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Adapt or Die: Customer Needs and New Solutions in Enterprise Storage

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For example, while word processing solutions reside at the heart of the vast majority of business productivity applications, their current forms were far from predictable. IBM introduced the Selectric typewriter in 1961, replacing the typical typewriter's mobile carriage and individual type strikers with a movable, revolving "typeball." In 1964, IBM combined elements of Selectric technology with a magnetic tape drive into the MT/ST "word processing" machine, which allowed typed text to be edited without having to be retyped. The years following found innovations in memory storage and video displays sparking further improvements in word processing.

In the early 70s, demand for new solutions inspired electronic calculator innovator Wang Laboratories to begin developing stand-alone word processor products. By 1986 Wang dominated the market, employing 30,000 people and boasting $3 billion in annual revenues. However, as PCs rapidly gained ground, offering increasingly robust word processing solutions along with other software-based solutions, word processing specialists came under increasing pressure. In 1992, Wang Laboratories declared bankruptcy, a victim of both the rising popularity and capabilities of PCs, as well as its own inability to adapt to a changing market.

Changes in Enterprise Data Storage

Besides affecting the leisure and shopping habits of tens of millions of consumers, the Internet has sparked profound changes in enterprise and data center computing. Access to Web-delivered information has increased the volume of data collected and stored by typical businesses by several orders of magnitude, with no end in sight. As the reliability and affordability of high-speed networking technologies has increased, computing environments have become ever more dispersed and complex.

Enterprise data storage environments have been blessed by ongoing technological enhancements, but are also suffering growing pains as a result of increasing complexity inspired by these innovations. Recent trends in data storage technologies fall into five basic categories:

- Geographic distribution
- Heterogeneous computing
- Increasing disk capacity
- Cross-platform management solutions and
- Enhanced network connectivity.

In general, the changes in user behavior that define the first two categories have done much to drive the advances exhibited in the latter trio.

How Business Needs Are Driving Storage Evolution

By taking advantage of continuing technical innovations, enterprises are building out data storage networks as widely geographically distributed environments, connecting company headquarters to remote offices and sites that are sometimes more than a continent away. Part of the reason for this behavior is simply practical. Data storage solutions that fit the needs of specific classes of locations, work groups and business processes have become increasingly available and affordable. For example, product availability information can be aggregated for both supply chain workers and remote sales offices. Schematics and blue prints can be distributed to both engineering work groups and off-site manufacturing facilities. Since companies now have the means to place specific information in close proximity to the people and organizations that need it most or who can make the best use of it, most organizations have come to regard data storage not as a simple convenience but as a strategic necessity.

Additionally, businesses are actively purchasing and deploying solutions from multiple vendors. Despite major vendors' assurances that they provide complete solutions for every circumstance, storage customers appear to see things differently. The sheer range of devices and software solutions from large vendors and scores of smaller players has turned the storage market into a bazaar of remarkable proportions. As a result, customers can search out those solutions that offer the best price/performance, rather than depend on homogenous solution sets from single vendors. But playing mix and match with products from different vendors also has a serious downside. Making disparate products work well together is every IT manager's nightmare. Not only must IT staff perform numerous methods of common tasks such as data replication and backup, but they also need to learn management and troubleshooting processes for multiple platforms. Overall, deploying heterogeneous storage solutions can add layers of additional work and complexity to already complex storage environments, increasing costs and undermining whatever benefits users might have originally expected.

New Storage Technologies and Solutions

According to the Berkeley Study of data storage trends in 2000, between 1 and 2 exabytes (one exabyte is roughly equal to one billion gigabytes) of information are being stored annually. Until 1997, magnetic disk capacity doubled every 18 months, but since then capacity has doubled annually. While the actual limits of disk memory capacity has been debated for years, recent innovations suggest that increases in disk memory are likely to continue. Both IBM and Seagate Technologies are developing new disk drive products based antiferromagnetically-coupled (AFC) coatings that the companies claim will eventually support 100 gigabits of data per square inch of drive space, effectively tripling the storage capacity of current drives.

Storage management tools and solutions that work regardless of vendor or platform have long been both a dream and bugaboo for storage vendors. While vendors wish to appear supportive of their customers' heterogeneous proclivities, they have also been understandably loath to overset marketing and sales initiatives for their own homogenous products. Solutions to this quandary have taken several forms. Companies such as EMC, which once specialized in direct attached storage products, have broadened their product offerings to include scalable, network-attached storage devices, such as the company's CLARiiON product line. Other vendors have inked product support agreements with favored competitors, along the lines of the strategic initiative announced recently by HDS and Sun Microsystems. Storage ISVs have continued their long-term efforts to partner with hardware manufacturers, offering products

that can be configured for a variety of platforms. Vendors have also begun exploring ways of working more closely with their rivals to offer more truly heterogeneous storage management solutions. After EMC recently introduced the Wide Sky initiative as part of its AutoIS toolset, the company announced an agreement with Compaq to exchange storage management APIs and support each other's storage products.

Networking For Storage Success

Fibre Channel is currently the favored method for data transmission in centralized enterprise storage environments. The technology's 1 Gbps transmission rate makes it an able solution for connecting servers to shared storage devices or interconnecting storage controllers and drives. Since Fibre Channel's transmission speed is roughly three times that of SCSI, it is also being utilized for connecting servers and clustered storage devices. Despite these capabilities, Fibre Channel suffers limitations in the distance it can effectively transmit data, a critical issue for businesses that favor widely distributed storage environments. Additionally, interoperability issues have made Fibre Channel an issue among heterogeneous computing proponents.

Enhancements in network connectivity sparked by technologies including iSCSI and InfiniBand suggest elemental changes are coming to enterprise storage environments. Since the iSCSI protocol allows SCSI data to be carried over conventional IP networks, it can be used to transfer data over company Intranets, such as WANs and LANs, and to facilitate transfer of stored data over long distances. As iSCSI can run over existing Ethernet networks, it is more cost-effective than Fibre Channel over IP (FC/IP) solutions that can only be used with Fibre Channel technologies. A large number of storage and networking vendors have announced iSCSI products, which are scheduled to become available beginning early in 2002.

InfiniBand is another emerging technology that will likely have considerable impact in enterprise data centers. InfiniBand is an architecture and specification for optimizing I/O dataflow between processors and peripherals such as storage systems and databases. With current processor speeds running three to four times faster than I/O, the data bottlenecks that plague certain kinds of data transfers will likely increase as processor speeds continue to improve. Enabled by a network-attached appliance-style device, InfiniBand switches and links will be able to connect an almost unlimited number of servers, storage and networking devices in a central, unified fabric that allows multiple I/O devices to simultaneously request data from the system CPU without causing delays or congestion. The enhancements of application performance, server density and data center reliability offered by InfiniBand make it enormously interesting to enterprise hardware vendors. Companies including Intel, IBM, EMC, Compaq, HP, Oracle, and BMC, along with a host of smaller players, are participating in the InfiniBand Trade Association (IBTA), and early deployments of InfiniBand add-on PCI cards, are likely to be seen late in 2002.

What Does It All Mean?

Considering all these happy coincidences, ongoing improvements and emerging wonders, all must be well in the world of enterprise storage. Right? Well, yes and no. On the plus side, processors are getting faster, drive capacity is getting denser and name players are trying to play nice in one another's sand boxes. Additionally, it looks as if iSCSI might enable effective solutions for widely dispersed enterprise storage environments, and in a couple of years, InfiniBand could give Fibre Channel a run for its virtual and literal money.

All to the good. But what we also see in this too hazy crystal ball is yet another variation of the formula that has driven enterprise computing for decades: increased performance + increased complexity = increased headaches. While the spirit of compromise that appears to be blossoming among storage management players is a helpful sign, it lags enhancements of storage hardware and networking technologies. From where we stand, despite the best intentions and most willing spirits, the challenges of managing enterprise storage are likely to improve only slightly or worsen markedly as storage environments get bigger, faster and more widely distributed. So does that translate entirely to bad news, evil doings and grim tidings for storage users as the holidays approach? Not at all. In many ways, the market has never been better for storage customers. They have never had as many choices at better price/performance ratios than they do today, and all things point to a future where hardware and network solutions are likely to continue to improve.

But if enterprise storage is evolving as notably as we believe, we can point to some troublesome changes. For one thing, the consolidation that has energized (or plagued, depending on your point of view) the high tech industry recently is likely to continue. If this trend continues, the riskiest roles will be filled by bit players and newcomers who are willing to trade the threat of a broken leg or neck for a chance at the brass ring. This does not mean that small companies will not continue to offer the high levels of innovation they have delivered historically. We only suggests that in changeable market and industry environments, partnerships will go a long way toward defining and delivering both survival and success.

The result will be a competitive matrix that is likely to harbor decreasing numbers of increasingly larger storage players including IBM, EMC and HP/Compaq. For users in this market, reliability and brand trust are likely to trump innovation. At the same time, as emerging technologies push the performance of storage networks toward hyperspace enterprises will be both anxious and wise to seek integrated management solutions such as IBM/Tivoli and HP OpenView, which have been around the block a few times and lived to tell the tale. What this could offer both enterprise storage vendors and their customers is the support and stability they need to weather this newest cycle of market evolution, rather than risk extinction.