What Makes Up a Hard Drive

Hard Drives are one of the most important parts on your computer. They are also one of the most expensive. All hard drives share a basic structure and are composed of the same physical features. However, not all hard drives perform the same way, as the quality of the parts of the hard drive will affect its performance. Following is a description of the common features of the hard drive and how each part works in relation to the others. Hard drives are extremely sensitive equipment and the internal workings of a hard drive should not be handled by anyone other than an experienced professional.

The platters are the actual disks inside the drive that store the magnetized data. Traditionally platters are made of a light aluminum alloy and coated with a magnetically material such as a ferrite compound that is applied in liquid form and spun evenly across the platter or thin metal film plating that is applied to the platter through electroplating, the same way that chrome is produced. Newer technology uses glass and/or ceramic platters because they can be made thinner and also because they are more efficient at resisting heat. The magnetic layer on the platters has tiny domains of magnetization that are oriented to store information that is transferred through the read/write heads. Most drives have at least two platters and the larger the storage capacity of the drive, the more platters there are. Each platter is magnetized on each side, so a drive with 2 platters has 4 sides to store data.

The Spindle and Spindle Motor

The platters in a drive are separated by disk spacers and are clamped to a rotating spindle that turns all the platters in unison. The spindle motor is built right into the spindle or mounted directly below it and spins the platters at a constant set rate ranging from 3,600 to 7,200 RPM. The motor is attached to a feedback loop to ensure that it spins at precisely the speed it is supposed to.

The Read/Write Heads

The read/write heads read and write data to the platters. There is typically one head per platter side, and each head is attached to a single actuator shaft so that all the heads move in unison. When one head is over a track, all the other heads are at the same location over their respective surfaces. Typically, only one of the heads is active at a time, i.e., reading or writing data. When not in use, the heads rest on the stationary platters, but when in motion the spinning of the platters create air pressure that lifts the heads off the platters. The space between the platter and the head is so minute that even one dust particle or a fingerprint could disable the spin. This necessitates that hard drive assembly be done in a clean room. When the platters cease spinning the heads come to rest, or park, at a predetermined position on the heads, called the landing zone.

The Head Actuator

All the heads are attached to a single head actuator, or actuator arm, that moves the heads around the platters. Older hard drives used a stepper motor actuator, which moved the heads based on a motor reacting to stepper pulses. Each pulse moved the actuator over the platters in predefined steps. Stepper motor actuators are not used in modern drives because they are prone to alignment problems and are highly sensitive to heat. Modern hard drives use a voice coil actuator, which controls the movement of a coil toward or away from a permanent magnet based on the amount of current flowing through it. This guidance system is called a servo.

The platters, spindle, spindle motor, head actuator and the read/write heads are all contained in a chamber called the head disk assembly (HDA). Outside of the HDA is the logic board that controls the movements of the internal parts and controls the movement of data into and out of the drive.

Types of Hard Drives

Almost everyone with computer experience has heard of IDE, SCSI, EIDE, etc. This describes the interface between the disk and the computer. All interfaces share a few attributes. They all have an interface adapter card. They all have the ability to interpret the data. They all have the means to send data to the disk and retrieve it when needed. The actual data storage differs between the interfaces. Let's get more specific:

IDE Drives

Integrated Drive Electronics (IDE) systems put most of the electronics on the drive itself. The encoding and decoding and the control signals are done on the circuit board under the drive. The adapter card just relays the signals from the drive to the computer. In essence, the drive is an independent thing from the computer and it takes care of itself. IDE Drives are today's standard and are the default drive on almost all modern computers. But, with the need for speed that many people have, the IDE drive is sometimes passed over for a faster interface.

SCSI Drives

SCSI (pronounced "skuzzy") stands for Small Computer Systems Interface. SCSI drives are independent. Their bus is completely separate from the usual buses, such as PCI or ISA. They also do not rely on the BIOS to be able to talk to the computer. They are completely independent.

When the computer boots, it checks for additional hardware ROMs. As it does this, it finds your SCSI adapter card, if you have one. It gets no details as to what is attached to the adapter. You can connect as many as seven SCSI devices to the adapter, without the computer's knowledge. The adapter keeps track of the data flow across the SCSI bus. Each device gets its own SCSI address. Each device can talk with the other SCSI devices across the bus, all-independent from the computer.

The SCSI interface certainly speeds up the computer, but many problems come with the added speed. There are no set standards for SCSI; there is the original SCSI and the newer SCSI-2. These two sometimes have a hard time talking to each other in your computer. Also, many companies have developed proprietary SCSI standards. A drive like this may not be able to talk with a SCSI device of another make.

SCSI hardware requires drivers unique to the operating system you are using and your special hardware combination. Each device requires its own ID number, with the end of the chain being set to be the end device. For these reasons, configuring SCSI is considered hard.

EIDE Drives

EIDE is simply Enhanced IDE. It takes out some of the limitations of the original IDE interface. You can put as many as four devices on one controller. EIDE also allows non-disk devices to be used, such as CD-ROMS. The original IDE allowed only hard drives. EIDE allows the use of much higher capacity drives, up to 9 GB or more. It has a transfer rate of around 11.1 MB per second, much faster than IDE, and it also allows you to take advantage of the PCI interface from your new video card.

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