

WHITE PAPER

How HBA Selection Affects Total Cost of SAN Ownership

Impact of Downtime Is Critical

by Graeme Thickins



The rapid adoption of storage area networks (SANs) over the past several years has happened for one simple reason: these networks facilitate more efficient use and easier management of the exploding amount of data that enterprises must store, protect, and make available - both inside and outside their headquarters' walls.

How big is this market? "Storage networking is the fastest-growing portion of the storage market," said Rick Villars, research VP for storage systems at IDC, at the recent Storage Networking World conference. "By 2005, SAN storage spending will be as much as *all* storage was in 2003."

Though most of that SAN growth to date has been in the large enterprise sector, we're increasingly seeing the technology adopted in the so-called midrange market. There is a noticeable trend toward SAN implementation by smaller organizations, as well as by departments or units within the larger enterprises.

Why? Because SANs can deliver two to three times more effective disk utilization than direct-attached storage (DAS), which is still the most common form of storage in mid-sized firms. And these smaller organizations are starting to realize that DAS won't cut it as a mainstream solution going forward - because the management costs in direct-attached environments are too daunting as storage volume grows. Experts project that the midrange storage market overall will grow to \$13 billion by 2005, driven in large part by the increased adoption of SANs.

SANs connect servers and storage devices, including RAID disk systems and tape libraries, into networked storage infrastructures. Unlike the DAS approach, SANs allow multiple servers to connect to multiple storage devices, and share storage. In this way, SANs are more flexible and scalable, which makes them more useful in critical applications such as data warehousing and a variety of business continuance scenarios, in a world driven by such phenomena as always-on ecommerce.

As some would say, the game today is changing to "*24 x 7 x Forever.*"

Education Needed

In this environment of the spread of a much-needed technology from the data centers of the world's largest firms down to what many would label "mainstream business," much education has to occur. For example, one topic that's being written about more and more is "total cost of ownership" (TCO) of storage areas networks. And rightly so. SAN technology is about much more than just an initial investment. Though it reduces the human management costs of DAS storage, it nonetheless has ongoing costs to be aware of, as with any IT investment. And unforeseen expenses lurk for the unprepared.

Storage area networking is also a complex and evolving technology, including a gradual shift that's already begun from the expensive fibre channel (FC) protocol used in most SANs to date, to the more mainstream, familiar, and less costly IP (Internet Protocol) networks. This movement is accelerating, though experts say the FC and IP approaches will co-exist for some time.

Companies setting out to implement their first SAN need help. Every situation is different, and the potential pitfalls are many. Consultants, integrators, and the storage vendors themselves, as well as their channel partners, all have much to offer the mid-sized firm in understanding, planning for, and successfully implementing their first SAN - and in helping them prepare to manage it over time.

This white paper takes a look the costs of SANs, obvious and not-so-obvious. We look at not just the startup investment, but the longer term "total cost of ownership." Specifically, we delve into one particular aspect of the latter that deserves attention due to evolving innovation in this critical component of the SAN: the host-bus adapter, or HBA. And, we look at how HBA selection can affect a major TCO line item - downtime.

Just What Is An HBA?

Host Bus Adapters (HBAs) are critical components in SAN implementations and can play a major role in reducing the TCO of SANs.

You may think of HBAs as only providing the physical and data connections from servers to the storage network. But they do much more than that. They gather information about the status and activities of the entire SAN - information that helps you manage your storage more efficiently and cost effectively.

Think of an HBA as a computer on a card. It has its own processor and real-time operating system. In the world of Ethernet networking, a similar device would be the network interface card, or NIC. But the NIC is simply an I/O adapter, which passes packets between the network and server. In contrast, in the fibre channel and SCSI world, the HBA does much of the protocol processing work that a NIC would pass on to the server CPU. The HBA differs in another major way as well: it keeps track of the state of every I/O transaction.

The smarts are in the HBA *driver*, which is the software that runs the HBA. Many firms make HBAs (at least four major suppliers), but these are far from commodity hardware products. “The big differentiation now is the drivers,” said IDC analyst Rick Villars at Storage Networking World in October.

Because the HBA driver tracks the well-being of all the components and links in a SAN, it can have a major impact in reducing your ongoing costs for managing your networked storage. Thus, selecting the right HBA (and associated driver) for your storage network is an important consideration in your planning and budgeting process.

As with many IT investments, the upfront cost of a SAN becomes only a fraction of what the ongoing costs turn out to be, for managing, upgrading, and troubleshooting. Further, these ongoing costs tend to increase annually as the amount of stored data grows, and as the SAN becomes more complex with more users. Thus, monitoring and anticipating these costs is critical.

A Look at Upfront SAN Costs

The components of SAN infrastructure include servers, storage devices, switches, and HBAs. On top of this hardware, there are, of course, software and services expenses.

“Average” or “typical” SAN costs are hard to pin down, because there are so many variables, and so many vendors selling different solutions. Other factors come into play relating to the cost of integration - that is, someone has to put all the piece parts together, which often come from 3, 4, 5, or more vendors. On top of this, the industry is in the midst of working hard to make the technology more affordable for smaller firms. We're now seeing an almost continuous stream of announcements of new, lower-cost SAN offerings - including bundled, or packaged, solutions.

In a search of current literature, you'll find more than one article that cites the “typical entry point for an enterprise-class SAN” as being \$250,000. Entry point, we can assume, means infrastructure hardware costs, along with some basic software and services to get started. However, no reference is made with this figure as to how much storage is included. A figure often cited in the past as a starting point to justify a SAN is 2 terabytes (but rules of thumb can be dangerous, and every customer's situation is different).

A more specific idea of SAN costs, in late-2003 terms, comes from established storage consulting firm and integrator Datalink, based in Minneapolis. According to product manager Paul Mayer, a good ballpark for SAN upfront costs in a midrange environment would be as follows, assuming 30 servers connected:

- \$75,000 for connectivity
- \$60,000 for a 200-slot tape library
- \$40,000 for 10Tb of storage
- \$40,000 for 4 tape drives

These figures total up to \$215,000 - for hardware only. “Then you would add software and services,” says Mayer, “which would probably add about another 30-40%, depending on how fancy you got.” That puts his total ballpark, get-started figure at about \$280,000 - 300,000. But note it includes 10 terabytes of storage. (We told you storage volumes were growing.) Also note that no new server costs are included, which would add another \$4000 or so a pop, and up.

To arrive at their ballpark estimate, Datalink's figures were based on the storage component of the SAN costing \$3-5 per gigabyte in today's terms (for an “enterprise RAID system”). Other per-server costs the firm used were as follows:

- Host Bus Adapter cost per port = \$1500
- Switch cost per port = \$1000

It's important to note that both the latter costs are trending downward due to a number of factors. A September 2003 article from Infoworld entitled “Affordable HBAs On the Way” (http://www.infoworld.com/article/03/09/19/37storinside_1.html?storage) reported that new fibre channel HBAs from AMCC (formerly JMI Corp.), one of the major HBA vendors, were coming out at \$800-1000 per port. Specifically, the product cited was the new

JNI | AMCC 2Gbps ZStar line, initially for Windows and soon Linux - targeted at entry-level companies. This reduced price, says the article, "is a move that should attract new customers to the FC (fibre channel) market." What's driving the price reduction? The article suggests one reason: "...the cost of an HBA, a key component of a SAN, (has been) inconsistent with what customers pay for an entry-level Linux or Windows server."

Other recent announcements about lower pricing for entry-level SANs include one by HP. In late November 2003, it introduced its new "StorageWorks Modular Smart Array" line, and also certain packaged solutions that include both the newly arrays and the company's ProLiant servers. HP's bundled solution for an entry-level SAN features a pair of ProLiant DL380 servers, an MSA1000 enclosure, two QLogic host bus adapters, and one eight-port fibre channel switch. It supports up to 20 servers for an upfront price of \$19,999. In a comment in the news announcement, Jamie Gruener, senior analyst at the Yankee Group, said: "Buying storage and servers from the same vendor can offer a significant number of advantages from a support perspective, as well as giving buyers more leverage with vendors."

How might the advent of IP SANs, using the iSCSI protocol, affect SAN pricing? One hint came recently in an announcement of an iSCSI SAN networking package for the SMB market called the "Hitachi TrueNorth iSCSI SAN Solution." It includes the Thunder 9570V storage system from Hitachi, combined with the Eclipse 1620 SAN internetworking switch from McData. Pricing, according to the news announcement, starts at about \$60,000. (But, again, realize these are just partial upfront costs, and the specific specs for such packaged solutions can vary widely. Also, the definition of "midrange" or "SMB market" can differ a lot depending on who's doing the talking.)

Ongoing SAN Management & Optimization and the Factor of *Downtime*

But back to the subject of total cost of ownership. "Hard costs," of course, are only part of the picture when it comes to SANs. In fact, ongoing soft costs are a much bigger component - namely, those incurred for management and optimization of the SAN. And we're not just referring to the *human capital* component of soft costs here. Certainly, the amount saved in labor cost is one of the single biggest benefits of a SAN when compared to direct-attached storage (DAS).

Nonetheless, as the SAN is implemented and operated, people must still be involved in its management, of course. (Thankfully, to a much lesser degree than with DAS, in terabytes per administrator.) But the category of ongoing soft costs for SANs has another cost culprit as well: downtime.

To illustrate its impact, let's first look at just what's involved in ongoing SAN "maintenance," as some might say. (Management and optimization are more descriptive term). Firstly, upgrades are a recurring requirement, whether for drivers, firmware, or new hardware. In addition, SANs require ongoing management - they're continually growing and being adjusted to meet performance requirements, which means parameter changes, adding new storage, or adding LUNs to existing storage. Yes, these tasks require people, and that's one aspect of cost (again, much reduced compared to DAS).

But consider this: up until now, all these tasks have also shared the requirement to *take the system down* - they each require that all the servers in the SAN be re-booted. And, unfortunately, such downtime is a soft cost that's not often taken into consideration up front when planning a SAN.

No matter the customer or installation, downtime is a fact of life in any SAN. Though some may see it as some vague "future cost" to worry about later, you're much better off thinking of it *now* as lost opportunity time, loss of business productivity, less uptime for critical web commerce operations, or...fill in your own blanks.

Note for this discussion we're not talking about the unplanned variety of downtime, which any good SAN design attempts to minimize through the use of redundancy. In fact, we're talking *planned* downtime, which can have an even greater impact.

Whether one calls it "soft dollars" or not, the planned downtime your SAN experiences over time will translate into very real costs to your company, with the same impact as the hard dollars you spend up front - in fact, even higher figures than many upfront SAN investments, as an example later in this paper will show. Yet, many companies fail to consider what the cost impact of this planned downtime is likely to be, as they budget for, plan, and implement a SAN - arguably one of the most strategic IT investments they will make.

A SAN, then, is far from being a single or annual investment. Its true, total costs are part of an ongoing process that can have unexpected or hidden factors. Most of these cost factors, however, can be anticipated, planned for, and even avoided in some cases. And downtime associated with re-booting is one such case.

A New Wrinkle in Reducing SAN TCO

Enter the *no-reboot HBA driver*, recently introduced by AMCC for both Solaris and Windows. “There are three main benefits, three conditions it addresses,” said AMCC’s Director of Product Management, Mike Heumann. “The first is no rebooting when changing SAN parameters - timeouts and 15 or 20 others - changes that are necessary as any SAN grows. One example is when adding a new server, everything must be changed,” he said.

“Secondly, whenever you have to update your HBA driver, for a bug fix, or for a new version of firmware,” Heumann continued, “you have to unload the existing driver and load the next one. Up until now, that also required rebooting. With our new no-reboot driver, that’s a thing of the past.” He noted that two of JNI’s competitors, QLogic and Emulex, have drivers that do not require rebooting for firmware updates - but that’s as far as they go. And, if the driver has to be updated at the same time, they do require rebooting, he said.

“Thirdly,” Heumann continued, “as you add new storage, or add LUNs to existing storage, to do something different, that has always required rebooting. Not anymore.”

Typically, these system changes (and the resulting IT service outages) had to be scheduled on weekends, holidays, or late at night to minimize downtime impact. But, with today’s mission-critical systems requiring 24 x 7 x 365 availability, finding windows for planned downtime has become increasingly difficult.

The version of the product for Windows (as referred to earlier in this paper) is the JNI | AMCC ZStar HBA with 5.2 Driver. Bundled with the JNI | AMCC EZ Fibre utility, the company says it’s “the easiest to use HBA available today for the Windows IT administrator.” Other features of the ZStar HBA include a Windows look-and-feel management interface, and context-sensitive help for all driver parameter settings.

One Example of Big Money Saved

A customer of AMCC’s that has implemented the no-reboot server is Household International. The firm recently became a unit of London-based HSBC, a global giant in financial services. It has a classic, tiered IT environment, with mainframes at the high end, UNIX servers in the midrange, and Windows servers on the front end. The company’s SAN crosses all these environments.

“The only way to effectively manage large-scale data is via SANs,” according to Tony Alberti, senior analyst, enterprise storage platforms, at Household International. “It is the only storage model that has the management capabilities to meet our needs.”

Alberti says the firm adopted the new JNI | AMCC 5.3 Solaris Driver with the no-reboot feature, and that has made a big difference. “Now, I can make changes on live systems, instead of scheduling downtime to make changes. The reduction in management time is crucial to the ability of my company to grow its storage needs. We will soon be significantly expanding our UNIX SAN, and these HBAs are the only way I could manage this growth with current resources.”

Reboots specifically related to HBA driver changes, parameter updates, and LUN additions are costly to end users. How much can a company save by reducing its HBA-related downtime with the no-reboot feature?

AMCC provides an example based on an environment with 10 enterprise servers, 6 midrange servers, and 60 front-end servers. These systems include:

- Class 1 - Enterprise servers like a Sun E10K or F15K
- Class 2 - Midrange servers like a Sun 6800, 4800 or 3800
- Class 3 - Front-end servers like a Sun V480, V880 or V1280

For a SAN with these types and quantities of servers, JNI says the customer would save *more than \$5 million* in the first year alone by implementing the no-reboot driver. The firm calculated these savings using an ROI calculator available on its web site <http://www.jni.com/calculator/index.cfm> along with a model it developed to help customers estimate the annual savings related to reduced downtime from not having to reboot.

According to this model, using the reboot drivers could avoid hundreds of reboots per year. With the average enterprise reboot costing between \$7000 and \$20,000, the drivers could save a company hundreds of hours of uptime and millions of dollars per year in downtime losses and reboot expenses.

Repeat After Me: Downtime Bad, Uptime Good

In a recent Network World column, Mike Karp, senior analyst at Enterprise Management Associates, wrote about this issue: “Any analysis of a buy decision must include an understanding of not only the technical benefits of what a system can do for you, but also what the *business benefits* are. Can your new system, for example, reduce - or even eliminate - planned downtime?”

A word to the wise: don't forget those “business benefits.”

And, just because you plan your downtime doesn't make it good. The more of it you save, the more you earn. And the end result spends just like cash.

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Graeme Thickins is a freelance technology writer based in Minneapolis and Southern California who writes often on storage networking, utility computing, and other topics. He may be reached at graeme@thickins.com.