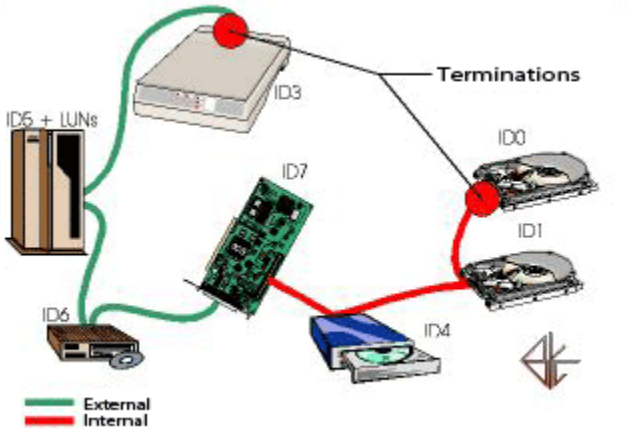
SCSI BASICS



The common computer utilizes either ATA or SATA hard drives, as was discussed in this previous Tech Tip. There is another standard for connecting hard drives which doesn't find its way into too many personal computers, but is quite prominent in servers and high-end work stations: SCSI.

SCSI stands for Small Computer System Interface, and if you don't want to pronounce each letter individually, it's OK to call it "skuzzy." SCSI, like ATA (Advanced Technology Attachment) or SATA (Serial Advanced Technology Attachment), can be used for connecting more than just hard drives to a computer system, and some of the other peripherals that can support SCSI include tape drives, optical drives, printers, and scanners.

This Tech Tip will take a look at a few basic features of SCSI, mostly as related to hard drives, and how ATA and SATA drives may compare.

The Basics

The SCSI standard was first introduced in 1986 (the same year the ATA standard was released), and significant advancements have been made to it over the years in areas such as speed, bus width, bus speed, and the number of devices that can be connected.

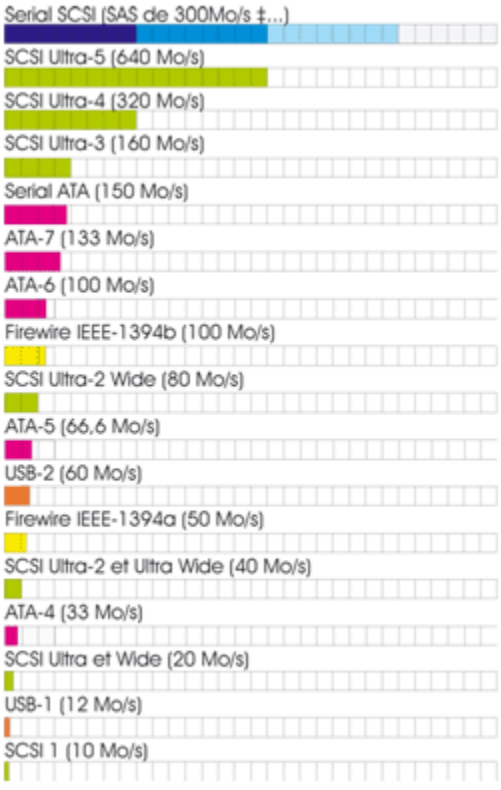
An adaptor card, also called a "host adaptor," is required for connecting SCSI drives to the motherboard, but this serves more like a gateway for data transfer, rather than a processing center. The SCSI controller allows system resources to remain freed up during heavy data processing because it is the individual drive controllers doing the bulk of the work. In addition, individual SCSI drives can communicate directly, requiring almost no CPU power, while ATA or SATA drives must all rely on the system to provide the processing for such communications. This becomes more important when considering that a single SCSI adaptor can support up to 15 drives (or other devices), which could overwhelm one controller if it had to manage the communications for all of them.

While discussing the means by which the various drives connect to a system, let's look at the physical connections. "Headers" (pin connection blocks) can be found onboard modern desktop motherboards to support the 40-pin ATA connector and/or the 7-pin SATA connector. Due to SCSI's more specialized nature, only high-end motherboards may have built in adaptors, and depending on the age and type, the header may have 25, 50, 68, or 80 pins. Stand-alone SCSI adaptors are available for PCI or PCI-X slots, and can be selected to match the drives on hand.

The cables requiredto connect SCSI drives are also different, not just because of the number of pins used to connect them, but because you can have so many drives on one “channel.” Cables can be chained together to add more drives to a SCSI channel, and in order to let the channel know where the end of the chain is, a device called a terminator must be installed at the end of the line. This cable features 3 connectors for Ultra160 SCSI drives and includes a removable terminator.

In order for all of the devices on a SCSI bus to be identified by the system, there is a set of jumpers or switches found on each drive. Each drive on the bus must have its jumpers configured so that it has a unique value, or SCSI ID, which would translate to a number between 0 and 15 on a system capable of 16 devices.

Performance



The SCSI standard released in 1986 (SCSI-1) was a parallel interface that allowed for data transfer at a rate of 5 MBps on an 8 bit wide, 5 MHz bus. One controller channel was capable of connecting up to 8 devices. The latest standard, Ultra320 SCSI, is still a parallel interface that now supports data transfers up to 320 MBps on a 16 bit wide, 40 MHz bus, and one channel on an adaptor is capable of connecting up to 16 devices (generally, 1 adaptor and 15 drives). Let’s compare this to ATA and SATA.

The latest (and last) ATA standard, ATA-133, is a parallel interface supporting data transfers up to 133 MBps on a 16 bit wide, 33 MHz bus, with one channel capable of connecting 2 devices.

SATA is in a transitional stage as the SATA-300 standard is just now becoming commercially available to challenge the popularity of the SATA-150 standard. SATA-150 is a serial interface supporting data transfers up to 150 MBps on a 1 bit wide bus, where one channel generally supports one device (some controllers can allow multiple devices on one channel with degraded performance). The SATA-300 standard maintains the majority of the original features, but the maximum transfer rate is now doubled to 300 MBps.

Regardless of drive type, real-world performance never equals theoretical maximum values, but higher specifications imply higher potential real-world performance. Even with the latest SATA standard doubling its speed, it is easy to see that the more established Ultra320 SCSI standard has a sizeable edge in transfer rates (320 MBps > 300 MBps), in addition to the other factors that make

SCSI so robust. By 2008, SATA throughput rates are expected to reach 600 MBps, but time will tell.

Another speed comparison can be made between the drives in terms of how fast the disk platters spin. ATA and SATA drives generally spin at a maximum of 7200 RPM (some SATA drives now go up to 10,000 RPM), while it is standard for a SCSI drive to operate at 10,000 or 15,000 RPM. Higher rotational speeds aid in lowering times to access data, as well as when reading and writing.

Price

Because the actual controller is part of the drive itself, the price of a modern SCSI drive is a great deal more than either an ATA or SATA hard drive of a comparable size. Using the inventory at Geeks.com as an example, you can see that even much higher capacity ATA/SATA drives are a fraction of the cost of a SCSI drive. A 120GB ATA-133 Maxtor drive costs $64, a 120GB SATA-150 Maxtor drive costs $100, andthis 73GB Maxtor Ultra-320 SCSI drive costs a significant $287.

In addition to the base price of the drive costing a good deal more, other factors such as a controller card, cables, and a terminator can add even more to the setup. Most ATA or SATA-based systems come with the controller built in, and for the most part the cables are also included or available for next to nothing. A controller built in to every drive contributes to the cost, but there is more to it than that.

Reliability

One of the key reasons for SCSI's higher price is reliability. SCSI drives are built to a much higher standard than typical ATA or SATA drives, and that doesn't come cheap. A typical SCSI drive may be specified with a Mean Time Between Failure (MTBF) of up to 1.5 million hours, while a typical SATA drive may have a MTBF of less than 1 million hours, sometimes much less. Referencing the Maxtor drives mentioned previously, the specifications on the SCSI drive show a MTBF of 1.4 million hours, while a fairly extensive search of Google and Maxtor's site couldn't turn up a value for these ATA or SATA drives, but typical desktop hard drives are rated at approximately 500,000 hours.

SCSI drives are expected to always be on, used in environments where 24/7 operation and uptime are not only necessary, but critical. The typical ATA or SATA drive is intended to be on for only about 8 hours per day. Your wallet might not agree, but the typical hard drive found in a personal computer is pretty cheap, and it is designed to be so.

Source : http://www.geeks.com/techtips/2005/techtips-JUL21-05.htm