Hard Disk Drive

A hard disk drive (HDD), hard disk, hard drive, or fixed disk, is an electro-mechanical data storage device that stores and retrieves digital data using magnetic storage with one or more rigid rapidly rotating platters coated with magnetic material. The platters are paired with magnetic heads, usually arranged on a moving actuator arm, which read and write data to the platter surfaces. Data is accessed in a random-access manner, meaning that individual blocks of data can be stored and retrieved in any order. HDDs are a type of non- volatile storage, retaining stored data when powered off. Modern HDDs are typically in the form of a small rectangular box.

Introduced by IBM in 1956, HDDs were the dominant secondary storage device for general-purpose computers beginning in the early 1960s. HDDs maintained this position into the modern era of servers and personal computers, though personal computing devices produced in large volume, like mobile phones and tablets, rely on flash memory storage devices. More than 224 companies have produced HDDs historically, though after extensive industry consolidation most units are manufactured by Seagate, Toshiba, and Western Digital. HDDs dominate the volume of storage produced (exabytes per year) for servers. Though production is growing slowly (by exabytes shipped, sales revenues and unit shipments are declining because solid-state drives (SSDs) have higher data-transfer rates, higher areal storage density, somewhat better reliability, and much lower latency and access times.

As the primary storage area for the operating system, applications, and vital data, the hard drive takes on a level of importance to PC users that borders on reverence. Considering the fact that the death of a drive can means many hours or days of tediously rebuilding your OS install, reloading applications, and re-creating data, such strong feelings make sense. And that reverence can turn quickly to agony if the user hasn't backed up his or her data in a while when the hard drive dies!

Topics that will be covered in this report:

- Installing Parallel ATA Hard Drives
- Installing Serial ATA Hard Drives
- Configuring CMOS Settings
- Comparing Solid-State Drives and Magnetic Hard Drives
- Exploring SCSI and RAID
- Troubleshooting Hard Drive Installations
- Installing Multiple Hard Drives in Preparation for RAID

1. Installing Parallel ATA Hard Drive

The general procedures for installing any hard drive are similar, but the exact steps required vary according to the specific drive and case. Most cases contain drive bays, which form a part of the chassis structure designed to secure drives in place. Others use removable drive cage or drive tray arrangements, in which you first secure the drive to a removable carrier and then attach the carrier to the chassis. Whatever the arrangement, once you've removed the cover it will almost certainly be obvious how to physically secure the drive within the case. If it isn't, refer to the hardware documentation.

To install a parallel ATA hard disk drive we need to follow the following steps:

Step 1: Shut down the system and remove the system cover, following proper electrostatic discharge (ESD) avoidance procedures.

Step 2: Disconnect all the ribbon cables from the hard drives and optical drives, but first note which device is connected to which cable and where the orientation stripe is located on each device. Be careful but firm. Grasp the cable as closely as possible to the connector on the drive and pull, rocking the connector gently from side to side. Examine the connector on the end of the ribbon cable.

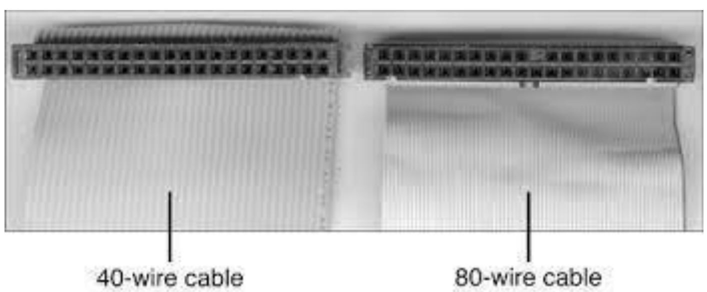

Fig 1- ATA cables: Comparing 80-wire and 40-wire ribbon cable connectors

Note: Molex plugs can be difficult to remove and brutal on the fingers. Little “bumps” on each side of the plug enable you to rock the plug back and forth to remove it.

Step 3: Now look at the motherboard connections, and note the orientation of the cable connectors. Disconnect the ribbon cables from the motherboard. Be careful but firm. Grasp the cable as closely as possible to the connector on the motherboard and pull, rocking the connector gently from side to side. Lay the cables aside for later reinstallation.

Step 4: Look at the PATA connections on the motherboard; they may be labeled “IDE”. Look closely at the motherboard and see if we can find writing on the board next to the IDE connections.

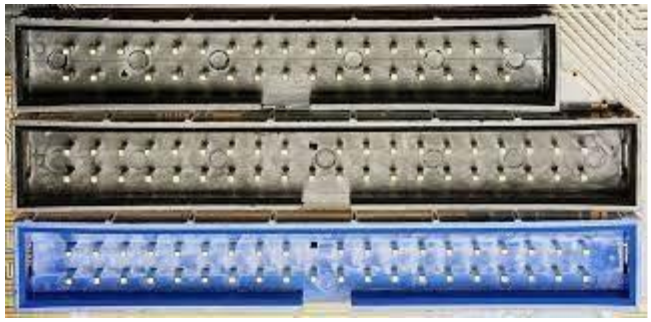

Fig 2- Viewing the PATA connectors on a motherboard

Step-5: Remove a hard drive from the system. Be careful to note the type of screws have been removed and store them for safekeeping. Also be sure to use proper ESD avoidance procedures when removing the drive from the system.

Because of the variety of cases, caddies, bays, slots, and so on, it’s not possible to give detailed instructions on how to remove the drive from the particular system. Look closely for caddy releases or retaining screws. Close inspection and a little logic will usually make It clears how to remove the drive. Make notes of how the drive comes out, as we must reinstall it later.

Step 6: With the hard drive out of the system and on a static-free surface, ground yourself, pick up the drive and examine it carefully.

Note its dimensions. It should measure about 6" × 3.5" × 1". Some drives may be larger than this, measuring 6" × 5.25" × 1"—these are known as bigfoot drives. Some drives are smaller, but those are used mostly in laptops.

Look at the largest surfaces of the drive (the top and bottom). The bottom is where the printed circuit board with a ROM chip is located. This circuitry is the hard drive controller. The top side of the drive normally has a label or another means of listing the specifications for the drive, but this is not always the case.

Step 7: Look at the end of the drive where the ribbon cable connects. Find the markings for where pin 1 of the ribbon cable should go.

Each PC system that boots from a PATA hard drive should have the hard drive located on the first PATA interface (IDE1). Normally the jumper must be set to Master so that the system can recognize it as the boot drive. A second drive (hard drive or optical drive) can be on the same cable but must be set to Slave.

Fig 3: Locating the PATA hard drive jumper setting

Step 8: Locate a broken hard drive and remove its cover.

Note: Never remove the cover from a functioning hard drive! Hard drives are extremely sensitive, so merely exposing the inside to the air will cause irreparable damage.

Notice the round polished platters that spin in the middle of the drive. This is where the data is stored magnetically.

Fig 4: Internal Part of a Hard disk

Here,

No 1 is the Voice coil motor

No 2 is the Platters

No 3 is the Read/write heads

Fig 5: External part of a Hard drive

Step 9: Insert the drive back into your system and secure it with the proper screws. Connect all the ribbon cables to all the drives and pay attention to the proper alignment of the connectors. Connect the Molex power connectors.

- Leave the system case off until we verify that everything works properly.
- If we used a working machine for the prior steps, we can verify that we've reinstalled the drives correctly by going to the next major step in the process of hard drive installation: CMOS configuration.

Step 10: Turn on the system and wait for it to boot to the desktop. Double-click the My Computer/Computer icon and confirm that the icons for the reinstalled drives are displayed. The fact that we were able to get to the desktop confirms that we've reinstalled the boot drive correctly.

2. Installing Serial ATA Hard Drives

Installing SATA hard drives is a simple matter of plugging in the data and power cables to the drive and attaching the other end of the data cable to the SATA controller card or motherboard connection. You don't have to pull the power from the PC. You don't even have to shut down Windows. No, really – It's that simple! Let's go through the steps.

SATA RAID has waltzed into the mainstream today. Motherboards are now being sold with a SATA RAID controller built-in, from Promise or another company, but we can also readily buy a PCIe or PCI SATA RAID controller at the local computer parts store.

To install a serial ATA hard disk drive we need to follow the following steps:

Step 1: It's time to get working with some SATA drivers. Shut down the system and
remove the system cover, following proper ESD avoidance procedures.

Step 2: Disconnect the data cable(s) from the SATA hard drive(s), as shown in Figure 6. Grasp the cable as closely as possible to the connector on the drive and pull, rocking the connector gently from side to side.

Fig 6- Removing the SATA data cable

Disconnect the power supply from the SATA drive(s) by unplugging the SATA connector from each one. Is the power supply a newer model with SATA connectors directly attached, or is there a Molex-to-SATA power adapter like the one shown in Figure 7?

Fig 7: Molex-to-SATA power adapter

Step 3: Now look at the motherboard connections and note the orientation of the connectors. Disconnect the data cables from the motherboard, being careful but firm. Grasp the cable as closely as possible to the connector on the motherboard and pull, rocking the connector gently from side to side. Lay the cables aside for later reinstallation.

Step 4: Look at the SATA connections on your motherboard. Look closely at the motherboard and see if you can find writing on the board next to the SATA connectors.

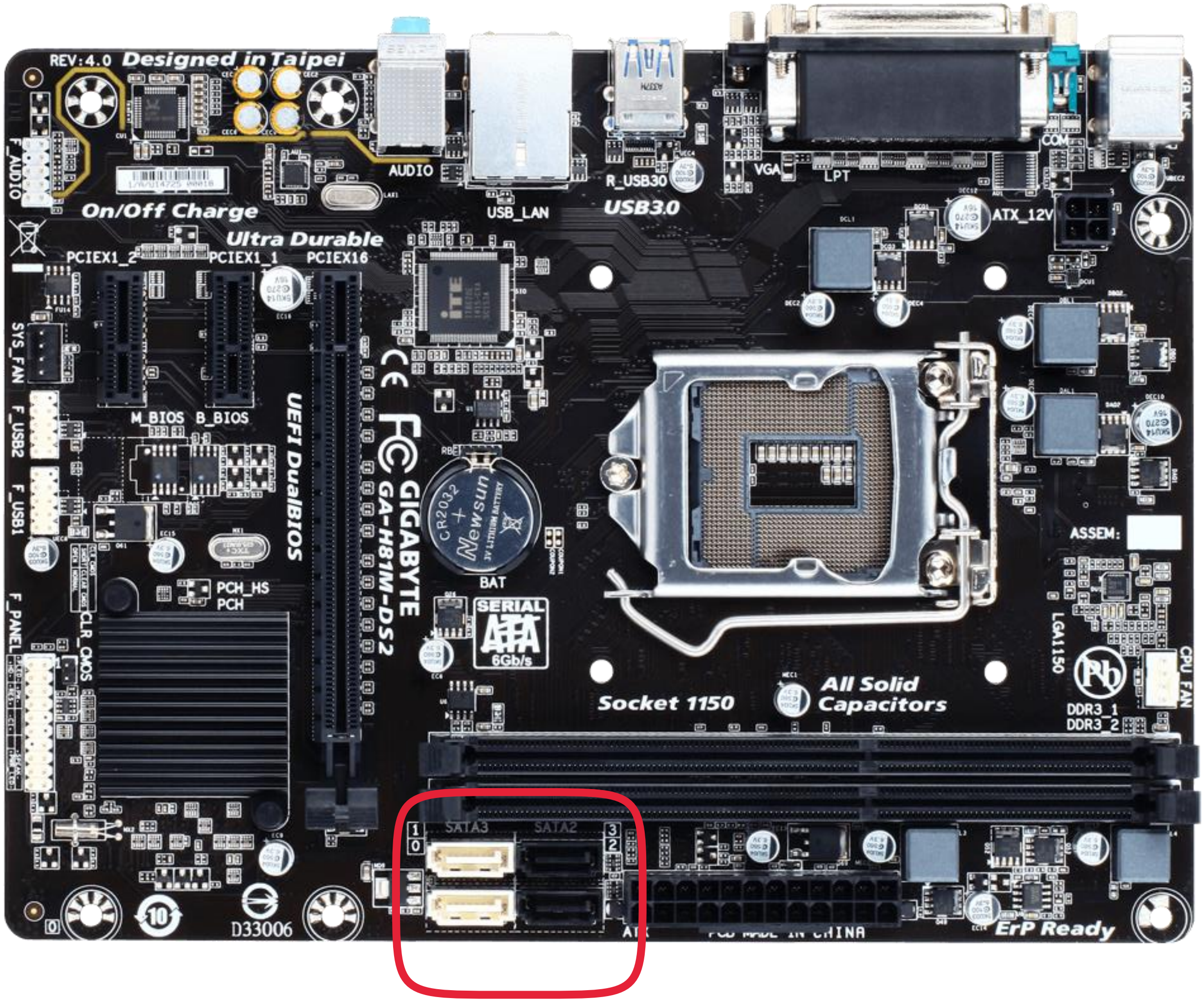

Fig 8: The SATA connectors on a motherboard

Step 5: As in the previous exercise, remove the hard drive from the system, note the type of screws that have been removed and store the screws for safekeeping. Be sure to use proper ESD procedures when removing the drive from your system.

Because of the variety of cases, caddies, bays, slots, and so on, it's not possible to give detailed instructions on how to remove the drive from the system. Look closely for caddy releases or retaining screws. Close inspection and a little logic will usually make it clear how to remove the drive.

Step 6: With the hard drive out of the system and on a static-free surface, ground yourself, pick up the drive and examine it carefully. Note its dimensions; it should measure about 6" × 3.5" × 1", the same as a PATA drive. Here, too, the bottom of the drive boasts the hard drive controller, and the top of the drive is normally labeled with the drive's specifications.

Step 7: To demonstrate one of the benefits of SATA—hot-swapping—we will now reinstall all the drives we removed and, if necessary, install an additional SATA drive to be hot- swapped. With the PC still powered down, insert all the original drives back into the system, and at least one additional SATA drive with no critical data. Secure the drives with the proper screws, connect all the data cables, and connect the SATA power connectors using Molex-to-SATA adapters if required.

Leave the system case off, to verify that everything is working properly and to facilitate the last steps.

Power up the PC and boot into Windows. Windows should pick up the drive(s) with no problems at all. Check My Computer/Computer to verify that the drive is installed and functional. If the drive has no partition, then of course it won’t show up in My Computer/Computer; if this is the case, we can use the Computer Management console to verify that the drive works.

Step 8: With Windows still running, disconnect the SATA data cable from the additional drive.

Step 9: Plug the data cable back in. The windows will see the drive.

Step 10: Need to try the same hot-swap test with the SATA power cable—unplug it, then plug it back in. We need to see if this produces the same effect as the hot swap with the data cable.

3. Configuring CMOS Settings

After installing either PATA or SATA devices, the second step we want to perform is the configuration of the BIOS to support these devices. On most motherboards, the BIOS automatically detects devices, so you will primarily be confirming the detection of all the devices and configuring advanced features such as RAID, S.M.A.R.T., and boot options. Auto-detection does not render CMOS irrelevant, though; you can do or undo all kinds of problems relating to hard drives using CMOS setup. This lab walks you through the important configuration options.

Configure the CMOS settings for the hard drive and confirming that the hard drive is indeed installed properly are the learning objectives.

There are many possible CMOS settings for the hard drive, depending on the BIOS installed on the motherboard. For example, every motherboard gives you the option to disable the built-in hard drive controllers. Why is this relevant? You can install a drive into a perfectly good system, but it won’t work if the controllers are disabled.

Steps of configuring the CMOS settings:

Step 1: Turn on the system and enter the CMOS setup utility by pressing the appropriate key(s) while the system is booting.

Select the Integrated Peripherals option from the main menu, or the Drive Configuration option from the Advanced menu (we may have to hunt around for where we enable the PATA/SATA devices in our CMOS setup program) and look for the various controllers. You can enable or disable the controllers here.

Note: This option may look somewhat different depending on the version of CMOS you are using. Look for a menu option such as one of these:

- Onboard Primary PCI IDE
- o Onboard Secondary PCI IDE
- o PCI Primary and Secondary IDE
- o Onboard IDE
- o Use Automatic Mode
- o SATA Port 0

When the controllers are disabled in CMOS, no device attached to them can be used— not even optical drives. This is why some systems will not let us disable the controllers at all.

Make sure all controllers are enabled, and then look for the Autodetection option in the CMOS settings. Older systems have a separate category in CMOS, appropriately named Autodetect or something similar; newer systems have it integrated into the main settings screen. Run this utility now. If the hard drive shows up in Autodetect as the drive we thought it would be—primary master, secondary master, SATA Port 0, or what have you then we installed and (if necessary) jumped it properly.

Step 2: Save the settings, exit CMOS, and reboot the PC. We should boot into Windows normally. Check My Computer/Computer to verify that we can see and access all drives.

Step 3: Reboot the PC and go into CMOS. Access the settings to enable or disable the Various controllers and disable them all. (This won’t affect the data; it will just prevent drive access for the next couple of steps in this lab).

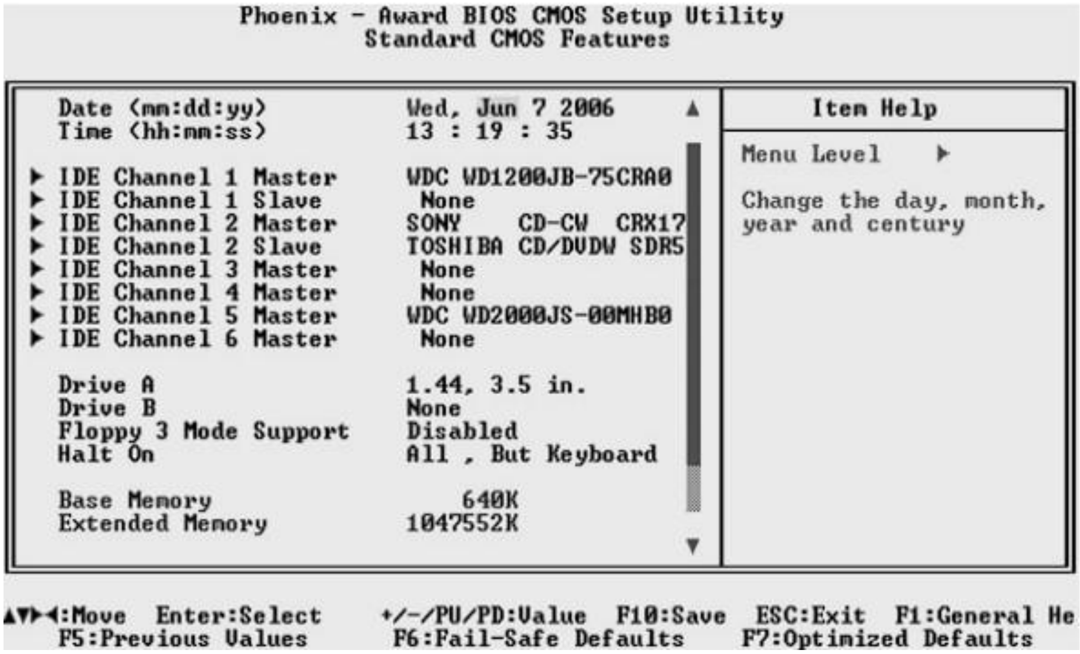

Fig 9: Various drives and their roles as listed in CMOS setup

Step 4: Save the settings, then exit CMOS to reboot the system. Making sure there is no floppy disk in the floppy drive, reboot normally and watch the monitor display for messages.

With most systems, the PC searches its various storage devices for a way to boot. It looks for a bootable drive (connected to an EIDE, SATA, or SCSI controller), a bootable optical or floppy disk, or a network connection—not necessarily in that order—and then stops if it cannot find the operating system. It then displays a message indicating “no bootable device” and waits for your instructions to continue.

Note: If the system is connected to a network and uses the network boot option, disconnect the network cable for this exercise to get the desired results. Be sure to plug the network cable back in when finished.

When the system is not able to find a disk (because the controller has been disabled), it will probably hang for a long period of time and then return a Primary Hard Drive Failure code or error message. Some systems try to recognize that you have a hard drive regardless of the disabling of features, but this is rare.

Step 5: Reboot the system, entering the CMOS setup utility by pressing the appropriate keystroke combination while the system is booting. Navigate to the menu where we disabled all the controllers and re-enable them.

Step 6: Now that the controllers are enabled, go back to the Auto-detection utility and look for any drives connected.

If Auto-detection still does not see a hard drive, save the settings, reboot the system, and reenter the CMOS setup utility. Then try it again.

Now we can see all the storage devices are installed in the system.

Step 7: While we're still in CMOS, navigate to the menu where all the storage devices can
be configured.

Step 8: At this point, if we did everything as described and if we started with a known good hard drive containing a working operating system, the system will boot back into the operating system. Otherwise, we'll have to wait until you partition and format the drive to see if everything's working as it should.

4. Comparing Solid-State Drives and Magnetic Hard Drives

PATA and SATA hard disk drives store data magnetically and have moving parts, but solid- state drives (SSDs) store data on dynamic RAM (DRAM) or flash memory boards and have no moving parts. In other words, SSDs use nonvolatile memory—memory that retains data even when it's not powered on—to store data and emulate a hard drive. Most common uses have been in what are called flash drives or thumb drives, but now PC users are installing SSDs as their primary storage in desktops and laptops. SSDs have no moving parts, which makes them tougher, quieter, and oftentimes faster than hard disks.

Solid-State Drive

A solid-state drive (SSD) is a solid-state storage device that uses integrated circuit assemblies to store data persistently, typically using flash memory, and functioning as secondary storage in the hierarchy of computer storage. It is also sometimes called a semiconductor storage device, a solid-state device or a solid-state disk, even though SSDs lack the physical spinning disks and movable read–write heads used in hard disk drives (HDDs) and floppy disks.[3] SSD also has rich internal parallelism for data processing.

SSDs based on NAND flash will slowly leak charge over time if left for long periods without power. This causes worn-out drives (that have exceeded their endurance rating) to start losing data typically after one year (if stored at 30 °C) to two years (at 25 °C) in storage; for new drives it takes longer. Therefore, SSDs are not suitable for archival storage. 3D XPoint is a possible exception to this rule; it is a relatively new technology with unknown long-term data-retention characteristics.

SSDs can use traditional HDD interfaces and form factors, or newer interfaces and form factors that exploit specific advantages of the flash memory in SSDs. Traditional interfaces (SATA and SAS) and standard HDD form factors allow such SSDs to be used as drop-in replacements for HDDs in computers and other devices. Newer form factors such as mSATA, M.2, U.2, NF1/M.3/NGSFF, XFM Express (Crossover Flash Memory, form factor XT2) and EDSFF (formerly known as Ruler SSD) and higher speed interfaces such as NVM Express (NVMe) over PCI Express (PCIe) can further increase performance over HDD performance. SSDs have a limited lifetime number of writes, and slow down as they reach their full storage capacity.

Magnetic Hard Drives

A magnetic disk primarily consists of a rotating magnetic surface (called platter) and a mechanical arm that moves over it. Together, they form a “comb”. The mechanical arm is used to read from and write to the disk. The data on a magnetic disk is read and written using a magnetization process.

The platter keeps spinning at high speed while the head of the arm moves across its surface. Since the whole device is hermetically sealed, the head floats on a thin film of air. When a small current is applied to the head, tiny spots on the disk surface are magnetized and data is stored. Vice versa, a small current could be applied to those tiny spots on the platter when the head needs to read the data.

Data is organized on the disk in the form of tracks and sectors, where tracks are the circular divisions of the disk. Tracks are further divided into sectors that contain blocks of data. All read and write operations on the magnetic disk are performed on the sectors. The floating heads require very precise control to read/write data due to the proximity of the tracks.

Early devices lacked the precision of modern ones and allowed for just a certain number of tracks to be placed on each disk. Greater precision of the heads allowed for a much greater number of tracks to be closely packed together in subsequent devices. Together with the invention of RAID (redundant array of inexpensive disks), a technology that combines multiple disk drives, the storage capacity of later devices increased year after year.

Magnetic disks have traditionally been used as secondary storage devices in computers and represented mainstream technology for decades. With the advent of solid-state drives (SSDs), magnetic disks are no longer considered the only option, but are still commonly used.

The first magnetic hard drive built by IBM in 1956 was a large machine consisting of 50 21-inch (53-cm) disks. Despite its size, it could store just 5 megabytes of data. Since then, magnetic disks have increased their storage capacities many times-folds, while their size has decreased comparably.

The size of modern hard disks is just about 3.5 inches (approx. 9 cm) with their capacity easily reaching one or more terabytes. A similar fate happened to floppy disks, which shrunk from the original 8 inches of the late 60s, to the much smaller 3.5 inches of the early 90s. However, floppy disks have eventually became obsolete after the introduction of CD-ROMs in the late 1990s and now have all but completely disappeared.

List of SSDs based on manufacturer and retailer websites

Maker	Cost	Capacity	Cons	Unique Features
ADATA	From 1450 BDT	120 GB	QLC NAND	use SLC caching
Apacer	From 1549 BDT	128 GB	QLC NAND	Dynamic SLC Caching
ASUS	From 4800 BDT	240 GB	Expensive	ASUS Turbowrite
Biostar	From 5500 BDT	512 GB	Lack DRAM Cache	Anti-shock protection
Corsair	From 4900 BDT	240 GB	Expensive	3D TLC NAND
Gigabyte	From 2290 BDT	240 GB	Expensive	Dynamic Thermal Guard
G.Skill	From 4050 BDT	120 GB	Not well known	Intelligent Turbowrite

List of Hard drives based on manufacturer and retailer websites

Maker	Cost	Capacity	Pros	Cons	PATA/ SATA	Unique Features
WD corporation	15$	500 GB	Reliable	Can be noisy	SATA	OptiNAND Technology
Seagate Technology	50$	2 TB	Variety of option	Not as fast as SSD	SATA	OptiCache Technology
Hitachi	20$	500 GB	Good value for money	Susceptible to damage	SATA	Active Armor Tech.

Toshiba	25$	500 GB	Long Warranty	Can be noisy	SATA	Dynamic Cache Tech.
Samsung	15$	500 GB	Reliable	Less Warranty	SATA	V-NAND Technology

Reason of SSD being Superior to Hard drive

Solid-state drives (SSDs) are superior to hard drives in several ways, including:

- **Speed:** SSDs are much faster than hard drives, especially when it comes to loading programs and files. This is because SSDs do not have any moving parts, which makes them much faster to access data.
- **Durability:** SSDs are more durable than hard drives because they do not have any moving parts. This makes them less susceptible to damage from shock, vibration, and heat.
- **Noise:** SSDs are silent, unlike hard drives, which can be noisy when they are working.
- **Power consumption:** SSDs consume less power than hard drives, which can help to extend the battery life of your laptop or tablet.
- **Form factor:** SSDs are available in a variety of form factors, including 2.5-inch, M.2, and PCIe. This makes them more versatile than hard drives, which are only available in 2.5-inch and 3.5-inch form factors.

5. Exploring SCSI and RAID

SCSI:

Small Computer System Interface (SCSI) is a set of standards for physically connecting and transferring data between computers and peripheral devices. SCSI was first introduced in 1986 and has been revised several times since then.

SCSI is a parallel interface, which means that multiple devices can be connected to the same cable. This makes it a good choice for devices that need to transfer large amounts of data quickly, such as hard drives and tape drives.

SCSI devices are typically connected to a computer using an SCSI controller card. The controller card converts the data from the computer's parallel bus to the SCSI bus.

There are several different types of SCSI interfaces, including:

- SCSI-1: This is the original SCSI standard and is still widely used.
- SCSI-2: This standard introduced several new features, such as faster data transfer rates and support for more devices.
- SCSI-3: This standard further improved the performance and features of SCSI.
- SCSI-4: This standard was never widely adopted.
- SAS: Serial Attached SCSI is a newer interface that is replacing SCSI. SAS uses a serial bus, which is more efficient than the parallel bus used by SCSI.

SCSI is a versatile interface that can be used for a wide variety of devices. It is a good choice for high-performance applications that require fast data transfer rates.

RAID:

RAID (Redundant Array of Independent Disks) is a data storage virtualization technology that combines multiple physical disk drives into a single logical unit for the purposes of performance, data redundancy, or both.

There are many different RAID levels, each with its own advantages and disadvantages. Some of the most common RAID levels include:

- **RAID 0:** This is the simplest RAID level and offers no data redundancy. Data is striped across multiple disks, which improves performance.
- **RAID 1:** This level provides data redundancy by mirroring data across two disks. This means that if one disk fails, the data is still available on the other disk.
- **RAID 5:** This level provides data redundancy by striping data across multiple disks and adding parity information to one of the disks. This means that if one disk fails, the data can be reconstructed from the remaining disks.
- **RAID 6:** This level is similar to RAID 5, but it adds an additional parity disk. This means that if two disks fail, the data can still be reconstructed.

What speed of data transfer can be achieved with parallel SCSI? Ans:

Ultra640 How many drives can be attached to a single controller? Ans:

One-to-one basis What is the price range of parallel SCSI drives? Ans:

Starting from 1259 USD

What is the SCSI chain? Ans: a term that describes the devices connected to one SCSI interface through one cable.

most popular implementations of RAID used on desktop machines

- RAID 0: This is the simplest RAID level and offers no data redundancy. Data is striped across multiple disks, which improves performance. This means that the data is split into equal chunks and spread across the disks. This can improve read and writing speeds, as the data can be read or written from multiple disks at the same time. However, RAID 0 offers no data redundancy, so if one disk fails, all the data on all the disks is lost.

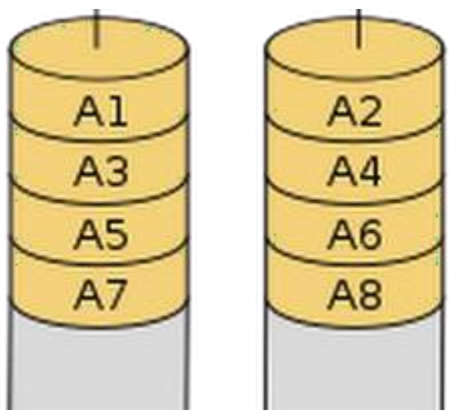

Fig 10: RAID 0 technology

- RAID 1: This level provides data redundancy by mirroring data across two disks. This means that if one disk fails, the data is still available on the other disk. This is the most common RAID level used for desktop machines because it offers good performance and data redundancy. However, it also requires twice as many disks as a single drive, which can be expensive.

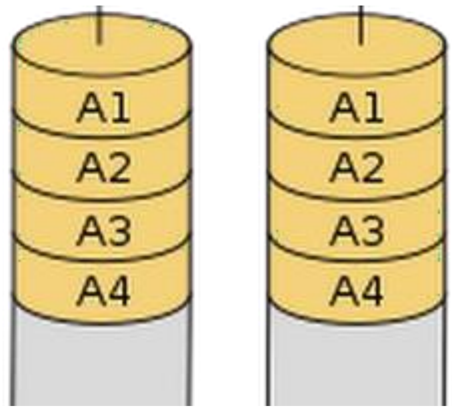

Fig 11: RAID 1 Technology

- RAID 5: This level provides data redundancy by striping data across multiple disks and adding parity information to one of the disks. This means that if one disk fails, the data can be reconstructed from the remaining disks. RAID 5 is a good compromise between performance and data redundancy. It offers better performance than RAID 1, but it requires fewer disks.

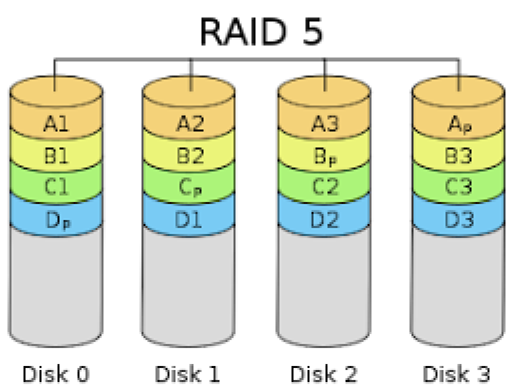

Fig 12: RAID 5 Technology

Number of drives required to support the various RAID levels

RAID Level	**Minimum Number of Drives**
RAID 0	2
RAID 1	2
RAID 5	3
RAID 6	4

RAID 10	4
RAID 50	6
RAID 60	8

Can you configure desktop RAID using both PATA and SATA drives?

Yes, you can configure a desktop RAID using both PATA and SATA drives. However, it is important to note that not all RAID controllers support this configuration. You will need to check the compatibility of your RAID controller before attempting to configure a mixed RAID array.

To configure a mixed RAID array, you will need to create a separate RAID array for each type of drive. For example, you could create a RAID 1 array for your PATA drives and a RAID 5 array for your SATA drives. You could also create a RAID 10 array, which would stripe data across both PATA and SATA drives.

Once you have created the RAID arrays, you can then connect them to your computer. You will need to use a RAID controller that supports both PATA and SATA drives.

Here are some of the factors to consider when configuring a mixed RAID array:

- The type of RAID controller: Not all RAID controllers support mixed RAID arrays. You will need to check the compatibility of your RAID controller before attempting to configure a mixed RAID array.
- The number of drives: You will need to use the same number of drives for each RAID array. For example, if you are creating a RAID 1 array, you will need to use two drives of the same type.
- The size of the drives: The drives in each RAID array must be the same size. For example, if you are creating a RAID 5 array, you will need to use drives that are all the same size.

6. Troubleshooting Hard Drive Installations

Troubleshooting hard drive installations is the process of identifying and resolving problems that prevent a hard drive from being installed or working properly.

Here are some common problems that can occur during hard drive installation:

- The hard drive is not detected by the BIOS: This can be caused by a variety of factors, such as a faulty hard drive, a bad cable, or a misconfiguration in the BIOS.

- The hard drive is detected but cannot be formatted: This can be caused by a faulty hard drive, a bad cable, or a corrupt file system.
- The hard drive is formatted but cannot be accessed: This can be caused by a faulty hard drive, a bad cable, or a virus.

The Steps of troubleshooting Hardware Installation:

Step 1: You must have a PC properly functioning for this lab to be effective, so verify first that you have a system up and running with one or more hard drives installed.

Step 2: Power down the system. Disconnect the data cable for the hard drive used to boot the system, then power up the system.

It is difficult to imagine not connecting the data cables to hard drives, but many times to add RAM or new devices, we must disconnect the cables to gain access to the component. It is easy to miss reconnecting one of the cables after installing the new device.

Disconnecting the cable also simulates a broken IDE or SATA cable. These cables are somewhat delicate and can fail after a sharp crease or a crimp from the system case. If you're having unexplained problems with your drive, check the cables prior to replacing the drive.

Step 3: Power down the PC and put the cable back on properly.

Step 4: On a PATA drive, change the jumper for the primary master hard drive to slave, and then power on the PC.

Step 5: Power down the PC and put the jumper back on properly.

Step 6: Install a second PATA drive onto the primary controller and set the jumpers on both drives incorrectly. Try variations: both as master; both as standalone; both as slave; both as cable select. Power on the PC and test each variation.

7. Installing Multiple Hard Drives in Preparation for RAID

We need follow these steps to install an additional PATA drive:

Step 1: Determine on which controller, and in which order, we will be installing the drives.

Step 2: Set the jumpers properly for both the master and slave drives. (Usually, the boot device is the master drive on the primary controller, whereas the optical drive is the master drive on the secondary controller, so the new drive is likely to be a slave to one of those drives.)

Step 3: Physically install the second drive, connecting the power and data cables properly.

Follow these steps to install additional SATA drives:

Step 1: Determine which controller we will use for the first additional drive and connect the SATA data cable to the controller on the motherboard.

Step 2: Physically install the first additional drive and connect the SATA power and data cables to the new drive.

Step 3: Determine which controller we will use for the second additional drive and connect the SATA data cable to the controller on the motherboard.

Step 4: Physically install the second additional drive and connect the SATA power and data cables to the new drive.

Follow these steps to verify the drives in CMOS.

Step 1: After installing all the hard drives, plug the power back in and boot the machine.

Step 2: Press the appropriate key(s) to enter CMOS setup and navigate to the configuration screen for installed devices.

Step 3: Perform auto detection if required and confirm that all the installed devices are present. If any of the devices are missing (and you remembered to reboot the machine if your system requires it), power the machine down, disconnect the power, and double- check all the cables and drive settings.

Conclusion

Hard drives are an essential component of any computer system. They provide a place to store data, such as operating systems, applications, and files. Hard drives come in a variety of sizes and capacities, so we can choose the one that best meets one needs.

When choosing a hard drive, you need to consider the following factors:

- Capacity: How much data do you need to store?
- Speed: How fast do you need the hard drive to be?
- Form factor: What size and shape of hard drive do you need?
- Interface: What type of interface does your computer support?
- Price: How much are you willing to spend?