



**Managed Storage Services:
Overseeing information assets in
an e-business environment**

Contents

- 2 *Assessing the e-business environment***
- 6 *Implementing a managed storage solution***
- 9 *IBM Managed Storage Services: Deconstructing the solution***
- 19 *An eye on the future: Storage solutions in a dynamic environment***
- 20 *Why IBM? Affecting change, realizing benefits***

Assessing the e-business environment

The e-business effect: Information management in the electronic age

The pervasive acceptance of e-business has raised data volumes to unprecedented levels. The Internet...enterprise resource planning...supply chain integration...e-mail...workgroup collaboration...customer relationship management. Each new trend brings another wave of data-intensive applications – flooding businesses with information requiring security-enhanced storage and careful oversight.

Along with this increase in volume has come a dramatic increase in data value. Accessing and harnessing the right information at the right time can result in streamlined costs, improved performance, faster time-to-market and enhanced customer relationships. In short, all the opportunities afforded by e-business.

At the same time, the rapidly dynamic nature of e-business makes it nearly impossible to forecast storage capacity needs. While there are some cyclical certainties, it is difficult to project the impact of the next Web trend, development project, marketing campaign or business alliance. It is no wonder that meeting the challenge of storage requirements has become a crucial concern for many companies, regardless of size and marketshare.

Information is no auxiliary player in the e-business environment. Today, all stakeholders – from employees to partners to customers – expect protected, accurate and highly reliable data that is, at the same time, current and wholly available. Therefore, storage solutions often play a critical role in supporting e-business. Without a coherent, enterprisewide strategy, it is impossible to achieve appropriate levels of data reliability and availability.

Most IT managers cite e-mail as the most conspicuous consumer of storage resources, with e-commerce activity and Internet service increasing the need for data availability and accessibility.

Surging data volumes

Data storage requirements are doubling annually – creating incredible and complex information technology (IT) challenges. Companies are seeing unexpected surges in data volumes due to new applications; unpredictable and unplanned demand peaks, and the utilization of an increasing variety of channels to move and access information across and beyond the enterprise. Responding to these issues can be a daunting and expensive proposition.

Climbing costs

As data volumes soar, so do the associated costs. The Enterprise Storage Group reports that storage now accounts for more than 50 percent of the total IT infrastructure costs.¹ Similarly, Gartner Dataquest research indicates that the cost of managing a terabyte of data can be five to seven times the cost of purchasing it.²

The two most significant contributors to growing storage costs are e-mail and e-commerce. Most IT managers cite e-mail as the most conspicuous consumer of storage resources – ahead of ERP and data mining. Indeed, e-mail traffic is growing and increasingly includes data-intensive attachments. The e-commerce expense is an issue of absolute data availability and accessibility. On the Internet – where quality of service is often the differentiator – there is no window for downtime.

The storage infrastructure is typically one of multiple platforms, increasing the need for skilled resources who can integrate system-management tools to properly manage information assets.

Technology trends

To further complicate the issue, the storage infrastructure is, in most cases, one of mixed technologies. Most companies support multiple platforms, including UNIX®, Microsoft® Windows NT®, S/390® and Novell, and since these companies typically lack sophisticated systems-management tools, infrastructure oversight and integration are labor-intensive.

That said, storage technology is dynamic and forward-looking. Today's options include:

Network storage

Building separate storage arrays for each server in an organization is costly – both in terms of equipment costs and management expense. Storage Area Network (SAN) and Network Attached Storage (NAS) technologies consolidate storage infrastructures and pool resources across the application portfolio, resulting in reduced administration and management costs, and higher utilization of the storage subsystem.

SAN and NAS technologies are both viable network-storage alternatives, presuming they fit an organization's technical requirements: SAN for block-based access, and NAS for simple, file-based access. On a more magnified level, while Fibre Channel is currently the prevalent SAN technology, the debate over Fibre Channel and iSCSI continues, and it is unclear whether a standard will emerge in the near term. Market acceptance will be driven as much by performance as by the cost to migrate to the new networking infrastructure.

Key storage requirements for e-business success:

Performance

Rapid retrieval of information satisfies service requirements.

Availability

24x7x365 data accessibility virtually eliminates traditional backup, upgrade and maintenance windows.

Scalability

A flexible and scalable storage infrastructure answers to highly volatile demands.

Security features

Provide access to authorized users while protecting assets from intrusion and compromise.

Interoperability

Hardware components and systems-management tools must support multiple vendors, enabling future-proof flexibility and helping to prevent technology obsolescence.

e-storage

There has been a tremendous amount of press coverage about the Storage Utility model, in which the storage infrastructure – owned by a service provider – is remotely accessed by the customer via a network connection and paid for as a utility. The goal is to provide storage at an agreed-upon service level on a “pay as you go” basis. Large enterprises – with concerns about availability, security and costs – have been slow to adopt, but there are still projections of strong growth in this segment, with U.S. storage utility spending expected to reach US\$6.0B by 2004.³

A centralized storage strategy must envision storage across the enterprise, understand existing storage investments, and create a plan that maps the current infrastructure with future business needs.

Implementing a managed storage solution

Developing an enterprisewide storage strategy

The concept of centralized storage is simple; achieving it is far more complex. The key to building a storage strategy that can support evolving business requirements is to appropriately align storage solutions with mission-critical applications. The challenge is to envision storage across the enterprise, gain an understanding of the existing storage investments and, finally, create a transformational plan that maps the infrastructure with business needs. It is not necessary to migrate to a single storage technology; most enterprises will leverage directly attached storage arrays, SANs and NAS technologies.

The output of an effective storage strategy should be:

- *An understanding of data-availability requirements, access and security demands and business continuity concerns*
- *An assessment of the existing storage and LAN infrastructure in light of distinctive business needs*
- *A gap analysis identifying significant business risk*
- *An implementation plan prioritized against gap analysis and risk assessment*

Consider a managed storage service

Buying storage through a utility service is a logical fit for companies whose applications are already hosted offsite. For companies in need of an enterprise storage strategy but lacking storage expertise, onsite storage service is an attractive alternative. Either way, it is crucial that companies secure a trusted service partner and select the service package that answers to their particular organizational needs.

IBM Managed Storage Services

IBM Managed Storage Services, under the auspices of IBM Global Services, provides premier storage services and customized, e-business-ready storage solutions. Through IBM Managed Storage Services, enterprises can purchase storage capacity and management services on a subscription basis. This helps assure solid information availability and data performance while enabling companies to focus on core business goals.

IBM Managed Storage Services: Enabling companies to choose flexible service level options

Services	Basic	Premium	Custom
Storage availability	99.9%	99.99%	Defined by customer
Maintenance windows	8 hours/month	8 hours/quarter	Defined by customer
Storage provisioning	<48 hours	<48 hours	Defined by customer
Connections			
Server/SAN	1	2	Defined by customer
SAN/Storage	1	2	Defined by customer
Performance (defined by HDA characteristic)	Medium	High	Defined by customer

IBM can integrate technology components from leading vendors.

IBM consultants help determine the performance, capacity and security needs of particular application portfolios, with the goal of helping to create world-class storage infrastructures supported by the latest storage networking technologies. IBM realizes that requirements vary by business unit and application set. Therefore, we offer a holistic and tightly integrated portfolio of solutions available in basic, premium or customized packages. These options answer to a variety of data-management issues and can help ensure effective storage administration, advanced performance measurement and effective capacity planning. They include:

Technology components

The IBM solution, based on SAN and NAS architectures, provides a bridge to isolated data and technologies and helps reduce the cost of the storage infrastructure. IBM integrates technology components from leading vendors including:

- *Storage equipment from IBM (Raid 5), EMC (Raid 1), Compaq and Network Appliance*
- *Switching products from Cisco Systems, McData and Brocade*
- *Storage management software from Tivoli[®], EMC and Compaq*
- *UNIX (Sun Microsystems,[™] IBM and Hewlett-Packard), S/390, Linux, Microsoft Windows[®] 2000 and Microsoft Windows NT servers*

IBM consultants offer holistic and tightly integrated storage solutions in basic, premium or customized packages to address a variety of storage management issues.

Storage management services

IBM offers full life-cycle support for the storage infrastructure. A team of storage specialists, working onsite or from one of our service-delivery centers, can provide:

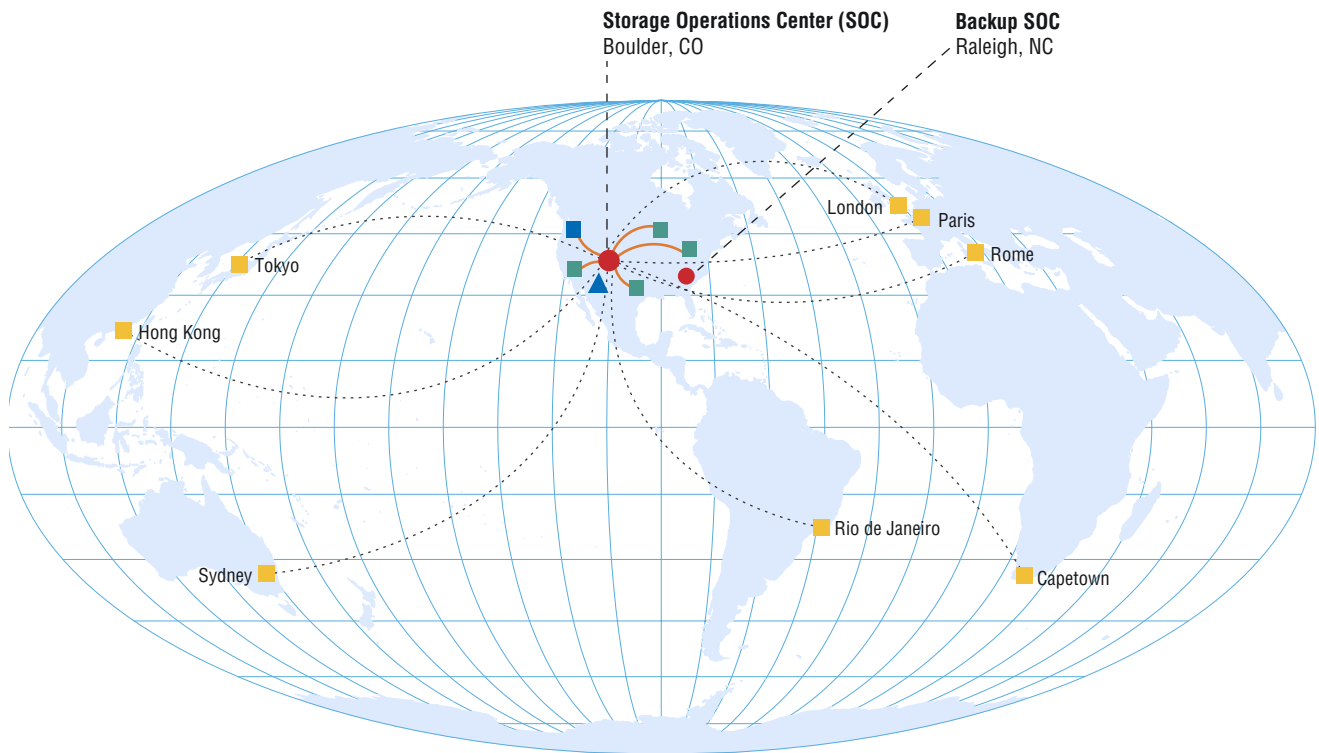
- *Availability and performance monitoring*
- *Problem management*
- *Change management*
- *Provisioning*
- *Capacity management*

IBM Managed Storage Services: Deconstructing the solution

Storage Operations Center

IBM managed storage implementations are monitored from our state-of-the-art Storage Operations Center in Boulder, Colorado, and a backup facility in Raleigh, North Carolina. These centers feature double-wall safeguards against natural disasters; water and fire protection; dual-power supplies (including dual-power sources, multiple power substations, battery and UPS backup, and diesel generators), and dual carrier connectivity. Plus, reiterative testing confirms failover capabilities between the primary and backup operations center.

Centralized management infrastructure provides global delivery



■ **IBM e-business Hosting Center**
Customer storage available for Internet/extranet applications

■ **Customer site**
Dark fibre connectivity to storage center provides access to storage management data

┌ **Fibre connection**
Fibre connectivity linking customer hosts to storage networks at SDC or e-business Hosting Center

▲ **IBM Delivery Center**
Storage located with customer's servers

■ **Customer site**
Storage remains on customer premises, remotely managed

⋯ **Remote Management**
Monitoring, communication and provisioning from the SOC in Boulder, CO

Best-of-breed storage solutions build availability and flexibility in today's service-delivery environments.

The staff at the IBM Storage Operations Center leverages an integrated tool set that includes Tivoli NetView,[®] Tivoli Enterprise Console,[®] Tivoli Storage Manager, IBM StorWatch,[™] EMC Command Center and Compaq Storage Works. These best-of-breed solutions are designed to enable:

- *24x7x365 availability and performance monitoring*
- *End-to-end problem management – from event logging, problem determination and management of vendor response to execution of notification/escalation scripts and root cause analysis*
- *Call-management service for Level 2/3 storage operations support*
- *Change management*
- *Realtime response to additional storage requests*
- *Storage asset inventory*
- *Service-level performance reports*

Storage Management disciplines

IBM Storage Management draws on the proven processes comprising IBM Systems Management Controls. IBM Systems Management Controls align problem management, change management, and performance and capacity planning so that any changes appropriately affect or notify all related processes. This methodology helps ensure effective planning, organization, measurement and oversight – all essential to building responsiveness and flexibility in today's service-delivery environments.

Change management and problem management can be aligned with current procedures to allow seamless support of the IT infrastructure.

Change management

The IBM change procedure offers verification that any changes to the infrastructure are recorded and approved before implementation. All changes – including hardware, software and microcode loads – are documented by the change requester and approved through the documented change process. Even in the event of an emergency outage or expedited request, appropriate approval contacts will be made prior to implementation.

Lead times and execution timelines, which are outlined as part of the standard change process, cover normal, expedited and emergency changes. Ideally, changes are scheduled to occur during pre-approved maintenance windows. As part of the final definition of any IBM Managed Storage Services contract scope, a comprehensive procedures manual will be developed and will include full documentation of all IBM change-management procedures.

Problem management

IBM Managed Storage Services provides a standard set of problem management processes to be used in conjunction with a sophisticated problem management tool. The problem-logging tool supports a range of reporting options and provides visibility into day-to-day operations as well as high-severity problems. The processes include initial problem notification, updates as defined, escalation procedures, documented resolutions and root cause analysis to help prevent the recurrence of any problem – all while managing and maintaining service-level commitments.

***IBM Managed Storage Services
Web Portal is designed to simplify
the request for and provision of
storage capacity.***

More specifically, the problem management process encompasses escalation procedures for defined severity levels as well as critical systems and enterprise software. Technical support staff and any other designated contacts are automatically notified of problems via paging. Plus, IBM can define time commitments and measure the success of escalation processes. These processes can be aligned with your current problem management procedures to allow seamless support of the IT infrastructure.

Capacity planning and provisioning

IBM has incorporated a world-class provisioning system into our Managed Storage Services. The Managed Storage Services Web Portal is designed to simplify the request for and provision of storage capacity while adhering to traditional authorization processes. Capacity requests are entered via the Web Portal and storage is, in turn, made available or deallocated as specified. What's more, IBM will monitor storage allocation and offer advice regarding storage thresholds.

Reporting

IBM also provides service reports on a regularly scheduled basis via the Managed Storage Services Web Portal. These reports include:

- *Capacity utilization – Tracking available pools of storage and planned growth against allocated storage. Reports can break down allocation of storage by server*
- *Response time and device utilization – Tracking IO rates, device utilization, response times and cache hit rates of the disk subsystems*
- *Service levels – Monthly performance reports include availability of service and provisioning response times*

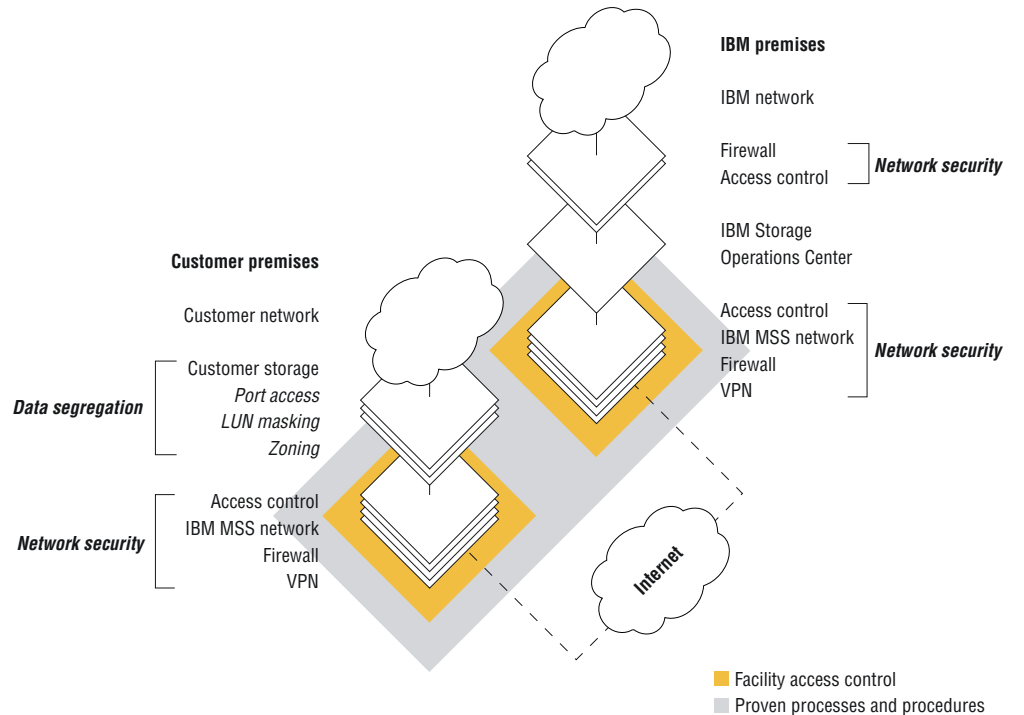
Web portal provides comprehensive view of IBM Managed Storage Services

Customer services	Web portal features	
Product catalog	View offerings Request sales contact Request proposal and user id	
Personalization	IBM and customer-defined authorizations Entitlement checking and panel Smartfill	
Billing	Set and view department and organization allocations View past and current invoices by level	
Service management reports	<i>Storage</i> Availability Provision time Capacity Usage Performance Topology	<i>Backup/restore</i> Capacity Transfer rates Success rates
New orders	Enablement status	
Change orders	Allocation Backup/restore Status of orders	
Help	Enter and track problems Instructions, manuals, procedures Contact information and alerts	

Data security

IBM storage solutions are designed to enhance the security features and maintain the segregation of client data. Logical disk images within the SAN environment will be addressable only by designated servers, thanks to a combination of fibre-channel zoning, Logical Unit Number (LUN) masking and Port Access control. Zoning is used to create separate logical subsets within the fibre-channel fabric, helping to prevent data loss and corruption by controlling access between devices. LUN masking controls access between client server Host Bus Adapters (HBA) and target devices (logical disk images).

IBM Managed Storage Services provides multitiered security features to protect data reliability and availability.



Port Access control is implemented within a storage subsystem that has multiple host connection adapters to define which adapters a particular host may use in accessing logical disk images. This multilayered approach helps ensure a discrete point-to-point data path within the fabric – unique to each client server.

Furthermore, the IBM infrastructure leverages firewalls, a Virtual Private Network, SAN and Fibre Channel protocol, and other access controls. The infrastructure comprises, at a minimum, a set of network servers requiring separate IDs and passwords, plus a final, password-controlled mechanism limiting access to the actual device. This protocol allows for administrative management but protects customer data from unauthorized access.

Optional services

IBM offers a full suite of storage solutions to complement our Managed Storage Services, including:

Backup and restore

IBM backup and restore services address the diversity inherent in today's enterprise environments, and apply a uniform standard for backup and restore across the organization. Tivoli Storage Manager (TSM), which serves as the hub for all IBM backup and restore services, is designed to integrate automated backup, restore, archive and storage management functions – helping

IBM offers a range of optional storage services — which support myriad platforms — to help ensure business availability and continuity.

to deliver business continuity verifications and “one-touch” control over the server infrastructure. TSM includes support for Microsoft Windows NT and Microsoft Windows 2000, AIX®, Sun Solaris, HP-UX and OS/390®, and protects many of the most popular client platforms, including Apple, Hewlett-Packard, IBM, Linux, Microsoft, Network and Sun Microsystems. Plus, TSM is designed to integrate fully with the IBM suite of storage devices and manage a range of backup storage media (from high-speed DASD to high-capacity tape cartridges) while also providing online backups of all major groupware, ERP applications and database products.

Upon installation, IBM creates a full backup of the data files. Thereafter, incremental backups are performed only if changes warrant them, saving network bandwidth for more critical applications. Generally, this means that system log files, files written by scripts or applications and newly installed content will be backed up. Backups occur in the background, without disruption to the server, applications, connectivity or monitoring capability — enabling business as usual at any time of day or night.

Storage and archival

For data retention, backup files are kept in the online tape library based upon the customer requirements established for the backup/restore process. When a file is modified, the incremental backup process maintains the most recent backup online indefinitely and stores the previous version of the file in the tape library for a default period of seven days. A file can also be archived according to schedule or on demand. An intelligent database maps all backups, facilitating restorations as needed. Additional functionality includes:

- *Local Disk Copy provides duplication of local data and enables prompt recovery of the data in the event of a path or disk failure*
- *Remote Disk Mirroring allows data to be copied to a remote location from the primary storage location utilizing capabilities from the hardware vendor*
- *Data Striping writes records across multiple disks – as opposed to sequentially on a single disk – and can boost the speed of I/O operations to better match application CPU processing*

Additional storage services

IBM offers a broad set of consulting, implementation and operational services to assist you in accelerating the deployment of new storage and storage technologies and promoting a high level of ongoing support. These services include information strategy development, infrastructure assessments, storage consolidation and total cost of ownership studies, interoperability testing at our worldwide testing centers, data migration, capacity planning, cabling (including fibre), configuration, installation and multivendor maintenance services.

An eye on the future: Storage solutions in a dynamic environment

IBM Managed Storage Services are designed to provide remote, state-of-the-art storage services up to and beyond 100 kilometers, by way of fibre optic-based Metropolitan Area Networks (MAN) with Dense Wavelength Division Multiplexing (DWDM) tracking. We are pursuing WAN technologies such as Synchronous Optical Network (SONET), Asynchronous Transfer Mode (ATM), frame relay and IP-based services for even greater distances and are watching developments in both iSCSI and InfiniBand for alternative SAN infrastructures.

IBM works with key industry leaders such as McData and Brocade to steadily evolve our Fibre Channel infrastructure and maintain a leadership position. We also advance our storage infrastructure by continuing open support of IBM, EMC, Compaq and other vendors' products. Plus, we are developing a comprehensive set of NAS offerings complete with multivendor support. Finally, IBM Managed Storage Services is preparing to deliver leading-edge, value-added services such as LAN-free and server-less backup and restore; large scale archival services and advanced systems-management solutions.

IBM customers cite financial restructuring as the number-one and bottom line reason for adopting IBM storage solutions.

Why IBM? Affecting change, realizing benefits

The benefits of engaging IBM Managed Storage Services are concrete and profound. Our customers have the potential to realize:

Financial advantages

Storage – with its hardware, software, networking, personnel and administrative expenses – is claiming an increasingly significant portion of the IT budget. IBM customers cite financial restructuring as the number-one and bottom-line reason for adopting IBM storage solutions. With an IBM Managed Storage Service agreement, companies can look forward to:

- *Reduction of storage capital requirements*
- *Capital availability for other IT projects*
- *Economical, variable, fee-based services*
- *Simplified and predictable budgeting*
- *Usage information enabling effective charge-back mechanisms.*

Improved service

Many companies are experiencing dramatic and unpredictable growth in storage demands. IBM Managed Storage Services are designed to help enterprises build reliable and highly capable storage infrastructures that can rapidly expand or contract as needs dictate. In addition, by selecting the appropriate service package, companies can meet availability, performance, security feature and business-continuity requirements...with confidence.

Customers can expect consistent delivery of industry-leading technology, processes and service levels around the world.

The IBM answer

IBM Managed Storage Services leverages an integrated tool set, proven operational procedures and leading-edge systems-management disciplines. For years, this framework has provided industry-leading storage-management services, and our commitment continues. IBM Managed Storage Services can resolve current storage requirement issues, and will expand to include the latest in SAN/NAS functionality as technology evolves. Specifically, an IBM Global Services solution can provide:

Consistent, global implementation

Because IBM delivers consistent, worldwide managed storage services, our customers can expand these services to other regions, confident that the same technology, processes and service levels provided in one area will be available across the globe.

Open, flexible architecture

Unlike some proprietary solutions that support a limited number of disk and SAN technologies, IBM Managed Storage Services supports a variety of industry-leading technologies, including EMC, IBM, Network Appliance and Compaq disk hardware, as well as Brocade and McData switch technologies. IBM will continue to expand the list of supported disk and switch hardware products as the service expands.

IBM offers a full range of storage services to help you design, implement and manage your storage solution.

Effective central management

IBM Global Services has been in the business of providing managed operations, outsourcing and hosting services for many years. We have successfully managed entire IT organizations for large, multinational companies. Many of these proven tools, processes and areas of technical expertise have been incorporated into our Managed Storage Services offering and IBM Storage Operations Centers. This approach allows IBM to deliver the service cost-effectively while maintaining high levels of technical support, 24x7.

Ability to grow

IBM has the financial strength, the global reach and the technical depth to keep pace with your company's requirements. Our Storage Operations Centers can effectively scale to support the volumes of growth and geographic dispersion anticipated by many of today's enterprises.

Leading-edge expertise

With over 5,700 storage and networking professionals skilled in designing, implementing and overseeing managed storage systems, IBM offers a virtually unparalleled resource pool in today's highly constrained technology market.

Strategic commitment to Managed Storage Services

IBM Global Services is building industry-leading Storage Area Network and Network Attached Storage solutions. We are prepared to assess all hardware technologies and, in turn, incorporate best-of-breed solutions into the Managed Storage Services offering. We are committed to delivering timely, cost-effective storage utility services to all of our customers around the world.

For more information

To learn more about how IBM can help you implement managed storage solutions, visit

ibm.com/e-business/hosting



Footnotes

¹Robinson, Teri. "Keep it Safe," *InternetWeek*, December 11, 2000.

²Couture, Adam. "Forecast Analysis: Storage Service Providers and Storage Utility Services," Gartner Dataquest, June 11, 2001.

³*ibid.*

© Copyright IBM Corporation 2001

IBM Global Services
Route 100
Somers, NY 10589
U.S.A.

Printed in the United States of America
10-01
All Rights Reserved

IBM, the IBM logo, AIX, OS/390, S/390, StorWatch and the e-business logo are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both.

Tivoli, Enterprise Console and NetView are registered trademarks of Tivoli Systems Inc. in the United States, other countries, or both.

Microsoft, Windows and Windows NT are trademarks of Microsoft Corporation in the United States, other countries, or both.

Sun Microsystems is a trademark of Sun Microsystems, Inc. in the United States and other countries.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Other company, product and service names may be trademarks or service marks of others.

References in this publication to IBM products and services do not imply that IBM intends to make them available in all countries in which IBM operates.