How to install a hard drive

Learning how to install a hard drive will take a bit of patience and a fair amount of careful plugging and unplugging. Following our user-friendly guide, you'll be well on your way toward a brand new hard disk drive, ready for action.

How to install a hard drive for a desktop PC

Step 1: Turn off the computer and unplug the tower from its power source. You'll want to place the tower on a sturdy, well-lit surface before opening up the case.

Step 2: Unscrew any nuts and bolts holding the chassis together and remove the sides of your computer tower's case. Make sure you have unrestricted access to the motherboard and SATA ports as you'll want to handle every PC component with care.

Step 3: Most computer towers feature a set of small screws responsible for holding the drive in place. Carefully remove them and then pull the hard drive out from the computer chassis. If you're replacing a current HDD, remove the old drive. If you're simply installing an additional HDD, it's not necessary to remove the old drive, but it may be helpful to have the extra space to tinker around.

Step 4: To remove the old drive, you'll need to disconnect all of the connected cables from both the motherboard and the power supply.

Step 5: Position your new hard drive and slide it into an open bay until you hear a secure clicking sound that ensures your hard drive is locked in. Make sure the holes on either side of the drive are perfectly aligned with the screw positioning on the tower's chassis. Tighten any screws firmly to keep your new HDD safely secured in place.

Pro-tip: If you are able, place the new hard drive into a bay with space above and below. This will allow for cooler, more efficient airflow throughout your system.

Step 6: Attach the newly installed drive to the motherboard using the same SATA power cable that connected your old HDD. If you plan to use your new HDD as your primary storage media, make sure the SATA cable is plugged into the first SATA channel. If you're unsure of where to look or which input port is the correct one, refer to your motherboard information documentation.

Step 7: Now that your new hard drive is installed, the final step is closing up your computer and powering back on. Replace the sides of your tower chassis and tightly screw each panel back into place. Reconnect your PC into its power sources and turn your computer on.

Partitioning and Formatting Hard disks



If you're installing a new hard drive, or need to wipe your drive clean for that "fresh" feeling, you'll end up formatting your drive.

Formatting will check the drive for errors, and prepare it for use. If a drive has data on it, formatting the drive will remove all of the pointers to your files.

Formatting can take hours to complete, but it is a good option when you have a new or inherited drive that is not properly formatted, a drive overrun by malware or other software problems, or a drive in need of a fresh start before a Windows installation.

Traditional, magnetic-platter hard drives as well as solid-state drives can be formatted. Before you begin, be sure to [back up important files](#) on the disk before you format.

Use Disk Management

To partition and format your drive, you can use Windows' built-in tool called Disk Management.

You can repartition and format your hard drives in Windows using the Disk Management tool.

In Windows 7, click *Start*. Next, right-click *Computer*, then click *Manage*. The “Computer Management” window will open.

In the left pane, click *Disk Management* (under *Storage*).

In Windows 8, right-click the Windows button, and select *Disk Management*.

If your disk is not initialized (as is sometimes the case with brand-new drives), you'll be prompted to initialize it. If your disk is 2TB or more in size, select *GPT*; otherwise, stick with *MBR*.

A list of all connected disk drives is displayed in the center. Unpartitioned drives appear with solid black bars and the label “Unallocated.” Partitioned drives appear with solid blue bars and a drive letter.

Partitioning your drive

To format an internal or external hard drive to use for backup or additional storage, the drive needs to be partitioned. Partitioning divides your drive into sections, but you can choose to simply have one partition (a single section encompassing the entire drive).

If your drive isn't partitioned, follow these instructions to partition it. Otherwise, skip down to the next section.

Right-click the black bar or the unallocated white space below it and select *New Simple Volume...* Don't be dissuaded by the word, “Volume.” It's just another term for “partition”. Click *Next*.

To create a single, whole-drive partition, make sure the “Simple volume size in MB” value is the same as the “Maximum disk space in MB” value. Click *Next*.

Assign a drive letter of your choice. Click *Next*

Select *Format this volume*. For *File System*, choose *NTFS* if you’ll be using the drive only with Windows machines. If you will be sharing the information on the drive with Macs, choose *exFAT*. Keep *Allocation unit size* at *Default*. Choose a name for the partition under *Volume label*. Do **not** select *Perform a quick format* or *Enable file and folder compression*. Click *Next*.

Confirm your selections and click *Finish*.

Formatting your partitions

Once your drive is partitioned, each partition will have to be formatted with a filesystem. Luckily, the Disk Management utility makes this really easy.

Right-click the blue bar or the white space below it and select *Format*.

Choose a name for the partition under “Volume label.” For File System, choose *NTFS* if you’ll be using this drive only with Windows machines. Linux machines can read unencrypted NTFS partitions as well.

If you will be sharing the information on this drive with Macs, choose *exFAT*. Keep “Allocation unit size” at *Default*. Do **not** select *Perform a quick format* or *Enable file and folder compression*. Click *OK*.

Confirm your choices.

Formatting for a Fresh Windows Installation

If you are formatting your primary hard drive with the intention of reinstalling Windows or restoring your PC to its factory-fresh state, you’ll need the restore disc(s) that came with your

computer. If your computer manufacturer did not include restore media or you've misplaced it, contact the manufacturer directly for a replacement. You may also be able to create your own restore disc(s) or reinstall Windows from a factory-created partition on your hard drive; consult your computer's documentation for details.

Insert your Windows installation disc or restore disc into your disc drive and restart your computer. [Boot your PC from the Windows disc](#). For instructions on booting to your recovery partition, review your system documentation.

If you are using a manufacturer's factory restore disc or hard-drive recovery partition, follow the prompts to initiate the restoration process. Unless stated otherwise, your drive's primary partition will be formatted and returned to its factory-fresh state.

If you are using a Windows 7 installation disc, select your language, accept the Windows license terms, and select *Custom (advanced)* when prompted.

Select 'Drive options (advanced)' to format a drive from the Windows installer.

Delete any partitions you want to remove by selecting them, clicking *Drive options (advanced)*, and clicking *Delete*. Create new partitions by selecting unallocated space, clicking *Drive options (advanced)*, and clicking *New*.

Select *Format* after creating your partition(s). After formatting is complete, click *Next* to start the Windows installation. Windows may prompt you to accept the creation of a small, system-reserved partition—accept it.

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Maintenance and Troubleshooting

Maintaining the Hard Disk Drives :

Scan the disk to check a particular volume for file system errors

File system errors indicate bad sectors on the volume

Chkdsk is used to check the disk for errors based on file system, displays status report, and repair errors

Lost clusters, cross-linked files or allocation errors are detected using Chkdsk

Disk Cleanup determine which files are no longer required on the hard drive and delete the same

Disk Cleanup enables you to free up the space on your hard drive

Maintaining Storage Devices :

Storage devices enable you to store and transfer data between the computer and different storage media

Different storage devices are :

- Floppy Drive
- Zip Drives
- CD & DVD Drive
- Tape Drive

Maintaining Floppy Drives :

- Do not use dirty or corrupted disks
- Clean the head regularly by using a floppy drive cleaning kit

Clean the CD-ROM drive for proper functioning

General PC hardware troubleshooting

You should check a few standard things before you get your elbows greasy and end up with cables and computer parts strewn all over the floor. Review the items in this list first to determine what's wrong:

- Is it plugged in?
- Is it connected?
- Are the wires intact, not frayed or split?
- Is it turned on?
- Press and hold down the Power button for several seconds to turn off any computer.

- Hot things cause trouble. Ensure that the console's air vents are unobstructed and that the fan is on. Touch a power brick to ensure that it's not too hot. If it is hot, unplug it.
- Check the Device Manager for hardware conflicts detected by Windows.
- Swap out questionable hardware with hardware that works to help pinpoint the problem.
- The printer must be on *and* online or selected before you can print.