Radified Guide to SCSI

Boot your System from a SCSI hard drive

This **SCSI guide** began with a group of friends who became interested in editing digital video. Disappointed with the performance of IDE drives at the time (especially as the timeline grew), we wondered if a **SCSI hard drive** would improve our editing experience .. and if so, how much.

I researched the subject, but found it impossible to find any consensus among enthusiasts in the PC community. Some hailed SCSI as the best thing since sliced bread, while others felt is was a complete waste of time and money.

I had a little extra cash on hand, so I decided to **see for myself** what all the SCSI hoopla was about. So I purchased an Ultra2-Wide SCSI controller (Tekram DC-390U2W), and the smallest (cheapest) 10Krpm SCSI hard drive I could find (9GB IBM Ultrastar 9LZX). I figured I could always sell the stuff if it turned out to be the waste of time that some had suggested.

After seeing what a difference (!) the SCSI boot drive made in my system, and how much more enjoyable editing video became, I transformed into a SCSI zealot overnight, recommending a **snarling SCSI beast** to those who wanted to give their systems the supercharged responsiveness of a SCSI-based workstation.

Hybrid Approach to Disk Storage

I advocate a **hybrid approach** to disk storage, which means that I recommend a **combination of both** SCSI & IDE/ATA drives. Specifically, I recommend a **small, fast SCSI boot drive** to run your:

- Operating System(s)
- Programs & Applications
- Swap/Page File

... and a **large IDE/ATA drive** (or two) to complement your system with plenty of **cheap**

mass storage. In this way you get the **best of both worlds**: the blazingly fast performance & **responsiveness** of a SCSI boot drive to run your operating system & applications, and plenty of disk storage from cheap IDE drives.

With this hybrid approach, you won't waste money by storing file archives on (relatively) expensive SCSI drives. Nor will your operating system and applications be limited by the (relatively) slow access times and spindle speeds (latency) associated with IDE drives and the single-tasking IDE interface.

The great **SCSI vs IDE debate** still rages in PC hardware forums all across the Net. It was no different back when I began researching storage solutions (~3 years ago). The optimal configuration seemed obvious. Yet back then, there were only two camps: **SCSI elitists** on one side, and **IDE fascists** on the other, and never the twain did meet. It surprised me that no one was advocating a combination of both.

To the best of my knowledge, I'm the first to advocate the hybrid approach to disk storage. Today, if you visit PC hardware forums, you'll find that the hybrid approach is now the **dominant** recommended disk storage solution for the performance-minded enthusiast .. certainly more so than the all-SCSI purists of yesteryear.

Since most people **already** have an IDE drive in their system, the addition of a SCSI drive produces an instant **hybrid** configuration. If someone is building anew system from scratch, they may, or may not, already have the IDE drive.

Note that this guide does *not* address the great *SCSI vs IDE debate* directly. Rather, my position is: **SCSI *plus* IDE** offers the best disk storage solution <for qualified users>. My system currently contains **three** IDE hard drives, so don't think that, because this is a **SCSI guide**, I'm here to bash IDE. I'm more pro-IDE than the staunchest IDE fascist. I contend that IDE drives have their place in **every** system.

The *SCSI vs IDE debate* can engage PC enthusiasts like few other techno-disputes. I do not wish to revisit this volatile topic. Here I merely try to present **the facts**, and provide **ample references** to support my claims. I leave the actual **decision-making** up to you, the reader .. to decide whether (or not) SCSI is right for you.

Before we jump into it, perhaps I should note that you can find this **SCSI guide** at any of these fine Radified URLs:

- **[**http://scsi.radified.com/**]**
- **[**http://scsi.radified.com/scsi_01.htm**]**
- **[**http://radified.com/SCSI/scsi_01.htm**]**

It has become surprisingly popular since being discovered by search engines. Try searching for **SCSI guide** in either Google or Yahoo, and you'll see what I mean.

I posted a **downloadable zipped PDF version** of this guide here (**99**KB, updated 18feb2002). This file will allow you to store the entire guide locally, on your hard drive, for quick & easy reference. If you merely wish to print out the entire guide, I posted an **printer-friendly PDF** version here (a modem-choking **150**KB, updated 18feb2002). The PDF is **33** pages. If necessary, Adobe Acrobat can be downloaded here (free from download.com).

Before we begin, I want to take a minute to mention <shameless plug> a few other **Radified guides** that you might find helpful. For example:

- The **[**Norton Ghost User's Guide**]** is the site's single **most popular** feature.
- The **[**ASPI drivers guide**]** is ranked **#2**, and is translated into more languages than any other guide.

- The **[**Guide to Ripping CD Audio & MP3 Encoding**]** receives **more kudos** than any other guide.
- I received more **reader input** for the **[**Asus CUSL2 Motherboard User's Guide**]** than any other.

- **[**Doc's Über FDISK Partitioning Guide**]** is referenced by **two Universities**.
- Doc's guide comes with a **companion** titled **[**Hard drive Partitioning Strategies**]**.

- The **[**Guide to the Best Software Programs & Applications**]** is **growing the fastest** (in popularity).

- The **newest** addition is an article on the **[**Intel Northwood Pentium 4 CPU**]**, which takes a look at the new 0.13-micron processor from the boys at Intel.

- There's also a page containing a sample of **[**PC Benchmarks**]** for making comparisons, including links to benchmarking programs.
- And **[**several others**]**. </shameless plug>

Let's get busy. Without further introduction, I'll break with convention, get right to the point, and begin with my **conclusion**:

SCSI is not for everyone

Rather, SCSI is for the person who <qualifier> **uses their PC in ways that take advantage** of the benefits offered by the SCSI interface & SCSI components (more on this later), and who **can afford it**:currently ~US$300 for *both* a SCSI hard drive & SCSI adapter (less if you know how to buy *used* equipment) </qualifier>.

By the very fact that you're still reading, I assume (perhaps incorrectly) that you have the **financial wherewithal** to afford a SCSI hard drive & controller card, and that there's at least *a possibility* that you may be able to put a SCSI disk storage subsystem to good use.

Permit me to state the obvious and say that this guide is intended for people who can afford the cost of a SCSI drive and adapter card (roughly the same cost as a good 3D gaming graphics card) and who will put a SCSI-based system to good use. If you satisfy these qualifying criteria, I vigorously contend that your computing life will be **much sweeter** when running your O/S & apps from an enterprise-class (10- or 15Krpm) SCSI drive.

Wow Factor

If you're anything like me, you'll be surprised by how **much snappier** your system responds, powered by a snarling SCSI beast. It's no small difference. I saw a dramatic improvement .. after upgrading my previous boot drive (7200rpm IBM Deskstar) to a 10Krpm LVD SCSI drive (IBM Ultrastar, which is not even the fastest drive on the

market).

The improvement I saw was comparable to upgrading to a Cable modem (from dial-up), or to installing my first 3D graphics accelerator card (Voodoo2). These are the only other PC upgrades that excited me enough to sit up and say, 'Whoa!'

Some people refer to this as **wow factor**. For me, upgrading my boot drive to an LVD-rated SCSI beast generated terrific wow factor. By contrast, my recent CPU upgrade - [from a C300a @464MHz to P3-700 @938MHz] - left me comparatively **disappointed** (zero wow factor). From a seat-of-the-pants perspective, it felt as if my system responded **three times faster** with the SCSI boot drive .. based solely on the subjective feel of system usage both before and after the upgrade (not benchmarks).

The reasons why SCSI hard drives perform so much better than their IDE/ATA counterparts (at running your O/S & apps) get technical. I'll address them in greater detail later. But for now, the good thing is that **you don't need to know all the über techno stuff** in order to take advantage of the performance benefits offered by today's SCSI drives. The heart of configuring a SCSI components is found in **SCSI IDs & termination**, which is *not* rocket science.

Ultimate Disk Storage Config

It might be worth noting that, if we had an *unlimited expense account*, we could maximize the performance of our disk storage system by purchasing a *separate* SCSI drive to run each part of our system. In other words, we could dedicate one drive solely to run our **operating system**, another to run our **applications**, and a third for our **swap/page file**. Perhaps even a forth drive for our **documents**, if we really wanted to wax decadent.

Altho this would improve our system's performance, it wouldn't be very practical. First of all, there's no such thing as an *unlimited* expense account. In the real world, everyone is interested in maximizing the performance bang for their hard-earned bucks. I'm sure you're no different. In this case, you should know that a *single* LVD-rated SCSI beast will provide the **lion's share** of performance enhancements offered by a SCSI hard drive and the SCSI interface.

This also might be a good place to note that SCSI is a **true multitasking** interface, while IDE/ATA is a **single-tasking** interface. Each device on an IDE channel needs total control of the bus in order to 'talk' (transfer data). SCSI, on the other hand, can have

multiple 'conversations' occurring concurrently. More on this later.

Before goinmg any further, perhaps I should note that **SCSI** is an acronym that stands for **S**mall **C**omputer **S**ystem **I**nterface. It's pronounced 'scuzzy'. The bus standard has been around for a while.

The Controller Card

Once you decide that SCSI is for you, the first item you'll need to consider is the **SCSI adapter**, which is also called the **SCSI controller**. You want to make sure that whatever SCSI adapter you select has the ability to run non-LVD devices (such as burners, scanners, CDROM & Zip drives) **without degrading performance** of devices running on the LVD channel (i.e. hard drives).

Mixing LVD (or U160) devices with non-LVD rated devices (on the same channel) will cause your LVD devices (hard drives) to run at non-LVD speeds (max **40**MB/s, in what is called **Single-Ended mode**). Altho you can run SCSI devices configured like this, this configuration is not optimal.

LVD is an acronym that stands for **L**ow **V**oltage **D**ifferential. It offers performance enhancements that you definitely want in your system. Most notably, the ability to transfer data at rates of **80**MB/s, or **160**MB/s in the case of the Ultra160 protocol.

While adapter cards supporting nothing faster than the UltraWide (UW) protocol, which max'es out at **40**MB/s, are not necessarily a poor decision, I don't recommend them, for reasons I'll address later. Note that in each case, actual, real-life transfer rates will be somewhat less than the theoretical maximum, taking into account things such as 'bus overhead'.

In the case of Ultra 160, PCI bus limitations (**133**MB/s theoretical, **110**MB/s realistic) also come into play (for 32-bit PCI slots). This means that today's 32-bit PCI bus is able to take *full* advantage of the U2W (**80**MB/s) interface, but not the U160 interface (**160**MB/s). This is *not* a major point, tho. If I were purchasing a card today, I would definitely buy an U160-capable card. But if cash is tight, you don't lose very much by opting for an U2W card.

I'm not sure if you can exceed the PCI limitation of 133MB/s when transferring data from one U160 drive to another, on the same channel (provided you have an U160-capable controller). I heard both yes & no. If someone knows for sure, let me know. This would

only apply if your system contains **two** U160 hard drives, Again, not a major point.

A BIOS makes SCSI a Snap

Once upon a time, in the not too distant past, SCSI could be a bear (difficult) to install & configure. But with today's **BIOS-sporting** adapters, it has become **surprisingly simple** to configure your very own SCSI-powered workstation. Like I mentioned earlier, you'll need to become familiar with **SCSI IDs & termination**. But I promise that you won't find it very difficult.

You shouldn't take this to mean that you won't have **a few quirks to iron out**. Every system is different, each with its own issues. Working thru initial configuration glitches is considered a SCSI **rite of passage**. If you don't have *any* problems, it probably means that you did something wrong. =)

Everybody seems to have **at least one** initial configuration glitch that needs working thru. But I only know of *one* person who had so many problems that he gave up on SCSI entirely. And that was years ago, back when SCSI was much less user-friendly. The very act of expecting & anticipating initial-configuration problems seems to take the sting out of any problems you might actually have.

Either way, this guide will help flatten the daunting SCSI learning curve, and minimize your potential for problems. Fortunately for you, I've already encountered most of the problems you're likely come across on the path to configuring a full-blown SCSI-based system.

I've also received reports from many other SCSI users, who've shared their own problems, solutions, & tips, using a variety of system configurations, with a variety of SCSI drives & adapters. In the pages that follow, I address the common pitfalls in a straightforward manner, and steer you away from them.

SCSI Nirvana

Note that you don't see any **advertising** here. So you don't have to be concerned about minced words, or parallaxed viewpoints. I try to tell it like I see it, and not make you read between the lines. Since I identify all of the common pitfalls, you have nothing but clear sailing into the blissful Shangri-La of true multitasking & blazing fast access times .. known as **SCSI Nirvana**. Discover for yourself why people get so excited about booting

their systems from a snarling SCSI beast.

Best of all, you can now employ world-class technology - [designed primarily for the most powerful e-commerce servers, running full throttle, 24/7/365] - at a **small fraction** of what it would've cost only a few, short years ago. Never before has such robust storage performance been available at such reasonable cost.

If you're still with me, you should be asking, "What is it about a system run from a SCSI hard drive that gets people so excited, and why do SCSI drives offer better performance than their ATA counterparts?" Those are good questions. Here's why:

Major Premise

The disk storage subsystem is - by many orders of magnitude - **slower than** both your CPU & RAM. CPU clockrates have already bust thru the 2GHz barrier (tho my system currently runs at a paltry 938MHz). RAM is so fast that adding *any* is virtually guaranteed to increase your system's performance (if you can put it to use). With CPUs & RAM, we're talking about performance in terms of **nano**seconds - or, 1 **billionth** of a second.

People tend to be more familiar with **billion** than **nano**, but billion (Giga) and nano are similar in magnitude - in opposite directions. Whereas billion is big/long, nano is small/short. But both have **9 zeros**, on different sides of the decimal point.

By contrast, when we talk about **hard drive performance**, we're talking in terms of **milli**seconds (small **m** - **three zeros**). You don't need a degree in Mathematics to see that the difference is huge. The difference between nano (CPUs & RAM), and milli (hard drives) is .. **Mega** (big M).

In other words, today's hard drives are (literally) **a million times slower** than your CPU & RAM. Put **in monetary terms** (which *everybody* understands), milli (3 zeros) gives you $1,000 - while billion (9 zeros) gives you $1,000,000,000. See what I mean?

In the High-End Buyer's Guide, Mike Andrews of Anandtech echoes these sentiments here, by saying:

> Hard drive performance has always been one of the biggest bottlenecks in the speed of a computer. After all, the only component whose speed is measured in milliseconds is the hard drive – everything else is

nanoseconds or microseconds. Even with the fastest drive on earth right now running at 15,000 RPM, the Seagate Cheetah X15 still has an access time of "only" 3.9 ms. Now 3.9 ms is phenomenal for a hard drive, but still an eon compared to 133 MHz SDRAM.

Now you don't *always* use your hard drive, but you use it **a lot**. Some folks use theirs more than others. It depends on what kinds of things you do with your PC. In each case, it **depends on the individual user**. But the way in which Windows is designed, everyone uses their hard drive much more than their CD-ROM, which is much slower (~10X) than the hard drive.

And this is one of the major factors which determines **whether SCSI is right for you**. The more you use your system in ways that **access the hard disk** (read from or write to), the more benefit you will derive from a SCSI boot drive.

Using a concept known as of the **limiting factor**, we can see that a family can only walk as fast as its slowest member - be it one of the kids or granny. In like fashion, anything we can do to increase the performance of our slowest frequently-used system component (hard drive) has the likelihood of producing a significant effect on our overall system performance.

"If this is true," you might be asking yourself, "why doesn't *everybody* boot their system from a SCSI hard drive?" Good question. *Two reasons*:

1. First, like the <qualifier> suggests, **not everyone uses their PC in ways** that take advantage of the benefits offered by SCSI hard drives and the SCSI interface. These are folks like my grandma, who only uses her PC for **email**, occasional **word-processing** (to make her shopping list for the grocery store), & **surfing the 'Net** .. to find the latest bingo scores.

   But if you do things like video editing, audio recording & editing, image or graphics editing, heavy multitasking, you're not in the same category with Gram. And I have a hunch that, if you found your way to Radified, you're someone who will appreciate the performance that SCSI offers, and will put it to good use. This leaves only item **#2** below as the **sole**

determining reason for determining whether SCSI is right for you.

2. **Cost**. SCSI costs more than IDE. Not only do SCSI drives themselves cost more than IDE drives, but you'll also have to purchase a SCSI adapter card, or a motherboard with a onboard SCSI controller.

   You see, IDE/ATA drives are designed primarily with **value** in mind (not performance). You get much more space with an IDE/ATA drive. SCSI drives, on the other hand, are designed primarily with **performance and reliability** in mind (not value).

   All motherboards currently come with (at least) two IDE/ATA controllers onboard. If you want to use SCSI components in your system, you'll have to pay extra for a controller - either integrated onboard, or with a **separate PCI card**. (I recommend the later approach.)

You can trade in that clunker and drive out of the showroom in a shiny new SCSI-based rocket for somewhere in the neighborhood of US**$375**. This includes the cost of *both* an **18**GB enterprise-class (10Krpm, new) hard drive and an **Ultra160** SCSI adapter card (also new).

This calculation is based on using the Tekram DC-390U3W SCSI adapter card (~$185) and an **18**GB Maxtor/Quantum Atlas 10K III (~$189). It wasn't that long ago when this number was **twice** as big. You can **reduce** this number by **$50** by opting for an U**2**W SCSI adapter card (Tekram DC-390U2W), which is *not* a bad decision.

I used to recommend the IBM Ultrastar, but I (and friends) have had too many **problems** with them for me to recommend any longer. Besides the **Atlas 10K III** is the **best-performing** 10Krpm drive that you can buy right now. The last SCSI drive that I purchased was an Atlas 10K III, and I like it. I can't say that I notice any real-world performance differences between the Atlas 10K III and the IBM Ultrastar 36LZX.

IBM has another 10Krpm drive coming out soon: the 73LZX. As yet, no one seems to have them in stock, but they might be worth considering when they arrive. The thing is, you don't know if a particular drive will encounter reliability issues until well after it's released. Even then, reports are largely anecdotal.

Fastest Drive on the Planet

The current reigning **FDOP** (**f**astest-**d**rive-**o**n-the-**p**lanet) is the Cheetah X15-36LP, manufactured by Seagate, the acknowledged leader in high-end SCSI drives. Seagate produced the first 10Krpm spindle, and the first 15Krpm spindle. The X15-36LP is available in both 18GB and 36GB sizes.

Note that a 15Krpm spindle is over **twice as fast** as the fastest IDE/ATA drives currently available on the market (**7200**rpm). For those who absolutely, positively gotta have the fastest drive that the universe has to offer, the X15-36LP sells for about US$259. Wow, they've really come down in price since I last checked .. now in my price range. Only $70 more than the Atlas 10K III. Dang, I might have to get me one of those bad boys. The **36**GB variety of the X15-36LP sells for US$**440** (but you don't need **36** gigs of SCSI).

If you wanna see what kind of performance your money buys you, I posted an HD Tach benchmark of the Seagate Cheetah X15-36LP hard drive, and also an Atto benchmark of the Seagate Cheetah X15-36LP, both compliments of **skypx** (thx, hombre).

Note that the Cheetah **X15** (not the 36LP flavor) is the **first-generation** 15Krpm SCSI drive from Seagate. The second-generation X15-**36LP** is better/faster.

IBM has their own version of a 15Krpm spindle drive, called the 36Z15. But I've seen neither hide nor hare of these things in stock. I've given up waiting. They feature a blazing **3.4**ms seek time, available in both 18GB & 36GB capacities. Digit Life featured a side-by-side comparison of 10 & 15Krpm SCSI drives.

Before buying *any* hardware online, you should always (always!) check with a price-comparing service such as Pricewatch & Shopper, and a vendor-evaluator like Resellerratings .. to verify that your prospective reseller is both established and reliable. New Egg is also a good place to shop. I've purchased drives thru Hypermicro, and found them to be reliable & competitively priced (no California tax).

Purchase only from established vendors with a good track record. Use a minimum Reseller rating of **5.5** as a good rule of thumb. Don't buy anything from a vendor with a rating of less than 5.0. I've deviated from this practice only twice. Both times I was in a hurry, and wound up sorry that I hadn't spent a few minutes checking. =(

At this point, the obvious question in everyone's mind should be: **Is SCSI worth it for me?**
The obvious answer is: **it depends** ... and this is what it depends on:

The Argument

No one argues that the SCSI interface is not superior to that of IDE/ATA. The argument is always over, *is it worth it?* .. which (naturally) involves a *value* judgment. A value judgment is something only the individual user can make for himself.

When I first posed the SCSI question (at *storagereview* forum), I was surprised to see such spirited debate in response. Some people - who obviously knew what they were talking about - said SCSI *was* worth it .. while others, seemingly just as knowledgeable, said it *wasn't*.

It took me a while to figure out that the proponents of both sides, each in their own way, were equally correct. It *was* worth it for some, but certainly not for all. But why such differences in opinion? And why such heated debate? Do people really care that passionately about the type of hard drive you install in your system? Let's explore what's behind the *value* question.

First, let's note that it should be obvious that the cost of a SCSI boot drive & adapter - however large or small it may seem to you - can *not* be worth it for the person who can't *afford* it .. no matter *what* kinds of things that person might do with their PC. Also note that the person who has never actually *used* a SCSI drive, is probably not the most qualified person to comment on the relative merits of the SCSI interface & its components. Sound reasonable?

The point I want to make is merely that knowledge based on *experience* is superior to knowledge based on *intellect*. I don't care how many books someone might've read about *how to fly an airplane*. When I step aboard, I want a pilot who has real-life, no-shit experience. [And, far as I'm concerned, the more the better.]

It's usually not until we meet Professor *Practical Experience* that we discover how little we actually know about a particular subject. This is why employers want to see a resume. They want to see what you've actually *done*. This is also why they'll pay more for those with more experience. If it seems like I'm laboring the point, it's cuz I've had people argue it.

I've found very few people who've actually set-up a SCSI-based system and later deemed it not worth it. I can count them with the fingers on one hand. And the majority of these are people who were comparing 3-year old SCSI technology with contemporary IDE/ATA drives .. which is absurd.

I only know of one person who actually ran 10Krpm LVD drives and didn't feel it was worth it. But this person had purchased multiple first-generation Cheetahs, which are notorious for running hot and loud. (Cheetahs are now in their 5th generation.) They were also very expensive when they first debuted (at 10Krpm).

Consider also the person who can *barely* afford SCSI. Let's note that SCSI is by no means a necessity. It's a performance *luxury* - no matter *what* things you do with your PC. Certainly no one knows your financial situation better than you. So, naturally, no one is qualified to answer the *value* question better than you. Let's simply close this point by agreeing that luxuries can be tough to justify .. certainly tougher than necessities.

If someone tells you that SCSI drives aren't worth it (for you), ask them if they ever actually owned a SCSI drive. They probably haven't. But if they have, ask them which one. Chances are they've used a model several generations old. Lastly, if they say they've owned a current-generation SCSI, ask them what they did with it. Chances are not much.

A SCSI drive is not going to do much for a person who merely checks their email & surfs the web .. especially if they have a dial-up connection. Their Internet connection is going to be the bottleneck. The difference between today's SCSI & ATA drives - [running the operating system & applications] - is so dramatic that you're not likely to find a single person who has used a current generation SCSI drive with an LVD adapter and found it not worth it. At least, I haven't.

The cool thing is that, even if someone *can't* afford a SCSI beast (now), they won't even know what they're missing. No one should feel bad if they can't afford a SCSI beast .. even tho they're no longer very expensive. It's hard to describe the difference between a SCSI-based & IDE/ATA-based system to someone who's never experienced a system run from a 10Krpm enterprise-class drive.

A Toyota will perform just fine. But if your neighbor lets you drive his Porsche for a week, afterwards, the Toyota might seem sluggish. Perhaps even *painfully* so. Or maybe you have a broadband connection (Cable or DSL), and you've stopped by your buddy's place and needed to use his Internet connection, which happened to be dial-up. Have you noticed how dial-up never seemed so slow until after you've had a broadband connection for a while?

It's the same way with SCSI. The *up*grade is nice, but you notice & appreciate it more when you *down*grade. [Note: I'm not knocking Toyotas. We have a Camry. They're great cars, but I wish I'd never drove that Porsche =)

Perhaps you're an online gamer, and have played games over an Internet connection, or maybe even at a LAN party. If so, you're in an excellent position to understand how a SCSI boot drive improves system performance. Here's why:

Next -> **[SCSI Guide - The Argument Part 2]**

The Argument - Part 2

Online gamers are especially suited to understand how a SCSI beast improves system performance, cuz they're familiar with the concept of *ping*. For those who don't know, *ping* is a term used to measure how long it takes (usually measured in milliseconds) for a small chunk of data to go from your computer, to another computer (usually a server) and return to your PC.

Online gamers typically tweak their Internet connection to make their ping as *small* as possible (data makes the fastest round-trip) .. which makes their game-play **more responsive**. That's what a SCSI boot drive does. It makes your PC experience *more responsive*. [I'm starting to get excited now. =)]

Dropping your ping from 300ms (dial-up) to 30 (broadband) to 3 (LAN party) makes a huge difference in game-play responsiveness. You'd think that such small differences wouldn't be noticeable, but they are .. dramatically so. Yet you don't notice the higher pings *until* after you've played at a lower ping. All of a sudden, you realize how bad it was before. Same thing with SCSI.

Suddenly the higher pings become annoying. You might ask yourself, "How can anyone notice a 6 milli-second difference in access times between SCSI and IDE drives?" Consider that your system often has more than a single file to fetch. Add up 6 millisecs many times and you'll see how small differences soon become amplified.

I'm getting ahead of myself. I address the importance of low access times later. But you may have anticipated the question. My response is, "Once you *experience* it, you'll see what I'm talking about. Some people who play at LAN parties, with single-digit pings, get so spoiled that they never want to play on the Net again. Same thing with SCSI.

Getting back to the *value* question: Is SCSI worth it *for you*. Let's talk about the person who *can* afford it. That's the *real* question: Is booting your system from a snarling SCSI beast worth it for the person who *can* afford it?

Anyone reading this far probably has the financial wherewithal to afford a SCSI. This was my case. For me, the real question was, "What does SCSI buy me?" I already knew that I could *afford* it, but I didn't want to waste my money if the gain wasn't noticeable. You might feel the same. So let's use the format I learned in a *Logic* class to look at the question a little closer, and answer your questions.

But before I do, let me clarify one thing. I'm *not* saying there's anything wrong with the IDE/ATA interface, or ATA drives. No, no, no. A thousand times, no. I *love* ATA drives. I have **3** of them myself (IBM 75GXP series) in my system. They rock. ATA drives provide great bang-for-your-storage-buck (key word: *storage*). But they simply don't compare in *performance* with current-generation SCSI drives .. at least not when we're talking about running your operating system & applications.

A drive's seek/access time spec is the most telling metric for determining how well a drive will run your OS & apps. Lowering a drive's seek time is both difficult & costly. This is why the seek/access times of ATA drives have remained essentially constant for the last few years. In fact, in the last year or so, they've actually *worsened* (for IDE drives).

SCSI drives are designed (primarily) with **performance** (not value) in mind, while IDE/ATA drives are designed (primarily) with **value** (not performance) in mind. I contend that *both* performance and value are important, and that, in order to make the best decision, you must first decide what you want to **do** with the drive. Someone who makes a blanket statement like, "SCSI is better than IDE" .. or .. "IDE is better than SCSI" .. without addressing what the drive is to be used for, exhibits a lack of understanding.

If you own a farm, and drive off-road a lot, you don't want a Ferrari (no matter how fast it goes). If you want a vehicle to win the Indy 500, you don't want a truck (no matter how many bales of hay it can carry). Make sense?

I tell people who ask about the real-world difference between SCSI & IDE drives, "SCSI accelerates the time between when you *click* the mouse, and stuff starts to happen - it minimizes the delay." The typical response from someone who has never booted from a SCSI drive is, "*What* delay?" That's the thing: you don't even notice it .. until ... It's not until that first beast-powered boot that you can say, "Oh, *that* delay." It's *most* noticeable after you've used SCSI for a few weeks, and then go back to IDE.

One of the things that the hardcore-ATA group sometimes claims against SCSI-users is that those in the SCSI camp (sometimes) come off as holier-than-thou snobs .. that they feel they're somehow morally superior cuz they boot from a SCSI drive.

Sadly, this is (sometimes) a valid point. I have witnessed it myself, yet only to a small degree. Naturally, those in the SCSI camp tend to better understand the finer points disk drive performance factors. Not always, but more often than not. Depending on how their argument is presented, it can come off as pedantic, or snobbish. Hopefully you understand what I'm saying, cuz people get fired up over the SCSI vs. IDE/ATA point.

What I'm against, is someone claiming that SCSI isn't worth it *for someone else*, simply because it may not be worth it *for them*. This happened to me. Consequently I passed on SCSI's performance cuz I'd heard it wasn't worth it. Someone with no SCSI experience isn't best qualified to tell you that SCSI isn't worth it for you.

After a while, I wanted to see for myself what all the hoopla was about. I planned to install a SCSI drive, see for myself, and then sell it. But when I saw what a difference it made, I not only kept the drive, but bought another. So I'm here to proclaim that (for me, anyway) it was *well* worth it (and it costs less now) .. which bring us to my next point.

Next -> [SCSI Guide - Minor Premise]

Minor Premise

The single biggest, and probably *only*, disadvantage of SCSI is its **cost**. It's also a bit more complicated to set up, but this is not a main point of contention.

Depending on your financial condition, the cost issue may range anywhere from a non-issue to an insurmountable obstacle. Everyone is different. On a cost/GB ration basis, SCSI hard drives typically cost 3 times more than their IDE counterparts. This is why I recommend a **small** SCSI drive. It's because *you don't need* very much space to run an operating system and applications. And this is where you'll notice the most dramatic performance improvements over an IDE/ATA drive.

The smallest 10Krpm SCSI drive you can buy today is **9**GB. This is *more* than enough space to run both WinME and Win2K, all your apps, and prolly even a Linux distro. Since the prices of **18**GB drives is only a little more than that of a 9GB drive, they currently offer the best value. Don't buy more than 18 gigs if you won't actually *use* that much space. Using a SCSI drive for mere file *storage* is a waste of money. You should be using (relatively) cheap ATA drives for that. With a 18GB drive, I'd make three **6**-gig partitions.

As mentioned on a previous page, you can buy a **18**GB, 10Krpm IBM Ultrastar 36LZX *Discovery* HDD, with 4MB cache & **4.9ms** seek time, for ~US$169. Let's take a minute to compare prices. The **60GB** IBM 60GXP Deskstar, a 7200rpm drive, with 2MB cache and **8.5ms** seek, sells for ~US$139. Note that the cost of each drive is ball-park equal (within $30), but the IDE drive buys you **~3X** more storage space.

This is why you don't want to use a SCSI drive for mere file storage. It costs 3 times more to rent space in a SCSI apartment it does to rent the same size apartment in ATA land. The ATA drive is where you want to store files that are *not* part of the operating system or applications. For example, file storage would include (but not limited to): MP3s, downloads, drivers, scans, jpegs, clip-art, back-up files, Norton Ghost images, movies, AVI files, perhaps even your games .. all the files that don't put the SCSI interface to its maximum use.

I have my favorite games, like Quake III Arena (Instagibs!) on a SCSI drive. Do I get more FPS with Q3A on a SCSI? No. Does the levels load faster? Yeah. Does it put my precious SCSI real estate to max use? Prolly not.

IDE & SCSI hard drives will co-exist peacefully in the same system. I currently have **3** ATA & **3** SCSI hard drives in my system.

I prefer IBM drives, but am not dogmatic about it. Now that Maxtor bought Quantum, they are the largest manufacturer of hard drives in the world. Before the Maxtor buy-out, Seagate was the biggest.

The *Cheetah* has been a perennial performance leader for years. Most agree that they make the finest SCSI drives, tho also the most expensive. Some have complained of a high-pitched whine from some Cheetahs. I've never used a Cheetah. First-generation 10K Cheetahs were notorious for running hot & loud. I've heard of more problems with *Western Digital* drives than any other manufacturer, but they do have attractive prices.

Storagereview says the *Atlas 10K III* is the fastest 10Krpm drive. Any current generation SCSI drive that spins at 10Krpm (or greater) is going to offer dramatic performance improvements over any IDE/ATA drive. In a recent survey at he Storagereview, IBM was far & away the most trusted HDD manufacturer, with 40% of the vote. Seagate & Quantum tied for a distant second at 15% each. Maxtor & Western Digital was scraping the bottom with 10% each. From the posts I've read at the SR, I tend to agree with the survey. Seagate SCSI drives should prolly be rated higher tho.

Next -> [**SCSI Guide - Seek / Access Times**]

Seek / Access Times

Two things make the SCSI interface superior to IDE for running an operating system, applications, and swap file:

1. dramatically lower low **seek/access** times (**3.6**ms seek for SCSI vs **8.5**ms for IDE - user benchmarks vary)
2. SCSI's **multitasking**, multi-threaded capability (IDE is a single-tasking interface)

In order to read a file, the disk actuator must first move the read/write heads to the correct cylinder. This is referred to as *positioning*, and is measured by a metric called **seek**. (typically 4 to 10 millisecs). Then the read/write heads have to wait for the correct sector, containing the desired data, to come spinning around. This time is solely dependant on spindle speed, and is referred to as **latency**. The faster the drive spins, the quicker the correct sector will arrive at the read/write heads, and the lower the latency.

Sometimes the correct sector will be right at the read/write heads, and no waiting (latency) will be involved. Other times, the correct sector will have just passed the heads, and it will take a full revolution for the correct sector to arrive at the heads. Typically, latency is *averaged* .. equal to *one half* the time it takes to make a full revolution. Seek + latency = **access**.

I once read that, *in the world of hard drive technology, one millisecond is an eternity*. If that's the case, then current generation IDE drives are several eternities slower than their SCSI counterparts. SCSI drives are more than *twice* as fast as IDE drives at getting to the data once a command is received.

The seek time spec is technically a function of the drive, and not influenced by the controller, or operating system per se. These things may have a *perceived* effect (benchmarks), but, technically, seek times are solely a function of the drive itself.

This is what gives a SCSI-based system that wonderful feeling of **responsiveness** that make SCSI users so fanatical. It's hard to describe if you've never experienced it. When I upgraded my system/boot drive from 7200rpm IDE/ATA (IBM), to a 10Krpm LVD SCSI (also IBM), I had great *Wow!* factor .. not unlike when I first got a Cable modem, or my first 3D accelerator. It was dramatic. From a seat-of-your-pants perspective, it felt as if my system ran *3X faster*.

By definition, (average) access time = (average) seek + (average) latency. Latency is determined (solely) by how fast a disc spins, and can be derived mathematically. Average latency for a 7200rpm HDD is 4.2ms, and 3.0ms for a 10Krpm drive, and 2.0ms for a 15Krpm drive. Let's compare access times (seek + latency) for the fastest ATA & SCSI drives.

- IBM 75GXP ATA100: 8.5ms (seek) + 4.2ms (ave latency) = 12.7ms access (actual, real-life = 12.3ms)
- Seagate Cheetah X15: 3.9ms (seek) + 2.0ms (ave latency) = a svelte 5.9ms access (actual, real-life = 6.5ms)

As you can plainly see, the X15 accesses data over twice as fast as the fastest ATA100 drive out there. This does not even take into account SCSI's multitasking/multi-threaded capabilities (which the ATA interface does not sppt). Perhaps you can see now, why a SCSI drive is so much faster than the fastest ATA drives.

IBM has recently announced a 15Krpm drive - the 36Z15 - with manufacturer seek/access specs of 3.4/5.4ms.

You don't have to know how & why this is so, but it helps to understand how things work. I have copied the contents of an interesting 5-point post I found at an online bulletin board. Note that the following five points are not my own, and I forget who posted it, but it's obvious that the gentleman knows what he's talking about, and says it more eloquently than I could. You may find it interesting. Paste begins here:

1. In general, real-world performance of a modern disk drive under a modern operating system using a modern file system is far more dependent on data access time (RPM and seek) than sustained transfer rate (density) - regardless of whether the system is a workstation or a server. You gain very little improvement in performance as density (STR) increases.

   In modern OS, such as Windows 2000, multiple threads do I/O independently and virtual memory system accesses paging file in stochastic manner. In addition, modern file systems such as NTFS does fragment, and uses transactional logs, permissions, etc. All these leads to disk access patterns that are random in nature.

2. Because of #1 above, IDE drives do not scale well as load (number of I/O requests) increases. Meaning that - if you put a non-trivial load, such as multitasking, on an IDE drive, your system will slow to a crawl.

3. Improvements in density (STR) far outstrip improvements in access times. In the last 3 years, density has increased by ~800% (double every year), while data access times improve by less than 100% (far less for IDE drives - seek time has improved very little for IDE drives over the past few years). The difference is now so large that a modern hard disk drive spends most of its time seeking, and not actually transferring data.

4. Winbench is largely a lightly-loaded, single-tasking benchmark. It does not accurately represent a real-world environment, where people typically perform non-trivial tasks. As such, it biases heavily against SCSI drives. For example, go to storagereview.com, and compare the latest Maxtor DiamondMax Plus 40 against the 2-year old Seagate Barracuda 9LP under Winbench and under Intel IOMeter.

   The Maxtor beats the Barracuda in Winbench by a large percentage, but the 2-year old Barracuda beats the Maxtor decisively in Intel IOMeter workstation test.

5. It's cheaper for manufacturers to improve density than access times, because higher density means less (number of) platters, and therefore, lower cost. Improvements in sustained transfer rates (STRs) is more or less a by-product of increased density. Thus, it's in the manufacturers best interest that consumers perceive STRs as the most important factor in determining performance - when in fact it is not.

   SCSI drives generally emphasize data access times, and that's also why Seagate's Cheetah X15 uses very small platters and can only store 18 Gigs on a low-profile drive while IBM's new 75GXP IDE drive, with a much higher density, can store 75 Gigs.

</paste>

The gist of these points is that the access time spec is more important than sustain transfer rates, when it comes to running an operating system, and that SCSI drives have much better access times than their IDE

counterparts. Note that no one is saying that IDE/ATA drives, or the IDE/ATA interface, sux. It doesn't.

IDE has its place in every PC (I'm currently running 3 IDE hard drives), but they do not perform (nearly) as well as SCSI drives at *running an operating system*.

The StorageReview says here that "*...it's evident that **random access dominates typical workstation usage** ... Though the loading of executables, DLLs, and other libraries are at first a sequential process, subsequent accesses are **random** in nature. Though the files themselves might be relatively large, parts of them are **constantly being sent to and retrieved from the swapfile**. Swapfile accesses, terribly fragmented in nature, are quite **random**.*

*Executables call other necessary files such as images, sounds, etc. These files, though they may represent large sequential accesses, consist of a very small percentage of access when compared to **the constant swapping that occurs with most system files**. Combined with the natural fragmentation that plagues the disks of all but the most dedicated defragmenters, these factors clearly indicate that erring on the side of randomness would be preferred."*

And here, SR adds, "*...**STR had relatively little effect upon overall drive performance**. Today, it should be clear that steadily-increasing **transfer rates have in effect "written themselves out" of the performance equation** ... it should be clear that **random access time is vastly more important than sequential transfer rate** when it comes to typical disk performance. Thus, the reordered "hierarchy" of important quantifiable specs would read*:

- ***Seek Time***
- *Spindle Speed*
- *Buffer Size*
- *Data Density*

The *Storage Review* is generally considered an *authority* in hard disk drive (HDD) technology, performance, & benchmarking measurements, and educators in the field of drive technology. There is much to learn about HD technology by reading their reviews & reference material, and hanging out at their general bbs forum - inhabited by some of the more brainier online types. They have the great *IDE/ATA vs SCSI* debated honed to a fine science.

Next -> [SCSI Guide - Tekram vs Adaptec]

Tekram vs Adaptec:

LVD-capable Tekram cards use the high-performance Symbios chipset, designed by LSI Logic. The beautiful thing about Tekram cards is that they come with all the cables and terminators you need. Adaptec cards come in both OEM & Retail flavors. OEM packages do not come with any cables or terminators.

SCSI cables & terminators can cost plenty when purchased separately, so make sure they come with your card. Typically, Tekram cards (at least those with the Symbios chipset) offer slightly better performance that their Adaptec counterparts, at significantly lower prices.

Heard that (some?) Adaptec U160 cards were having probs w/ Linux sppt - not so w/ Tekram. Have not looked closely into the issue, cuz I don't have an U160 card. My Tekram card had no probs using my SCSI drives in Linux (Mandrake 7 & Caldera 2.4), but I was unable to *boot* from any SCSI drive in Linux. Of course, for the newbie, nothing in Linux is very easy.

Some people claim that Adaptec tech sppt are arrogant, and tend to say that it's always *your fault*, or that of *your system*, that's the source of the problem .. that they're more interested in laying blame elsewhere, than finding a solution to your problem. I have only dealt with Adaptec sppt twice. But each time I came away with a bad taste in my mouth. They were close to the worst tech sppt experience I've ever had.

I wouldn't say the worst, cuz at least I wasn't given any inaccurate info. But I received no useable help. It's hard to convince someone that there's something wrong with their product, if they refuse to accept it. They weren't interested is working on a solution with me, and were generally uncooperative.

I thought it was me, until I heard others saying the same things. Lots of my friends have Adaptec controllers, and love them. I'm sure there are even some who've had wonderful experiences with Adaptec sppt. Unfortunately, I'm not one of 'em. If I could buy an Adaptec Retail package with comparable perf, for a similar price as Tekram, I'd buy it. But you can't.

On the other hand, Tekram sppt is non-existent. Sending them an email is a waste of bandwidth. I concede that sppt with an attitude is better than no sppt at all. Maybe now you can see why a SCSI user needs to be able to provide his own tech sppt.

The only reason I can see for buying an Adaptec card is that you're into 'buying American' - as Tekram is a Taiwanese corp. Personally, I am too much of a capitalist to pay significantly more money for equivalent or lower performance. As noted, Adaptec has better tech sppt, but you can get excellent support at various online hardware bulletin board forums - such as the ones at the storagereview.com. Those guys can walk you through any problem you might have - as long as you're nice to them. =) See here - go to *General* forum.

Darren Mason at **GamePC** did a great 5-page review of the Tekram DC390-U3W vs Adaptec 29160 here. His concluding thoughts:

<copy-n-paste> "*As the benchmarks prove, the Tekram board performs great. It is neck and neck with the Adaptec in all our benchmarks, and actually edges out Adaptec in a few areas.* ***The Tekram DC-390U3W is a remarkable value****. For a significantly lower price, you can get Adaptec quality features and performance. The Tekram can also support 30 devices, which is something Adaptec can only claim with their pricey 39160 dual channel card. However, the Tekram runs only half the devices at 160MB/s, since the 2nd channel only supports Ultra Wide.*

Regardless, this feature can easily make the Tekram a no-brainer to those who need the 2nd channel. Otherwise, ***the two cards match each other's features, but you pay quite a premium for the Adaptec name****. Congrats to Tekram for producing such a high quality component, that can easily compete with its Adaptec counterpart on every level.*" </copy-n-paste>

Storagereview also did a comparison review here, and came to the same conclusions.

But if you do go with an Adaptec card, like the **29160N**, I heard you should disable *Domain Name Validation*. Adaptec talks about what DNV does here. Also heard that you should use the Win2K drivers for the 29160N - not the 1.00b's that are on Adaptec's site, as ppl are having problems burning with the Adaptec drivers with DNV enabled. U2W and pre-U160 controllers do have DNV. They can be found at shopper.com for ~US$250. If vendors offer this card for much less, give them a close look before buying.

I heard the only difference between the Adaptec 19160 and the 29160N is driver support. The 19160 is a

Windows-only card. So if you ever want to use Linux, BeOS, or another OS besides Windows, don't get the 19160.

The Tekram DC-390**U2W** has no new drivers for over six months. I'm not sure if this is the ultimate sign of driver maturity, or that Tekram is no longer interested in supporting the card .. moving on to DC-390U3W & other U160 flavors.

DocSilly says there's a jumper on the Tekram DC-390**U3W** that set INT A or INT B. One setting uses the same IRQ for both channels (U160 + SE), and the other uses a separate IRQ for both (2 IRQs).

I've heard of some problems with non-LVD Tekram cards .. ones *not* based on the Symbios chipset. Tekram uses their own chipset in their non-LVD adapters. If for some reason you don't want an LVD-rated card, I'd suggest Adaptec. There are plenty of people running non-LVD Tekram cards without problems, but the Adaptec would be a safer bet. Note that I don't recommend a non-LVD rated card. They're really only good for running burners, and *Burnproof* technology has eliminated most/all of SCSI's burning advantages.

My SCSI system:

- Tekram DC390-U2W PCI adapter/controller card
- Plextor 8X CD-R burner (50-pin, early model, not CloneCD-compatible, bummer)
- Plextor UltraWide CD reader (68-pin, Plextors excel at DAE. I use the Exact Audio Copy CD audio ripper. Posted here is a CD Speed99 Audio benchmark of a Plextor UltraWide CD-ROM reader. Posted here is a CD Speed99 Data benchmark of a Plextor UltraWide CD-ROM reader)
- 3X IBM Ultrastar 36LZX (68-pin, LVD, 4MB cache, **4.9**ms) - one runs Windows ME & its apps, another Win2K, the third WinXP.

I've run this system for >1 yr now. Found it to be fast, stable & reliable. Tekram driver and bios support has been good (latest drivers are dated July 5th - see here). Tho their tech sppt blows chunks. Sending them an email is a waste of bandwidth. Currently running it in an Asus CUSL2 motherboard motherboard with an Intel P3-700 @938 (1.8v).

This particular Tekram SCSI adapter uses **a separate chip** that effectively **isolates non-LVD devices** (CD-R burner & CD reader) from the LVD channel. This means that running non-LVD devices won't degrade performance of devices on the LVD channel (hard drives). Not all SCSI adapters offer this feature, so check before buying. The Adaptec AHA2940-U2W is a comparable SCSI adapter, which also isolates the non-LVD channel, but uses a different method.

Tekram also makes a newer model, the DC-390U3W (max 160MB/s x-fer rate), but current PCI bus limitations (133MB/s) do not allow this newest SCSI protocol (Ultra160 or Ultra3) to perform at its full capacity. You would need a 64-bit PCI slot to take full advantage of this card. But the card will fit into an ordinary, 32-bit PCI slot.

These newest generations Tekram cards sells for about $180, and come with all the cables & terminators you'll ever need. They are not a bad investment for the future, but you get maximum bang for your buck with the DC390-U2W (max 80MB/s). The DC-390U2W has connectors like so:

- internal 50-pin (typically for burners)

- internal 68-pin UltraWide (typically for UltraWide CD-ROMs, like the Plextor)
- internal 68-pin LVD (for LVD-rated hard drives)
- external 68-pin LVD (for external LVD-rated hard drives)

Next -> [SCSI Guide - This vs that]

Onboard vs PCI adapter/controller card:

Some motherboards comes with onboard SCSI support. Typically mobo manufacturers put only the latest/greatest SCSI controllers on mobo's, cuz an onboard solution can't be upgraded. This is why I prefer a PCI card, even tho you tend to pay a little more for the PCI card solution, compared to an integrated (onboard) solution, cuz more PCB is involved with the PCI card solution.

PCB costs money, and manufacturing costs money. Since the onboard solution is cheaper to manufacture, the manufacturer is able to pass these savings along to you.

Personally, I'd rather pay a little more now & not have to worry about what to do when it comes time to upgrade my mobo. In fact, I have recently upgraded my (Abit) BH6 to a (Asus) CUSL2, but I kept the same SCSI card (Tekram DC390-U2W). If I'd had an onboard SCSI controller, I woulda had to buy another SCSI controller. But the onboard vs PCI card issue is mostly personal preference. Both sides make equally compelling cases. To me, It boils down to upgradability vs cost. I'll pay a little extra for upgradability.

The onboard solution weighs in better if you get a new mobo with a new chipset, with a new SCSI controller that just hit the market, cuz then the life of your integrated solution will be longer. For example, Ultra160 is currently the latest version/spec, with Ultra320 (320MB/s) somewhere in the pipeline.

Might be prudent to note here that the standard 32-bit PCI bus is limited to a maximum of 133MB/s (at 33MHz), with realistic data x-fers more in the area of 100MB/s (taking overhead into account) .. so a good portion of the advantages of the U160 spec (160MB/s) are wasted (on standard/current mobo's with 32-bit PCI bus). I know plenty of smart people have opt'ed for the onboard solution for reasons of getting big performance at a bargain basement price.

I have never used a mobo with an onboard SCSI solution, so I hesitate to talk much about them. But it's my understanding that using the onboard SCSI will mean you have one less PCI slot available .. that using your onboard SCSI will render one PCI slot useless. If this is not the case, pls lemme know. Again, this is more personal preference than anything else. I went with a PCI card solution and am happy with my decision. PlanetHardware looks more closely into this issue here.

Win98/SE/ME vs. Win2K/XP: Win2K makes better uses of SCSI's multitasking capabilities. You will still notice an impressive perf improvement with Win98/SE/ME, and just because Win2K multitasks better is not a (valid) reason to say SCSI is *not worth it* for those running the W9x kernel. It is not difficult to set up a dual-boot config, and use Win2K for the apps that take better advantage of it's multitasking/multithreaded capabilities. I have heard ppl say that SCSI is wasted on W98/SE/ME. It's not. Those 9x-kernel-based OS'es still take advantage of its blazing fast access times, and are (still) multitasking-capable.

IDE RAID vs LVD SCSI: Let me preface by saying I have never configured a RAID array - IDE, SCSI or otherwise. But I have researched the topic well. RAID does nothing to improve seek/latency/access times of the drive(s) in the array. In fact, I heard that an IDE RAID controller actually *adds* 1-to-3ms extra to access time .. altho I have not verified this. RAID's big advantage comes in the area of STRs - sustained transfer rates.

High STRs are great for things like audio & video files, but they're *not* good for things that depend on access times - like running an operating system, applications, or swap/paging file. So I'm not saying that IDE RAID is not good. I'm saying that it is not as good as SCSI for running an OS, apps & swap/page file.

IDE RAID is not a multi-tasking interface (SCSI is). Also, IDE RAID has lower reliability factor than SCSI, for two reasons:

1. SCSI drives are built better & more reliable than IDE drives (typical 5 yrs warranty vs 1-3 yr warranty).
2. a 2-drive (RAID-0) stripe has twice the chance of failure as a single IDE drive.

It doesn't matter how high of a transfer rate an array can sustain if it spends all its time *seeking*.

Games: Games do not use the SCSI interface to it's fullest, cuz, once the game is loaded initially, the only time a SCSI drive comes into play is when another level/map loads. During actually game play, the drive sits idle. Yet I know a surprising number of hard-core gamers who have all their favorite games on a SCSI hard drive, and would have it no other way. Game play is more affected by your graphics card, your CPU, your RAM, your monitor, and your network connection.

Low-level format: I have heard that low-level formatting should only be done as last resort. I have never had to low level format any drive.

80-pin SCA vs 68-pin connectors: Some places (most notably Egghead) offer attractive deals on 80-pin SCA drives. SCSA (I think) stands for Single Connector Architecture. Basically SCA incorporates the 4-pin power connector into the standard 68-pin connector. This makes it easy to swap out drives on monster, rack-mounted server/drive farms. I do not recommend 80-pin SCA drives, cuz you will have to get an 80-to-68-pin adapter.

Not only can these be expensive (I've heard some folks paying $40), but you typically want to avoid any kind of adapter. Adapters simply add one one part to the equation that can go wrong. If you find a (seemingly) killer deal on an deal on an 80-pin SCA drive, make sure you figure in the cost (+ shipping) of the adapter. Some 80-pin SCA drives come with adapters, but most don't. I would would gladly pay a little extra to *not* have to use an adapter. But I have friends who have them & use them with no probs, so use your own good judgment.

7200rpm vs 10Krpm drives: For reasons of performance, I do not recommend 7200rpm SCSI drives - unless you simply want to learn about how to configure a SCSI system. If you cannot afford a 10Krpm SCSI

drive, I recommend waiting until you can. A 7200rpm SCSI drive will still provide you with SCSI's multitasking/multi-threaded capabilities, but it's seek/access & STR perf is not enuf (IMHO) to justify the expense.

I've never purchased or used a 7200rpm SCSI drive, but have talked to people who have. Most are quite pleased with their 7200rpm SCSI drives, and say that they're definitely faster than 7200rpm IDE/ATA drives - at running their OS'es & apps .. even tho a current generation IDE/ATA drive may have a higher STR (sustained transfer rate).

10Krpm vs 15Krpm drives: I've never used a 15Krpm drive, but if you look at the performance numbers (benchmarks), you'll see that the difference between 10K & 15K is not as large as the difference between 10K & 7200rpm. Also the price jump from 10K to 15K is larger than the price jump from 7200rpm to 10K.

If you can afford a 15Krpm drive, it's definitely the way to go. But if you can't, 10Krpm will offer much of the performance benefits (especially compared to IDE drives) at a fraction of the cost.

Ultra160 vs Ultra2Wide: Ultra160 is a subset of the Ultra3 protocol. Only 3 of the 5 features in U3W have been implemented in U160. Packetization and QAS (quick arbitration) have been left out. Ultra160 supports bus speeds up to 160MB/s. Ultra320 is in the pipe - coming, but not here yet.

The problem is that most current motherboards do not have 64-bit PCI slots, and you need 64-bit PCI to take **full** advantage of the U160 protocol. Most current mobo's have 32-bit PCI busses, which max out at 133MB/s. However 100MB/s is a more *realistic* number, taking into account things like *overhead & housekeeping*. Note that this number (100MB/s) includes data x-fer'ed from **all** PCI - i.e. sound card, network card, SCSI card, etc. - everything on your PCI bus.

Current reigning fastest drive on the planet (FDOP) - Cheetah X15-36LP - can barely sustain a data x-fer rate of even **60**MB/s. So you can see that any bandwidth above U2W/LVD speeds (80MB/s) is likely to be wasted. So, the argument goes, why pay for more speed than you can use?

Two answers.

1. People like running their hard drives at same protocol as their controllers. Makes them feel better, like there's less chance of problems. Since most new drives come in U160 flavor, they like their SCSI adapter U160. In theory, it shouldn't matter. Mixing & matching protocols should work without a hitch. The SCSI protocols are specifically designed to be backward compatible.

2. Longevity. An U160 card will last longer then a U2W card.

Note that you can exceed the limitations of the PCI bus (133MB/s theoretical, 100-110MB/s realistic) with an U160 controller and U160 devices is the data being transferred doesn't have to go out to the PCI bus. In other words, if the data being transferred from one SCSI device to another, you can exceed 133MB/s. Obviously, you need more than one SCSI device to achieve this.

But it's difficult to justify U160 from a performance standpoint, cuz you pay for performance you can't use (yet). If I was buying today, I'd get the U160 card anyway. I prefer to get a piece of hardware, learn it's quirks, and keep it for as long as I can. I like the Tekram DC390-**U3W** controller (~$185).

Next -> **[SCSI Guide - Miscellaneous Info]**

Miscellaneous Info

Waxing more theoretical, SCSI stands for **S**mall **C**omputer **S**ystem **I**nterface, and is pronounced 'scuzzy'. It's a input/output (I/O) system that offers true multitasking/multi-threaded capabilities. Unlike the IDE interface, which needs complete control of a bus/channel in order to do anything, and can only execute one function (e.g. read/write) at a time, a SCSI subsystem can perform many different functions concurrently.

For example, SCSI can read from one drive, while writing to another. IDE, on the other hand, must wait until each function is complete, before beginning the next. This ability to perform multiple functions concurrently - without having to wait - is one of the main advantage SCSI holds over the IDE interface.

SCSI can be divided into two camps:

1. CD burners
2. Hard disk drives (HDDs)

The advent of BURN-Proof (invented by Sanyo) has neutralized SCSI burning advantage. Burn-Proof turns off the laser in the case of buffer under-runs. The only reason to get a SCSI burner these days is to save your IDE ports of (cheap) IDE drives. Sadly, companies often come out with their fastest, newest drives/features in IDE versions now.

Might be worth noting here that, even if you go with a SCSI CD-ROM (I have), you should still keep an old, cheap, IDE/ATA CD-ROM around the house. I had probs getting Linux to load from my SCSI CD-ROM - even tho Linux claimed the devices were supported. And that's the reason I keep one IDE channel open (I only use 3 IDE/ATA hard drives).

So, if I ever need to bust out the IDE/ATA drive, dust it off, I can set it on a small footstool by the PC - don't even have to install it in the case. Just plug in the ATA cable & a power connection. Once Linux is loaded - unplug & stash it back in the drawer.

If you want to be able to *boot* from your SCSI device(s) (burner or CDROM reader), you will need a SCSI card with a **BIOS** (basis input output system). No BIOS = no boot. BIOS'es are typically (re)flashable, which allows the SCSI adapter to be upgraded with new features and better performance. A BIOS, in effect, extends the useful life of an adapter. This typically makes a (card with a) BIOS, a smarter investment (than one without).

It has been my experience that people who diss SCSI the worst are those who have never actually used it. I've only heard of two people who tried a SCSI-based system and went back to IDE. One of them was somebody talking about **4**-year old SCSI technology, compared to modern IDE drives.

Next -> **[SCSI Guide - Miscellaneous Configuration Info]**

Miscellaneous Configuration Info

- LVD drives do *not* come with (any) terminators. Therefore, make sure you get one with your card, if you buy an LVD-capable adapter (which you should). Terminators are *not* cheap when purchased separately.

- Most/all current LVD-capable SCSI adapters come with **auto-termination**, which means the card sees what devices are installed/connected, and terminates (or *un*terminates) automatically. This is a nice feature, and you should look for it in a card. If not, you will have to manually set the card's termination

(with jumpers), and this is one more place where you can screw up. Naturally, the *less* places where you can screw up, the better.

- The LVD terminator goes on the **very last** connector of the twisted-pair LVD cable. If you put the terminator on any connector (also called a *position*) other than the very last one, you will have what it called a *dangling cable*, which can generate signal interference, reflectivity, and other bad things. Before learning this, I have run my system with a 'dangling cable' and it seemed to run well. But everyone I consulted insisted that I place the terminator on the very last position.

- None of my IBM Ultrastar SCSI hard drives came with the **W**rite **C**ache **E**nabled (WCE). Enabling the **write cache** provides significantly better performance. I use Adaptec's EZSCSI 5 to enable the write cache on my IBM drives. (Thx to Joshua for that tip.) Apparently, the SCSI standards are tight enough that the Adaptec utility will work fine on a Tekram card. IBM also has a utility, but it is a POS (piece of cow manure), and will make your head hurt trying to use it.

- Seagate also makes a similar utility - far better than IBM's, but not nearly as easy as EZSCSI 5. For those with Win2000, you can go to the *Disk Properties* tab for the hard drive in the Device Manger, and put a check in the *Write cache* box. That will enable your write cache, too (very easy - and will stay for stay for Win98/ME, too).

- Some people have problems with the write cache reverting back to its original disabled status after a reboot. I've gotten quite a few emails about this, and frankly, have no solution, other than use a utility made the the drive's manufacturer. I've never had this problem.

- Enabling the **write cache** on the HDD allows the system to move on to the next task/function/operation, as soon as data is in the *cache*. If the write cache is **dis**abled, the system must wait until the data is (actually) on the disk itself before it recognizes the write as complete. Because RAM/cache is several orders of magnitude (1 million times) faster than HDD disks, writing will take significantly longer.

- My system ran noticeably slower at times with the write cache disabled. Here's what Adaptec EZSCSI has to say about it, and here is discussion from the Adaptec website. Microsoft has this to say about the subject.

- There is a **risk** involved with enabling the write cache. If you have critical (system) data being written to the drive, and your system loses power *after* the data arrives in the cache, but *before* the data (actually) makes it to the disk, you could have serious problems. The chances for this happening are small, depending where you live, and the reliability of your local power company, time of year (summers are worst, due to high demand for electricity to run air conditioners, and therefore, even dependant on the weather.

- Worst case scenario = you could have to reformat & re-install your OS & apps. For this reason, it's a good idea to run a UPS (uninterruptible power supply). I use the BackUPS 650 by APC.

- Heard that some drives won't keep/hold the write-cache enable setting, using either the W2K check box or EZSCSI5. But I don't think this applies to IBM drives, cuz I have no prob with either method.

- None of my IBM Ultrastars (9LZX & 18LZX) came with *Autostart* enabled by (factory) default. You have to manually set this jumper (jumper config is spelled out on the IBM web site, and on a sticker attached to the drive itself). If you don't set the *Autostart* jumper, the drive will not power up when you press the start button on your PC.

- This can be a source of angst, especially if you just paid a good chunk of cash for it. Alternately, you can enable *Send Start Unit* in the (Tekram's) SCSI card's bios. This will spin up the drive when the SCSI bus starts its scan. But this will take a few more secs than setting the **Autostart** jumper. You want to set the *Autostart* jumper - at least on IBM Ultrastars.

- **Update**: just got a **36LZX** (Jan, 2001) which had the *Autostart* jumper set by default. Also the SCSI ID was set to **6** by default. Usually you'll want that to be set to SCSI ID **0**. You do this with jumpers.

- Be extra careful when setting SCSI ID jumpers, especially if when selecting an ID other than **0**, and especially with IBM Ultrastars. (I have no experience with drives made by any other manufacturer.) It seems that IBM made the selection of SCSI ID's as confusing as possible. The numbers are backwards, right-to-left. Anyway, you'll see what I mean. SCSI ID 0 is easy, cuz you simply remove all the jumpers used to set SCSI IDs. But for any other ID, it can get confusing. Triple check your jumper settings with those for your drive at the manufacturers web site.

- I disable the start-up bus scan for all SCSI IDs except ones I'm actually using. This shaves a few secs from your start-up time, which can add up, over the months & years. **But** you have to remember to re-enable the bus scan for the ID of any new devices you add to the chain. Nothing like adding a new hard drive, or CDROM, & not having it show up, cuz you forgot to enable the bus scan. Doh!

- For maximum compatibility, use Microsoft's FDISK to both partition & format both your SCSI and IDE drives. Forgetting to partition & format is one of the big Doh!s that people make with SCSI hard drives. They install it, see it in the BIOS scan, Windows sees it, but they can't access it. Still have to partition & format the drive. I use Microsoft's FDISK to partition, and have used Partition Magic a few times to modify things, to make room for Linux (ext2) partitions, and Linux swap(s).

- Use Partition Magic to partition & format EXT2 partitions for Linux. Many use PM to partition SCSI & ATA drives. Nothing wrong with that, but I think MS FDISK has better compatibility, as more (that I know) use it. If you're not handy with FDISK, see Doc's Guide to Partitioning a Hard Drive with FDISK.

- For SCSI CD-ROMs & burners, for W98/SE/ME, you want to look in the device manager and enable *Sync data transfer* and *Disconnect*. I disable auto-insert notification, as it bothers CDRWin (burning app), but this is more pers pref If you want to disable AutoInsert notification in W2K, you need to use *TweakUI*, or at least I did. There is also a registry edit that will do this, but I can't seem to find it right now.

- I use 4GB for each of my Windows partitions (WinME & Win2000), and 1.8GB for each of my Linux partitions (Linux swap = 128MB). This is plenty (for me). I have each OS on a separate (physical) hard drive, but this is not necessary.

- In order to run LVD devices in/with LVD mode/protocol, you need *every* part of your hardware config (to be) LVD-rated. In other words, to run your LVD/Ultra160 hard drive(s) in/with LVD mode/protocol, you need an LVD-rated adapter/controller, an LVD-rated cable (68-pin), an LVD terminator, and of course, and LVD/Ultra160-rated hard drive. So far, hard drives are the only storage devices capable of operating in LVD/Ultra160 mode.

- If any one of the previous components is *not* LVD-rated, then everything on the bus default to Single-Ended (SE) mode. Max SE transfer rate = 40MB/s. LVD/Ultra2Wide = 80MB/s. Ultra160 = 160MB/s, but this tends to be a misnomer, cuz the PCI bus can only handle max 133MB/s. I think I've already discussed this elsewhere, so will not beat a dead horse. Consider too, that the fastest drive out right now, the Cheetah X15-36LP, can only sustain a maximum transfer rate of about 60MB/s.

Next -> [SCSI Guide - Miscellaneous Configuration Info Part 2]

Miscellaneous Configuration Info Part 2

- The previous principle (all or nothing) only applies to LVD. For all the transfer protocols *below* LVD, you can/will run each device at its max-rated transfer rate - as long as the adapter/controller supports that protocol. In other words, As long as your adapter supports the UW (UltraWide) protocol, you can run an UW CDROM (like the Plextor I have) at 40MB/s, and a SCSI-2 (also called fast SCSI) at 10MB/s. Each will operate at their max speed.

- If all this SCSI protocol is confusing, don't feel bad. You're not alone. But sooner than you think, it will start making sense to you. Really, you only need to learn about your particular config. You don't have to know *every*thing about SCSI.

- Just to confuse you a little more, here's one more protocol nuance: you can run both U2W (LVD, 80MB/s max) & Ultra160 (also LVD, 160MB/s max) each at their own max-rated speeds - as long as the adapter is U160-rated. In other words, if you have an U160-rated controller, and two hard drives - one U2W, and one U160 - the U160 drive will run at U160-rated speeds (160MB/s max), and the U2W drive will run at 80MB/s (U2W speed).

- So it should be getting clear that LVD is the dividing line. At or above it, individual devices won't affect/degrade other devices. While, the same goes for devices below the LVD protocol. The is assuming, naturally, that the SCSI adapter supports the max-rated speed/protocol of the fastest device you want to use. Naturally, you cannot run LVD devices at LVD speeds if your SCSI adapter does not support the LVD protocol.

- Generally, you will have less problems with newer technology. Of course, brand new technology always seems to have its share of growing pains .. but I've found that the older devices tend to have more probs

than new ones - in general, with all else being equal.

- Whenever you see the word WIDE, that's talking about 16-bit bus. On the other hand, anything that is not WIDE is NARROW. By definition, NARROW means 8-bit wide bus. To get your data x-fer rate, you multiply bus bit width times frequency (MHz). In other words, 16-bit wide bus (WIDE) times 40MHz (U2W runs at 40MHz) = 80MB/s. Somebody let me know if I screwed up the math. But I'm pretty sure that's right.

- A few years ago, installing a SCSI system in your PC could've been a configuration nightmare, but no more. Since most SCSI cards now have a bios, they install surprisingly easy. For the Tekram DC390-U2W adapter, when you install, let Windows install the generic Symbios driver, then update that driver with the current one from Tekram.

- Many SCSI enthusiasts like to point out SCSI's advantages over the IDE/ATA interface/devices .. such as, longer warrantees (typically 5 yrs vs 1-3 for IDE), ability to use more devices (up to 15) with less IRQs. There are other advantages, & some get technical, but all that doesn't mean a hill of beans if you can't notice any improvement in performance. That's where SCSI really shines - in actual use.

- **EvilHorace** has the Tekram DC-390**U3W** card and reports that you you'll get a STOP ERROR when trying to install Windows, and that this is solved by hitting the **F6** key when prompted, then installing the Tekram drivers you you should have ready & waiting on a floppy (previously downloaded from Tekram site). He says this procedure is described on **page 62** of the manual. Thx Evil.

- Regarding setting up a Quantum Atlas 10K II on a Tekram DC390-U3W adapter, I read a post where Puppet5 said this:

  You may have trouble recognizing the Quantum's. After your first boot, and before you start to load more drivers as Windows asks, go to the Device Manager. Under SCSI, you'll see 2 entries for you card. Each entry is one channel. If have a yellow **!** next to one of them, and you've already loaded the drivers for both channels, and your system is running in DOS compatibility mode (check the Performance tab)

  Click on the offending channel and click the *Settings* tab. There you will see a blank, white box. In that box type: **DisableDomainValidation=1**, and reboot. The controller should now recognize your Quantum's as U160 and you system will return to 32bit operation. You may also need to update SCSI card's BIOS, too.

- **ASPI** stands for **A**dvanced **S**CSI **P**rogramming **I**nterface. For related info see my Guide to updating ASPI drivers.

Next -> **[SCSI Guide - Configure & Compare]**

SCSI Configuration & Comparison with IDE

The two main things you need to know about getting your SCSI system up & running are:

1. **SCSI ID numbers** - each SCSI device gets a unique SCSI ID, from 0 thru 15, with the card (typically)

taking #7 for itself. Boot HDD should be set to SCSI ID 0, while CD burners and CDROMs typically get SCSI IDs #3 & 4. SCSI IDs are set with jumpers as per manufacturers specs. Most of the time the default SCSI ID will work fine, but you need to check first.

2. **Termination** - the adapter card will scan for attached devices and self/auto-terminate (or *un*terminate) as needed. LVD drives do not come with (LVD) termination. The LVD terminator goes on the very last position/connector of the cable. For non-LVD devices, terminate the very last device on the chain, and no others (between the end and the card).

It can be helpful to draw a diagram of your SCSI system with lines for cables, and boxes for components. For the newbie, this can clarify exactly which devices need termination and which ones don't.

Type / Speed / Connector

- **SCSI-1** / 5MBps / 25&50-pin
- Fast SCSI (**SCSI-2**) / 10MBps / 25&50-pin

- **FastWide** SCSI (SCSI-2 & 3) / 20MBps / 68-pin
- **Ultra** SCSI / 20MBps / 50-pin

- **UltraWide** SCSI / 40MBps / 68-pin
- **Ultra2** (narrow, not wide) SCSI / 40MBps / (not used is practical application)

- **Ultra2Wide** (**LVD**) SCSI / 80MBps / 68-pin
- **Ultra160** SCSI / 160MBps / 68-pin

See here if for more info about Type / Speed / Connector.

In closing, I'll put aside all the techno-babble & try to characterize the differences between running your operating system & apps from an ATA drive & an LVD SCSI beast. If you do similar things with your PC, compared to what I do with mine (especially audio & video editing), chances are you'll have a similar experience.

Compared to running your system & programs with an LVD SCSI drive, the IDE/ATA interface/drive feels clunky. Please note, I'm not saying ATA is clunky. I'm saying it *feels* clunky *compared to SCSI*. Cuz, the thing is, you don't even notice it .. until that first SCSI boot. That known as the SCSI epiphany, and you'll say, "Ah, I see what Rad was saying now."

When you minimize the delay between when you click the mouse, and when something (actually) happens (especially when shuttling small files), and more especially, when you're being **creative** with your PC, such as video/audio/gfx editing .. you tend to become *one* with the PC.

I know that sounds corny and mystical, but it's the best way to describe it. So, naturally, you must be proficient with your programs before you can get to that mystical place. If the PC is waiting on you most of the time, cuz you're a rookie with the program, prolly oughta wait on the SCSI.

But when you become proficient with your apps - especially when using many diff programs at the same time - that's when a SCSI drive will serve you good. If you know your apps well, and you work with many open at the

same time, and your working on something creative, that's when a SCSI drive helps you get in the zone. It actually makes me feel more creative.

Current HD benchmarks are *sequential* .. which means that they don't take into account SCSI's multitasking capabilities, which make for a poor comparison based on numbers. Based purely on **feel** .. if I ran a bench of my IDE/ATA drive, and received a score of **1000** (purely arbitrary number), I would expect my SCSI drive to score somewhere around **2500** to **3000** .. cuz it *feels* about **2.5** to **3** times faster. Again, this is totally subjective.

Next -> **[SCSI Guide - SCSI vs IDE Comparison]**

SCSI vs IDE Comparison

Both SCSI & IDE are **file storage & retrieval** systems. A file is *stored* when it gets written to your hard drive. A file gets *retrieved* when it's read from your hard drive. Both actions put your storage system to work. Imagine your drive's storage & retrieval system as your local public **library**, and that the books in the library are the files on your hard drive. The only difference with this library is that you can't get the books yourself. Library attendants must get them for you.

Both the IDE library and the SCSI library employ athletic-looking attendants. They both have rippling arms with bulging biceps. They both can run almost as fast as each other. The SCSI attendants can run slightly faster than IDE attendants, but not much faster. How fast they can run is analogous to STR .. or, sustained transfer rate. That means, the speed they can run once they have the book in their hand. The attendants perform one of two functions:

1. Store a book
2. Retrieve a book

When you *give* them a book, they haul ass to store it, and when you *want* a the haul ass to retrieve it for you. The problem with IDE is that, when you want a book, IDE library attendants are slow at finding where the book is stored. Finding where the book is stored is analogous to a drive's access time. Drive's that have low access times are fast at finding where books are stored in the library. This should be an easy model to conceptualize.

SCSI library attendants eat IDE attendants for lunch when it comes to finding books quickly. IDE attendants seem to do a respectable job, and indeed they do. But not nearly as quickly as the attendants at the SCSI library. It's not until you pay a visit to the SCSI library that you even notice how sluggish IDE attendants are. IDE attendants run fast back to you once the find the book, but it takes them significantly longer to find your books.

Suppose you give your library attendant a list of 7 books you want. The IDE attendant will get book number one first, then book number two, then three, four, five, six, and lastly seven .. even if this isn't the most economical. SCSI attendants are smart enough to to re-order the way they retrieve files .. depending where in the library the files are stored. For example, it might be fastest to retrieve files files in the following order: 6,1,4,7,3,2,5. SCSI works more like a *team* of attendants .. than IDE's single attendant.

As long as the attendant gets all you books (files), you don't can what order he retrieved them in. Whatever is fastest for him is best for you .. cuz you don't like to wait .. cuz you're a busy man, and have important stuff to do. This intelligent re-ordering for maximum performance is an advantage of the SCSI interface.

Suppose you have more than one hard drive, and you want to both store & retrieve books. The SCSI attendant

has a powerful helper named Billy Multitasking, who can *retrieve* a book while the SCSI attendant is *storing* a book .. and vice-versa. IDE is a single-tasking interface. In other words, with two drives on the same channel (master/slave), it can't retrieve a book until it finishes storing first.

The SCSI attendant is much better at doing many things at once. He makes a big job look easy .. while the IDE attendant starts huffing and puffing. The SCSI attendant is back saying, "What else can I do for you, Sir?" .. while the IDE attendant is still trying to finish the last job you gave him.

Now if you're the type of person who doesn't go to the library much, you're prolly not gonna notice a big difference between the IDE & SCSI libraries. But the more time you spend at the library, the more you'll appreciate how fast the SCSI attendants are at retrieving books for you.

Note that both IDE & SCSI attendants can run fast with *huge* books (video & audio files) .. but again, SCSI attendants still get to the big files faster. SCSI attendants have a greater advantage when you want them to retrieve a *large* number of **small** books at once. This is analogous to what it takes to run your operating system, which is full of small files.

SCSI has *less* of an advantage when you only want to retrieve a *small* number of **large** books. It still has an advantage, tho not as large as when many small books (files) are involved. That's why it's good to put your operating system, apps & swap/page file on a SCSI drive. This takes max advantage of SCSI's primary strengths.

I read a post by Tony Wilson of Australia that characterized SCSI drives this way: "SCSI drives .. are genuine champions in all fields. They are quiet and unassuming. Under little pressure, they perform like any other good player .. but under severe pressure, they just keep on performing where lesser players give up."

That's a great way of saying it. I notice my SCSI drive most when I have to use an IDE-based system .. just as I notice my Cable modem most when I have to use someone's dial-up connection. And I notice my Ferrari most .. in my dreams. =)

I've read that a performance increase of 10% is a barely a worthwhile upgrade .. 15% is worthwhile .. 20% is definitely worthwhile .. 25% is a no-brainer .. and anything above 30% is 'shame-on-you-for-not-upgrading-sooner'. Maybe now you have a better idea of what kind of performance your SCSI dollars buy you.

I got into SCSI from video-editing. Started with the DV300, by Pinnacle/Miro. Firewire card with onboard Adaptec 2940 UW controller. Very cool concept - for the time. Video comes into the PC from DV camcorder (we had Sony TRV9) -> to capture card (DV300) -> to SCSI bus -> to the awaiting SCSI drive .. dedicated solely for video/AVI files. Video files never even see the PCI bus (where there's much more traffic). Both the Firewire & SCSI busses were dedicated *solely* for video.

This, naturally, made the capture/output as reliable as you could get at the time - at least, without spending 5X as much. Kind of like having your own freeway to drive on. Harder to get in an accident if you're the only car on the road. Then we upgraded the boot drive to 10Krpm LVD SCSI (with a Tekram DC390-U2W adapter), and that took video-editing to a whole new level. Made a big difference.

If you get into video-editing, you'll find yourself learning about hard drive performance & operational factors. Almost impossible not too. Posted my experiences here -> Lessons from building a workstation designed to edit digital video. It can save you much pain if you want to get into NLE (non-linear editing).

Wouldn't have taken the time to write this if SCSI wasn't so cool - especially booting your system from an LVD beast. Wish I could be there for that first, snarling boot, when you say, "Rad was right." =)

Shout out to **DocSilly**. *The Doc* walked me thru my first SCSI boot. Put up with all my stupid questions. Nice to have someone on ICQ that you can dialogue with real-time. The Doc knows more about SCSI than anyone I know. I'm sure the guy who runs the mother-of-all SCSI FAQs (Gary Field) knows more, but I don't know him. I will add tho, that Gary has never failed to get back to me when I had questions that no one else could answer.

Remember that no one but you can say whether or not SCSI is worth it for you. Only you can make that call. I've heard staunch IDE/ATA people say, "There goes another one to **the dark side**," when some *goes SCSI*. I see it differently - more like what the blind man in *John 9:25* said: *This one thing I know: whereas I once was blind, now I see.* =)

Next -> [SCSI Guide - Linkage & User Comments]

SCSI Linkage:

- The most comprehensive, mother-of-all SCSI FAQs: here
- SCSI at Ars: here
- SCSI ala Adaptec: here
- IDE/ATA vs SCSI at the StorageReview here (have to scroll down past the box at the top).
- Installing a SCSI HDD ala IBM: here
- Glossary of SCSI terms: here
- SCSI FAQ at Paralan, parts 1 & 2: here
- SCSI FAQ at Paralan, parts 3 & 4: here
- SCSI drives at Hypermicro: here
- SCSI cabling & terminators: here (at CS Electronics in Irvine, Ca.)
- More SCSI parts: here (at Granite Digital)
- SCSI & IDE here

- SCSI School here
- SCSI at PC Guide here
- Techie terms & standards here

Comments from SCSI users:

Everything will feel faster! You can't go back to IDE after that.
The JoJo

My five year old Cheetah Mark 1 is *still* more responsive than any IDE drive yet made, and will remain so until IDE access times improve. Of those who go SCSI, very few ever go back. You buy one SCSI rig and you can expect you'll buy others as the years go by - because once you get to know the power of fine SCSI drives, you'll never feel satisfied with IDE drives again. Most of the benefit in SCSI drives - if pushed to put a figure on it, I'd say 70 or 80% - is due to their superior seek times and lower latency.
Tannin

I made the switch, and I don't believe I would go back to EIDE. Only if I needed mass storage at a cheap price, but this is not the case. When I moved from my WD Expert drive to my Atlas 10KII, what a difference. Just in converting MP3's to wav it was awesome. I even sit and watch defrag run sometimes because it screams right by. SCSI isn't for everyone, but for those do use it will notice the difference.
Handruin

I just got my first SCSI rig, an IBM 36LZX (18.4GB) on a Tekram DC-390U3W card. It is MUCH more responsive than my old IDE system. I also appreciate SCSI's fringe benefits. I can use one channel of my current card for SCSI CD-ROMs, etc., but I prefer to use ATAPI, since they tend to be a cheaper, and there isn't any performance difference for equivalent models. Using a SCSI boot drive, I have 2 free IDE channels. I can put a CD-ROM on one, a CD-RW on the other. This allows me to copy from one to the other. I could also add cheap, huge IDE storage IDE drives.

I will never again build a system with an IDE boot drive. The 10K RPM drives are reasonably cheap these days, running well under US$200, and once you get a card and drive, it will last you for a LONG time, from what I have heard...so the cost does have some mitigating factors.

All in all, I'm VERY happy with my SCSI rig...I think you will be too. If you're looking for "feel," then 10k RPM will give it to you. Only go 15k if you put your system under heavy stress, or if you have a large budget (I don't...sigh)
balding_ape

It is not just the low access times. The SCSI interface is far more intelligent than IDE, capable of queuing I/O requests and reordering them on the fly to optimize performance. Therefore, SCSI shines in multitasking environments. For example, if you have several processes running, accessing your drive at the same time and in different places, SCSI will run smooth in situations where IDE gets bogged down.

If you were to ask for a single word characterization, I would sum it up by saying that the low access times contribute to "responsiveness," while the multitasking capabilities create that great feeling of "smoothness."
leokor

The end.