

## IBM TotalStorage DS Family

*A complete range of disk storage solutions providing power and freedom for an on demand world*



## Highlights

- *Designed to simplify storage infrastructures, support business continuity and improve information lifecycle management*
- *Focused on providing significant improvements in functionality, performance and total cost of ownership by leveraging leading IBM® technology*
- *Offering a range of scalable solutions to address your storage needs, from the smallest distributed storage server to the largest data center*
- *Provides a continuum of enterprise storage products that support IBM as well as non-IBM open systems and mainframe servers*
- *Offers excellent price/performance options with a broad array of products that serve as a foundation for tiered storage environments*
- *Enables streamlined systems management with common management tools based on open standards*
- *Offers a broad family of disk storage solutions that provides the freedom and choices to best match the value of data with the most appropriate storage*

The success of a business often depends on its ability to manage information efficiently. Yet many businesses are finding that without an on demand environment, the rapid growth of information is outpacing their ability to collect, store and maintain it. To help facilitate effective and efficient information management, IBM introduces the IBM TotalStorage® DS Family of disk storage systems, including:

- DS8000 series—Setting new standards in functionality, linear scalability, performance and investment protection for enterprise-class disk systems that are designed for the most demanding IT environments
- DS6000 series—Offering enterprise-class functionality with a dramatically reduced size and price
- DS4000 series—Delivering attractively priced storage systems for heterogeneous UNIX® and Windows® environments (formerly the IBM TotalStorage FASTT storage servers)
- DS300 and DS400 products—Providing low-priced systems for entry-level storage environments

The IBM TotalStorage DS Family is designed to help your company simplify its storage infrastructure, support business continuity and improve information lifecycle management. It combines cost-effective scalability, a more consistent method to store and access data across the

enterprise, streamlined data management tools and advanced virtualization technologies. The potential benefits are clear: increased efficiency and employee productivity, enhanced data protection and improved return on investment.

With a wide range of product offerings based on open standards and sharing a common set of tools, interfaces and innovative features in a common operating environment, the IBM TotalStorage DS Family gives you the freedom to choose the right combination of solutions for your current needs and the flexibility to help your infrastructure evolve as your needs change.

### **Simplify your infrastructure**

The IBM TotalStorage DS Family is designed to simplify your IT infrastructure by offering opportunities for consolidation, virtualization and streamlined storage management.

### **Consolidate your storage assets**

Consolidation begins with compatibility. The IBM TotalStorage DS Family supports a broad array of IBM and non-IBM server platforms, including IBM z/OS®, z/VM®, OS/400®, i5/OS™ and AIX® operating systems, as well as Linux®, HP-UX, Sun SOLARIS, Novell NetWare, UNIX and Microsoft Windows environments. The TotalStorage DS Family supports multiple server

platforms, including IBM @server® pSeries®, iSeries™, xSeries® or zSeries® servers and other major server lines. Consequently, you can have the freedom to choose preferred vendors and run the applications you require to meet your business needs while extending your previous IT investments.

Whether your goal is to minimize the complexity of department workgroups or consolidate the entire IT infrastructure, the IBM TotalStorage DS Family can also help you reduce the number of storage systems you need to use. The scalability of TotalStorage DS Family systems lets you add storage capacity without having to purchase additional units. At the same time, the flexibility of TotalStorage DS Family systems to work with an array of other IBM and non-IBM products means that you can construct a simple, cost-effective and compact storage infrastructure.

### **Virtualize your storage systems**

Storage asset consolidation can be greatly assisted by virtualization. Virtualization software solutions can logically combine separate physical storage systems into a single, virtual storage pool. By pooling storage resources, you can greatly simplify storage management, reduce system complexity and lower IT costs.

Virtualization offers dramatic opportunities to reduce the

total cost of ownership (TCO) of storage systems by increasing not only the efficiency of systems, but also their availability and flexibility. Virtualized systems allow administrators to migrate data to replace physical storage without disrupting the flow of information and to offer the freedom to choose the most cost-efficient storage solution that meets their needs.

Utilizing the innovative logical partitioning technology built into IBM POWER5™ processors, the DS8000 series introduces a new level of virtualization with IBM Virtualization Engine™ technology, which delivers the storage industry's first use of "storage system logical partitioning." While the IBM TotalStorage SAN Volume Controller provides disk-level virtualization and the IBM SAN File System provides file-level virtualization, the DS8000 series brings the flexibility of server systems to the storage space.

With this virtualization capability, you can maintain two completely separate "virtual" storage subsystems running the same or different storage environments. The virtual subsystems can be used for distinct production, test or other unique storage environments, all operating within a single physical enclosure. This virtualization capability helps to reduce total costs and allows further consolidation of the storage environment. In addition, it helps to leverage the linear scalability of the DS8000, delivering superior scalable performance to each storage system logical partition (LPAR).

### **Streamline storage management**

The IBM TotalStorage DS Family incorporates management tools to help reduce the complexity and costs of storage management. These streamlined tools provide easy-to-use interfaces, extensive remote management capabilities and numerous automated tasks.

The IBM TotalStorage DS Storage Manager—a high-function, straightforward graphical user interface (GUI) management console based on open SMI-S (Storage Management Initiative Specification) interfaces—manages multiple subsystems and controllers, performs logical configurations and administers copy service management functions. Accessible from any location through a Web browser with network privileges, the TotalStorage DS Storage Manager can greatly improve ease of use and management efficiency.

IBM TotalStorage Productivity Center software takes storage management to a new level. This collection of software further simplifies systems management by providing a single administrative interface for multiple individual IBM storage units as well as non-IBM disk arrays that are also based on open SMI-S interfaces.

To simplify ongoing maintenance, DS8000 and DS6000 storage systems and DS300 and DS400 products use Light Path Diagnostics and controls to help technicians identify and repair systems quickly. Additional autonomic features, such as IBM Predictive Failure Analysis® capabilities, are designed to take preemptive actions to keep data secure without administrative interaction.

These and other intelligent management features help you minimize the demands of mundane data management so your organization can focus resources on more strategic tasks.

### **Supporting business continuity**

To succeed in an increasingly on demand world, companies need to make sure that they can access mission-critical data 24x7. The IBM TotalStorage DS Family offers systems with a range of redundant components and a comprehensive suite of resiliency tools and features to help deliver around-the-clock availability and data security, even in the event of a disaster.

Equipped with multiple paths to hard disk drives (HDDs) through Fibre Channel switches for switched connections, IBM TotalStorage DS Family systems keep functioning even if a component fails. Controller units are built with redundant RAID controller cards, power supplies and fans to keep data available in the event of a hardware failure. Components are hot-swappable, allowing repairs and upgrades without disrupting system availability.

The IBM TotalStorage DS Family also offers systems to support enterprise-class data backup and disaster recovery capabilities. As part of the IBM TotalStorage Resiliency Family of software, IBM TotalStorage FlashCopy® point-in-time copy capabilities back up data in the background while allowing users nearly instant access to information on both source and target volumes. Metro and Global Mirror capabilities create duplicate copies of application data at remote sites. High-speed data transfers help to back up data for rapid retrieval.

These unique copying and mirroring capabilities are designed to help you maintain constant access to critical information during both planned and unplanned local outages—providing levels of data availability and resiliency that are essential for success in on demand fields.

Because the IBM TotalStorage DS Family is based on open standards, you can construct a disaster recovery solution that makes use of the full range of DS Family systems as well as other systems. For example, you can mirror a DS8000 series system with a DS6000 series system or an IBM Enterprise Storage Server® (ESS) Model 750 or 800 to help you lower the total cost of the disaster recovery solution. Now you can select the right mix of technologies to construct an effective disaster recovery system that meets both your business needs and your budget.

### **Improve information lifecycle management**

The IBM TotalStorage DS Family systems enable businesses not only to store and maintain data, but also to improve the management of information according to its business value—from the moment of its creation to the moment of its disposal. Given the budgetary pressures of today's highly competitive world, companies are forced to evaluate the value of data constantly. How often do we need to access this information? How quickly do we need access? How long should we keep it? Where do we most effectively store this information?

IBM TotalStorage DS Family systems help improve the management of information based on its value by providing a multi-tiered storage environment and integrated policy-based management tools.

### **Multi-tiered storage**

The IBM TotalStorage DS Family offers a broad array of storage solutions, giving you the freedom to select the storage enclosure, or combination of enclosures, that best matches the types of information you intend to store. Though companies may find that one TotalStorage DS Family model or another better suits their immediate needs, the storage systems in the TotalStorage DS Family are designed to complement one another in a multi-tiered environment.

With an integrated multi-tiered approach, businesses can lower storage costs by retaining frequently accessed or high-value data in one storage server and archiving less valuable information in a less-costly one. To help simplify multi-tiered environments, you can leverage the IBM Virtualization Engine services of SAN Volume Controller and SAN File System software to pool storage tiers and dynamically place data into storage tiers based on policies.

## Policy-based retention and management

The passage of government and industry regulations that mandate the retention of certain information has forced organizations to find ways to store data so that they can comply with regulations, while also lowering the costs of storage over the data's required lifespan.

The IBM TotalStorage DS Family can help businesses meet those challenges in two ways: First, by offering a wide range of storage models, the TotalStorage DS Family allows businesses to store required data in cost-effective places. Second, by integrating policy-based data retention, content and records management capabilities and the hierarchical storage management features provided by the value-added TotalStorage software, the TotalStorage DS Family can help store, retrieve and dispose of required data automatically.

The policy-based management capabilities built into the IBM Open Software Family, IBM DB2® Content Manager and IBM Tivoli® Storage Manager for Data Retention are designed to help organizations automatically preserve the types of data required by regulations, while preventing deletion of that data before its scheduled expiration. Using hierarchical storage management (HSM) capabilities, the tasks of classifying and distributing data according to its value can be performed automatically.

Automated, policy-based capabilities determine where specific information should be stored based on its value to a business, the need for fast retrieval and the cost structures of available storage devices. By adding the IBM TotalStorage Data Retention 450, a disk solution with optional tape support, organizations have an effective means of complying with new regulatory requirements.

These features ensure that businesses comply with regulations while minimizing the burden of compliance on their resources.

### **Realize the power and simplicity of a single vendor**

Beyond the shared features, tools and technologies of the IBM TotalStorage DS Family, these storage systems are united by flexible terms, conditions and financing options, making choices simpler for businesses as they select solutions today and build on those solutions tomorrow. Furthermore, all of the TotalStorage DS Family models are backed by outstanding IBM support through an extensive range of IBM and IBM Business Partner services.



**IBM TotalStorage DS8000 series: new standard in scalability, performance and investment protection**

The IBM TotalStorage DS8000 series is the flagship of the TotalStorage DS Family. Building on the solid foundation of the IBM Enterprise Storage Server environment, this generation of storage systems is designed to set an

entirely new industry standard for high-performance, high-capacity storage systems by delivering a dramatic leap in performance, scalability, resiliency and total long-term value. The innovative design of this series incorporates industry-leading components; a high-bandwidth and fault-tolerant Fibre Channel interconnect; a highly expandable, flexible cache with new performance optimization capabilities; and Fibre Channel attached disk technology. Created for medium and large enterprises, the DS8000 series is designed to consolidate system storage, simplify systems management and help to support system availability to meet the needs of an increasingly on demand world.

The DS8000 series resets the standard for scalable storage performance, flexibility and efficiency by using a dual-clustered POWER5 server-based architecture. Leading-edge 64-bit POWER5 processors are configured in dual 2-way processor complexes (DS8100 model) or dual 4-way processor complexes (DS8300 model) to help reduce cycle times and lower costs by

dramatically enhancing capacity utilization. Innovative storage system LPAR capabilities allow the creation of multiple, discrete logical images to support changing workload requirements. These capabilities offer more scalability and security, delivering increased investment protection, the potential for growth and lower long-term costs.

Each DS8000 series storage system is also equipped with up to 256GB of processor memory for caching and nonvolatile storage (NVS) to help support high-capacity workloads and to bring information to businesses and their customers—smoothly and rapidly. To facilitate rapid data transfers between storage enclosures and servers, the DS8000 series supports up to 128 Fibre Channel/FICON® ports or up to 64 ESCON® ports. All of these performance enhancements are designed to deliver tangible results: DS8000 series systems are as much as six times faster than a base IBM ESS Model 800 storage unit—all in a smaller package.

The DS8000 series is well prepared to address the exponential growth of data within an enterprise. Currently, the physical storage capacity of DS8000 series storage systems can range from 1.1TB to 192TB; however, the systems have an architecture designed to scale to over 1 petabyte. Internal disk capacity can be increased without system disruption by adding integrated HDD packages. The DS8000 series allows additions and upgrades from one model to another to adapt to changing business requirements.

The DS8000 series offers powerful FlashCopy and Global and Metro mirroring capabilities. These full-function offerings are designed to support high system availability and data resiliency.

This series includes a range of features that demonstrate the strong IBM focus on investment protection. Extensive storage system LPAR capabilities provide the flexibility to scale your system as your needs change. The ability to perform model-to-model upgrades in the field allows you to extend the life of your investment. The DS8000 series also comes with a four-year warranty on hardware and Advanced Functions, which reflects IBM's long-term commitment to you and your assets.

The DS8000 series is designed to deliver outstanding performance along with exceptional long-term value. The flexibility of DS8000 storage systems can help you integrate these systems with a wide range of IBM or non-IBM servers. Easy scalability will help these systems grow with your needs. At the same time, extensive virtualization capabilities can help you improve utilization of your storage assets, simplify your infrastructure and reduce data-center real estate costs by allowing you to use fewer storage devices. The power and value of the DS8000 series can help you honor service level agreements and achieve greater storage management productivity.



**IBM TotalStorage DS6000 series: Enterprise-class capabilities in a space-efficient, modular package—all at an attractive price**

The DS6000 series offers true enterprise-class functionality with a dramatically reduced size and a revolutionary price. Intended for medium and large businesses, the DS6000 series can help simplify data management, offer broad data protection and recovery capabilities and enable easy scalability. Implementing a common set of core functional code used in the DS8000 series, the DS6000 series is a fraction of the size of competitive systems, yet is designed to deliver greater scalability and excellent performance.

The DS6000 series is the first storage system in its class that helps businesses simplify their IT infrastructures by supporting a wide range of servers, including both mainframe and open systems, at a variety of price/performance levels. The series also supports environments based on a wide array of operating systems, including IBM z/OS, OS/400, i5/OS and AIX systems, as well as Linux, Microsoft Windows, HP-UX and Sun SOLARIS.

To simplify management, the DS6000 series is equipped with intuitive Web-based interfaces, including the IBM TotalStorage DS Storage Manager. Support for the IBM TotalStorage Multiple Device Manager (MDM) further simplifies systems management by providing a single administrative interface for individual IBM and non-IBM disk arrays.

The DS6000 series also features state-of-the-art serviceability, helping to enable businesses to maintain their own systems without requiring the intervention of IBM support personnel. In addition to hot-swappable, redundant hardware components, the DS6000 series provides multiple paths to each HDD and use redundant Fibre Channel switches to help sustain system availability. Light Path Diagnostics help customers repair failures without having to access a service console. The DS6000 series also features enterprise-class data backup and disaster recovery capabilities, including FlashCopy point-in-time copy functions and Global and Metro Mirror capabilities.

With a modular design, the DS6000 series has an entry configuration of four HDDs and can be scaled from 292GB to 67.2TB of physical storage capacity by adding storage expansion enclosures. If and when businesses

need to move up from the DS6000 series to a larger system, IBM makes that migration easy. IBM offers migration services from the DS6000 series to the IBM TotalStorage DS8000 series, providing businesses with the flexibility to change with their evolving needs.

The DS6000 series uses the IBM PowerPC® micro-processor, a fourth-generation processing technology that is designed to capitalize on 64-bit technology to reduce cycle times and accelerate data response times, giving users faster access to vital information. While the DS6000 series offers impressive performance and capacity gains over the previous generation of storage devices, its base control unit and storage expansion units are housed in modest 3U enclosures—a small fraction of the size of comparable units, enabled by IBM patented Calibrated Vecteded Cooling™ technology that was developed for xSeries and @server BladeCenter™. The price for the DS6000 series matches its compact size, offering businesses lower acquisition, management and real-estate costs. With the DS6000 series, customers can now reap the benefits of the enterprise-class capabilities while remaining within their budget.



**IBM TotalStorage DS4000 series:  
Flexible options designed for easy  
scalability**

The IBM TotalStorage DS4000 series (formerly the IBM TotalStorage FASTT storage servers), offers a flexible, high-performance platform that allows businesses to build a storage infrastructure with pay-as-you-grow upgrades. Equipped with 2Gb Fibre Channel interfaces, DS4000 series models deliver high-bandwidth performance with a wide variety of Intel® and UNIX operating environments. With modular designs and models at multiple price points, DS4000 storage systems can be used as storage add-ons or integral components of multi-tiered enterprise infrastructures.

The DS4000 series is tightly integrated into the IBM TotalStorage DS Family. All DS4000 series storage systems provide common management functionality and common components with the rest of the DS Family, helping companies to simplify systems management and protect their IT investments. DS4000 series models include redundant power and cooling supplies, and they enable businesses to use the same advanced copy and mirroring capabilities that benefit the entire TotalStorage DS Family, helping to support high availability and resiliency.

DS4000 series storage systems offer either cost-effective Serial ATA (SATA) drives or fast Fibre Channel disk drives, so customers can select the price and performance that best addresses the needs of their tiered storage environments. Maximum physical storage capacities range from 2TB for a single-controller DS4300 to 56TB for a DS4500 system.

With the DS4000 series, scaling physical storage is easy. IT administrators can add internal disk drives or attach DS4000 SATA—or Fibre Channel—Expansion Units, each of which includes 14 hot-swappable Fibre Channel or SATA drives. Using Dynamic Volume Expansion and Dynamic Capacity Addition capabilities, administrators can increase storage by bringing unused storage online without system disruption.



### **IBM TotalStorage DS300 and DS400 products: Low-cost entry to the TotalStorage DS Family**

The IBM TotalStorage DS300 and DS400 products offer low-cost entry points to the IBM TotalStorage DS Family. Designed to work with IBM @server xSeries and BladeCenter servers in either direct-attached or network-attached configurations, the DS300 and DS400 products can deliver advanced functionality at breakthrough prices. These products provide exceptional solutions for workgroup storage applications, such as print and Web functions, as well as for collaborative databases and remote booting of diskless servers.

The exceptional performance and scalability of the DS300 and DS400 products can help companies consolidate storage. With standard xSeries hot-swappable Ultra320 SCSI drives and a modular construction, the DS300 and DS400 products allow administrators to add storage and perform upgrades easily. Advanced software features, such as access control lists (ACLs), online capacity expansion and online RAID migration, can help administrators reconfigure storage quickly according to their changing usage needs. To attach to host servers, the DS300 uses an iSCSI server attachment; the DS400 features a Fibre Channel attachment.

To help support on demand availability and resiliency, the DS300 and DS400 products are equipped with redundant, hot-swappable power and cooling modules, battery-backed data caches, RAID reliability and high-availability software. The systems are furthermore designed to support high-bandwidth and redundant data paths so the systems can keep functioning even if a single line or controller fails. IBM FlashCopy and optional Metro Mirror capabilities can help protect critical data while minimizing storage backup windows.

### **Working together to provide simplicity, flexibility and optimal data management**

How do the IBM TotalStorage DS Family systems work together? Take the hypothetical case of a large bank that is acquiring more and more customer information, while also storing a wide range of data that it legally must retain for several years. Unfortunately, the bank has accumulated a broad collection of servers and storage systems for both its back-office and customer-facing functions. Now, as the bank searches for a means to expand its information infrastructure, it is faced with a complex environment that is increasingly costly to maintain.

The bank faces several challenges. First, it needs to provide its employees and its customers with fast access to information, even during peak usage periods. Second, it hopes to reduce the complexity of the infrastructure, but it needs to ensure around-the-clock availability and data resiliency so that it could quickly recover from a disaster. Finally, the bank must keep IT costs under control to remain competitive with other institutions.

The bank invests in a TotalStorage DS8000 series storage system for the core applications that support its multiple customer-facing touch points from its branches to its online banking Web site. The DS8000 series storage system provides plenty of room for growth as the bank acquires more customers and more customer data. The bank also replaced several of its outdated storage units and greatly simplified its infrastructure with a single system. Meanwhile, the powerful processing power of the DS8000 series helps make information available rapidly for online and offline users.

The bank capitalizes on the Virtualization Engine technology built into the DS8000 series system. Different workloads can now be run in different storage system LPARs, providing the flexibility and resiliency of multiple storage systems, while exploiting the cost-effectiveness of the DS8000 series' linear scalability.

The bank also has regional data centers that need high-performance storage, but not all of the capabilities of the DS8000. In these locations, the bank installs the DS6000 series, allowing the bank to leverage one set of skills to support both products. The technical staff from the bank's central data center can configure and manage the DS6000 series systems remotely, eliminating the need to have highly trained personnel in those regional data centers.

As part of its business continuity strategy, the bank adds a DS6000 series storage system to work alongside existing IBM ESS 800 and ESS 750 systems at a remote location to mirror essential data from the primary site's DS8000 series system. Because the bank stores data with a range of business values, it also deploys modular DS4000 series storage systems with SATA drives plus WORM tape systems for a lower-cost means of storing and archiving less-frequently accessed data, including the data that it needs to store to meet governmental regulations. The bank now has a flexible, scalable solution that can help to improve data lifecycle management and support business continuity.

### **Delivering enterprise-class storage for medium-sized firms**

With the IBM TotalStorage DS Family, medium-sized businesses now can access much of the same outstanding performance, flexibility and security of enterprise systems at prices that best match their needs. For a clothing retailer with a small chain of stores and a rapidly growing online business, easy expansion is essential, but so are low costs.

Imagine that from the day it opened its doors until now, the retailer has added applications, operating systems and hardware components to meet its momentary needs with little thought about the future. Now the company is looking for a unified solution that can respond quickly to changes in usage, while supporting business continuity and helping to turn its growing pool of data into a valuable asset. The company must also work with a somewhat limited IT budget, a small IT department and limited real estate in its data center.

To store its fast-growing reservoir of information, the retailer selects a DS6000 series storage system for enterprise-level performance. The company uses the DS6000 series system to store data from its mission-critical applications, including its inventory system that is integrated with its Web site and accessed by dealers and sales personnel, as well as its e-mail system. Built on open standards, the DS6000 series is an excellent match for the company, which will continue to run its wide range of servers and operating environments.

Despite the lower costs, the DS6000 series delivers powerful enterprise-level performance and functionality. With intuitive configuration and management software, setting up and running the DS6000 series is very straightforward. The design of the DS6000 series also allows for easy system maintenance, repair and upgrade. Intuitive software management tools help to reduce the IT burden on an ongoing basis, and advanced FlashCopy capabilities help provide data resiliency.

The modular design of the DS6000 series allows the retailer to scale storage capacity rapidly as its business grows. But adding storage capacity will not increase real estate costs. The DS6000 series enclosure is a mere 3U in size, providing the retailer an enterprise-class solution in a small, cost-effective package.

### **Conclusion**

The IBM TotalStorage DS Family offers businesses the freedom to choose from a full range of storage solutions to meet the rapidly changing requirements of an on demand world. Whether your company intends to ramp up storage capacity to address the exponential rise in business data or construct a multi-tiered storage environment to optimize the management of information over its lifespan, the IBM TotalStorage DS Family has a solution to address your needs. Designed to deliver powerful performance and easy scalability while protecting your investment and lowering your cost, the TotalStorage DS Family provides a breakthrough in storage system solutions for the enterprise continuum.

With support for a host of virtualization and automated management tools, the IBM TotalStorage DS Family helps you simplify and consolidate your infrastructure. At the same time, the inclusion of redundant components and advanced copying and mirroring capabilities can help support business continuity and data resiliency in the event of outages. And with a variety of storage options, at a range of highly competitive price levels, you can construct a fully compatible multi-tiered infrastructure that optimizes the use of information while keeping costs under control.

### **For more information**

For more information about the IBM TotalStorage DS Family, contact your IBM representative or an IBM Business Partner, or call 1 800 IBM-CALL within the U.S. Also, you can visit the IBM Web site at:

**ibm.com**/totalstorage/disk



[ibm.com/totalstorage/disk](http://ibm.com/totalstorage/disk)

© Copyright IBM Corporation 2004

IBM Systems and Technology Group  
3039 Cornwallis Road  
Research Triangle Park, NC 27709-2195  
Produced in the United States of America  
September 2004  
All Rights Reserved

IBM, the IBM logo, the e-business logo, AIX, Calibrated Vectored Cooling, BladeCenter, DB2, ESCON, Enterprise Storage Server, @server, FICON, FlashCopy, i5/OS, iSeries, OS/400, POWER5, PowerPC, Predictive Failure Analysis, pSeries, Tivoli, TotalStorage, Virtualization Engine, xSeries, z/OS, z/VM and zSeries are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries or both.

Linux is a trademark of Linus Torvalds in the United States, other countries or both.

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

Intel, Intel Inside (logos), MMX and Pentium are trademarks of Intel Corporation in the United States, other countries, or both.

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.

This document could include technical inaccuracies or typographical errors. IBM may make changes, improvements or alterations to the products, programs and services described in this document, including termination of such products, programs and services, at any time and without notice. Any statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only. The information contained in this document is current as of the initial date of publication only and is subject to change without notice. IBM shall have no responsibility to update such information.

IBM is not responsible for the performance or interoperability of any non-IBM products discussed herein. Performance data for IBM and non-IBM products and services contained in this document was derived under specific operating and environmental conditions. The actual results obtained by any party implementing such products or services will depend on a large number of factors specific to such party's operating environment and may vary significantly. IBM makes no representation that these results can be expected or obtained in any implementation of any such products or services.

MB, GB and TB equal 1,000,000, 1,000,000,000 and 1,000,000,000,000 bytes respectively where referring to storage capacity. Actual storage capacity will vary based on many factors and may be less than stated. Some numbers given for storage capacities give capacity in native mode followed by capacity using data compression technology.

THE INFORMATION IN THIS DOCUMENT IS PROVIDED "AS IS" WITHOUT ANY WARRANTY, EITHER EXPRESSED OR IMPLIED. IBM EXPRESSLY DISCLAIMS ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT. IBM products are warranted according to the terms and conditions of the agreements (e.g., IBM Customer Agreement, Statement of Limited Warranty, International Program License Agreement, etc.) under which they are provided.

References in this document to IBM products, programs or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business. Any reference to an IBM program or product in this document is not intended to state or imply that only that program may be used. Any functionally equivalent program or product that does not infringe IBM's intellectual property rights may be used instead. It is the user's responsibility to evaluate and verify the operation of any non-IBM product, program or service.