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Storewidth, the Future of Enterprise Storage
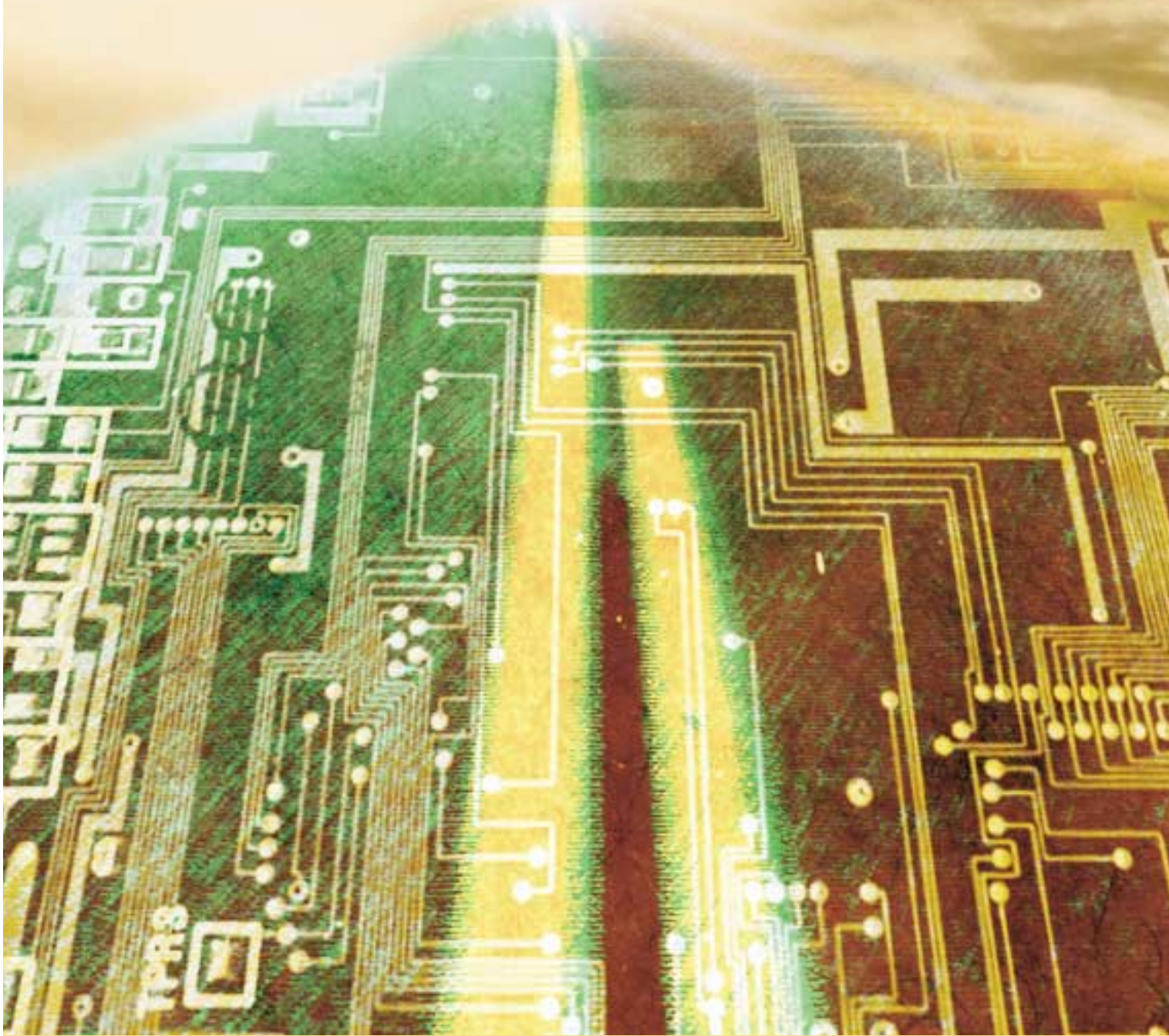
GILDER PUBLISHING LLC

George Gilder

Storewidth, the

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magine a car deep in the jungle. No roads, just impenetrable vegetation and trackless swamps surround the car, rendering it immobile and apparently useless.

And yet when the natives of the nearest village, who have never seen a car before, discover it, they see it not as useless and stranded, but as the most marvelously valuable device they have ever encountered.

First and foremost, the car gives off light: two great beams pushing back the jungle night. It has heat and electricity, and even air conditioning — a palace compared with any other nearby dwelling. The radio brings unfathomably beautiful music and news of an unknown and endlessly fascinating outside world. It even has modest storage facilities in the rear, and a horn, perfectly designed to frighten off wild animals.

It is easy to imagine how the villagers' lives, economy, culture, and social and political structures could all be transformed by the car, even if it never moves an inch on its oddly shaped rubber feet.

But one day the people who had abandoned the car, a road construction crew from a far country, show up again. Only this time, trailing behind them is a newly constructed highway leading to the country's capital city and beyond.

The natives listen, amazed and appalled, to the construction crew's explanation of the car's real purpose. Some favor putting the car on the road, others are furiously opposed. Bitter internecine struggles split the tribe. In the end, however, those who favor putting the car on the road triumph, because only by joining the road can the tribe be linked to the land of light, music, and air-conditioned plenty beyond the dense jungle walls, far outstripping what the car alone can provide.

For a generation and more we treated our computers and their storage peripherals like cars in the jungle with no acknowledgment that the real magic of storage and computing comes in conjunction with networks. Yes we had LANs (Local Area Networks), but at LAN's end was a communications cliff and a bandwidth scandal, the three-kilohertz wires of the telephone companies.

Future of Enterprise Storage

by George Gilder, Chairman, Gilder Publishing, LLC, with Mary Collins and Richard Vigilante

As the Internet lurched slowly into our consciousness and even more slowly into practical reality, Google CEO and Novell Chairman Eric Schmidt, then at Sun Microsystems, declared the "network is the computer," and we awakened to the real potential of our car parked in the jungle. But old paradigms die hard, and nowhere has the old paradigm been as reluctant to give up its ghosts as in what we still misleadingly call "storage."

Last year, the *Gilder Technology Report*, which we copublish with *Forbes*, introduced the "storewidth" paradigm to distinguish an era of dramatic storage and networking innovation from the era of direct attached storage tethered to servers, isolated and surrounded on all sides by jungle.

Pre-network storage solutions were designed when bandwidth was scarce, especially outside the computer. The advancement of optical technologies has now made bandwidth abundant. This bandwidth abundance will fundamentally change the way enterprises think about storage and manage their data.

Storage must now adapt to a tsunami of new bandwidth availability. The lambda network and WDM (Wavelength Division Multiplexing) advances will create a new circuit-switched regime that will dramatically improve network connectivity over the next few years, driving the proliferation of distributed network storage systems. A fragmented approach to enterprise storage is no longer practical; cost of ownership would grow in direct proportion to the size of ever-growing data pools. Data has become an enterprise's number-one asset. Networks are crucial to the aggregation of tools and labor necessary to manage growing troves of corporate data.

Defined as the conversion of abundant bandwidth and heterogeneous petabytes of data into accessible

> ## Old paradigms die hard, and nowhere has the old paradigm been as reluctant to give up its ghosts as in what we still misleadingly call "storage."

information, storewidth addresses the information management challenge faced by the enterprise in the next phase of network development.

The End of an Era

To fully grasp the pre-network storage paradigm, contemplate an environment far more exotic and intimidating than any jungle, filled with objects surpassingly more difficult to comprehend and catalog than the rarest of flora, whose persistence in the environment outstrips the explanatory powers of the most ingenious student of evolution: to wit, your basement.

"Storage" is what you have in your basement, the trunk of a car (whether tangled in the jungle or an overstuffed garage), in the disk drives of a computer isolated from the network, or on tapes stacked three feet deep in an abandoned janitor's closet. The principles of basement storage are fairly simple. It's easier to put things in than to get them out, so you try not to put in anything you are likely to need soon or often, and if you do, then you try not to bury it too deep. Occasionally you try to organize things. But really there are more pressing matters and lots of that stuff you'll never need again, so you don't devote too many resources to the retrieval system. You do occasionally yearn for more room, and if more room is not readily attainable you occasionally throw things out or acquire more space. It's simple asset management, knowing how much stuff you have and whether you have enough space in which to store it.

Awkward as that all sounds, basement storage works for isolated systems, whose needs are modest and local. Its problems are self-limiting. The pool of people wanting to get things out of the basement is generally no larger than the pool of people putting things in, and the amount

stored is generally limited to what can be generated by the people who live in the house or use the computer.

Storage is primitive and impassive. The term does not convey the power of a storage system linked to the network. Storage is what you do in your basement with stuff you may never want again but can't quite bring yourself to throw away.

Networks are not for storage. Networks are for sharing and collaboration, within and across enterprises. Networks are dynamic. Imagine trying to retrofit your basement storage for the needs of a high-traffic department store and you have a fair idea of the complications of trying to adapt the principles of a pre-Internet storage system to the needs of your modern enterprise.

Old Paradigms Die Hard

Plummeting costs of magnetic disk storage contribute to IT spending managers' reluctance to let go of the good old days of storage, when servers and storage peacefully coexisted in their master-slave relationships, cut off from all other network resources. Powered by semiconductor advances, disk drive read-write heads now fly at less than ten nanometers above the disk's surface. Disk density has increased by a factor of 3 million and the cost per bit of storage has fallen to a mere 1/30,000th of what it was 40 years ago.

The "hard" costs of storage seem awesomely inexpensive, but the storage management cost curve retains a steep upward slope. Storage management costs consume 91

percent of enterprise budgets for storage infrastructure build-out and management. Many of these costs are associated with the simple fact that the sheer volume of data is escalating exponentially; the average person accumulates 250 additional megabytes of personal digital content every year. But a larger portion of increased management costs are due to the misuse and underutilization of the roadways leading out of the jungle — newly adopted networked storage solutions in the form of storage area networks (SANs) and network attached storage (NAS) appliances.

The roads have been built but their benefits have been too often misinterpreted and their potential obscured. Like the many natives that continue to dwell beneath the dark canopy of jungle using their newly constructed roads to crack coconuts, the majority of storage and server vendors were so awed by the improved transfer speeds and extended networking distances offered by Fibre Channel SANs that they have continued to use SANs as a mere extension of SCSI (Small Computer System Interconnect).

Something Has to Give

At Gilder Publishing's Storewidth 2001 conference, StorageNetworks CTO Bill Miller pointed out that poor asset and network utilization causes productivity to deteriorate. If current

Cost per Gigabyte
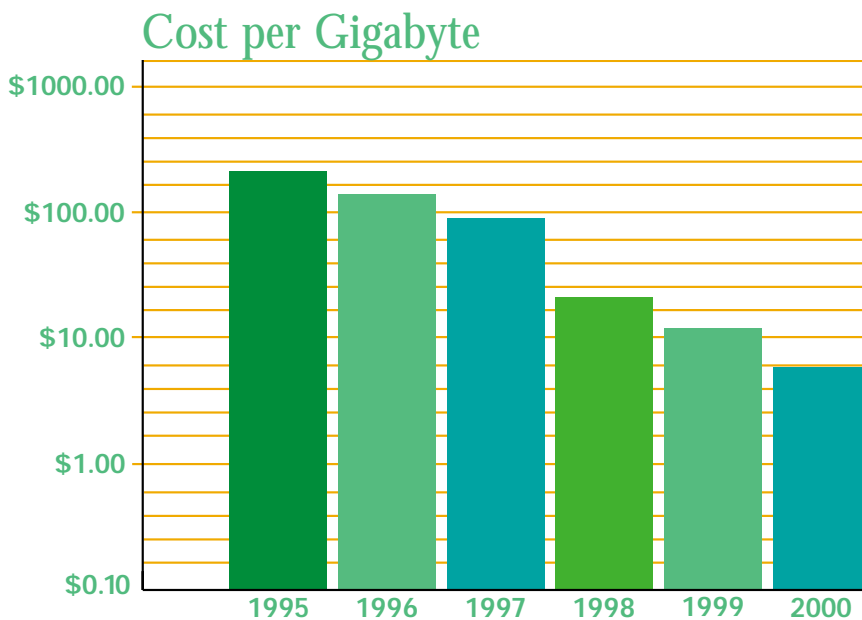
Source: IDC, 2001

old-paradigm storage networking behavior continues to predominate, then the $100 billion storage infrastructure market will continue to grow at 15 percent per year and the cost to store information will actually exceed our national GDP in 2046.

Catastrophic storage costs nearly all result from misguided attempts to retrofit data basements into marketplaces of ideas. Storage management costs will continue to skyrocket if businesses do not alter storage networking approaches. Gigabit networks will redefine the economy as the computer era gives way to the storewidth era.

Abundance and Scarcity

Every economic era is marked and measured by key abundances and scarcities that shape the field of economics, the substance of business, and the fabric of culture. As Japanese futurist Taichi Sakaiya wrote, "Survival dictates that human beings . . . develop ethics and aesthetics that favor exploiting fully those resources that exist in abundance and economizing on items that are in short supply." That is how we exist. We do not breathe xenon or eat platinum.

The canonical abundance of an era is the crucial factor of production whose price is rapidly approaching zero. Ushered in by new abundances, a new era also brings new scarcities, often spawned by the very abun-

dances that powered the previous age. The sudden reversal can create horrific bottlenecks. In one such reversal we find both the source and the solution to the crisis in storage management costs.

Reversals of Fortune

We have just passed through the computer age. The abundance of that age was transistors. Nearly all the architectures and structures of the computer age, including storage devices enslaved to computer boxes, emerged during a time when transistors and the processing power they

yielded were abundant. Scarce by comparison was storage capacity. And scarcer still was bandwidth — those three-kilohertz lines from the phone company never seemed to grow and made skimpy T1s seem heroic. Processing, once the universal solution, is now a perpetual problem.

Today we are undergoing another shift, from the computer era to the network era. In a great reversal of scarcities, bandwidth has become fabulously abundant. This bandwidth abundance more radically alters the old storage paradigm than even the abundance of raw storage capacity. As a demonstrated practical potential,

bandwidth is becoming virtually unlimited as its price asymptotically approaches zero.

You can easily put ten gigabits per second on a single wavelength channel of a single fiber thread. Systems coming to market soon will put at least 1,000 such channels in a single fiber. That's ten terabits per second, closely equivalent to the bandwidth that the entire global telephone system employs today. And today a single fiber sheath or cable may comprise 864, soon 1,125, fibers in a single sheath, making the capacity of a single cable sheath more than one

Gigabit networks will redefine the economy as the computer era gives way to the storewidth era.

petabyte per second, the total Internet traffic for an entire month in 1999.

Outside the Box

No matter how fantastic the yields of the continuing progress of Moore's law, compared with bandwidth, processing power is now relatively scarce. This inversion, the greater abundance of both bandwidth and storage capacity compared with processing power, reorganized the computer economy into the network economy and dictated the architecture of the network, storage system, and the computer itself.

The first consequence was that

Cliff Reeves

Microsoft Brings New Power to Enterprise Data Centers with Prescriptive Architectures

by Jeff Burger

The Redmond software giant positions itself as the platform for the next generation of data centers

It's no secret that a significant share of corporate data is created using Microsoft applications and/or managed on systems running Microsoft software. "Beyond the creation of data, we are also doing some really interesting things in creating new opportunities for managed data," says Cliff Reeves, Vice President of Marketing in Microsoft's Windows.NET Server Product Management Group. "We are beginning to see IT as owning a really important asset, in that the server is becoming the shared workspace for teams of people. Knowledge workers within the enterprise are now creating huge amounts of business-critical data — data that needs to be shared, secured, managed, and recovered. It's a huge corporate asset."

While Microsoft brings a tremendous amount to the table in terms of innovative tools and the kind of data that is created

pre-defining and pre-testing the key combinations of technology, operating systems, network capability, storage, and application software that our enterprise customers combine and use themselves."

Microsoft allows no second-class players in this initiative. "Hitachi is a partner in a really significant number of dimensions. They are clearly a leading player in storage, as well as having a brand and reputation that allow them to be a provider of the next generation of storage across the network."

The sentiment is echoed at Hitachi Data Systems. "We've seen for quite some time that Microsoft is one of the critical markets for our future growth," says Mark Kay, Vice President, Global Alliances and Business Development at Hitachi Data Systems. "Their products and prescriptive architectures pro-

"The server is becoming the shared workspace for teams of people."— *Cliff Reeves, Vice President of Marketing in Microsoft's Windows.NET Server Product Management Group*

with them, the company's agenda goes well beyond that. "It is very important that we play in a world where reliability, scalability, and manageability are absolutely fundamental," Reeves says. "You get that by deploying best-of-breed products, as well as implementing best practices and procedures. Those include your choices in providers and partners, how you configure and set up the equipment, and how you control access and change."

While systems integrators have and will play an important role in defining architecture, Microsoft sees the industry as moving away from roll-your-own strategies. "We have been working for quite some time with our largest customers, as well as major suppliers like Hitachi Data Systems, on developing prescriptive architectures," says Reeves. "This includes

vide an absolute vital foundation of a software-hardware values stack. Microsoft is one of the key data center environments on which applications of the future will be built."

Microsoft's Reeves says that his company is very focused on listening to its customers and continuing to better align itself to parallel enterprise IT needs. "We're engaging enterprise customers at a new level — in a new, more collaborative way. I think we're the people very best equipped to take enterprises into the new data center world. We bring a perspective that ranges all the way from high-end transactional systems, advanced technology, and hardware operating systems to influential end users. That is an absolutely necessary set of ingredients in the way data centers are and IT organizations think." ∎

storage could be detached from the computer with no delay penalty. Why, after all, did we put the computer in the same box as its disk drive in the first place? Why was "direct attached storage" attached? Only because the once speedy links inside the computer far exceeded bandwidth outside the computer. External or remote storage brought a delay penalty. But in a world of bandwidth abundance, networks are faster than the computer bus and I/O systems.

Out of the Jungle

When the network became faster than the backplane, faster than the bus, faster than the peripheral-connectors of the computer, the computer exploded into smithereens out across the network, giving birth to the first NAS appliances and SAN architectures. But to say we *can* attach storage to the network or connect storage in a SAN is not to say *why* we want to.

One reason is that networks are for communications. We are returning to a circuit-switched system that trades abundant bandwidth for scarce connectivity; there will be more roads leading out of the jungle. These new pathways will be constructed by paving over the center of the Net, where it is currently soft, with glass, and by softening the edge where companies and individuals access the network. The soften-

ing at the edge will come from the softening of microchips, which are increasingly becoming dynamically programmable.

Value of the Network

As WDM multiplies both sheer bandwidth and the number of lambda circuits available to users, the fiber-sphere explodes into ever more parallel paths, drawing more users to the network by offering access to more circuits. Such a network will re-

We are returning to a circuit-switched system that trades abundant bandwidth for scarce connectivity.

semble the original circuit-switched network of the telephone system, a system that was designed to waste bandwidth in an age of abundant bandwidth for voice communications.

Metcalfe's law (the value of a network is proportional to the square of the number of devices connected to it) implies that the more terminals attached to the network the greater the traffic per terminal. Improved network connectivity will place great demands on all networked storage devices. The more roads leading in and out of the jungle, the more traffic there will be in the jungle. The more users connected to the network, the more user terminals demanding efficient access to cached and RAID (Redundant Arrays

of Independent Disks) protected data housed on SANs and in NAS appliances within the enterprise and around the globe.

The Weakest Link

How will storage systems handle increased demands? Amdahl's law decrees that when it comes to storage systems the whole is not better than the sum of the parts. A system can be no faster than the slowest link in the data path. Storage systems designed with a shared-bus architecture can slow to a standstill waiting for the bus to handle one request at a time.

Prior to the deployment of the cross-bar switch in the telephone system's network, one technology futurist predicted that every able-bodied woman in the U.S. would be employed as a switchboard operator. Just as switched circuits provided the connectivity essential to the success of the voice communications network, intelligent storage switches will be integral to the success of enterprise storage systems. An IP-like architecture will allow applications with multiple protocols to run anywhere.

Storage vendors must learn the

Jay Kidd

Brocade Communications Provides the Fabric for the Intelligent Storage Network

If switches had IQ ratings, Brocade's would be MENSA candidates

by Jeff Burger

Today's enterprise must be based on intelligent networks in order to rapidly deploy new business strategies and maintain competitive advantage. In turn, intelligent networks rely on intelligent connectivity between components such as servers and storage devices. For this reason, Hitachi Data Systems works very closely with Brocade Communications Systems, Inc., purveyors of the SilkWorm® family of fabric switches. Creating, testing, and deploying complementary products results in a platform for greater intelligence and more sophisticated policy management software for managing storage, applications, and computing resources.

"The large-scale applications that corporations are deploying to fundamentally automate the business functions require enterprise-class storage," says Jay Kidd, Vice President of Product Marketing at Brocade Communications. "They require high availability, scalability, manageability, and security from the fabric, combined with powerful storage arrays into a dynamic storage network. Hitachi delivers these capabilities — and at a very attractive value. That's why they are one of Brocade's highly valued partners and one with whom we work closely."

Even in scenarios where a single carrier-class Hitachi Freedom Storage Lightning 9960 handles all the storage needs, this vast capacity must be connected to a variety of servers. The scenario becomes even more challenging when multiple storage products are on-line. "Brocade's SilkWorm fabric switches provide the intelligent connectivity required to create a SAN (Storage Area Network) that eliminates the headaches and limitations of direct-attached storage," says Mark Kay, Vice President, Global Alliances and Business Development at Hitachi Data Systems. "You essentially have the ability to seamlessly scale storage and servers independently."

Another key advantage in systems built on Hitachi storage and Brocade SAN infrastructure is that customers can deploy additional applications much more quickly than in a direct-attached storage environment. "The intelligence in the fabric allows the SAN to be configured, reprovisioned, or scaled to very large sizes quickly and at reasonable management cost," says Kidd. "As we see greater levels of virtualization, the time required to deploy a new storage array or a new application might reduce from a week or two to a matter of minutes. We're talking about dramatically shortening the time required to deploy revenue-producing applications, which translates into a tangible competitive advantage."

Both companies see their strategic alliance as important to their customers. In fact, Hitachi Data Systems and Brocade are involved with each other at every phase of the game — development, testing, sales, deployment, training, and service. "Part of the way we can demonstrate our leadership in interoperability is through collaboration with companies like Brocade to provide end-to-end solutions," says Kay.

Brocade's Kidd sums it up well: "It says something when customers see the two vendors are working closely together, not just on their transaction, but for the long haul. All the CIOs talk to each other . . . and when a CIO has heard from three or four of his friends that Hitachi Data Systems and Brocade came in and deployed something and it worked great, that news spreads. And that gives people a greater confidence that these two vendors will work together and deliver a fully working, well-supported solution that will meet their needs." ∎

> "We're talking about dramatically shortening the time required to deploy revenue-producing applications."
> — *Jay Kidd,*
> *Vice President*
> *of Product Marketing,*
> *Brocade*
> *Communications*

same lesson that the switch and router vendors have already learned: If you want to move data at gigabit speeds you need to implement data management functions in hardware wherever possible. Storewidth class efficiencies will develop as more and more storage networking functions migrate into the switches.

Switching Focus

Famed business philosopher and management theorist Peter Drucker has said that the key profits of any era go to those companies that can supply the missing link that consummates or completes a system — removes the bottlenecks.

To handle the onslaught of demand, storage systems must blast open the bottlenecks of the shared-bus architecture. Carrier-class storage calls for SANs that mimic the non-blocking switched architecture of the Internet. Software-intensive storage servers that were designed primarily for computation become I/O bound in today's high-throughput networks. To avoid the I/O bottleneck between users and their data, NAS appliances sitting in the data path must adopt a parallel server architecture that more resembles a switch and conforms to the naturally parallel optics at the center of the network.

Storewidth servers must match the parallel flood of photons with parallel paths of electronic processing and

relinquish some of the general-purpose flexibility of the microprocessor. Firms are pursuing these billion-dollar storewidth challenges with frenzied ingenuity and creativity. The *Gilder Technology Report* covers the competitors in our monthly newsletter, and every month we are serially impressed by the ingenuity being brought to bear on the problem.

The storage server market is, by some measures, already as much as four times as large as the market for traditional general-purpose servers. That is the sort of consideration that

Spanning the Globe

Enterprises want the ability to pool the contents of disparate or geographically dispersed enterprise data centers. Companies like Merrill Lynch, with over 250 offices around the globe, or Morgan Stanley, with 609 corporate data centers, are not keen on managing and maintaining backup systems at each and every location. Global financial service institutions would benefit from a virtualization

scheme able to span multiple locations allowing for centralized backup and distribution of data to all 250 office locations. Globally dispersed enterprises want storage as a utility.

Nonlimiting partnerships between the various storewidth players are essential to achieving this goal. Controlling storage infrastructure operational and management costs will require SAN-to-SAN connectivity. As Hitachi Data Systems COO Dave Roberson told us recently, "No SAN is an island. A network demands that vendors, partners, and competitors

Storewidth servers must match the parallel flood of photons with parallel paths of electronic processing.

has prompted long-term veterans of the general-purpose server market, like Hitachi Data Systems and Sun Microsystems, to shift focus to the storewidth market.

work together to solve the needs of the consumer. No one company can be as good as the sum of the parts. The establishment of a global storage network requires all of us working together."

SAN providers need the right combination of partnership technologies and services to deliver the level of data security and availability required by the modern global enterprise. Sun Microsystems believes that unlike direct attached storage, which is often purchased as a set of point products, networked storage solutions demand a higher degree of integration and support.

Storage service provider (SSP)

Mark Canepa

Sun Offers Mission-Critical IT Infrastructure and Support Incorporating Hitachi Freedom Storage Products

by Jeff Burger

World-class Sun servers, storage, software, and services combine to ensure application service delivery to high-end data centers

Sun Microsystems, Hitachi, Ltd., and Hitachi Data Systems recently signed a multibillion-dollar agreement that extends the Sun StorEdge product line and brings greater performance, availability, and scalability with lower-cost architecture to high-end data center environments. The Sun StorEdge 9900 series is a superset of the carrier-class Hitachi Freedom Storage Lightning 9900 family. The Sun product incorporates joint mission-critical support centers, certification for Sun Cluster, a comprehensive suite of storage software, and more. With its industry-leading Sun Enterprise and Sun Midframe servers, this fusion in products, technology, and services yields end-to-end solutions specifically tailored to the demands of the glass house where massive heterogeneity, storage consolidation, and extreme availability are required.

"Sun is focused on delivering superior storage products that meet the requirements of our customers from the workgroup through the high-end data center," says Mark Canepa, Executive Vice President, Sun Network Storage. "Traditional glass-house environments require availability approaching six sigma, along with extreme levels of performance and connectivity. This is what led us to our relationship with Hitachi Data Systems. By integrating their best-of-class high-end storage systems with Sun's industry-leading servers and software, we are able to provide an integratable stack that delivers maximum application service levels to our data center customers."

"We are delighted to team up with Sun to change the landscape of the storage industry," says Dave Roberson, Hitachi Data Systems' Chief Operating Officer. "With the vast reach of Sun's sales and marketing organization, the benefits of Hitachi Freedom Storage's reliability and scalability will become available to far more customers worldwide than ever before. Moreover, our existing customers will gain the benefit of using Sun's storage software like HighGround SRM."

The Lightning 9900's extreme connectivity, including support of multiple open systems platforms and mainframes, was just one of the factors leading to Sun's decision. "We analyzed all of the vendors that you would expect," Canepa recalls. "We tested the daylights out of this box. It outperformed the competition in all respects. The Lightning 9900's switched-fabric architecture and linear performance under heavy load were quite impressive."

Sun took Hitachi Data Systems' relationship with another Unix vendor — Hewlett-Packard — as a positive. "Hitachi Data Systems was the only company on our list that had successfully put together a relationship with another server vendor," Canepa explains. "This signified to us that they had the experience necessary to shorten the start-up ramp.

"Our relationship is predicated from the start to leverage the sales, systems engineering, and support organizations that are required to help make a customer successful," Canepa concludes. "We are starting with Hitachi product and building incremental services on top of it that you can only get from Sun. This includes jointly staffed mission-critical support centers worldwide, along with the things that Sun customers expect, like certification for Sun Cluster, ongoing certification and performance programs, and support for ongoing product releases. Most importantly, customers can get support for the entire IT stack with a single phone call." ∎

> "Sun is focused on delivering superior storage products that meet the requirements of our customers from the workgroup through the high-end data center."
> — *Mark Canepa, Executive Vice President, Sun Network Storage*

StorageNetworks remotely manages 50 terabytes of data stored by Hitachi in the metro New York-area Merrill Lynch data centers from the Storage-Networks Global Operations Center in Waltham, Massachusetts. Carrier-class Internet Data Centers (IDCs), located in optimal locations for gaining increased connectivity, supply the reliability, dedicated bandwidth, redundant systems and power supplies, and high-level security required to marry storage to the Net.

With many enterprises there will remain a trust issue. Enterprises continue to have difficulty physically handing data over to an SSP, heightening the demand for storage systems with remote storage management capabilities. Internet data and co-location centers will play a significant role in providing virtual storage to locations where enterprises do not wish to locate or cannot accommodate physical storage, such as satellite offices where employees have little or no technical expertise.

Battling Storewidth Scarcities

The fight against latency partly explains the rise of both the IDC and the SSP. In its ideal, the Net is nonlocal and instantaneous, so words like *distributed* and *centralized* lose their ordinary meaning. We "centralize" data in large data centers straddling the big bandwidth long-haul links of the Net in order to "distribute" it to the end user.

One reason we do this is to battle speed-of-light latencies. The maximum velocity of the universe becomes a relative scarcity in an era of bandwidth abundance. A steadily rising share of turnaround time migrates to light-speed latency. It takes about 30 milliseconds to cross the continent and twice that to cross the oceans to other continents, and about ten milliseconds between cities on the East Coast.

These speed-of-light delays may seem tolerable until you realize that in the current Internet topology, the average packet makes 17 hops before arriving at its final destination. The average Web page has between 20 and 25 objects on it, each needing to be independently fetched and requiring TCP/IP acknowledgments of to and fro transactions. Multiply 25 objects by 17 hops, times ten milliseconds, to be conservative, and that's over a four seconds basic speed-of-light delay for an average Web page on the Net with its current topology. Four seconds is completely unacceptable and inimical to the business plans of the thousands and thousands of companies that are betting on the emergence of a broadband Internet.

When you can't increase the speed, the only answer is to shorten the distance. I can't increase my speed down the Massachusetts Turnpike from Lee to Boston, no matter how many lanes they add to the highway. My round-trip time is fixed by the speed limit and the power of my automobile, and the only solution is written on the sign that I see at the other end of the Massachusetts Turnpike that says, "If you lived here, you'd be home now."

> **Internet data and co-location centers will play a significant role in providing virtual storage to locations where enterprises cannot accommodate physical storage.**

With light-speed latency as the fundamental limit, data must be moved closer to the user, even if it means moving multiple copies of data farther from the data source. And it really has to be moved close enough to the user so that the total delay is under 100 milliseconds. Once you understand this collision with the light-speed limit, you understand that caching, remote mirroring, and statistics reporting, and remote management capabilities in general, all become the key focuses of storewidth companies.

And yet, as important as the speed of light is as a limit and locus of latency,

John Maxwell

VERITAS Software Brings Simplicity and Optimization to the Intelligent Storage Utility

The leading software for intelligent storage becomes ubiquitous

by Jeff Burger

Software plays a key, unifying role in the industry trend toward intelligent storage — and no software company is further ahead of the curve than VERITAS. "Like Hitachi Data Systems, our vision down the road is one of storage utilities," says John Maxwell, Vice President, Product Marketing at VERITAS Software. "That means placing intelligence in the various component devices. While a lot of people have the perception that VERITAS is mainly a host-based software company, our software can actually run on anything that has a processor.

"We are making sure that a Global 2000 company can have common tools in how they manage data regardless of their storage network architecture," Maxwell continues. "They

> "Our customers are going to have a lower total cost of ownership on a major component of their IT budgets." —*John Maxwell, Vice President, Product Marketing at VERITAS Software*

could take the form of a lot of different technologies out there. It's really irrelevant to us. We just want to provide the intelligent software layer that yields the continuity and a common means of management. So we are making sure that our intelligent source software stack is propagated on all devices in the storage network — whether they are host-based or embedded."

VERITAS products address two major areas of importance — simplicity and optimization. "The problem out there is that the average IT storage environment is growing at rates of 100 percent to 400 percent per year," Maxwell points out. "Yet staffing is certainly not increasing to match. The only way to keep up is by simplifying management tasks.

"Regarding optimization," Maxwell continues, "analyst reports tell us that 50 percent of today's IT budgets are consumed by storage — and that figure is supposed to rise to 75 percent or 80 percent by 2003. Yet another recent study states

that less than 50 percent of the average open systems disk is utilized. By working with Hitachi and providing intelligent storage software solutions, we can drive the utilization of that up to 80 percent or 90 percent with the confidence that you're not going to have a space problem. So if we provide the one-two punch of Hitachi as best-of-breed hardware and our intelligence in software, our customers are going to have a lower total cost of ownership on a major component of their IT budgets."

For VERITAS, placing emphasis on working with Hitachi is a no-brainer. "The fact is that they are now a tier-one player," Maxwell states. "We have focused more with Hitachi in the past six months than we have in six years. Hitachi is the up-and-coming player. Two years from now, there won't be any question who is the number-one enterprise storage provider."

The close relationship between Hitachi Data Systems and VERITAS allows for very tight integration of software and hardware. "Hitachi is the technology leader in enterprise storage hardware," says Mark Kay, Vice President, Global Alliances and Business Development at Hitachi Data Systems. "VERITAS is the leader in High Availability from a software perspective. With this combination, Hitachi Data Systems is now able to go beyond hardware to offer end-to-end solutions covering the entire spectrum from the application down. We're deploying, installing, and supporting VERITAS software with Hitachi Freedom Storage systems to give our customers incremental performance, availability, and scalability. Jointly, we create a significant competitive advantage that differentiates us from other offerings in the marketplace." ∎

it represents a minority of the problem. Like the speed-of-light limit and the traffic jam at the file server, the shortage of IT talent and the excesses of IT payroll are two limits that point to the consolidation of storage out on optimal locations on the Net. Consolidated storage is inherently easier to manage. The purpose of the aggregated storage model is the connection of storage, relatively scarce computer power, bandwidth, and manageability. The issue of manageability will only intensify as distributed applications become more pervasive. Housing all of your equipment in a high-level Internet data center — controlling your storage, bandwidth, and processing power from one centralized facility — can cut your IT tab by half or more.

Winning the Battle

The cost and sluggishness of network build-out has held back progress and deployment of remote storage and storage management solutions. Enterprise networks cannot scale gracefully when waiting four to six months for the telcos to provision a new circuit. And as Hitachi Data Systems' Chief Technologist Hu Yoshida recently noted, "Many enterprises have been reluctant to pay close to $150 per foot to dig up the street and lay cable or to outsource for fear that an act of God or a backhoe fiber cut will isolate them from their data."

The supreme force of economic and cultural change, and the ultimate weapon of the storewidth era, is optical bandwidth. Petabits per second of traffic will explode down the paths of light. The familiar Sun epigram, "the network is the computer," will not suffice unless the network morphs into a colossal storage system.

Storage has become as important to any enterprise as power and running water. Storage utility companies will be required to offer and meet comprehensive SLAs (Service Level Agreements), guaranteed to meet on-site or remote management, scalability, and interoperability enterprise

The maximum velocity of the universe becomes a relative scarcity in an era of bandwidth abundance.

needs. SSPs must strategically align themselves with Internet data centers. IDCs will provide the connectivity, security, and global footprint required for SSPs to meet strict SLAs.

To battle the IT shortage, network latencies, and speed-of-light and customer-time scarcities, data must be immune to location. Remote mirroring allows persistent data and metadata to be located in IDCs around the globe. Improved connectivity between data centers will further open up the remote storage market. The physical location of enterprises and enterprise data will be trivial.

The storage industry must embrace the fibersphere. Storewidth is what happens when storage confronts the exploding potentials of the network. My experience shows me that the storewidth marketplace is far richer and deeper and more efflorescent with clustering troves of enterprise than I readily imagined. After centuries of misanthropic economists treating humans as mass men or assembly-line cogs, the power of individual minds is now detonating across the Net.

Wasting bandwidth to achieve connectivity will extend the reach of storage and contribute to the evolution of a storage-centric, global optical network. WDM advances will help to aggregate disparate networks into managed optical networks capable of accommodating all flavors of native storage networking protocols. The all-optical network will facilitate data distribution and SAN-to-SAN connectivity. The enterprise will become external as data moves out of the basement and beyond the jungle walls of the isolated corporate data centers, transforming the enterprise network into a global storewidth network. ∎