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IBM Storage

Business Partner Guidebook

A Seller's Roadmap to IBM Storage Solutions

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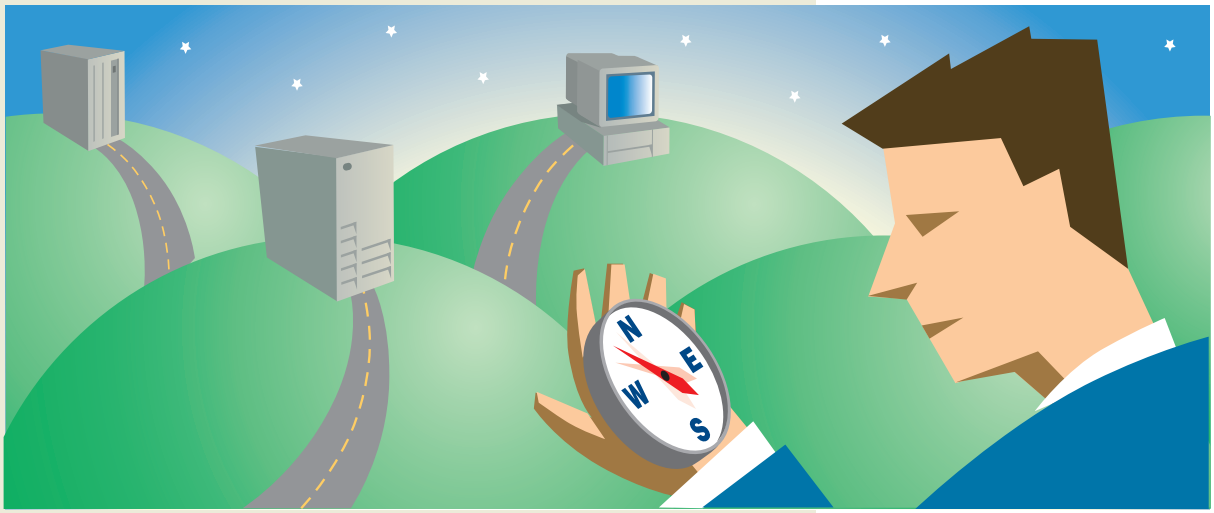

Edited by Jim Hoskins

IBM Storage Business Partner Guidebook

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IBM Storage Business Partner Guidebook

Seventeenth Edition

A Seller's Roadmap to IBM Storage Solutions

Edited by Jim Hoskins

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- Explore training and certification opportunities
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Introduction

About This Guidebook

This MaxFacts™ interactive guidebook brings together—all in one place—the resources you need to be successful as an IBM System Storage Business Partner. It contains information gathered and adapted with permission from multiple IBM and non-IBM sources. There are embedded links to more detailed and fast-changing information maintained on the Web so you can have the most current information at your fingertips. We are confident you will find this a useful tool. As we are always working to better help you succeed, please forward any suggested improvements to this guidebook to info@maxpress.com.

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1

You and IBM

In this chapter we take a look at some business basics about IBM and our System Storage Information Infrastructure offerings to consider as you move forward with your own business.

Why Team with IBM?

If you are seeking to truly differentiate yourself in the marketplace by extending your market reach with more profitable end-to-end solution offerings, IBM is uniquely positioned to help you make this happen. IBM provides you with an integrated portfolio of hardware, software, services, and channel programs that can take your business wherever you want it to go. IBM is committed to helping your clients realize business innovation through industry leading technology, open standards support, and proven best practices.

IBM collaborates across a worldwide ecosystem of business partners to deliver industry leading and cost efficient business solutions. By providing innovative technology that delivers flexibility and high performance, easy to administer programs, and flexible financing options, IBM has an unmatched understanding and appreciation of channel importance that translates into success and prosperity for our partners.

Consider these facts about IBM:

- One of the world's top 10 most valuable brands
- A market leader in the storage and server industries
- Second largest software business in the world
- In each year for over a decade, IBM has earned more patents than any competitor, according to the U.S. Patent Office.

It is an exciting time to be involved with information technology. The worlds of business and computer systems are blending in ways that will result in productivity breakthroughs greater than the sum of their parts. Teaming with IBM will allow you to provide the insight, solutions, and innovation that matter to help your customers succeed.

A Smarter Planet

On today's smarter planet, intelligence is being built into the world around us. Trillions of instrumented devices, structures and objects—homes, cars, soft drink machines, smart phones, household appliances, clothes, highways, bridges, waterways and more are creating a literal torrent of data. Powerful computers and analytical software are enabling us to capture that raw data and transform it into insight that can help predict weather patterns, ease traffic congestion, reduce energy consumption, and improve healthcare, to name just a few. In just about every industry, every country around the world, the idea of a smarter planet is moving from metaphor to reality.

Smarter planet success stories are practically everywhere. Consider the success of these IBM clients. One of the largest cities in the United States is using data analysis to predict crime rather than just react to it. An Italian bank is upgrading its storage infrastructure to reduce online banking response times by 10 percent. A water utility in the United Kingdom is reducing operational costs by implementing a high-performance shared-storage platform. A European confectioner is using smarter technologies to eliminate a nine-hour backup window and provide 24x7 systems availability. The opportunities are virtually limitless.

More on the Web

- A Smarter Planet info on IBM.com

But the reality is that these new opportunities and this burgeoning wealth of data require organizations to adopt a new IT model if they want to take advantage of new revenue streams and create smarter business models.

Smarter Computing

To take advantage of the opportunities a smarter planet offers, IT organizations need to be able to roll out higher quality services quickly and efficiently. And they need to respond quickly to shifts in today's volatile marketplace, dramatic increases in demand, and new, data-intensive workloads. By optimizing systems for new, smarter workloads, by using federation technologies to create a unified interface to enterprise-wide data, and by addressing changing user expectations of service quality and delivery, organizations can create

a more efficient computing model that builds in efficiency and enables innovation. It's what we call "smarter computing."

Smarter computing is a new way of thinking about how information technology is **accessed** by the organization, how it's **applied** to the objectives of the business and how it's **architected** to align with those goals. It's a new approach that is designed to optimize specific workloads and improve service delivery. By integrating IT systems to break down informational silos, automating workloads to lower costs and increase productivity, and establishing new levels of security, organizations can take advantage of new technologies and operational models such as cloud computing. They can begin to leverage what we call "big data"—the federated data that resides in the enterprise and can be unlocked to provide insight that can inform and improve decision making.

Take healthcare, for example. One of our clients operates a cancer center. A new gene sequencer for DNA analysis at the center can generate one terabyte of data in just five hours, creating more data in a day than its older machines created in a whole month. The center's new computed tomography (CT) and positron emission tomography (PET) scanners deliver 16 times the resolution of earlier technology, and more powerful computers there are rendering 3-D magnetic resonance imaging (MRI) scans in minutes rather than hours. The issue is compounded by regulatory mandates that require healthcare organizations to save records for a patient's life span plus seven years—putting increased pressure on the center to address long-term storage and regulatory requirements.

It's clear. Insatiable demand coupled with unsustainable economics and the adoption of new delivery models mean

that IT organizations have to transform the way they access IT, apply it to business objectives, and architect it to improve service delivery. The smarter computing initiative from IBM can transform the economics of IT and free up teams to focus on innovation.

More on the Web

- Smarter computing overview on IBM.com

2

Smarter Storage Basics

In this chapter, we will quickly review the idea behind IBM Smarter Storage and the core capabilities of the IBM Storage family.

IBM Smarter Storage

We live on a Smarter Planet where systems are highly instrumented, interconnected, and intelligent. Data is coming from new places, in greater volumes, and at faster rates. Companies able to harness data unlock patterns faster, serve customers better, and outpace competitors.

IBM Smarter Storage delivers actionable insights faster and gives you a more efficient, adaptive storage infrastructure.

More on the Web

- Smarter Storage info on IBM.com

Data

The dramatic increase in the adoption of social, mobile, and machine-based data over the past few years has resulted in huge amounts of data flooding into organizations. To better understand the impacts of this, the IBM Institute for Business

Value teamed with the University of Oxford to survey 1,144 businesses and IT professionals in 95 countries. The results are published in the 2012 Big Data @ Work Study. We learned about a global telecommunications company that collects billions of detailed call records from 120 systems each day and stores them for at least nine months. We talked to an oil exploration company that analyzes terabytes of geological data. And we heard from a stock exchange that processes millions of transactions each minute. We also discovered that nearly two out of three respondents realize competitive advantage from the use of information (including big data) and analytics.

Growth in corporate data comes in part from increasing numbers of corporate connected devices, new data from social applications and programs, and the desire for more real-time and dynamic information across the enterprise. To compete and win in the rapidly evolving marketplace, companies must create actionable insight at the point of impact from the exponentially increasing volume, variety, and velocity of structured and unstructured data—and they must be able to reliably discern the accuracy of that information. Only then will they be able to quickly identify opportunity and act with confidence.

Today, storage departments must manage the explosive growth of storage infrastructure and capacity while reducing the costs associated with growing data sets. Data volumes tend to double annually. However, while primary data continues to grow, IT budgets and the number of IT resources to manage this increasing capacity remain flat.

Clients must architect their IT and storage infrastructure based on three important design points:

1. First, the ability to deliver actionable insights by delivering precise, real-time operational intelligence by accelerating the flow between data, analytics, and the transaction
2. Second, flexibility to access all data, no matter where it resides, through shared access of files and data
3. Finally, organizations must empower clients at the point of impact by architecting end-to-end for maximum availability of business insights.

Within this type of environment, IBM Smarter Storage delivers actionable insights faster and gives you a more efficient, adaptive storage infrastructure to run your business.

Gain Actionable Insights Faster

IBM FlashSystem offerings with MicroLatency provide 2.5 times better response time than the lowest published competitive offering. This leads to faster decision making by accelerating the critical applications that deliver real-time insights needed to compete effectively in the marketplace. While some storage vendors measure their speed in milliseconds, IBM FlashSystem with IBM MicroLatency measures speed in microseconds: 1 second = 1,000 milliseconds = 1 million microseconds.

IBM FlashSystem consistently operates with a response time of 100 microseconds for up to 20 TB of data in a 1U enclosure. This is equivalent to 1/10,000th of a second response

time. As a point of reference, the average human eye blink takes 350,000 microseconds (3,500 times slower than IBM FlashSystem).

You can also be assured your data will be kept safe with IBM FlashSystem technology that is 10 times more durable than competitive flash offerings and that keeps data readily available with patented Variable Stripe RAID and 2D flash RAID technology.

IBM Storwize entry systems deliver 50 percent higher maximum IOPS and 100 percent more maximum throughput; IBM Easy Tier improves application performance up to three times with flash optimization. The IBM Storwize family incorporates IBM Easy Tier internal analytics software to automatically place the hottest data on the fastest tier of storage with absolutely no effort needed from storage administrators. With Easy Tier, performance can be improved by three times in a very cost effective manner, with only 5 percent of total capacity on flash storage. Today these capabilities are now available on entry level IBM Storwize systems to bring the power of Smarter Storage to small and mid-size businesses.

IBM System Storage DS8870 accelerates performance up to five times with Easy Tier flash optimization enhancements. The new Easy Tier Server feature introduces the capability to place a copy of the most frequently-accessed ("hot") data on IBM Power server (AIX) direct-attached flash drawers. With this fifth generation Easy Tier enhancement, data can now be read directly from flash storage on the server, which not only boosts performance but also enables the DS8870 to apply its resources to address other critical enterprise workloads, as well as reduce traffic on the storage network. DS8870 com-

bines extreme performance and extreme availability for your critical enterprise environment.

Shared Access to Files—Anytime, Anywhere

IBM Active Cloud Engine for IBM Storwize family helps improve performance and lower networking costs by automatically moving files close to the user. Having shared access to trustworthy information across an organization is critical for enabling employees and meeting client needs. Regardless of where data resides, IBM can provide access to unstructured data with secure, virtualized file storage and information lifecycle management tools. IBM Active Cloud Engine delivers files automatically to designated locations across the globe based on policies that are established in advance. This leads to better collaboration and productivity of employees, while at the same time eliminating manual administration of the system. IBM Storwize with Active Cloud Engine delivers information to users anywhere and at the right time.

Maximize Data Availability and Business Insight

Lower the cost of storing and archiving data up to 90 percent by using IBM Linear Tape File System Enterprise Edition and tape libraries as 2nd tier storage in GPFS-based disk environments. This tape file system is ideal for lowering your overall storage and archiving costs for growing amounts of data by using tape libraries instead of disk as 2nd tier storage. Benefit from:

- Data portability
- Lower price point

- Higher energy efficiency
- Overall lower TCO.

LTFS is an open standards product, but only IBM has LTFS Enterprise Edition to enable efficient management and performance of tape as 2nd tier storage.

IBM Tivoli Storage Manager introduces an all new, simplified user experience for backup administrators: Tivoli Storage Manager Operations Center. Tivoli Storage Manager Operations Center is the next generation of backup administration from IBM that enables new levels of scalability, simplicity, and quality for backup and recovery environments.

Cloud

Having a cloud ready IT infrastructure has improved efficiency for our clients and sped up the process of making market-based decisions. By building an efficient and scalable cloud infrastructure, they now have the agility and speed needed to propel their business to the next era of IT. You too can enjoy better utilization, improved flexibility, and faster deployments by leveraging IBM's patterns of expertise with cloud optimized integrated systems management, service automation, and self-service provisioning. Benefits of a cloud infrastructure include:

- Virtualized computing, storage, and networks enable a scalable, flexible infrastructure to support all applications and data

- Central management of diverse virtual resources enables workloads to run with optimized performance when needed
- Virtualized storage is efficiently used for structured and unstructured data across multiple devices. Real-time data compression improves efficiency even more.
- Improved quality of service through quick provisioning of storage resources to run applications or store business data when and where they're needed
- Access to applications and data almost anywhere via any device
- Cost-effective scalability that's required to handle delivery of new IT services, data growth, and usage spikes.

An Efficient, Virtualized, and Scalable Cloud Storage Infrastructure

IBM Storwize family and IBM XIV allow 33 percent more data to be stored in the same space with new 4 TB disk drives. Experience better-than-ever TCO with 4 TB disks that increase usable capacity by 33 percent. Storing more data in the same physical space allows for an efficient cloud infrastructure that operates with lower TCO—reduce your energy, cooling, and space costs with greater storage density per floor tile. This results in 25 percent less energy per usable TB. For XIV systems the new 4 TB drives also lower the price per usable TB compared to smaller drives—26 percent lower than 2 TB drives and 11 percent lower than 3 TB drives.

IBM Storwize family also has new 1.2 TB drives that store 33 percent more data in the same space as 900 GB drives in use today.

IBM Storwize family stores up to five times more data in the same space with IBM Real-time Compression while also improving system performance with Easy Tier flash optimization. IBM's patented Real-time Compression software can store your primary active data in up to 80 percent less space than non-compressed data. This allows for incredibly efficient use of storage space without affecting the performance of your applications. When Real-time Compression is used in combination with IBM Easy Tier software the results are even more amazing. Easy Tier can deliver results faster by placing your most active data on high performing flash storage, and moving less active data that doesn't require optimum speed to traditional disk drives. IBM Storwize systems are equipped with these software-defined technologies that enable clients to use a cloud storage environment in the most efficient way possible to gain competitive advantage.

Move volumes between IBM XIV storage systems without application disruption using the new IBM Hyper-Scale Mobility function. IBM Hyper-Scale technologies enable easily managed, highly flexible cloud environments with performance-providing operational agility amid the dynamic cloud reality to simplify scenarios that typically challenge traditional systems, such as data center workload balancing and machine repurposing. The new Hyper-Scale Mobility feature enables application-transparent volume mobility between any two systems in a group of up to 10 XIV Gen3 systems across the data center. The IBM Hyper-Scale Manager feature (available since 4Q 2012; previously "Multi-System Manager") provides a scalable intuitive graphical user interface (GUI) that enables integrated and consolidated management of multiple XIV systems

across the enterprise. IBM Hyper-Scale capabilities help you meet your dynamic cloud computing and large deployment needs with exceptional flexibility, elasticity, and simplicity.

Rapidly Deploy All Flash Storage

To meet high performance requirements, the IBM FlashSystem family delivers less than 1/10th the cost per transaction while using 4 percent of the energy and 2 percent of the space compared to hybrid disk and flash implementations. These results are based on an actual client implementation and internal testing at IBM. In addition to incredible speed, IBM FlashSystem is designed for the lowest energy consumption and smallest data center footprint.

At a wholesale supplier client, IBM FlashSystem is using 75 percent less floor space in the data center compared to hard disk storage, and is using 75 percent less energy. IBM FlashSystem makes it possible to store 1 petabyte of data on a single floor tile—for an extremely efficient storage infrastructure.

When IBM FlashSystem is used in combination with IBM Storwize family, you are assured of having a robust storage infrastructure with the ability to increase performance and efficiency in the cloud even more.

IBM Storwize family is the perfect solution for cloud storage. It has highly efficient technologies like virtualization, Easy Tier, and Real-time Compression, and is easily scalable to grow as you need. With its virtualization capabilities, IBM Storwize family is the ideal complement for virtualized server environments such as VMware that are at the heart of cloud deployments.

Combining SAN Volume Controller—a member of the Storwize family—with IBM FlashSystem delivers the best of both technologies: Extraordinary performance for critical applications with IBM MicroLatency coupled with sophisticated function. For example, the SAN Volume Controller FlashCopy function can create "instant" snapshots for backup, while thin provisioning and Real-time Compression help optimize use of IBM FlashSystem capacity. The high performance design of SAN Volume Controller enables the full performance of IBM FlashSystem while adding valuable capability rarely found in dedicated flash storage.

IBM Storwize family is cloud-ready:

- Achieve cost-efficiency and better utilization of storage with built-in virtualization and thin provisioning
- Grow capacity and performance of your cloud workloads
- Realize faster benefits by deploying IBM's purpose built Storwize integrated cloud solutions and self-service provisioning tools.

3

General Storage Resources

This chapter provides you with general information and valuable resources that will help you as you sell IBM products.

How to Sell IBM System Storage Products

In this section, we offer ideas that will help you identify and explore opportunities for selling IBM System Storage.

Identifying Storage Sales Opportunities

Following are some "triggers" that tell you there is a sales opportunity for IBM Storage.

General

- Is the customer buying servers? Server buyers tend to buy storage within three months of their server purchase.
- Is the number of users of the application increasing? Adding employees or upgrading applications generally leads to additional storage needs.
- Are existing storage assets coming off lease or nearing the end of the depreciation cycle? The data on multiple older storage controllers can often be consolidated onto a single newer, faster system with cost savings.

- Does the customer already have IBM external storage installed but is running out of capacity? This is an opportunity to upgrade the storage.

Storage Efficiency

- Is your data growing and are the costs of managing your storage infrastructure growing?
- Are you concerned about how well utilized your storage is or your staff's ability to support this growth?
- How satisfied are you with the cost effectiveness of your current storage?
- Is the management of your storage infrastructure complex?
- Are you looking for new functionality or help to manage your storage growth and costs?

Data Protection

- Are your data storage needs growing?
- How will this growth impact your ability to adequately protect critical data? With the data growth you're experiencing, what impact have you seen in your backup & recovery?
- Can you electronically locate critical business information, documents, email, attachments, and messages when required?

- Are you looking for help to improve your company's backup and recovery time and reliability?
- Do you need to store all types of information (structured and unstructured) in a single repository which can be configured to archive information with compliance and non-compliance retention needs?
- Do you have needs to keep data for long periods of time?

How to Facilitate a Storage Efficiency and Data Protection Discussion

Here are some pointers on how to start conversations with your clients and discover sales opportunities.

General Questions

- Are your data storage needs growing?
- Are you spending money on distributed storage capacity attached to your servers that is not being fully utilized?
- Do you have storage systems coming off lease or nearing the end of their depreciation cycle?
- Who is your current storage vendor and are you happy with the TCO that your current storage vendor is providing you?
- Can you benefit from storage virtualization?
  - Storage virtualization can reduce administrative costs by up to 50 percent and increase disk utilization by up to 30 percent.

  - Storage virtualization can improve throughput and help resolve bottlenecks.

- Can you benefit from storage consolidation?
  - IBM Storwize V7000 can increase disk utilization up to 30 percent.
  - IBM System Storage XIV can decrease storage requirements by up to 90 percent and reduce power, cooling, and space costs by up to 59 percent.
  - IBM System Storage DS8000 can consolidate storage across platforms: Windows, Unix, and System z.
- Can you benefit from data migration and storage tiering?
  - Moving 4–5 percent of data to a solid-state disk can gain 70+ percent improvement in average response time.
  - IBM offers integrated multi-tier storage systems with simplified management, helping clients optimize price and performance.
- Can you benefit from data compression and deduplication?
  - IBM ProtecTIER deduplication can reduce store 25 TB of data onto 1 TB of storage capacity with in-line throughput over 1000 MB/sec.
  - IBM Real-Time Compression appliances can shrink NAS data up to 80 percent with no performance degradation.

  - Tivoli Storage Manager's integrated deduplication can store more backup data on disk for faster restores, without a separate deduplication solution.

- Can you benefit from improving your backup and restore processes?
  - Reduce the amount of data at risk of loss, and shrink restore times.
  - IBM ProtecTIER virtual tape solutions reduce backup infrastructure costs up to 45 percent over standard non-deduplicated virtual tape library systems.
- Can you benefit from implementing a smarter archive strategy?
  - Blended disk and tape solutions cut TCO by 50 percent.
  - Archiving is a Best Practice that makes most applications run better.

Typical Findings After Asking the Above Questions

- Multiple islands of storage are becoming hard to manage and are driving up costs.
- Performance is not always sufficient to meet users' needs.
- Reliability is not at desirable levels. Even a small outage is a big deal when it happens in a remote location.
- Storage capacity is not being used efficiently. Some users and servers need more storage, while capacity on other servers sits idle.

- Data backup is becoming hard to manage.
- Total storage costs are getting out of control as storage needs rise.
- Information is exposed to security risks that are not understood, or not managed.
- Regulatory requirements cannot consistently be met at the desired level.
- Personnel costs to manage storage are rising rapidly, or there is a shortage of manpower to complete all of the management work in a timely fashion.

Key Storage Efficiency Offerings

Here are some of the key offerings (all covered later in this guidebook) that are in the realm of storage efficiency.

- **SAN Volume Controller**: A storage virtualization system that enables a single point of control for storage resources to help support improved business application availability and greater resource utilization.
- **IBM Storwize V7000**: A powerful midrange disk system that has been designed to be easy to use and enable rapid deployment without additional resources. Storwize V7000 offers IBM storage virtualization, SSD optimization, and "thin provisioning" technologies built in to improve storage utilization and to enable the system to be reconfigured to meet changing business needs quickly and easily.

- **IBM XIV Storage System**: Helps deliver consistently high performance through the elimination of hot spots and the full exploitation of system resources. Outstanding availability and reliability are delivered through a revolutionary redundancy scheme, enabling automated self-healing with exceptionally fast rebuild times.
- **IBM System Storage DS8000 Turbo series**: Helps support the most demanding business applications with its exceptional performance and superior data throughput. This, combined with its world-class resiliency features and five-nines availability, make it an ideal storage platform for supporting today's 24x7 global business environment.
- **IBM System Storage DS5000 series**: Delivers industry-leading performance, real reliability, multi-dimensional scalability, and unprecedented investment protection.
- **IBM System Storage DS3500 Express**: Entry-level disk systems delivering midrange performance, scalability, and features such as Turbo performance, Remote Mirroring, Disk Encryption, mixed host interface, and tiered storage.
- **IBM Smart Business Storage Cloud**: A storage-virtualization solution designed to support your storage optimization efforts. It can help alleviate your data storage challenges by enabling quick implementation of a scalable, global file storage system with flexibility in deployment and management options.
- **IBM Tivoli Storage Productivity Center**: Helps customers reduce the complexity of managing their storage environ-

ments by centralizing, simplifying, and automating storage tasks associated with storage systems, storage networks, replication services, and capacity management.

- **IBM Storage Optimization and Integration Services**: Helps to reduce complexity, optimize performance, and manage growth by creating a cost-effective, scalable, and resilient storage infrastructure.
- **IBM Scale Out Network Attached Storage**: Centralize and virtualize your data in a single storage environment. SOFS are designed to eliminate your information sharing challenges through swift implementation of a highly scalable, global, clustered NAS system.
- **IBM Real-time Compression**: Shrink NAS data up to 80 percent with no performance degradation and can keep up to 5x more data online to improve business analytics and reduce the amount of data stored.

Key Data Protection Offerings

Here are some of the key offerings (all covered later in this guidebook) that are in the realm of data protection.

- **IBM Information Archive**: A policy-driven, cloud-ready, next generation information retention solution that provides immediate archiving of all business information. Built-in deduplication, compression, and automated data migration to tape offer efficiency. Its scalable and flexible architecture is simple to use, manage, and expand. It offers tiered storage (disk and tape) archiving capability with built-in HSM for per-

formance and longevity. Its enhanced security features allow for retaining information to support regulatory compliance.

- **IBM Tape portfolio**: A broad portfolio of tape products to help your clients achieve efficiency and better TCO for the long term.
- **IBM Grid Medical Archive Solution**: integrates software, storage, and server products to deliver a flexible and scalable virtualized storage solution for mid-size to large healthcare organizations and hospital networks.
- **IBM ProtecTIER data deduplication solutions**: Employs an advanced form of data compression that identifies and eliminates redundant data across the data landscape, making it possible to significantly reduce the amount of data that needs to be protected.
- **IBM Information Lifecycle Management Services**: ILM Assessment, Enterprise Archive services, and Enterprise Content Management services assess a client's existing environment and help design a comprehensive strategy aligned with their business goals and performance needs.
- **IBM Content Collection and Archiving**: Enables a deeper understanding of what information to archive through discovery and analytics-based assessment technologies. Reduce point solution complexity and costs by unifying data and content archiving through common collection and classification technologies.

Qualifying Questions

Here are questions you can use to gauge a possible sales opportunity:

- Are you under pressure to control costs and IT expenditures?
- How many servers and what operating systems do you have?
- What are the key applications that drive your storage demand?
- Can your storage scale easily to meet growth and new application needs?
- Are you unable to add additional storage capacity because of budget constraints?
- Are you concerned that you can't predict future growth? Do you need a storage system that can be upgraded to higher capacity and performance without losing your initial investment?
- Do you often find that you are adding additional servers and associated storage to keep pace with your growth?
- Do you need more capacity and performance—at a better price?
- Does storage management cost you money for staffing, education, and time?
- How much benefit would you see from having a single interface—fewer tools to learn and use—for server and storage management?

- Are your storage needs satisfied by the internal storage in the server?
- Do you need to lower IT costs and complexity while still providing a computing infrastructure with high levels of server and storage performance typical for database and online transaction processing?
- Do you have a large number of server/storage platforms and/or operating environments?
- What competitive storage or server hardware is installed and which competitor(s) are bidding for the business (EMC, HP, Dell, Sun)?
- Do you need to run test applications against live data?
- Do you need the ability to set up a disaster recovery plan?
- Do you understand the risks and costs associated with data access delay or data unavailability? Do you have the skills to complete an analysis? (IBM does—storage study.)
- Are your backup windows getting shorter?
- Are you confronted with significant complexities of storage management and looking to simplify the environment?
- Do you need to improve the security of your information?

IBM PartnerWorld Web Site

IBM maintains a Web site called PartnerWorld, which has a great deal of information of use to all IBM Business Partners

worldwide. On the site you will find the latest presentations and marketing materials (such as brochures, data sheets, and case studies) as well as competitive information, consultant reports, IBM white papers, education and events, tools, technical support, and much more.

In this ebook, we have summarized and provided direct links to much of the PartnerWorld information that is most important to IBM System Storage Business Partners. As such, this ebook is your personal "guide" to the PartnerWorld Web site. Just the same, we encourage you to spend some time just browsing the PartnerWorld site so you can get a feel for the full scope of resources available to you.

More on the Web

- IBM PartnerWorld Web site
- IBM PartnerWorld news and newsletters
- Join PartnerWorld

You will need your IBM-assigned user ID and password to access some areas of PartnerWorld. If you don't have your user ID and password, you can contact IBM PartnerWorld help. (Follow the link in the "More on the Web" box.)

Storage News and Events

You can keep current with the fast paced world of IBM System Storage by frequently checking the link shown in the "More on the Web" box.

More on the Web

- IBM Storage news and events

Incentives and Promotions

IBM offers many incentives and promotions for both business partners and your clients to help drive sales. You can find a list of the most current incentives and promotions by following the "More on the Web" links.

More on the Web

- Incentives and promotions for storage
- Cross brand incentives and promotions

System Storage Education

As with almost any endeavor, time spent educating yourself and your team on appropriate topics such as selling techniques and storage product offerings will help you succeed. In this chapter we discuss two ways you can get the education you need to succeed in selling IBM System Storage products.

PartnerWorld University

The IBM PartnerWorld University is a Web-based repository of information in many different formats. It provides technical and sales information to help you succeed as a storage business partner. You will need your PartnerWorld user ID and password to access these resources.

More on the Web

- PartnerWorld University

IBM Training

IBM Training provides an array of education offerings including instructor-led training in traditional classrooms, customized

training services at client locations, and IBM technical conferences built around IBM Systems platforms and solutions.

In addition, IBM also provides technical training offerings that build integration skills around the IBM Systems portfolio and complementary solutions from other strategic partners, such as Cisco, Linux, ISC(2), and VMware.

More on the Web

- IBM Training

Systems College

IBM Systems College is a key education resource offering sales and technical training, education roadmaps, certification information, tools, resources, and much more. Take advantage of on-demand learning opportunities to help you become more successful today and over the long term.

More on the Web

- Systems College

Within Systems College are the job role roadmaps, designed to build strong selling and product knowledge skills. The job role roadmaps categorize training under basic, intermediate, and advanced levels. Course and roadmap completion are automatically tracked to demonstrate progression through the various training paths.

IBM Professional Certification Program

The IBM Professional Certification program offers a business solution for skilled IT professionals who seek to develop and demonstrate their expertise to the world. It's designed to validate your skills and demonstrate your proficiency in the latest IBM technology and solutions, as well as to perform

role-related tasks and activities at a specified level of competence. It is also beneficial for companies that wish to ensure minimum skill levels for their employees. Skills attainment is a key element for business partner firms to move from Member to Advanced and Premier levels in PartnerWorld.

More on the Web

- IBM Professional Certification info

Certifications may be required to meet business partner authorization requirements, may be listed as options to meet program qualifications for programs such as Storage Specialty or Systems Connect for Storage, or may be pursued for personal achievement. Consult the latest authorization and program documentation for the current list of accepted certifications.

IBM System Storage Specialty

The IBM System Storage Specialty Offering is designed to reward IBM Business Partners who make a significant investment in skills and certifications, customer references, and have the ability to successfully sell and deploy IBM Storage solutions. The program is open to IBM resellers and solution providers who acquire products from IBM and authorized IBM Distributors and who meet the criteria outlined on the specialty Web site, and determined by the local channel partner channel organization. Storage has two levels of specialty:

- Specialty: Advanced demonstration of skills and market success consistent with strategy.

- Specialty Elite: Superior/Market leadership demonstration of skills and market success consistent with strategy.

IBM is committed to continue to support and develop this specialty and to provide additional resources to our top partners as we pursue an aggressive program of growth through 2012 and beyond. In addition, IBM will continue to simplify our business processes and align resources and benefits to those partners who actively demonstrate a willingness to invest in IBM focused skills and resources. By achieving the Storage specialty designation, Business Partners will be able to play a greater role in helping clients meet the challenges of rapidly growing data, reduced budgets, and greater customer expectations.

More on the Web

- System Storage Specialty info on PartnerWorld

The benefits of participating include:

- Support resources—Accredited System Storage Specialty Business Partners will receive an assigned storage growth team representative to help them plan for future growth and proactively work with them to find the resources and support they need to extend their storage practice and drive additional revenue with IBM.
- Financial rewards—Additional incentives may be available for accredited System Storage Specialty Business Partners to invest in education, marketing, and offering development.
- Training benefits—Receive education and certification vouchers to assist in funding the education and training of your employees.

- Specialty mark—Accredited Business Partners get to raise the visibility of their leadership and capabilities in the marketplace using the System Storage Specialty mark in their advertising and collateral. The mark is evidence that their firm has acquired the skills and experience in System Storage solutions and is recognized by IBM as an expert having met the specialty criteria.
- Additional benefits are provided for those Partners achieving the "Elite" level.

You must apply for the specialty to participate, and your company must meet the specified criteria through eligible certifications and verified customer references, and achieve and maintain the minimum annual IBM System Storage revenue requirements. Higher levels of certification and revenue contribution are required for Specialty Elite.

System Storage Sales Certifications

Several certifications are offered to test an individual's knowledge and skills in a given market segment. The candidate must have general experience in disk, tape, and other products in the segment. There are also several product-specific tests that provide candidates with an opportunity to demonstrate their depth of technical expertise through certification.

More on the Web

- Professional Certification Program—Storage
- Schedule an appointment to take a test at a Prometric Test Center

Follow the path to certification:

- Select the role that most closely represents your daily tasks.
- Review the job role/target audience description and test objectives, which describe the skills tested.
- Review the recommended training and study aids for the selected test, with a focus on areas where you need to improve your skills.
- Check your readiness to sit for the test by reviewing the sample test or taking the assessment test provided on the certification Web site. Use the results of the assessment test to identify areas where you may still need more preparation.

Sources for Competitive Marketing Information

IBM maintains information about competing products in the COMP section of PartnerWorld. You can access a searchable set of reports/presentations/quick reference cards about the marketplace, competitors, and competitive products. You will find materials developed by IBM as well as outside sources such as Gartner, IDC, DH Brown, IDEAS International, etc.

More on the Web

- IBM COMP on PartnerWorld

You can also sometimes find "product-to-product comparison" information. Explore the links in the "More on the Web" box for competitive information.

Sales Kits for System Storage

Sales kits provide business partners with a package of key client-ready sales and marketing enablement resources. You'll find client-ready presentations and brochures, education resources and opportunities, seller guides, client references, and more, all to help you unleash your selling potential and the power of our unique technologies (see the "More on Web" box).

More on the Web

- Listing of all System Storage Sales Kits

Sales Plays

Sales plays are designed to help you generate new selling opportunities. Each play focuses on a set of common client pain points and recommends specific solutions to address them.

More on the Web

- Storage selling tools

Find everything you need to know about the latest System Storage sales plays and initiatives—with a special focus on the small and mid-size market. Download the "reasons of call," proposal letters, presentations, benchmarks, and sales tools to help you identify, progress, and close deals. Find tips for increasing deal size with services and relevant financing to improve your odds of winning the sale.

IBM Web Content Syndication (For Your Web Site)

IBM Web Content Syndication automatically delivers IBM product and marketing content to your Web site. It combines

the power of content syndication, automatically sending and updating content, with built-in lead tracking capabilities. The Web Content Syndication Center provides simple, fast, online registration, implementation, and support. The Partner Console allows you to view the latest news and content, manage your company's profile, and view and manage leads. Syndicated content is available for IBM Hardware, Software and Services in 11 local languages. Syndicating IBM content enables you to save time and money, and with its customization features, is an easy fit into every Business Partner's Web marketing strategy. This PartnerWorld benefit is available at no cost to all registered PartnerWorld members.

More on the Web

- Web content syndication info on PartnerWorld
- Web content syndication registration

IBM System Clothing Pointers

Whenever you are proposing the sale of a server, it only makes sense to include the needed storage devices in the original proposal. Selling storage solutions with servers is known as "clothing." Clothing the servers with storage solutions is a proven key to selling success. Follow the links in the "More on the Web" box to see what storage devices to propose with each type of server.

IBM Global Financing

IBM Global Financing (IGF) continues to focus on meeting customer needs by concentrating on key business areas:

More on the Web

- Compatibility/interoperability info for IBM storage products
- Storage products for Power Systems
- Storage products for System x and BladeCenter servers
- Storage products for System z servers
- Storage products for Sun
- Storage products for HP
- Storage software for managing the information infrastructure

leasing and lending, remarketing and refurbishing, and asset management. IGF conducts business in more than 40 countries, financing IBM and non-IBM hardware, software, and services, with a full range of flexible, low-rate offerings. IGF's customers find that financing their information technology solutions offers many advantages in both robust and difficult economic climates, because financing frees up their capital for other investments.

Many information technology installations, including those for customer relationship management, data mining, and e-business require a substantial investment. IGF financing enables customers to pay for their new technology in affordable monthly payments during the life of the project. Our customers run the gamut from the smallest, family-owned business purchasing a single server and software to the largest, multinational corporation, acquiring tens of thousands of PCs for offices on several continents.

In addition to working directly with customers, we work with IBM Business Partners to provide financing for their clients and to help them build their own businesses. This includes a full suite of commercial financing offerings to support inventory and accounts payable and receivable financing needs, and state-of-the-art online tools, such as Rapid Online Financing, which allows partners to request quotes and deliver ready-to-sign financing contracts in under one hour.

More on the Web

- IBM Global Financing
- Rapid Online Financing

Why should business partners offer financing? Offering financing enhances your selling efforts and allows you to:

- Facilitate closing the entire solution without scaling back
- Close deals faster by overcoming budget issues
- Decrease discounting by making payments more affordable
- Differentiate your solutions from the competition
- Lock in future sales with upgrades and end-of-lease options.

Financing can be beneficial to a partner's overall business in the following ways:

- Receive payment from IBM Global Financing faster than you would with a cash purchase (free up cash to fund your growth)
- Create an opportunity to receive an incentive for selling financing
- Eliminate client credit risk—IBM Global Financing assumes the risk

- Your firm can use our "rate buy-down" capability to offer below-market financing rates on your own solutions to avoid discounting, keeping your "street price" whole.

Systems Advisor Tool

Follow the links in the "More on the Web" box to explore the IBM Systems Advisor tool. This is invaluable in helping you define specific solutions that include servers and storage products.

More on the Web

- Systems Advisor tool
- More sizing guides and configuration tools

What Are "IBM Express Advantage" Offerings?

IBM Express Advantage offerings are a key component of IBM's strategy for serving the IT opportunity in the mid-market sector. These easy-to-run and scalable hardware, middleware, services, and financing solutions are designed and priced for mid-size businesses (less than 1000 employees).

More on the Web

- Express Seller Toolkit info on PartnerWorld

Each IBM Express Advantage offering must meet a stringent set of technical and go-to-market criteria in order to qualify. Business partners can be confident in selling or building solutions with IBM products that are easy to acquire, easy to implement, and easy to maintain.

You can already benefit from the features and functions of Express Advantage offerings to build solutions that meet the real-life, specific needs of your clients at a price they can afford.

What Is Storage Virtualization?

Storage virtualization is technology used to insulate the details of a storage infrastructure (hardware and software) from the applications and users who use that storage infrastructure. By doing so, storage virtualization reduces cost and complexity.

More on the Web

- IBM storage virtualization info on IBM.com
- Storage virtualization concepts on Wikipedia

IBM has a broad range of storage virtualization offerings including the SAN Volume Controller, Virtualization Engines, Virtual File Manager software, and more. Follow the "More on the Web" links for more specifics on storage virtualization.

Technical Support for Business Partners

Technical Sales Support from IBM provides business partners with extensive pre-sales support through the PartnerWorld program online via the Web and by voice. Voice support can be accessed via PartnerWorld Contact Services, the single point of entry to all key support organiza-

More on the Web

- Contact Techline
- Technical Sales Library
- PartnerWorld technical resources & support
- PartnerWorld contact services
- CompeteCenter

tions. PartnerWorld Contact Services provides access to Techline for hardware and software technical sales support, and to Competeline (Americas only) for win strategies and competitive information. CompeteCenter (Europe only) is accessed through the CompeteCenter Web site. Systems business partners entitled through the PartnerWorld program have access to IBM System x and IBM System Storage solutions and selected major competitive platform support including:

- Remote solution design assistance/review
- Technical marketing assistance
- Product and promotion information
- Configuration assistance
- Competitive product information
- Sales strategy information
- Solution assurance assistance.

Follow the links in the "More on the Web" box to access Technical Sales Support online (region selectable).

Social Media Resources for IBM Business Partners

Social media is quickly growing in importance for businesses of all sizes. Whether you are already involved in social media or just getting interested, the "More on the Web" box provides some links that will be of interest to you.

More on the Web

- IBM PartnerWorld communities
- Twitter search results for IBM Storage
- IBM Business Partner Twitter: @ibmsystemsbps
- Search Twitter for mentions of your business or competitors
- Google blog search results for IBM Storage
- Search blogs for mentions of your business or competitors
- LinkedIn social network (has an IBM Business Partner Group)
- Use Twitter to Grow Your Business (IBM Software Business Partner Blog)

4

System Storage Quick Reference

In this chapter, we explore the IBM System Storage hardware, software, and packaged solutions you will be selling and offer some resources that will help you succeed.

More on the Web

- System Storage product guide
- DS Storage Portal

Disk Storage

The IBM System Storage family includes a variety of disk storage products ranging from direct-attached disk drives to complete enterprise storage systems. In this section, we look at the product offerings in the disk storage arena.

Flash Storage

IBM leads the industry with flash optimization in storage, systems, and software. IBM recently announced flash caching in System x and tiering in Power Systems. Combined with the announcement of the IBM FlashSystem family, IBM offers the most comprehensive flash portfolio to help your business compete, innovate, and grow.

To achieve a competitive advantage in a world of 24x7 continuous operations, organizations need to perform more frequent and complex analytics on vast volumes of data—including varying types of big data—and cannot afford downtime. IBM FlashSystem empowers organizations to take advantage of best-in-breed solutions to build a compelling advantage by providing macro efficiency in the data center, enterprise reliability, and microsecond response times so that business can quickly harness the value of stored data. IBM Storage has acquired and improved upon flash technology that has a 34-year history and is in its eighth generation of technology refinements to provide the macro efficiency and enterprise reliability business needs to compete, innovate, and grow in today's real-time world.

An excellent example of technology that's Designed for Data is All-Flash storage—designed from the silicon up to handle massive volumes of data at unprecedented speed.

We believe that Flash storage is now reaching an economic tipping point where it is a valuable alternative to spinning disk systems. Improved performance is generally understood as a huge benefit of Flash, but what's not as obvious are the various cost savings:

- Greater system utilization = fewer cores needed
- Therefore less hardware is needed
- This leads to fewer software license costs
- Plus significant savings on power, cooling, and floor space

- These combined factors now create an economic tipping point when the upfront cost of acquiring Flash storage is quickly outweighed by the ongoing cost savings to run the system.

IBM has introduced the FlashSystem portfolio, enabling our clients to leverage the economics of data management with flash. With superior resiliency, availability, and serviceability features, IBM FlashSystem offers continuous availability.

HW-based vs. SW-based design is the basis of how FlashSystem differentiates. FlashSystem uses FPGA design and all data logic is handled at the atomic, board level, never outside the board or by external components with heavy SW/OS logic to manipulate the data path. HW-based design is what makes FlashSystem extremely fast, reliable, and efficient.

In a 24/7 market, enterprise clients often strive to achieve maximum performance coupled with deep features and functionality. And naturally, it must be delivered cost effectively. With the introduction of IBM FlashSystem 820 behind SAN Volume Controller, a solution now exists. Businesses can simplify management and enable business continuity with consistent data availability day or night, even at peak loads.
IBM clients gain…

- The extreme performance of IBM FlashSystem powered by IBM MicroLatency
- Advanced storage functionality of IBM SVC
  - Thin Provisioning—allocate storage "just in time"
  - Easy Tier—storage efficiency
  - FlashCopy—point in time copies

  - Mirroring/Copy Services—data replication and protection
  - Real-Time Compression—up to 5X more data in the same physical space.
- An ability to cost effectively deploy quickly and realize immediate results.

IBM FlashSystem Portfolio

Flash technology is redefining the landscape of computing. Data management has reached a tipping point with flash and will move rapidly to all-flash based systems for operational information. IBM flash storage provides extreme IOPs and low latency. When compared to disk technology, flash is superior in performance, cost efficiency, packaging, energy consumption, and speed to deployment. Businesses can finally unleash the power of their most critical applications to make real time strategic decisions. It's time to create new applications with IBM flash storage. It's time for flash.

- Ideal for OLTP databases, data warehousing, and OLAP environments
- Designed for multitenant heterogeneous applications requiring high availability
- Virtualization and virtual desktop infrastructure (VDI)
- Technical Computing and High Performance Computing (HPC)
- Cloud infrastructure, private and public
- Deliver extreme performance to enterprise storage area network (SAN)

- Ideal for content delivery networks, rendering, video editing, modeling, and simulation.

Extreme Performance: Enable business to unleash the power of performance, scale, and insight to drive services and products to market faster.

- SLC and eMLC
- Capacity varies from 1-10 TB for 710/810 and from 6–24 TB for 720/820,
- High Availability option available with 5–20 TB capacity for 720/820
- 5 GB/s Bandwidth.

MicroLatency: Deliver a microsecond response time to accelerate critical applications to achieve competitive advantages.

- Low latency of 100 µs (read) and 25 µs (write)
- Purpose-built, highly parallel design
- Maximize host CPU efficiency and productivity.

Macro Efficiency: Driven by consolidation of hardware and software, deployment speed, efficient use of strategic IT staff, and power and cooling savings. Leverage the economies of scale with flash and achieve real and measurable IT efficiencies.

- 1U form factors—minimal footprint for best of breed ROI
- Four 8 GB Fibre Channel controllers or 40 Gb QDR IB

- QDR InfiniBand controllers
- 400 watt power draw
- Hot Swap flash modules enabling uninterrupted operations.

Enterprise Reliability: Durable and reliable designs that use enterprise class flash and patented data protection technology.

- Variable Stripe RAID to protect against chip failure
- Redundancy for power, data, and management
- 2D Flash RAID eliminates single point of failures
- Available integrated spare flash card limiting down time
- Error Correcting Code
- (ECC) at chip level.

IBM FlashSystem 810 and 710

IBM FlashSystem 810 and IBM FlashSystem 710 (Figure F.1) are designed to speed up the performance of critical enterprise applications, including data warehousing and OLAP applications, content delivery networks, video rendering and editing software, and 3D modeling and simulation applications. These systems deliver extreme performance per gigabyte so organizations can quickly uncover business insights from IBM DB2, Oracle, and other database applications. In addition, FlashSystem 810 and FlashSystem 710 eliminate storage bottlenecks with MicroLatency that enables faster decision making.

Specifications

Series	IBM FlashSystem 810	IBM FlashSystem 710
Model	9830-AE1	9830-AS1
Flash type	eMLC	SLC
Usable capacity (terabyte [TB]/ tebibyte [TiB]	10.3 TB/9.4 TiB	5.2 TB/4.7 TiB
Raw maximum capacity (TB/TiB)	13.7 TB/12.5 TiB	6.9 TB/6.3 TiB
Incremental usable capacity upgrade (TB/TiB)	2.1 TB/1.9 TiB	1.0 TB/0.9 TiB
Minimum latency (write)	60 µs	60 µs
Minimum latency (read)	110 µs	100 µs

- FlashSystem 810 on PartnerWorld
- FlashSystem 710 on PartnerWorld
- FlashSystem 810 and 710 info on IBM.com
- FlashSystem info on COMP
- IBM FlashSystem blog search
- IBM FlashSystem Twitter search

Figure F.1. IBM FlashSystem 810 and 710 at a glance (and links to more detail).

Here are some quick FlashSystem 810 and 710 facts:

- Gain enterprise-class reliability with IBM Variable Stripe RAID technology—without sacrificing performance or usable capacity
- Reduce time to decisions with faster applications, including data warehouses and online analytical processing (OLAP) databases
- Improve IT efficiency with IBM MicroLatency, high bandwidth and extreme input/output operations per second (IOPS) performance in a small footprint
- Realize macro efficiencies with green storage designed for fast data access at low wattage
- Extract immediate value from your investment with quick time to deployment.

IBM FlashSystem 820 and 720

IBM FlashSystem 820 and IBM FlashSystem 720 (Figure F.2) are designed to speed up the performance of multiple enterprise-class applications, including OLTP and OLAP databases, virtual desktop infrastructures, technical computing applications, and cloud-scale infrastructures. These IBM systems deliver extreme performance per gigabyte, so organizations can quickly uncover business insights using traditional data analytics as well as new, big-data technologies. In addition, FlashSystem 820 and FlashSystem 720 eliminate storage bottlenecks with IBM MicroLatency—that is, less than 100-microsecond access times—to enable faster decision making. With these low latencies, the storage disk layer can operate

Specifications

Series	FlashSystem 820	FlashSystem 820	FlashSystem 720	FlashSystem 720
Model	9831-AE2	9831-AE2	9831-AS2	9831-AS2
Flash type	eMLC	eMLC	SLC	SLC
	10 TB	20 TB	5 TB	10 TB
Usable capacity (terabyte [TB]/ tebibyte [TiB]	12.4 TB/11.3 TiB	24.7 TB/22.5 TiB	6.2 TB/5.6 TiB	12.4 TB/11.3 TiB
Usable capacity RAID 5 (TB/TiB)	10.3 TB/9.4 TiB	20.6 TB/18.8 TiB	5.2 TB/4.7 TiB	10.3 TB/9.4 TiB
Raw maximum capacity (TB/TiB)	16.5 TB/15 TiB	33 TB/30 TiB	8.3 TB/7.5 TiB	16.5 TB/15 TiB
Minimum latency (write)	25 µs	25 µs	25 µs	25 µs
Minimum latency (read)	110 µs	110 µs	100 µs	100 µs

- FlashSystem 820 on PartnerWorld
- FlashSystem 720 on PartnerWorld
- FlashSystem 820 and 720 info on IBM.com
- FlashSystem info on COMP
- IBM FlashSystem blog search
- IBM FlashSystem Twitter search

Figure F.2. IBM FlashSystem 820 and 720 at a glance (and links to more detail).

at speeds comparable to those of the CPUs, DRAM, networks, and buses in the I/O data path.

Here are some quick FlashSystem 820 and 720 facts:

- Reduce business interruptions without sacrificing performance or usable capacity, with IBM Variable Stripe RAID technology
- Accelerate decision making across multiple applications, including online transactional processing (OLTP) and online analytical processing (OLAP) databases
- Boost IT efficiency and gain high bandwidth and extreme input/output operations per second (IOPS) performance in exceptionally dense, 1U storage systems—without compromising on latency
- Realize macro efficiencies with green storage for data centers, designed for fast data access at low wattage
- Extract immediate value from your investment with quick time to deployment.

Disk Storage Cross Reference by Workload Size

It is often a mistake to associate entry-level, midrange, and enterprise-class storage products with small, medium, and large size businesses respectively. For example, did you know that 30 percent of DS8000s are used by small and medium businesses? Did you know that 70 percent of SAN Volume Controllers are used by small and medium businesses?

Conversely, did you know that nearly every large enterprise uses entry-level and midrange storage products in addition to enterprise-class devices? For example, some large

enterprises have branch offices or remote areas where smaller storage systems are more appropriate. Measurements often used to classify business size, such as the number of employees or sales revenue, do not always correlate with the amount of information those businesses store. For this reason, product recommendations based on workloads often make more sense, though they still should be considered only as general guidelines. In this section, you will find a list of disk storage products organized by workload size (entry, mid-size, and enterprise) to help you find the best solution for your client.

Disk Storage for Entry-Level Workloads

Here is a list of disk storage products designed for businesses with entry-level workloads. Click on the links and you will jump to the section of this ebook that describes the product (you can click on the back arrow to jump back to this page).

DS3500 Express

Storwize V3700

N3000 Express

More on the Web

- Disk storage for entry-level workloads

Disk Storage for Mid-size Workloads

Here is a list of disk storage products designed for mid-size workloads. Click on the links and you will jump to the section of this ebook that describes the product (you can click on the back arrow to jump back to this page).

Storwize V7000

Storwize V7000 Unified

Flex System V7000 Storage Node

DS3950 Express

DS5000

EXP2500 Express

EXP3500 Express

EXP5060

DS5020 Express

EXP520

DCS3700

N6000

Real-time Compression Appliance STN7800

More on the Web

- Disk storage for mid-size workloads

Disk Storage for Enterprise Workloads

Here is a list of disk storage products designed for large enterprise workloads. Click on the links and you will jump to the section of this ebook that describes the product (you can click on the back arrow to jump back to this page).

DS8000

XIV Storage System

SONAS

N7000

San Volume Controller

More on the Web

- Disk storage for enterprise workloads

DS3500 Express

IBM System Storage DS3500 Express (Figure D.1) combines best-of-breed development with leading 6 Gbps host interface and drive technology. With its simple, efficient, and flexible

Specifications

Part numbers	1746A2S DS3512 Express Single Controller Storage System 1746A2D DS3512 Express Dual Controller Storage System 1746A4S DS3524 Express Single Controller Storage System 1746A4D DS3524 Express Dual Controller Storage System 1746T4D DS3524 Express DC Dual Controller Storage System
RAID controller	Single or dual active, hot-swappable controllers
Cache	1 gigabyte (GB) cache per controller with 2 GB upgrade (battery-backed)
Host interface	Two 6 Gbps SAS host ports per controller standard with the option to add a daughter card with additional connectivity Four options: • Four or eight 6 Gbps SAS ports • Eight 8 Gbps Fibre Channel ports and four 6 Gbps SAS ports • Eight 1 Gbps iSCSI ports and four 6 Gbps SAS ports • Four 10 Gbps iSCSI ports and four 6 Gbps SAS portss)
Drive interface	Single controller subsystem: One 6 Gb SAS drive expansion port Dual controller subsystem: Two 6 Gb SAS drive expansion ports
Data protection levels	RAID levels 0, 1, 3, 5, 6, 10 and/or DDP
Software features	Thin provisioning with DDP, 128 storage partitions, 32 Enhanced FlashCopy images, host-attachment support for Microsoft Windows and Linux on x86/IBM POWER, IBM AIX, HP-UX, Solaris and MAC OS
Maximum drives supported	• Up to 192 drives—high-performance SAS drives, nearline SAS drives, SSDs and SED SAS drives • EXP3512 (2U 12 3.5-inch drives) and EXP3524 (2U 24 2.5-inch drives) enclosures, which can be intermixed behind a DS3500 Express enclosure
Fans & power supplies	Dual redundant, hot-swappable
Rack support	2U, 19 in., industry-standard rack
Management software	IBM System Storage DS Storage Manager

- DS3500 Express details on PartnerWorld
- DS3500 Express details on IBM.com
- DS3500 Express competitive info on COMP
- DS3500 blog search
- DS3500 Twitter search

DS3512 Product Tour

DS3524 Product Tour

Figure D.1. IBM System Storage DS3500 Express at a glance (and links to more detail).

approach to storage, the DS3500 Express is a cost-effective, fully integrated complement to IBM System x servers, IBM BladeCenter, and IBM Power Systems. By offering substantial improvements at a price that fits most budgets, the DS3500 Express delivers superior price/performance ratios, functionality, scalability, and ease of use for the entry-level storage user.

Building on the solid foundation of 3 Gbps SAS technology, 6 Gbps SAS is the enterprise version of SAS. This 6 Gbps SAS offers increased performance, scalability, and reliability enhancements to support the ever-increasing reliance on information, while delivering the outstanding value that organizations demand.

Here are some quick DS3500 Express facts:

- Deliver mid-range performance and scalability at entry-level prices
- Leverage built-in management expertise in intuitive and powerful storage management software
- Deliver simplified data protection management and automated recovery
- Support Enhanced Global Mirroring over IP and/or Fibre Channel
- Deliver continuous data security with full disk encryption and support highperforming solid-state drives (SSDs)
- Ensure data integrity with support for the T10 Protection Information (T10-PI) standard

- Comply with Network Equipment Building System (NEBS) and European Telecommunication Standards Institute (ETSI) and support 48 V DC power supplies.

DCS3700

The IBM System Storage DCS3700 storage system (Figure D.2) is ready to meet the challenge. Designed for applications with high-performance streaming data requirements, DCS3700 offers optimal space utilization, low power consumption, and high performance. By combining proven IBM storage controllers with up to 60 drives in just 4U of rack space, DCS3700 can reduce operational costs for capacity-intensive applications.

DCS3700 provides a simple, efficient, and flexible approach to storage that is based on seven generations of design knowledge and firmware development. DCS3700 can act as a cost-effective, fully integrated complement to IBM System x, IBM BladeCenter, and IBM Power Systems servers for a wide variety of intensive computing environments.

Here are some quick DCS3700 facts:

- Gain fast, highly available, dense storage capabilities at an affordable price
- Deliver simplified data protection management and automated recovery with Dynamic Disk Pooling (DDP)
- Improve backup and restore capabilities with enhanced IBM FlashCopy technology
- Achieve solid uptime, massive scalability, and green efficiencies

Specifications

Models	DCS3700 storage system DCS3700 with Performance Modules storage system DCS3700 expansion unit
RAID controller	Dual-active, intelligent controllers
Cache	Base DCS3700 storage system: 4 GB cache (2 GB per controller) with field or plant upgrades to 8 GB (4 GB per controller) DCS3700 with Performance Modules storage system: 12, 24 or 48 GB (6, 12, 24 GB per controller)
Drive interface	Two 6 Gbps SAS drive ports
Data protection levels	Single controller subsystem: One 6 Gb SAS drive expansion port Dual controller subsystem: Two 6 Gb SAS drive expansion ports
Software features	Base DCS3700 storage system: Thin provisioning with DDP, 128 storage partitions, 32 Enhanced FlashCopy images, host-attachment support for Microsoft Windows and Linux on x86/IBM POWER, IBM AIX, Mac OS and Solaris DCS3700 with Performance Modules: Thin provisioning with DDP, 512 storage partitions, 32 Enhanced FlashCopy images, host-attachment support for Windows and Linux on x86/POWER, AIX, Mac OS and Solaris
Maximum drives supported	Thin provisioning with DDP, 128 storage partitions, 32 Enhanced FlashCopy images, host-attachment support for Microsoft Windows and Linux on x86/IBM POWER, IBM AIX, HP-UX, Solaris and MAC OS
Maximum drives supported	Base DCS3700 storage system: Up to 180 drives per system with the attachment of two DCS3700 expansion units (60 drives per enclosure), 20 drives minimum drive quantity per enclosure* DCS3700 with Performance Modules: Up to 360 drives per system with the attachment of five DCS3700 expansion units (60 drives per enclosure), 20 drives minimum drive quantity per enclosure*
Fans & power supplies	Two each per enclosure
Rack support	Slim 4U, 19-inch rack mount enclosure
Management software	System Storage DS Storage Manager

- DCS3700 Express details on PartnerWorld
- DCS3700 details on IBM.com
- DCS3700 Express competitive info on COMP
- DCS3700 blog search
- DCS3700 Twitter search

Figure D.2. IBM System Storage DCS3700 Express at a glance (and links to more detail).

- Help optimize the flow of large, file-based data while retaining ease-of-data access
- Leverage multi-level data protection using a mix of replication features
- Ensure data integrity with support for the T10 Protection Information (T10-PI) standard
- Leverage management expertise built into intuitive and powerful storage management software
- Help optimize the flow and management of large, file-based data while retaining ease-of-data access when combined with best-in-class IBM General Parallel File System (IBM GPFS)
- Achieve superior serviceability and easy installation with front-load, 12-drive drawers that can be extended while the drives remain active, allowing for individual drive replacement without affecting the operation of other drives
- Utilize multi-level data protection with IBM Enhanced FlashCopy, Volume Copy, and optional disaster recovery features across Fibre Channel or IP networks
- Save energy costs today and tomorrow by deploying a high-density enclosure, power supplies designed with multiple efficiency standards, and variable-speed fans
- Reduce overall operation and acquisition costs with mixed host interfaces that support IBM DB2 Administration Server and storage area network tiering
- Support low-power, highly reliable, and high-performance SSDs.

EXP2500 Express Expansion Unit

IBM has combined best-of-breed development with leading 6 Gbps host interface and drive technology in the IBM System Storage EXP2500 Express (Figure D.3), a cost-effective, fully integrated complement to IBM System x and IBM BladeCenter servers. Offering substantial improvements at a price that will fit most budgets, the EXP2500 Express delivers superior price-to-performance ratios, functionality, scalability, and ease-of-use for the entry-level storage user.

Easy to manage, flexible, and extendable, IBM System Storage EXP2500 Express is designed to work as a direct-attached external disk storage solution for IBM System x and IBM BladeCenter servers using ServeRAID controllers. EXP2500 Express helps organizations enhance capacity seamlessly to address their current and future data needs.

EXP2500 Express is a performance-oriented SAS platform designed to increase both bandwidth and throughput with next-generation storage technology. It also includes support for IPv6, meeting the latest government requirements to help ensure compliance.

Here are some quick EXP2500 facts:

- Based on 6 Gbps SAS interface connectivity, IBM System Storage EXP2500 Express provides an affordable external disk solution for direct attachment to IBM System x and IBM BladeCenter servers via ServeRAID controllers
- Get flexible support for high-performance and nearline disk drives, as well as solid state drives (SSDs)

Specifications

Model	1747-HC1 (PN 174712X)—System Storage EXP2512 Express Storage Enclosure; 1747-HC2 (PN 174724X)—System Storage EXP2524 Express Storage Enclosure
RAID controller	EXP2500 Express supports: Direct attachment to selected System x servers using: • IBM ServeRAID M5025 SAS/SATA Controller (part number 46M0830) • IBM ServeRAID M5120 SAS/SATA Controller (PN 81Y4478) Direct attachment to select BladeCenter servers using: • BladeCenter SAS Connectivity Module (part number 39Y9195) • IBM ServeRAID MR10ie (CIOv) Controller (part number 46C7167)
Drive interface	SAS
Supported drives	EXP2512: 300 GB, 450 GB and 600 GB 15k rpm 6 Gbps SAS 3.5-inch HDD 1 TB, 2 TB, 3 TB and 4 TB 7.2k rpm 6 Gbps SAS nearline 3.5-inch HDD* EXP2524: 146 GB and 300 GB 15k rpm 6 Gbps SAS 2.5-inch HDD 600 GB, 900 GB and 1.2 TB 10k rpm 6 Gbps SAS 2.5-inch HDD 1 TB 7.2k rpm 6 Gbps SAS nearline 2.5-inch HDD 200 GB and 400 GB 6 Gbps SAS 2.5-inch SSD
RAID levels	Supports RAID levels supported by ServeRAID Controllers: Standard 0, 1, 10, 5, 50; Optional 6, 60
Maximum drives supported	12 in the EXP2512 enclosure 24 in the EXP2524 enclosure
Fans & power supplies	Two hot-swappable 515 watt (115–230 V ac) power supplies
Rack support	19" industry-standard rack

- EXP2500 info on PartnerWorld
- EXP2500 info on IBM.com

Figure D.3. IBM System Storage EXP2500 Express at a glance (and links to more detail).

- Improve scalability with a high-density 2U enclosure that supports up to 12 3.5-inch disk drives on IBM System Storage EXP2512 Express and 24 2.5-inch disk drives on IBM System Storage EXP2524 Express
- Deliver high availability and reliability with dual-AC power supplies and fans.

EXP3500 Express Expansion Unit

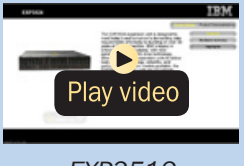
The IBM System Storage EXP3500 Express (Figure D.4) consists of two models—EXP3512 and EXP3524 expansion units—designed to affordably meet the demanding data requirements of today and tomorrow by building on more than 30 years of design expertise. The IBM legacy in enterprise storage systems, with 6 Gbps SAS drive technology, enables the System Storage EXP3500 expansion units to deliver best-of-breed technology, reliability, and performance. EXP3500 expansion units are 2U cabinet-mountable 6 Gbps drive enclosures that are designed to support either a total of 12 3.5-inch SAS drives (EXP3512) or 24 2.5-inch SAS drives (EXP3524) for optimal flexibility and efficiency. EXP3500 expansion units can be a key component of a high-performance storage solution. With each external SAS port on the environmental service module (ESM) supporting a 6 Gbps x4-wide connection, EXP3500 can achieve excellent throughput to the host.

With global commerce and 24×7 information available on demand, businesses require continuous access to information in order to be productive, competitive, and able to ensure customer satisfaction. EXP3500 expansion units offer the assurance of high availability with redundant power supplies

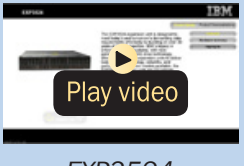
Specifications

Part number	1746A2E – EXP3512 Express 1746A4E – EXP3524 Express
Drive interface	6 Gbps SAS
Supported drives	6 Gbps SAS 3.5” drives: • 300 GB, 450 GB, and 600 GB 15k rpm • 2 TB, 3 TB, and 4 TB 7.2k rpm nearline 6 Gbps SAS 2.5” drives: • 146 GB 15k rpm • 300 GB 10k rpm • 300 GB 15k rpm • 600 GB 10k rpm • 900 GB 10k rpm • 1 TB 7.2k rpm nearline • 300 GB 10k rpm SED Solid-state SAS 2.5” drives: • 200 GB and 400 GB SSD
Maximum drives supported	EXP3512—12 3.5" drives; EXP3524—24 2.5" drives Scalability up to 192 drives (optional mix of expansion enclosures)
Fans & power supplies	Dual
Rack support	Included standard

- EXP3500 info on PartnerWorld
- EXP3500 info on IBM.com



EXP3512 Product Tour



EXP3524 Product Tour

Figure D.4. IBM System Storage EXP3500 Expansion Unit at a glance (and links to more detail).

and ESMs, which help ensure that contact with the drives continues even in the rare instance of a component failure. With hot-swappable components, you can remove and replace ESMs, power supplies, and drives with minimal or no down-time.

Here are some quick EXP3500 facts:

- Provide a highly available storage system by supporting attachment to the IBM DS3500 Express storage system
- Support high bandwidth and random I/O applications with 6 Gbps x4-wide SAS ports
- Support up to 48 TB of SAS disk storage in a single enclosure and up to 768 TB when fully expanded up to 192 drives
- Provide high-performance SAS, capacity-optimized SAS hard disk drives, self-encrypting drives (SEDs), and solid-state drives (SSDs) with intermixed support
- Help support continuous access to data for data availability 24×7 with redundant components
- Enhance data integrity with support of T10-PI protocol.

DS3950 Express

IBM System Storage DS3950 Express (Figure D.5) is designed to provide lower total cost of ownership, high performance, robust functionality, and unparalleled ease of use.

The advent of 8 Gbps Fibre Channel allows companies to reduce the number of host bus adapters (HBAs) per server and the number of overall ports in their Fibre Channel SAN

Specifications

Models	1814-94H and 1814-98H
RAID controller	Dual active
Cache	Model 94H: 2 GB; Model 98H: 4 GB battery-backed
Host interface	Model 94H: Four 8 Gbps Fibre Channel Model 98H: Four 8 Gbps Fibre Channel and four 1 Gbps iSCSI
Drive interface	4 drive ports—Fibre Channel Switched and Fibre Channel Arbitrated Loop (FC-AL) standard, auto-sensing 2 Gbps/4 Gbps
Supported drives	4 Gbps Fibre Channel: 300 GB, 450 GB and 600 GB 15k rpm 4 Gbps SATA: 1 TB and 2 TB 7.2k rpm 6 Gbps FC-SAS (2.5-inch): 300 GB, 600 GB and 900 GB 10k rpm
RAID levels	0, 1, 3, 5, 6, 10
Storage partitions	4, 8, 16, 64, or 128
Maximum drives supported	112 Fibre Channel, FC-SAS or SATA drives (using 6 EXP395 Expansion Units)
Fans & power supplies	Dual redundant, hot-swappable
Rack support	19" industry-standard rack
Systems management software	IBM System Storage DS Storage Manager version 10.xx
SAN support	IBM Fibre Channel switches and directors (product numbers 2005, 2006, 2109, 2026, 2027, 2031, 2032, 2034, 2042, 2054, 2061 and 2062, and IBM BladeCenter)

- DS3950 Express details on PartnerWorld
- DS3950 Express details on IBM.com
- DS3950 Express competitive info on COMP
- DS3950 Sales Kit on PartnerWorld
- DS3950 blog search
- DS3950 Twitter search

Figure D.5. IBM System Storage DS3950 Express at a glance (and links to more detail).

infrastructure without sacrificing performance, thus saving on both acquisition and operational costs. Additionally, the DS3950 auto-negotiating 8 Gbps Fibre Channel interfaces allow for seamless integration into an existing 2 Gbps or 4 Gbps infrastructure, while providing organizations with investment protection going forward when the SAN standard increases to 8 Gbps.

The design of DS3950 avoids over-configuration for an affordable, entry-point price, while also offering seamless pay-as-you-grow scalability as requirements change. Its efficient storage utilization lowers raw capacity requirements, and its support for intermixing high-performance and high-capacity drives enables enclosure-based tiered storage. These unique capabilities reduce the number of drives needed to meet performance and capacity demands—resulting in lower acquisition and operational expenditures.

Here are some quick DS3950 facts:

- Simplify storage infrastructure with 8 Gbps Fibre Channel interfaces
- Leverage mixed-host interfaces support (Fibre Channel and iSCSI) for storage area network (SAN) tiering
- Gain balanced performance well-suited for virtualization and consolidation
- Support for intermixing Fibre Channel, SATA and FC-SAS drives enabling cost-effective tiered storage
- Support up to 112 disk drive modules using up to six IBM System Storage EXP395 expansion units.

DS5020 Express

The IBM System Storage DS5020 Express (Figure D.6) is designed to provide low total cost of ownership, high performance, robust functionality, and unparalleled ease of use.

Utilizing 8 Gbps Fibre Channel connections allows companies to reduce the number of host bus adapters per server and the number of overall ports in their Fibre Channel SAN infrastructure without sacrificing performance, thus saving acquisition and operational costs. Additionally, auto-negotiating 8 Gbps Fibre Channel interfaces allow DS5020 Express to integrate seamlessly into an existing 2 Gbps or 4 Gbps infrastructure, while offering investment protection going forward when the SAN inevitably becomes 8 Gbps.

The system is designed to help you avoid over-configuration for an affordable entry-point while offering seamless "pay-as-you-grow" scalability as requirements change. Its efficient storage use is designed to reduce raw capacity requirements. The ability to intermix high-performance and high-capacity drives enables tiered storage in a single enclosure. These unique abilities reduce the number of drives needed to meet performance and capacity demands and can significantly reduce acquisition and operational costs.

Here are some quick DS5020 Express facts:

- Enable storage area network (SAN) tiering with support for mixed Fibre Channel/iSCSI interfaces
- Support virtualization/consolidation with balanced performance
- Support low power, fast solid-state disks (SSDs)

Specifications

Model	1814-20A
RAID controller	Dual active
Cache	4 GB battery-backed
Host interface	Four 8 Gbps Fibre Channel Eight 8 Gbps Fibre Channel Four 8 Gbps Fibre Channel Four 1 Gbps iSCSI
Drive interface	4 drive ports—Fibre Channel Switched and Fibre Channel Arbitrated Loop standard, auto-sensing 2 Gbps/4 Gbps
Supported drives	4 Gbps Fibre Channel full disk encryption (FDE): 300 GB, 450 GB and 600 GB 15k rpm 6 Gbps FC-SAS: 300 GB, 600 GB and 900 GB 10k rpm 6 Gbps FC-SAS FDE: 300 GB and 900 GB 10k rpm FC-SAS: 300 GB 15k rpm FC-SAS FDE: 300 GB 15k rpm SSD*: 200 GB and 400 GB 4 Gbps SATA: 1 TB and 2 TB 7.2k rpm 6 Gbps FC-SAS nearline: 3 TB 7.2k rpm 6 Gbps FC-SAS nearline FDE: 3 TB 7.2k rpm
RAID levels	0, 1, 3, 5, 6, 10
Maximum capacity	Up to 336 TB of FC-SAS nearline physical storage capacity, or up to 224 TB of SATA physical storage capacity, or up to100.8 TB of FC-SAS physical storage capacity, or up to 8 TB of SSD physical storage capacity
Storage partitions	4, 8, 16, 64, or 128 storage partitions
Maximum disk drives	112 Fibre Channel, SED, FC-SAS, FC-SAS nearline, SSD or SATA drives (using 6 EXP520 expansion units)

- DS5020 Express details on PartnerWorld
- DS5020 Express details on IBM.com
- DS5020 Express competitive info on COMP
- DS5020 enhancements announced
- DS5020 blog search
- DS5020 Twitter search

Figure D.6. IBM System Storage DS5020 Express at a glance (and links to more detail).

- Secure data throughout the drive's lifecycle with self-encrypting drives (SEDs)
- Intermix Fibre Channel, SED, SATA, FC-SAS, FC-SAS nearline and SSDs for cost-effective tiered storage
- Maximize use and minimize storage total cost of ownership with feature-rich management software
- Ensure confidence with key application certifications
- Support IBM AIX and IBM Power Systems T10-PI Data
- Integrity Initiative.

DS5000 series

The IBM System Storage DS5000 series (Figure D.7) is designed to meet the demanding open-systems requirements of today—and tomorrow—while establishing a new standard for life cycle longevity. Building on many decades of design expertise, the DS5000 storage system's architecture delivers industry-leading performance, real reliability, multidimensional scalability, and unprecedented investment protection. DS5000 supports IBM AIX and IBM Power Systems T10-PI Data Integrity Initiative.

More on the Web

- EXP5000 details on PartnerWorld

DS5000 storage systems are equally adept at supporting transactional applications such as databases and online transaction processing (OLTP), throughput-intensive applications such as high-performance computing (HPC) and rich media, and concurrent workloads for consolidation and virtu-

Specifications

Model	DS5100 -1818-51A, DS5300 -1818-53A
RAID Controller	Dual active
Cache	Up to a total of 64 GB cache • Options include 4 GB, 8 GB, 16 GB, and 32 GB of cache per controller • Dedicated cache mirroring channels • Persistent cache backup in the event of a power outage • Field-upgradable
Host interface	DS5100: • 8 × 4/8 Gbps Fibre Channel host interface cards (4 Gbps cards auto-negotiate to 1 Gbps, 2 Gbps and 4 Gbps speeds; 8 Gbps cards auto-negotiate 2 Gbps, 4 Gbps and 8 Gbps speeds) • 1 Gbps iSCSI—dual ported (sixteen total host ports) • 10 Gbps iSCSI—dual ported (eight total host ports) DS5300: • Up to 16 × 4/8 Gbps host interface cards (4 Gbps cards auto-negotiate to 1 Gbps, 2 Gbps and 4 Gbps speeds; 8 Gbps cards auto-negotiate 2 Gbps, 4 Gbps and 8 Gbps speeds) • 1 Gbps iSCSI—dual ported (16 total host ports) • 10 Gbps iSCSI—dual ported (8 total host ports)
Drive interface	Sixteen 4 Gbps Fibre Channel drive interfaces support up to: • 28 EXP5000 drive enclosures or 8 EXP5060 drive enclosures
Supported drives with EXP5060	SATA: 1 TB and 2 TB 7.2k rpm FC-SAS nearline: 3 TB 7.2k rpm
RAID levels	RAID 0, 1, 3, 5, 6, and 10
Storage partitions	8, 16, 32, 128, 256, or 512 storage partitions
Maximum drives supported	448 drives maximum with use of 28 EXP5000s or EXP810s, or a mixture of both (not to exceed 28); 480 drives with EXP5060

- DS5000 details on PartnerWorld
- DS5000 details on IBM.com
- DS5000 Sales Kit on PartnerWorld
- DS5000 competitive info on COMP
- DS5000 blog search
- DS5000 Twitter search

Figure D.7. IBM System Storage DS5000 series at a glance (and links to more detail).

alization. With relentless performance and superior reliability and availability, DS5000 series storage systems can support the most demanding service level agreements (SLAs) for the most common operating systems, including Microsoft Windows, UNIX, Linux, and Apple Macintosh. When requirements change, you can add or replace host interfaces, grow capacity, add cache, and reconfigure the system on the fly—ensuring that it will keep pace with your growing organization.

Here are some quick DS5000 facts:

- Provide balanced performance—up to 700,000 input/output operations per second (IOPS) and 6,400 MB/s—that is well-suited for virtualization and consolidation
- Scale up to 448 drives (1.34 PB) using the EXP5000 enclosure and up to 480 drives (1.44 PB) of high-density storage with the EXP5060 enclosure
- Allow for intermixing drive types (Fibre Channel, FC-SAS, FC-SAS nearline, self-encrypting drives [SEDs], SATA and solid-state drives [SSDs]) and host interfaces (Fibre Channel and iSCSI) for investment protection and cost-effective tiered storage
- Support high availability with hot-swappable components and nondisruptive firmware upgrades.

EXP5000 Drive Enclosure

The EXP5000 drive enclosure is more than "just a bunch of disks." The enclosure is designed to optimize performance, availability, and serviceability by offering:

- 4 Gbps Fibre Channel interfaces for connectivity

- Up to 16 dual-ported Fibre Channel, FC-SAS, FC-SAS nearline, SED, SSDs or SATA disk drives that are intermixable in the same enclosure
- An environmental service module (ESM)-embedded "loop switch"
- Redundant 4 Gbps Fibre Channel drive loops to ensure complete accessibility to all drives in the event of a loop or cable failure
- Redundant power supplies, cooling fans, and ESMs
- A 24×7 four-hour response warranty.

All primary components are hot-swappable and can be easily accessed, removed, or replaced.

EXP5060 Storage Expansion Unit

The IBM System Storage EXP5060 Expansion Unit (Figure D.8) offers tremendous storage density and significant operational savings for data-intensive applications and other environments that store vast amounts of data.

The 60-drive EXP5060 expansion unit provides up to three times greater storage density than traditional drive enclosures, which means a 1.44 PB DS5000 series system can now reside in a standard 19-inch rack. The highly efficient power supplies and cooling fans enable the EXP5060 to reduce power consumption and increased density reduces floor space requirements by up to 50 percent when compared to previous generation enclosures.

Specifications

Models	1818G1A
Supported drives	SATA: 1 TB, 2 TB, 3 TB
Maximum drives supported	60 SATA drives
Fans & power supplies	Dual redundant
Rack support	Yes
Size	4U
Supported systems	DS5300/DS5100
Capacity	Up to 180 TB per 4U 60-drive enclosure
High-availability	Supports individual drive replacement while others remain active
Operational efficiency	Reduces rack space by up to 50 percent
Serviceability	Individual extension of 12-drive drawers eliminates excessive weight on the front of the rack
Supported disk systems	DS5300 and DS5100
Warranty	One year limited warranty; CRU and on-site service, 24 hours per day, 7 days a week, 6 hour average

- EXP5060 details on PartnerWorld
- EXP5060 details on IBM.com

Figure D.8. IBM System Storage EXP5060 Expansion Unit at a glance (and links to more detail).

Here are some quick EXP5060 facts:

- Designed to expand the capacity of the DS5000 series storage systems and supports up to 60 SATA drives in just 4U of rack space—reducing the physical footprint by up to 50 percent
- Reduces power consumption with an intelligent design and high-efficiency power supplies
- Offers uninterrupted data availability, with online serviceability of individual drives
- Eliminates excessive front weight on the rack, with individual extension of 12-drive drawers.

EXP520/EXP395 Storage Expansion Unit

The EXP520 and EXP395 (Figure D.9) are the disk drive enclosures for the DS5020 and DS3950 disk systems respectively. These 3U enclosures have 4 Gbps Fibre Channel (FC) interfaces and supports up to 16 disk drives. The EXP520 and EXP395 Storage Expansion Units are designed to accommodate 4 Gbps Fibre Channel Enhanced Disk Drive Modules (E-DDM), and 4 Gbps Serial ATA Enhanced Disk Drive Modules (E-DDM). It support redundant AC power and cooling modules and ESM interfaces, and are available in a 19-inch rack mount package.

Storwize V3700

IBM Storwize V3700 (Figure D.10) is designed to provide small and mid-size organizations with the ability to consolidate and share data at an affordable price, while leveraging

- EXP520 details on PartnerWorld
- EXP520 enhancements announced
- EXP395 details on PartnerWorld
- EXP395 enchancements announced

Figure D.9. IBM System Storage EXP520/EXP395 Storage Expansion Units at a glance (and links to more detail).

advanced software capabilities usually found in more expensive systems. Providing up to 120 drives of capacity, Storwize V3700 delivers proven ease of management, functionality, and interoperability.

Storwize V3700 comes with an easy-to-use management interface based on the breakthrough Storwize family graphical user interface (GUI). With dynamic and customizable views, the interface is designed to give administrators intuitive control of the system, while interactive menus, tabs, and charts can also help improve productivity.

Using thin provisioning, applications consume only the space they are actually using, versus the total space that they have been allocated. Designed to keep business overhead low, thin provisioning optimizes efficiency by allocating disk storage space in a flexible manner among multiple users, based on the minimum space required by each user at

Specifications

Host interface	1 Gbps iSCSI and 6 Gbps SAS (optional 8 Gbps Fibre Channel, 1 Gbps iSCSI, 6 Gbps SAS or 10 Gbps iSCSI/Fibre Channel over Ethernet)
User interface	Storwize V3700 graphical user interface
Single/dual controller	Dual controller
Cache per controller	4 GB upgradable to 8 GB
Drive type	Dual-port, hot-swappable 6 Gb SAS disk drives
Supported drives	Small form-factor (SFF) 2.5-inch disk drives: 146 GB, 300 GB at 15k rpm; 300 GB, 600 GB, 900 GB and 1.2 TB at 10k rpm; 500 GB, 1 TB at 7.2k rpm SAS nearline Large form-factor (LFF) 3.5-inch disk drives: 2 TB, 3 TB, and 4 TB at 7.2k rpm; 900 GB and 1.2 TB at 10k rpm; 300 GB at 15k rpm SSD drives: 200 GB and 400 GB
RAID levels	RAID 0, 1, 5, 6, 10
Maximum drives supported	SFF enclosure: 24 x 2.5" drives LFF enclosure: 12 x 3.5" drives
Fans & power supplies	Fully redundant, hot-swappable
Rack support	Standard 19" rack-mount enclosure
Management software	Storwize V3700 machine code
Advanced functions included with each system	Internal virtualization, thin provisioning, one-way data migration and FlashCopy (up to 64 targets)
Optional licensed functions	FlashCopy upgrade (up to 2,040 targets), Easy Tier, Remote Mirror and turbo performance

- Storwize V3700 info on PartnerWorld
- Storwize V3700 info on IBM.com
- Storwize V3700 competitive info on COMP
- Storwize V3700 blog search
- Storwize V3700 Twitter search

IBM Storwize V3700 overview (2:30)

Figure D.10. IBM Storwize V3700 at a glance (and links to more detail).

any given time. This can help organizations save power, lower heat generation, and reduce hardware space requirements.

Here are some quick Storwize V3700 facts:

- Easily manage and deploy storage using a breakthrough graphical user interface
- Gain efficiency with internal storage virtualization and high-performance thin provisioning
- Have continuous access to data with integrated nondisruptive migration
- Improve network utilization for remote mirroring with innovative replication technology
- Optimize costs for mixed workloads, with up to three times performance improvement with only 5 percent flash storage capacity using IBM Easy Tier
- Comply with Network Equipment Building System (NEBS) Level 3 and European Telecommunication Standards Institute (ETSI) specifications.

Storwize V5000

Storwize V5000 (Figure D.11), the latest addition to the family, is a virtualized, flexible, easy-to-use solution that enables mid-size organizations with complex storage and scalability needs to overcome storage challenges. As an intermediate offering, Storwize V5000 is designed to help consolidate and provide new capabilities to existing storage infrastructures. And because of its flexible licensing options, Storwize V5000

Specifications

Host interface	1 Gb iSCSI, 6 Gb SAS, and 8 Gb Fibre Channel or 10 Gb iSCSI/FCoE
User interface	Graphical User Interface (GUI)
Single/dual controller	Dual
Maximum cache	32 GB (with two-way clustered systems)
Drive type	Dual-port, hot-swappable, 6 Gb SAS disk drives
Supported drives	Small form factor 2.5-inch disk drives: • 146 GB, 300 GB @ 15k rpm • 600 GB, 900 GB, 1.2 TB @ 10k rpm • 1 TB @ 7.2k rpm SAS nearline Large form factor 3.5-inch disk drives: • 300 GB @ 15k rpm, SAS 2.5-inch • 900 GB, 1.2 TB @ 10k rpm, SAS 2.5-inch • 2 TB, 3 TB, 4 TB @ 7.2k rpm SSD 2.5-inch drives: • 200 GB, 400 GB, 800 GB
RAID levels	RAID 0, 1, 5, 6, 10
Maximum drives supported	Up to six Storwize V5000 expansion enclosures (maximum of 168 drives per system and 336 drives in two-way clustered systems): Small form factor enclosure: 24 x 2.5-inch drives Large form factor enclosure: 12 x 3.5-inch drives
Fans & power supplies	Fully redundant, hot-swappable
Rack support	Standard 19-inch rack-mount enclosure
Management software	IBM Storwize family software for Storwize V5000
Advanced features included with each system	Embedded GUI, Dual-system clustering, Virtualization of internal storage, Thin provisioning, One-way data migration, Interoperability with most major server platforms and operating systems
Optional advanced functions	Easy Tier, External virtualization, FlashCopy, Remote mirroring

- Storwize V5000 info on PartnerWorld
- Storwize V5000 info on IBM.com
- Storwize V5000 competitive info on COMP
- Storwize V5000 blog search
- Storwize V5000 Twitter search

IBM Storwize V5000 overview (6:27)

Figure D.11. IBM Storwize V5000 at a glance (and links to more detail).

is simple to deploy with complementary storage solutions, such as IBM ProtecTIER.

Here are some quick Storwize V5000 facts:

- Higher flexibility: Easily customize your storage system with flexible software options
- New Generation GUI: Simplifies management with industry-leading graphical user interface
- Easy Tier: Helps to increase performance up to three times using only 5 percent flash storage with optional IBM Easy Tier technology
- External virtualization: Consolidates and provides IBM Storwize V5000 capabilities to existing storage infrastructures
- Replication over IP: Improves network utilization for remote mirroring with innovative replication technology
- Clustered systems: Ability for block systems to both scale up and out for performance and capacity.

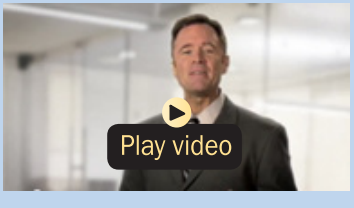
Storwize V7000 and Storwize V7000 Unified Disk System

IBM Storwize V7000 and Storwize V7000 Unified (Figure D.12) are virtualized storage systems that allow businesses to respond to the demands of the rapidly changing marketplace. To complement virtualized server environments, the IBM solutions provide extraordinary performance, availability, advanced functions, and highly-scalable capacity never seen before in midrange disk systems.

Specifications

Host interface	SAN-attached 8 Gbps Fiber Channel (FC) , 1 Gbps iSCSI and optional 10 Gbps iSCSI/FCoE, NAS-attached 1 Gbps and 10 Gbps Ethernet
User interface	Graphical User Interface (GUI)
Supported drives	3.5" disk drives: • 2 TB, 3 TB, 4 TB 7.2k Nearline SAS disk 2.5" disk drives: • 146 GB, 300 GB 15k SAS disk • 300 GB, 600 GB, 900 GB 1.2 TB 10k SAS disk • 200 GB, 400 GB E-MLC SSD • 1 TB 7.2k Nearline SAS disk
RAID levels	RAID 0, 1, 5, 6, 10
Maximum drives supported	240 per control enclosure; 960 per clustered system
Fans & power supplies	Fully redundant, hot-swappable
Rack support	19" industry standard
Management software	IBM Storwize V7000 and Storwize V7000 Unified Software
Cache per controller/ control enclosure/clustered system	8 GB/16 GB/64 GB
Advanced features included with each system	System Storage Easy Tier, FlashCopy, thin provisioning, Active Cloud Engine (Storwize V7000 Unified only)

- Storwize V7000 portal on PartnerWorld
- Storwize V7000 Express details on IBM.com
- Storwize V7000 competitive info on COMP
- Storwize V7000 blog search
- Storwize V7000 Twitter search
- FastBack for Storwize V7000



IBM Storwize V7000 overview (6:27)

Figure D.12. IBM Storwize V7000 and Storwize V7000 Unified Disk Systems at a glance (and links to more detail).

As members of the Storwize family, Storwize V7000 and Storwize V7000 Unified are powerful midrange disk systems that have been designed to be easy to use and to enable rapid deployment without additional resources. Storwize V7000 supports block workloads, whereas Storwize V7000 Unified consolidates block and file workloads into a single storage system for simplicity of management and reduced cost.

Storwize V7000 and Storwize V7000 Unified offer greater efficiency and flexibility through built-in flash storage optimization, thin-provisioning technologies, and integrated Bridgeworks SANSlide technology that helps optimize network bandwidth for remote mirroring. Integrated Real-time Compression enhances efficiency even further by enabling organizations to store up to five times as much active primary data in the same physical disk space. Storwize V7000 and Storwize V7000 Unified advanced functions also enable nondisruptive migration of data from existing storage, simplifying implementation and minimizing disruption to users. Finally, these systems also enable you to virtualize and reuse existing disk systems, supporting a greater potential return on investment (ROI).

Here are some quick Storwize V7000 facts:

- Deliver sophisticated enterprise-class storage functionality for businesses
- Support your growing business requirements while controlling costs
- Provide up to three times performance improvement by moving as little as five percent of data to flash storage

- Enable storing up to five times more active data in the same physical disk space using IBM Real-time Compression with Storwize V7000 (Block)
- Improve network utilization for remote mirroring with innovative replication technology
- Consolidate block and file storage for simplicity, greater efficiency, and ease of management
- Enable near-continuous availability of applications.

Flex System V7000 Storage Node

IBM Flex System V7000 Storage Node (Figure D.13) is a powerful block storage system designed to enable exceptionally rapid storage deployment and breakthrough management simplicity through full integration with IBM compute, storage, networking, virtualization, and management infrastructures.

IBM PureFlex System and IBM Flex System represent a new category of computing that integrates multiple server architectures, networking, storage, and system management capabilities into a single system that is easy to deploy and manage. These next-generation integrated systems support open industry standards—such as operating systems, networking and storage fabrics, virtualization, and system management protocols—to easily fit within existing and future data center environments. IBM PureFlex System and IBM Flex System solutions are scalable and extendable with multi-generation upgrades to protect and maximize IT investments.

Flex System V7000 Storage Node is built on the industry-leading storage virtualization and efficiency capabilities of IBM

Specifications

Host interface	SAN-attached 8 Gbps Fiber Channel, 10 Gigabit Ethernet (GbE) FCoE and iSCSI host connectivity
Cache per controller/control enclosure/clustered system	8 GB/16 GB/64 GB
Supported drives	2.5-inch disk drives: 500 GB and 1 TB 7.2k nearline SAS; 146 GB and 300 GB 15k SAS; 300 GB, 600 GB, 900 GB and 1.2 TB 10k SAS; 200 GB and 400 GB enterprise multi-level cell (E-MLC) SSD
RAID levels	RAID 0, 1, 5, 6, 10
Maximum drives supported	240 per control enclosure; 960 per clustered system
Chassis support	IBM Flex System Enterprise Chassis
Management software	IBM Flex System Manager
Advanced features included with each system	8 GB/16 GB/64 GB
Advanced features included with each system	System Storage Easy Tier, IBM FlashCopy, internal virtualization and thin provisioning, data migration, system clustering
Optional features	Remote mirroring, Real-time Compression, external virtualization

- Flex System V7000 Storage Node info on PartnerWorld
- Flex System V7000 Storage Node info on IBM.com
- Flex System V7000 Storage Node competitive info on COMP
- Flex System V7000 Storage Node blog search
- Flex System V7000 Storage Node Twitter search

Figure D.13. IBM Flex System V7000 Storage Node at a glance (and links to more detail).

Storwize V7000 while being physically integrated into PureFlex System or Flex System solutions.

Here are some quick Flex System V7000 Storage Node facts:

- Automate and speed deployment with integrated storage for IBM PureFlex System or IBM Flex System
- Simplify management with an integrated, intuitive user interface
- Reduce network complexity with FCoE and iSCSI connectivity
- Store up to five times more active data in the same disk space using IBM Real-time Compression
- Virtualize third-party storage for investment protection
- Optimize costs for mixed workloads, with up to three times better performance with only 5 percent flash storage capacity using IBM Easy Tier
- Improve network utilization for remote mirroring with innovative replication technology.

DS8000 series (DS8870)

DS8870 is a high-performance, high-capacity, secure storage system designed to deliver the highest levels of performance, flexibility, scalability, resiliency, and total overall value for the most demanding, heterogeneous storage environments (Figure D.14).

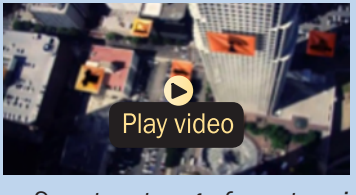
Smarter storage, such as IBM DS8870, can help organizations simplify their storage environments to spend less time

Specifications

Models	DS8870 (961, 96E)
Shared SMP processor configuration	IBM POWER7/POWER7+ dual 2-core, 4-core, 8-core or 16-core*
Other major processors	IBM PowerPC, ASICs
Processor memory for cache and non-volatile storage (min./max.)	16 GB/1024 GB
Host adapter interfaces	4- and 8-port 8 Gbps Fibre Channel/FICON
Host adapters (min./max.)	2/16
Host ports (min./max.)	8/128
Drive interface	6 Gbps point-to-point switched SAS-2 connection to an 8 Gbps Fibre Channel backbone
Number of disk drives (min./max.)	8/1,536 (small-form factor) 8/768 (large-form factor)
Drive adapters	Up to 16 4-port, 8 Gbps Fibre Channel
Maximum physical storage capacity*	3,072 TB
Disk sizes	400 GB flash drives: 146 GB (15k rpm), 300 GB (15k rpm), 600 GB (10k rpm), 900 GB (10k rpm)‡ 1,200 GB (10k rpm), 3 TB (7.2k rpm and 3.5-inch form factor)‡, 4 TB (7.2k rpm and 3.5-inch form factor)
RAID levels	5, 6, 10

* IBM POWER7 controller processors will be withdrawn December 6, 2013.
† Usable capacity depends on factors such as data format, RAID level and spare disks configured.
‡ The 900 GB (10k rpm) and 3 TB (7.2k rpm) drive options will be withdrawn December 6, 2013.

- DS8000 Sales Kit on PartnerWorld
- DS8000 details on IBM.com
- DS8000 competitive info on COMP
- DS8000 blog search
- DS8000 Twitter search



DS8870 video: Smarter storage for enterprise systems

Figure D.14. IBM System Storage DS8000 series at a glance (and links to more detail).

managing them and more time exploring ways to exploit data to grow their businesses. Quick and reliable data access is the driving force behind real-time business analytics, and this intelligent, high-end IBM system sets the standard for what an enterprise storage system should be with extraordinary performance, reliability, and agility that allows users to make information available exactly where and when it's needed—easily and effectively.

As the latest model in IBM DS8000 series, DS8870 can bring simplicity to your storage environment with self-optimizing performance for both random and sequential application workloads on an extensive variety of distributed server platforms and the mainframe. And with the agility and automation to manage all these workloads simultaneously, DS8870 can greatly reduce the challenge of managing your increasingly complex storage environment as your business requirements change.

DS8870 offers a range of self-tuning features—such as intelligent caching algorithms, automated quality-of-service (QoS) management, and advanced storage tiering—that can even coordinate optimal data placement between the system itself and the enterprise servers attached to it. This is smarter storage for a smarter planet, and for organizations seeking the ultimate in performance and agility, DS8870 is the right choice.

Here are some quick DS8870 Storage facts:

- Achieve extraordinary input/output operations per second (IOPS) and low response times with IBM POWER7+ controllers

- Optimize performance with all-flash and hybrid-flash systems for fast transaction processing and real-time operational analytics
- Deliver extreme system resiliency with full hardware redundancy and advanced business-continuity
- Maximize performance and costs with new drive options, IBM Easy Tier, and other self-optimizing features
- Consolidate storage with high scalability, automated quality-of-service (QoS) management, self-tuning performance, drive tiering, and support for many platforms and application workloads.

DCS3700

The IBM System Storage DCS3700 (Figure D.15) is ready to meet the challenge. Designed for applications with high-performance streaming data requirements, DCS3700 offers optimal space utilization, low power consumption, and high performance. By combining proven IBM storage controllers with up to 60 drives in just 4U of rack space, DCS3700 can reduce operational costs for capacity-intensive applications.

DCS3700 provides a simple, efficient, and flexible approach to storage that is based on seven generations of design knowledge and firmware development. DCS3700 can act as a cost-effective, fully integrated complement to IBM System x, IBM BladeCenter, and IBM Power Systems servers for a wide variety of intensive computing environments.

IBM System Storage DCS3700 with Performance Modules delivers twice the performance and scalability of the stan-

Specifications

Models	DCS3700 storage system; DCS3700 with Performance Modules storage system DCS3700 expansion unit
RAID controller	Dual-active, intelligent controllers
Cache per controller	Base DCS3700 storage system: 4 GB cache (2 GB per controller) with field or plant upgrades to 8 GB (4 GB per controller) DCS3700 with Performance Modules storage system: 6, 12, 24 GB or 48 GB (6, 12, 24 GB per controller)
Host interface	Base DCS3700 storage system: Two 6 Gbps SAS host ports per controller standard with the option to add a daughter card with additional connectivity; Two 6 Gbps SAS ports per optional host interface card; Four 8 Gbps Fibre Channel ports per optional host interface card (includes eight 8 Gb short-wave small form-factor pluggable transceivers); Two 10 Gbps iSCSI ports per optional host interface card DCS3700 with Performance Modules storage system: Four 8 Gbps Fibre Channel host ports per controller with the option to add daughter cards with additional connectivity; Four 8 Gbps Fibre Channel ports per optional host interface card (includes eight 8 Gb shortwave small form-factor pluggable transceivers); Four 6 Gbps SAS ports per optional host interface card; Two 10 Gbps iSCSI ports per optional host interface card
Drive interface	6 Gbps SAS drive ports
Data protection levels	RAID levels 0, 1, 3, 5, 6 and 10 or DDP
Maximum drives supported	Base DCS3700 storage system: Up to 180 drives per system with the attachment of two DCS3700 expansion units (60 drives per enclosure) 20 drives minimum drive quantity per enclosure DCS3700 with Performance Modules: Up to 360 drives per system with the attachment of five DCS3700 expansion units (60 drives per enclosure) 20 drives minimum drive quantity per enclosure
Fans & power supplies	Two each per enclosure
Rack support	Slim 4U, 19" rack mount enclosure
Management software	System Storage DS Storage Manager

- DCS3700 info on PartnerWorld
- DCS3700 info on IBM.com
- DCS3700 competitive info on COMP
- DCS3700 blog search
- DCS3700 Twitter search

Figure D.15. IBM System Storage DCS3700 at a glance (and links to more detail).

dard DCS3700 storage system. Key design features include increased processor speeds and larger cache memory capacities for use in both general-purpose and high-performance computing environments.

DCS3700 with Performance Modules is built on a powerful hardware platform that features a 2.13 GHz quad-core processor and support for up to a 48 GB cache/controller pair with eight 8 Gbps Fibre Channel ports/controller pairs. An additional eight 8 Gbps Fibre Channel host ports, four 10 Gbps iSCSI or eight 6 Gbps SAS ports are supported with optional host interface cards. Drive density increases with up to 360 drives per system allowing more than 1 PB of raw capacity.

Here are some quick DCS3700 facts:

- Gain fast, highly available, dense storage capabilities at an affordable price
- Deliver simplified data protection management and automated recovery with Dynamic Disk Pooling (DDP)
- Improve backup and restore capabilities with enhanced IBM FlashCopy technology
- Achieve solid uptime, massive scalability, and green efficiencies
- Help optimize the flow of large, file-based data while retaining ease-of-data access
- Leverage multi-level data protection using a mix of replication features
- Ensure data integrity with support for the T10 Protection Information (T10-PI) standard.

DCS3860

The IBM System Storage DCS3860 storage system (Figure D.16) delivers the performance and scalability organizations need to succeed in this new era of big data. Designed for high-performance computing applications, DCS3860 supports up to 60 drives in just 4U of rack space—and it can scale up to 360 drives, including up to 24 solid-state drives (SSDs), with the attachment of five expansion units. This high-density system also helps make the most of today's IT budgets by increasing capacity while reducing the storage footprint, power consumption, and related operational costs.

DCS3860 provides a versatile, easy-to-use solution for storage area network (SAN) deployments. It works as a cost-effective, fully integrated complement to IBM System x and IBM BladeCenter servers for a wide variety of intensive computing environments.

Here are some quick DCS3860 facts:

- Expand performance, flexibility, and operational efficiency with scalable, high-density storage systems
- Simplify data protection management and automate recovery tasks with Dynamic Disk Pooling
- Help ensure data integrity with support for the T10 Protection Information (T10 PI) standard.

XIV Storage System

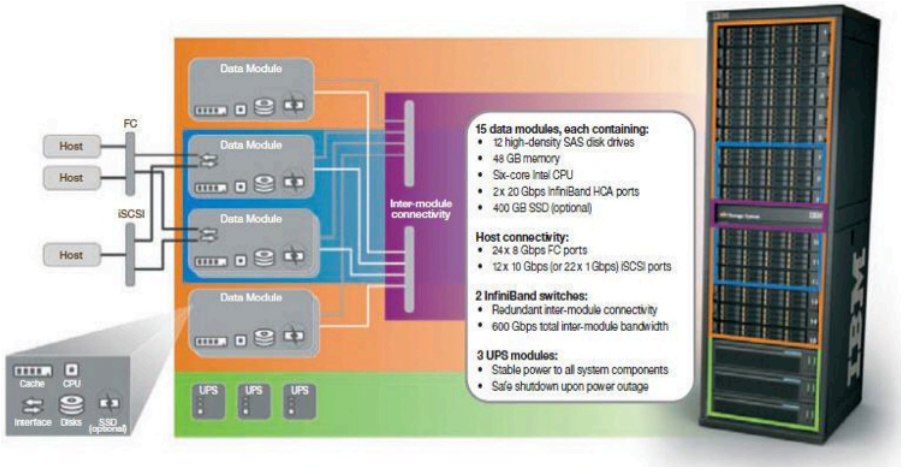
The IBM XIV Storage System (Figure X.1) is high-end disk storage that supports the need for high performance, availability, operational flexibility and security while helping

Specifications

Models	DCS3860 storage system (181386H) DCS3860 storage system (181386C)
RAID controller	Dual-active, intelligent controllers
Cache per controller	12 GB
Host interface	6 Gbps SAS
Drive interface	6 Gbps SAS
Supported drives	3.5-inch, 6 Gbps SAS drives: 4 TB 7.2k rpm nearline HDD 2.5-inch, 6 Gbps SAS drives: 300 GB 15k rpm HDD
RAID levels	0, 1, 3, 5, 6, 10 and Dynamic Disk Pooling
Storage partitions	512
Maximum drives supported	1.44 PB
Fans and power supplies	Two each per enclosure
Rack support	Slim 4U, 19-inch rack mount enclosure
Management software	System Storage DS Storage Manager

- DCS3860 info on PartnerWorld
- DCS3860 info on IBM.com
- DCS3860 competitive info on COMP
- DCS3860 blog search
- DCS3860 Twitter search

Figure D.16. IBM System Storage DCS3860 at a glance (and links to more detail).



- XIV details on PartnerWorld
- XIV info on PartnerWorld
- XIV details on IBM.com
- XIV competitive info on COMP
- XIV configuration and functionality table
- XIV blog search
- XIV Twitter search

Figure X.1. IBM XIV Storage System at a glance (and links to more detail).

minimize costs and complexity. Built optimized to simplify storage, XIV Storage System is enabling thousands of organizations to take control of their storage and gain business insights from their data. Designed for consistent, enterprise-level performance and five-nines availability, XIV storage handles static and dynamic workloads with ease. Never compromising performance for reliability, the XIV grid architecture delivers massive parallelism—resulting in uniform allocation of system resources at all times. XIV storage secures your

data through industry-standard data-at-rest encryption while keeping performance uninterrupted—with key management support by IBM Tivoli Key Lifecycle Manager.

XIV storage sets a new standard for ease of use by automating most tasks and providing an extraordinarily intuitive user interface—and scaling its ease of management to a multi-system XIV environment. An equally rich and comprehensive command line interface (CLI) is provided for tailoring the system to user requirements. IBM XIV Mobile Dashboard enables anytime, anywhere XIV monitoring via iOS- and Android-based devices.

Exceptionally elastic, XIV storage delivers strengths that are an ideal match for the unique requirements of cloud computing. Through IBM Hyper-Scale, XIV offers a new paradigm in scalability for cloud and large deployments.

Here are some quick XIV Storage System highlights:

- Deliver consistent, tuning-free, high performance and remarkable ease of use via a grid-based architecture
- Provide linear scaling up to 325 terabytes (TB) per array and IBM Hyper-S cale for extreme operational agility over multiple systems
- Enable elasticity, open-standards support and mixed-workload affinity for optimized compute clouds and virtualized environments
- Offer high reliability and availability via full redundancy, self-healing, and unprecedented rebuild speed

- Provide compelling data economics through superb price-performance, low-touch and simplified management, footprint density, power efficiency, and all-inclusive software licensing.

SAN Volume Controller

IBM System Storage SAN Volume Controller (SVC) (Figure V.1) is designed to deliver the benefits of storage virtualization in environments from large enterprises to small businesses and midmarket companies.

Organizations of all sizes are faced with a tidal wave of data coming from a myriad new sources, including sensors, social media, mobile platforms, and more. And while the sheer volume of this new data may seem overwhelming, the value of information is stronger than ever—some even consider it the new currency of business. To help maximize the benefits of growing amounts of data, businesses are turning to software-defined environments, which can provide flexibility and responsiveness to business demands—along with higher scalability and greater efficiency.

The IBM Storwize family is the primary IBM storage solution for supporting software-defined environments and virtual infrastructures. Storwize family systems come with a number of built-in functions—such as virtualization, Real-time Compression, and Easy Tier—that enable extraordinary levels of efficiency.

In addition, as the pace of innovation continues to accelerate, the Storwize platform enables rapid integration of new technologies from both IBM and third-party vendors. For example, Storwize family systems now include Bridgeworks

Specifications

Shared SMP processor configuration	One (optionally, two) Intel Xeon 5600 Series six core
Processor memory for cache	24 GB (optionally, 48 GB) per engine
Host adapter interfaces	Four (optionally, eight) 8 Gbps Fibre Channel Two 1 Gbps iSCSI Two 10 Gbps iSCSI/FCoE (optional)
Number of disk drives	Up to four SSD devices per SAN Volume Controller node
Maximum storage capacity	Internal: Up to 6.4 TB raw SSD capacity per I/O group or up to 25.6 TB in an 8-node cluster External: Up to 32 PB usable capacity
Internal SSD sizes	200 GB, 400 GB, 800 GB
RAID levels for internal SSD	0, 1, 5, 6, and 10

- SAN Volume Controller Sales Kit on PartnerWorld
- SAN Volume Controller info on PartnerWorld
- SAN Volume Controller info on IBM.com
- SAN Volume Controller Interactive Demo
- Forrester White Paper: The Total Econonmic Impact of IBM System Storage SAN Volume Controller
- SAN Volume Controller competitive info on COMP
- SAN Volume Controller blog search
- SAN Volume Controller Twitter search

Figure V.1. IBM System Storage SAN Volume Controller at a glance (and links to more detail).

SANSlide technology to help optimize the use of network bandwidth.

Originating at IBM some 40 years ago, virtualization has taken on new life in a variety of contexts: Virtual servers to virtual storage, optimized networks, workstations in virtualized environments, and application virtualization. The potential benefits are far reaching, ranging from increased utilization, business flexibility, and improved productivity to lower total costs of computing and improved reliability. Depending on the starting point, type, and extent of the virtualization implemented, clients can quickly achieve many of these benefits.

Here are some quick SAN Volume Controller facts:

- Enhance storage capabilities with sophisticated virtualization, management, and functionality
- Move data among virtualized storage systems without disruptions
- Store up to five times as much active data in the same physical disk space using IBM Real-time Compression
- Optimize flash storage deployments automatically with IBM System Storage Easy Tier
- Allow for nondisruptive scalability from the smallest configuration to the largest
- Improve network utilization for remote mirroring with innovative replication technology

- Implement stretched configurations for high availability and data mobility between data centers.

N series

IBM System Storage N series multiprotocol storage products provide a wide range of network attachment capabilities to a broad range of host systems, and are designed to integrate network attached storage (NAS) and storage area network (SAN) storage within a single platform by supporting NFS, CIFS, Fibre Channel, iSCSI, HTTP, and FTP protocols.

N3000 Express series

The IBM System Storage N3000 Express systems (Figure N.1) are designed to provide primary and secondary storage for mid-size enterprises, consolidating all of their fragmented application-based storage and unstructured data into one single-code system. Easily managed and expandable, this platform can help IT generalists increase their effectiveness. N3000 Express systems offer integrated data access, intelligent management software, and data protection capabilities—such as those found in higher-end IBM System Storage N series systems—all in a cost-effective package. N3000 Express series innovations include internal controller support for SAS or SATA drives, expandable I/O connectivity, and onboard remote management.

The N3000 Express series is compatible with the entire family of N series storage systems, which features a comprehensive lineup of hardware and software designed to address a variety of possible deployment environments.

Specifications

Product	N3150	N3150	N3220	N3220	N3240	N3240
Machine type-model	2857-A15	2857-A25	2857-A12	2857-A22	2857-A14	2857-A24
Controller configuration	Single	Dual (active/active)	Single	Dual (active/active)	Single	Dual (active/active)
Processor speed and type	Dual-core Intel Xeon 1.73 GHz	Dual-core Intel Xeon 1.73 GHz	Dual-core Intel Xeon 1.73 GHz	Dual-core Intel Xeon 1.73 GHz	Dual-core Intel Xeon 1.73 GHz	Dual-core Intel Xeon 1.73 GHz
Random access memory	6 GB	12 GB	6 GB	12 GB	6 GB	12 GB
Fibre Channel ports (speed)	N/A	N/A	2 (8 Gbps)	4 (8 Gbps)	2 (8 Gbps)	4 (8 Gbps)
Ethernet ports (speed)	4 (1 Gbps) onboard 2 (10 Gbps)	8 (1 Gbps) onboard 4 (10 Gbps)	4 (1 Gbps) onboard 2 (10 Gbps)	8 (1 Gbps) onboard 4 (10 Gbps)	4 (1 Gbps) onboard 2 (10 Gbps)	8 (1 Gbps) onboard 4 (10 Gbps)
Maximum raw capacity	240 TB	240 TB	501 TB	501 TB	576 TB	576 TB
Maximum number of disk drives	60 12 internal	60 12 internal	144 24 internal	144 24 internal	144 24 internal	144 24 internal

- N3000 details on PartnerWorld
- N3000 details on IBM.com
- N3000 competitive info on COMP
- N3000 blog search
- N3000 Twitter search

Figure N.1. IBM System Storage N3000 Express series at a glance (and links to more detail).

Here are some quick N3000 facts:

- Leverage a high-performing and flexible operating system (OS), data management software, and redundancy for continuous operations
- Achieve better data protection and retention with support for disk-based backup with file- or application-level recovery
- Simplify management by performing on-the-fly provisioning with self-diagnosing systems
- Improve versatility through support for concurrent file and I/O block serving over Ethernet and Fibre Channel storage area network (SAN) infrastructures
- Scale SAN and network-attached storage (NAS) to tens of petabytes without reconfiguring running applications, using Clustered Data ONTAP.

N6000 series

With IBM System Storage N6000 series systems (Figure N.2), you can meet your NAS needs and provide high levels of application availability for everything from critical business operations to technical applications. You can also address NAS and SAN as primary and secondary storage requirements. In addition, you get outstanding value—flexible IBM systems offer excellent performance and impressive expandability at a low total cost of ownership.

IBM N series systems enable easy provisioning, managing, and upgrading so you can quickly adapt your storage infrastructure to meet your changing business and techni-

Specifications

Product	N6220	N6220	N6220	N6220	N6250	N6250
Machine type/ model	2858-C15	2658-C25	2858-E15	2858-E25	2858-E16	2858-E26
Gateway machine type model	2858-C15 (with feature code 9551)	2858-C25 (with feature code 9551)	2858-E15 (with feature code 9551)	2858-E25 (with feature code 9551)	2858-E16 (with feature code 9551)	2858-E26 (with feature code 9551)
Controller configuration	Single (C)	Dual (active/active) (CC)	Single + IO Exp (CI)	Dual (active/active) (CI-HA)	Single + IO Exp (CI)	Dual (active/active) (CI-HA)
Processors speed and type	2.3 GHz Intel (Quad Core)	2.3 GHz Intel (Quad Core)	2.3 GHz Intel (Quad Core)	2.3 GHz Intel (Quad Core)	2.3 GHz Intel (Quad Core)	2.3 GHz Intel (Quad Core)
Number of processors (cores)	1	2	1	2	2	4
Random access memory	12 GB	24 GB	12 GB	24 GB	20 GB	40 GB
Non-volatile memory	1.6 GB	3.2 GB	1.6 GB	3.2 GB	2 GB	4 GB

- N6000 details on PartnerWorld
- N6000 details on IBM.com
- N6000 competitive info on COMP
- N6000 blog search
- N6000 Twitter search

Figure N.2. IBM System Storage N6000 series at a glance (and links to more detail).

cal needs. To help you maximize staff productivity, all N series systems use the Data ONTAP operating system and the same suite of application-aware management software. Also, OnCommand enables the consolidation and simplification of shared IT storage management.

N6000 series systems offer a versatile storage platform for handling the large amounts of diverse data moving through your business. With an N6000 series system, you can consolidate varied data sets simultaneously—whether block- or file-based—onto a single storage platform.

With N6000 series, you can unlock the full potential of your growing virtualized server environment by enabling virtual machine mobility and offloading the work of data protection. N6000 systems enable you to connect your heterogeneous server environment (including Microsoft Windows, UNIX, and Linux servers) and clients to one storage system by using standard storage protocols and interfaces.

Here are some quick N6000 facts:

- Increase NAS storage flexibility and expansion capabilities by consolidating block and file data sets onto a single multiprotocol storage platform
- Improve application performance with high-bandwidth, 64-bit architecture, and the latest I/O technologies
- Maximize storage efficiency and growth and preserve staff and capital investments with data-in-place upgrades
- Improve business efficiency by reducing data management complexity in heterogeneous storage environments

- Scale storage-area network (SAN) and NAS to tens of petabytes without disrupting running applications, using Clustered Data ONTAP.

N7000 series

IBM System Storage N7000 series systems (Figure N.3) are designed to help you tackle the challenge of effective data management using virtualization technology and a multiprotocol storage architecture. The N7000 series is designed to deliver high-end enterprise storage and data management capabilities with midrange affordability. Built-in serviceability and manageability features help support your efforts to increase reliability, simplify and merge in a single-code storage infrastructure and maintenance, and deliver exceptional economy.

The N7000 series, like all N series systems, provides powerful virtualization and thin-provisioning capabilities to help you maximize storage utilization while minimizing the use of power, cooling, and floor space. At the same time, you can improve staff productivity with an integrated suite of application-aware manageability software that offers policy-based automation to otherwise manual tasks, improving storage efficiency.

N7000 series can integrate Fibre Channel, SAN, iSCSI SAN, NAS, Fibre Channel over Ethernet (FCoE), primary, nearline, and regulatory compliance data retention and archival storage in a single-code architecture. N7000 series also offers massive expandability to support growth and consolidation. The combination of N series system versatility and simplicity is intended to help you respond quickly to changing business needs.

Specifications

Product	N7950T	N7950T
Machine type model	2867-C20	2867-E22
Gateway machine type model	1 2867-C20 (with feature code 9551)	2867-E22 (with feature code 9551)
Controller configuration	Dual (active/active) (CC)	Dual (active/active)
Processor speed and type	2.26 GHz Nehalem quad-core	2.93 GHz Intel 6-core
Number of processors	4	24
Random access memory	96 GB	192 GB
Nonvolatile memory	4 GB	8 B

- N7000 details on PartnerWorld
- N7000 details on IBM.com
- N7000 competitive info on COMP
- N7000 blog search
- N7000 Twitter search

Figure N.3. IBM System Storage N7000 at a glance (and links to more detail).

Here are some quick N7000 facts:

- Meet growing business needs with a robust and expandable infrastructure designed for nondisruptive expansion to more than 5.7 PB (5,760 TB) storage capacity

- Gain management versatility with simultaneous file serving and block I/O over Ethernet and Fibre Channel SAN infrastructures
- Help ensure that critical workloads get priority service using FlexShare
- Enable near-continuous operations with support for application-level recovery in minutes, not hours
- Scale SAN and network-attached storage (NAS) to tens of petabytes without disrupting running applications, using Clustered Data ONTAP.

N series Software

More on the Web

- N series software info on IBM.com

The IBM System Storage N series also provides a selection of features and functions delivered through software offerings which are designed to provide a comprehensive set of robust management and operational tools as well as high availability features, disaster recover, and data copy services that help the system administration provide a high level of support for environments requiring IP attached storage solutions.

Here are some examples of the many different N series software offerings:

- Data compression
  - Transparent inline data compression to store more data in less space, reducing the amount of storage you need to purchase and maintain

  - Reduces the time and bandwidth required to replicate data during volume SnapMirror transfers

- Deduplication
  - Performs block level data de-duplication on NearStore data volumes
  - Volume data is automatically scanned and deduplicated, resulting in immediate space savings with minimal impact on operations.

- Data ONTAP
  - N series storage operating system provides full-featured data management for both block and file serving environments
  - Single architecture and user interface simplify data management and reduce costs for NAS deployments that support SAN environments.

- Disk sanitization
  - The process of physically obliterating data by overwriting disks with specified byte patterns or random data
  - Helps prevent recovery of current data by any known recovery methods.

- Flash Pool
  - Enables automated storage tiering and combines solid-state drive (SSD) and hard disk drive (HDD) technology

  - Helps to achieve optimal performance and efficiency while lowering the cost of the storage infrastructure.

- FlexCache
  - Creates a flexible caching layer within your storage infrastructure that automatically adapts to changing usage patterns to eliminate bottlenecks
  - Improves application response times for large compute farms, speeds data access for remote users or creates a tiered storage infrastructure that circumvents tedious data management tasks.
- FlexClone
  - Instantaneously creates LUN and volume clones without requiring additional storage
  - Accelerated test and development and storage capacity savings.
- FlexShare
  - Prioritizes storage resource allocation to highest value workloads on a heavily loaded system
  - Ensures that best performance is provided to designated high-priority applications.
- FlexVol
  - Creates flexibly sized LUNs and volumes across a large pool of disks and one or more RAID groups

  - — Fast, simple, and flexible storage provisioning and high-capacity utilization
  - — Regulatory compliance solution for spreadsheets, presentations, and other unstructured application data.
- Gateway
  - — Supports attachment to IBM Enterprise Storage Server series, IBM XIV Storage System, IBM System Storage DS8000, IBM System Storage DS5000 series, and a broad range of IBM, EMC, Hitachi, Fujitsu, and HP storage subsystems.
- MetroCluster
  - — An integrated high-availability/disaster recovery solution for campus and metro-area deployments
  - — Ensures high data availability when a site failure occurs.
- MultiStore
  - — Securely partitions a storage system into multiple virtual storage appliances
  - — Enables secure consolidation of multiple domains and file servers.
- NearStore (near-line)
  - — Increases the maximum number of concurrent data streams (per storage controller)

  - Enhances backup, data protection, and disaster preparedness by increasing the number of concurrent data streams between two N series systems.

- OnCommand
  - Enables the consolidation and simplification of shared IT storage management by providing common management services, integration, security, and role-based access controls delivering greater flexibility and efficiency.

- RAID-DP
  - Double parity bit, RAID protection (N series RAID 6 implementation)
  - Protects against data loss due to double disk failures and media bit errors occurring during drive rebuild processes.

- SecureAdmin
  - Authenticates both the administrative user and the N series system, creating a secure, direct communication link to the N series system
  - Helps protect administrative logins, passwords, and session commands from "cleartext" snooping by replacing rsh and telnet with the strongly encrypted SSH protocol.

- Single Mailbox Recovery for Exchange (SMBR)
  - Enables the recovery of a single mailbox from a Microsoft Exchange Information Store

  - Can extract a single mailbox or email directly in minutes compared to hours with traditional methods
  - Helps eliminate the need for IT staff.
- SnapDrive
  - Provides host-based data management of N series storage from Windows, UNIX, and Linux servers
  - Simplifies host-consistent Snapshot copy creation and automates error-free restores.
- SnapLock
  - Write-protects structured application data files within a volume to provide non-erasable, non-rewriteable disk storage
  - Provides storage enabling compliance with government records retention regulations.
- SnapManager
  - Provides host-based data management of N series storage for databases and business applications (MS Exchange, SAP, Oracle, MS Sharepoint, VMware, and MS Hyper-V)
  - Simplifies application-consistent Snapshot copies, automates error-free data restores, and enables application-aware disaster recovery.
- SnapMirror
  - Enables automatic, incremental data replication between systems: synchronous or asynchronous

  - Provides flexible, space- and network-efficient site-to-site mirroring for disaster recovery and data distribution.

- SnapMover
  - Enables rapid reassignment of disks between controllers within a system without disruption
  - Enables fast, non-disruptive load balancing within an active-active controller system.
- SnapRestore
  - Rapidly restores single files, directories, or entire LUNs and volumes from any Snapshot backup
  - Enables near-instantaneous recovery of files, databases, and complete volumes.
- Snapshot
  - Makes incremental, data-in-place, point-in-time copies of a LUN or volume with minimal performance impact
  - Enables frequent, non-disruptive, space-efficient, and quickly restorable backups.
- SnapValidator
  - Maximizes data integrity for Oracle databases
  - Enhances Oracle database resiliency in compliance with Oracle HARD initiative.
- SnapVault
  - Exports Snapshot copies to another N series system, providing an incremental block-level backup solution

  - Enables cost-effective, long-term retention of rapidly restorable disk-based backups.

- Storage encryption
  - Provides support for self-encrypting disk (SED) drives in N series disk shelf storage and integration with license key managers, including IBM Tivoli License Key Manager.
- SyncMirror
  - Maintains two online copies of data with RAID-DP protection on each side of the mirror
  - Protects against all types of hardware outages, including triple disk failure.

Scale Out Network Attached Storage (SONAS)

IBM Scale Out Network Attached Storage (SONAS) is designed to embrace and deliver cloud storage in the petabyte age (Figure N.4). SONAS can meet today's storage challenges with quick and cost-effective IT-enabled business enhancements designed to grow with unprecedented scale.

SONAS can also deliver storage services that make the supporting technology almost invisible. It allows applications and services to be uncoupled from the underlying infrastructure, enabling businesses to adjust to change quickly. As a result, SONAS can easily integrate with your organization's strategies to develop a more dynamic enterprise.

Organizations with fast-growing, rapidly multiplying file systems are beginning to discover that traditional network-attached storage (NAS)—even clustered NAS—has serious problems. Managing and supporting storage as it scales to millions

Specifications

Host interface	CIFS, NFS, FTP, HTTP
Management software	SONAS software Optional Tivoli Storage Manager client (requires license) Optional Tivoli Productivity Center 5.1 (requires license)
Supported drives	SAS: 300 GB (15k rpm) Nearline SAS: 2 TB and 3 TB (72k rpm) SSD: 200 GB and 400 GB SAS 2.5-inch
RAID levels	RAID 6
Maximum drives supported	7200

- SONAS details on PartnerWorld
- SONAS details on IBM.com
- SONAS competitive info on COMP
- SONAS blog search
- SONAS Twitter search

Figure N.4. IBM Scale Out Network Attached Storage (SONAS) at a glance (and links to more detail).

and billions of active files is extremely complex. When such massive numbers of files require separate file systems connected with many separate servers, operational complexity grows exponentially. Consolidating tens, even hundreds,

of these file servers into high-end scale-out NAS becomes a necessity. This is where SONAS helps. SONAS is designed to scale out to store millions to billions of active files in a single namespace. SONAS offers operational efficiency and administrative savings, combining massive scalability with automated file management to quickly deliver information around the world.

Here are some quick IBM SONAS facts:

- Accommodate capacity growth with scale-out performance for both random-access and streaming file workloads
- Enable ubiquitous access to files between SONAS and IBM Storwize V7000 systems across the globe quickly and cost effectively with IBM Active Cloud Engine, leveraging its disaster recovery and business continuity capacity
- Enable cloud storage via seamless integration with IBM SmartCloud Storage Access
- Lower TCO by up to 40 percent with automated lifecycle management and migration to tape
- Provide gateway option for IBM XIV, IBM System Storage DCS3700, and Storwize V7000 disk systems
- Deliver high performance with a new performance module and twice the drive support with up to 360 drives.

Real-time Compression Appliance STN6500

IBM Real-time Compression Appliance STN6500 (Figure N.5) shrinks primary, online NAS data in real time, without perfor-

Specifications

Models	2452-650
1 GbE ports	16
10 GbE ports	None. See STN6800 for 10 GbE connectivity
Processor	Two 2.4 GHz four-core Intel Xeon processors with QuickPath Interconnect technology
ECC Memory (GB)	72
Storage interface	NAS: Microsoft SMBv1 and SMBv2, CIFS and NFS version
Connectivity	1 GbE
Hot swap components	Power supplies, fan modules, disk
Rack support	2 rack unit form factor
Management software	• Intuitive web GUI • Command line interface (CLI) for management tasks • Comprehensive SNMP MIB providing statistics information and alerts • Active Directory integration supports external Syslog server for sending notifications and audit information
High Availability	• Transparent path failover, when deployed in pairs • Predictive Failure Analysis for hardware components • Link Aggregation (IEEE 802.3ad) • Ethernet Trunking (Cisco EtherChannel)
Warranty	1 year 9 × 5 next business day, upgrade to 24 hour × 7 days a week × 4 hour

- Real-time Compression details on PartnerWorld
- Real-time Compression details on IBM.com

Figure N.5 IBM Real-time Compression Appliance STN6500 at a glance (and links to more detail).

mance degradation. By significantly reducing storage requirements, you can keep up to five times more information online for analytics, use the improved efficiency to reduce storage costs, or achieve a combination of greater capacity and reduced cost. IBM Realtime Compression can deliver improved user response time and overall throughput, because applications spend less time waiting for disk requests.

IBM Real-time Compression Appliance STN6500 effectively increases the capacity of the existing storage infrastructure to help you meet the demands of rapid data growth while also enhancing storage performance and utilization. All IBM Real-time Compression Appliances apply IBM's patented real-time data compression techniques to primary and existing storage, delivering optimization and savings throughout the entire storage life cycle. The result is unprecedented cost savings and return on investment, along with operational and environmental efficiencies.

Here are some quick STN6500 facts:

- Shrink primary NAS data in real time, without performance degradation
- Deploy and administer quickly and easily
- Leverage automated failover option for high-availability environments
- Support 16 1 GbE ports between NAS systems and network switches.

Real-time Compression Appliance STN6800

IBM Real-time Compression Appliance STN6800 (Figure N.6) effectively increases the capacity of the existing storage infrastructure to help you meet the demands of rapid data growth while also enhancing storage performance and utilization. All IBM Real-time Compression Appliances apply IBM's patented real-time data compression techniques to primary and existing storage, delivering optimization and savings throughout the entire storage life cycle. The result is unprecedented cost savings and return on investment, along with operational and environmental efficiencies.

IBM Real-time Compression's patented Random Access Compression Engine (RACE) technology is based on proven Lempel-Ziv (LZ) data compression algorithms. RACE enables IBM Real-time Compression Appliances to deliver real-time, random access, deterministic, and lossless data compression, maintaining reliable and consistent performance and data integrity.

Here are some quick STN6800 facts:

- Shrink primary NAS data in real time, without performance degradation
- Deploy and administer quickly and easily
- Support mixed 10 GbE and 1 GbE environments with flexible port configurations
- Support eight 10 GbE NAS ports for maximum throughput, or four 10 GbE and eight 1 GbE NAS ports for maximum flexibility
- Leverage automated failover option for high-availability environments.

Specifications

Model	2452-680
1 GbE ports	Up to 8
10 GbE ports	8, or 4 with mixed 1 GbE and 10 GbE option
ECC memory (GB)	72
Processor	Two 2.8 GHz six-core Intel Xeon processors with QuickPath Interconnect technology
Host interface	TCP/IP or UDP
Storage interface	NAS: Microsoft SMBv1 and SMBv2, CIFS and NFS version 3
Connectivity	10 GbE and 1 GbE options
Hot swap components	Power supplies, fan modules, disk
Rack support	2 rack unit form factor
Management software	• Intuitive web GUI • Command line interface (CLI) for management tasks • Comprehensive SNMP MIB providing statistics information and alerts • Active Directory integration supports external Syslog server for sending notifications and audit information
High Availability	• Transparent path failover, when deployed in pairs • Predictive Failure Analysis for hardware components • Link Aggregation (IEEE 802.3ad) • Ethernet Trunking (Cisco EtherChannel)

- Real-time Compression STN6800 details on PartnerWorld
- Real-time Compression STN6800 details on IBM.com

Figure N.6. IBM Real-time Compression Appliance STN6800 at a glance (and links to more detail).

Real-time Compression Appliance STN7800

BM Real-time Compression Appliance STN7800 (Figure N.7) increases the effective capacity of the existing storage infrastructure to help users meet the demands of rapid data growth while also enhancing storage performance and utilization. The IBM Real-time Compression Appliance applies patented IBM real-time data compression techniques to primary and existing storage, delivering optimization and savings throughout the entire storage lifecycle. The result is unprecedented cost savings and return on investment, along with operational and environmental efficiencies.

The patented Random Access Compression Engine (RACE) technology used in the IBM Real-time Compression Appliance is based on proven Lempel-Ziv data compression algorithms. RACE enables the appliance to deliver real-time, random-access, deterministic and lossless data compression, maintaining reliable and consistent performance and data integrity.

Here are some quick STN6800 facts:

- Shrink primary network-attached storage (NAS) data in real time, without performance degradation
- Deploy and administer quickly and easily
- Support 10 GbE and 1 GbE NAS ports for maximum flexibility
- Leverage automated failover option for high-availability environments.

Specifications

Model	2452-780
1 GbE ports	16 or 8 with mixed 1 GbE (copper) and 10 GbE (optical) option
10 GbE ports	8 or 4 with mixed 1 GbE (copper) and 10 GbE (optical) option
ECC memory (GB)	96 GB
Processor	2 Intel Xeon CPU E5-2680 @ 2.70 GHz 8-core processors
Host interface	TCP/IP or UDP
Storage interface	NAS: SMB v1 and SMB v2, Microsoft CIFS and UNIX NFS v3
Connectivity	10 GbE (optical), 1 GbE (copper), or mixed 10 GbE (optical) and 1 GbE (copper) options
Hot swap components	Power supplies, fan modules, disk
Rack support	2U form factor
Management software	• Intuitive web GUI • Command line interface (CLI) for management tasks • Comprehensive SNMP MIB provides statistics information and alerts • Active Directory integration supports external Syslog server for sending notifications and audit information • Simple per-appliance software licensing
High Availability	• Transparent path failover, when deployed in pairs • Predictive failure analysis for hardware components • Link Aggregation (IEEE 802.3ad) • Ethernet Trunking (Cisco EtherChannel)

- Real-time Compression STN7800 details on PartnerWorld
- Real-time Compression STN7800 details on IBM.com

Figure N.7. IBM Real-time Compression Appliance STN7800 at a glance (and links to more detail).

Tape Storage

Server systems are woven deeply into today's business processes and are at the core of day-to-day operations. This information is thus a valuable corporate asset that must be protected. Tape storage provides a cost-effective and efficient means of backing up and archiving the information held on disk storage. Tape storage plays a vital role in reducing storage costs, maintaining data availability in the event of hardware failures, restoring data files accidentally or maliciously erased, restoring operations after a disaster, and so forth. In this section, we examine IBM's tape storage offerings.

More on the Web

- All tape offerings on IBM.com

Tape Storage Cross Reference by Workload Size

It is often a mistake to associate entry-level, midrange, and enterprise-class storage products with small, medium, and large size businesses, respectively. The amount of data stored often does not correlate with the number of employees or revenue metrics often cited in determining size. For this reason, recommendations on products based on actual workloads often makes more sense, though still should be considered only a general guideline. In this section, you will find a list of tape storage products organized by workload size (entry, mid-size, and enterprise) to help you find the best solution for your client.

Tape Storage for Entry-Level Workloads

Here is a list of tape storage products designed for entry-level workloads. Click on the links and you will jump to the section of this ebook that describes the product.

- TS2240 Express
- TS2250 Express
- TS2260 Express
- TS2340 Express
- TS2350 Express
- TS2360 Express
- TS2900 Tape Autoloader
- TS7620
- Linear Tape File System Single Drive Edition

More on the Web

- Tape for entry-level workloads

Tape Storage for Mid-Size Workloads

Here is a list of tape storage products designed for mid-size workloads. Click on the links and you will jump to the section of this ebook that describes the product (you can click on the back arrow to jump back to this page).

- TS3100 Express
- TS3200 Express
- TS3310 Tape Library
- TS3500 Tape Library
- Crossroads ReadVerify Appliance (RVA)
- Linear Tape File System Library Edition
- Linear Tape File System Storage Manager
- 7226 Multimedia Storage Enclosure

More on the Web

- Tape for mid-size business workloads

Tape Storage for Enterprise Workloads

Here is a list of tape storage products designed for large enterprise workloads. Click on the links and you will jump to the

section of this ebook that describes the product (you can click on the back arrow to jump back to this page).

- TS1130 Tape Drive
- TS1140 Tape Drive
- TS3500 Tape Library
- Crossroads ReadVerify Appliance (RVA)
- Linear Tape File System Storage Manager
- Linear Tape File System Enterprise Edition

More on the Web

- Tape for enterprise workloads

Crossroads ReadVerify Appliance (RVA)

Crossroads ReadVerify Appliance (Figure T.1) provides full visibility into the utilization, performance, and health of the tape drives and media in a tape library environment. The detailed insight provided by ReadVerify Appliance can lead to operational improvements by helping to complete backup jobs on time, minimize purchases of unnecessary resources, and prevent premature wear of overused resources. ReadVerify Appliance collects data directly from the tape drives and library during data transactions, without impacting the storage applications.

ReadVerify Appliance also supports two advanced features. ArchiveVerify (optional feature) offers the fully automated ability to verify readability of long-idle or suspicious media, providing an audit trail for regulatory compliance policies. The Read Verify Advanced Reporting integrated feature gives customers the dynamic ability to generate fully customized, multivariable reports for identifying hidden patterns and relationships between the different components of their tape environment.

Specifications

Physical characteristics	
SAN connectivity	1, 2, 4 GB FC Support
AC power	100–240 V ac autosensing 50/60 Hz, 4.0 A
Dimensions	Height: 43.1 mm, 1U (1.72 in., 1U) Width: 426 mm (16.8 in.) Depth: 358 mm (14.1 in.)
Weight	10.4 kg (23 lbs)
Operating environment	
Temperature	10° to 40°C (50° to 104°F)
Relative humidity	20% to 80% noncondensing
Heat output	564 BTUs
Energy consumption efficiency	NA
Warranty	One year limited warranty

- Crossroads ReadVerify Appliance details on PartnerWorld
- Crossroads ReadVerify Appliance details on IBM.com
- Crossroads ReadVerity competitive info on COMP
- Crossroads ReadVerify blog search
- Crossroads ReadVerify Appliance Twitter search

Figure T.1 Crossroads ReadVerify Appliance at a glance (and links to more detail).

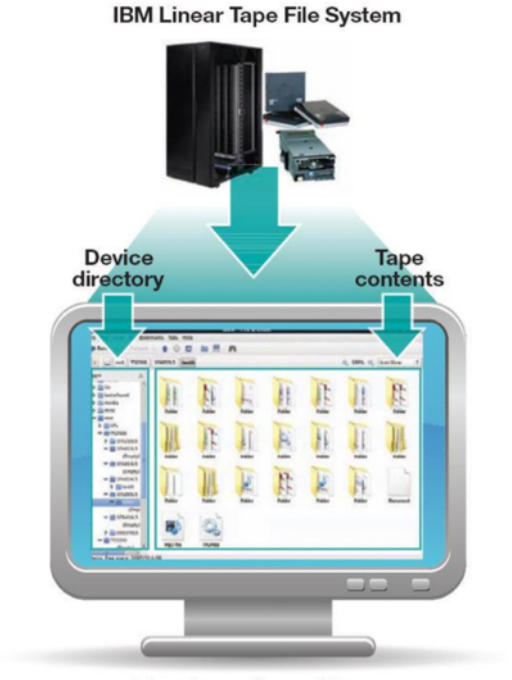
Here are some quick RVA facts:

- Helps reduce data risk by monitoring library activity and providing alerts on the health and integrity of the tape drives and media
- Optimizes tape resources by providing visibility into the root cause of incomplete backups, unbalanced drive usage, and low performing assets
- Helps meet regulatory compliance and reduce long-term data risk through fully automated, policy-driven validation of tape media readability (requires ArchiveVerify optional feature)
- Provides dynamic, multivariable user-managed reporting for understanding complex system interactions and projecting future budget and system needs.

Linear Tape File System Single Drive Edition

The IBM Linear Tape File System (LTFS) format provides direct, intuitive, and graphical access to data stored on Linear Tape-Open (LTO) Ultrium 6 or 5 tape cartridges, as well as IBM 3592 tape cartridges. It eliminates the need for additional tape management and software to access data (Figure T.2).

LTFS is a significant step in moving tape storage away from its reputation as complex and difficult to use. Unlike disk storage, tape has previously required device-specific software to read, write, and manage data stored on its cartridges in libraries. But LTFS is the first file system that works in conjunction with LTO Ultrium tape technology to set a new standard for ease of use and portability for open systems tape



- LTFS Single Drive Edition specifications
- LTFS info on PartnerWorld
- LTFS info on IBM.com
- LTFS competitive info on COMP
- LTFS blog search
- LTFS Twitter search

Figure T.2 IBM Linear Tape File System (and links to more detail).

storage. Users can run any application designed for disk files against tape data without concern for the fact that the data is physically stored on tape.

Here are some quick LTFS Single Drive Edition facts:

- Access and manage files on tape as easily as if they were on hard disk
- Drag and drop files to and from tape without requiring device-specific software
- Share file data across platforms, similar to using a USB drive.

Linear Tape File System Storage Manager

With IBM Linear Tape File Storage Manager (LTFS SM) software, accessing data stored on an IBM tape cartridge—instead of on disk—is transparent. LTFS SM enables high performance and reliable access across the storage infrastructure. This allows data centers to add extensive capacity with lower media, floor space and power costs. And with policy-based migration, archive capacity can be expanded without impacting data availability.

LTFS SM enables organizations to create operational storage tiers with tape—rather than storing static, unchanging files on costly disks—as well as to archive digital assets for the long term, so assets can be referenced and monetized for years to come.

More on the Web

- LTFS Storage Manager specifications
- LTFS info on PartnerWorld
- LTFS info on IBM.com
- LTFS competitive info on COMP
- LTFS blog search
- LTFS Twitter search

In addition, LTFS SM is highly customizable through its XML-based job templates. Customization includes, but is not limited to, pool-based file replication, setting user-defined

metadata to files and job scheduling. LTFS SM easily integrates with user applications through the web-services application programming interface (Simple Object Access Protocol [SOAP]) to launch archive, restore, and other management operations and to monitor their execution. It can be configured to manually launch operations, to query archive content, to monitor folders on a file system or to detect—and automatically archive—new files.

Here are some quick LTFS Storage Manager facts:

- Access and manage files in IBM Linear Tape File System (LTFS) tape libraries without tape volume directories
- Fully manage the location and usage of both online and offline files
- Utilize hierarchical storage management (HSM) functionality to load balance resources for file writes and recalls
- Create operational storage tiers with tape—rather than storing static, unchanging files on costly disk
- Take advantage of on-disk metadata support, which allows faster searches for archived files based on user-defined metadata.

Linear Tape File System Library Edition

IBM Linear Tape File System Library Edition (LE) can support data either on single tape cartridges or multiple cartridges in a tape library, automatically loading the cartridges per file access. It also graphically displays tape library contents in the OS graphical user interface (GUI) format, typically a folder/

tree structure. The metadata of each cartridge, once mounted, is cached in server memory. Metadata operations, such as browse directory and filename search, do not require tape movement.

LTFS LE can integrate with IBM Linear Tape File System Storage Manager for even more functionality, from managing scheduling and access to tape cartridges in multiple drives, to supporting data and control path failover.

Here are some quick LTFS Library Edition facts:

- Access and manage files in IBM tape libraries as easily as if they were on disk
- Perform metadata operations such as browse directory and filename search without tape movement
- Eliminate the need for an external database for access to—or creation of—files
- Provide direct, intuitive and graphical access to data stored in IBM tape drives and libraries
- Set a new standard for ease and portability for open systems tape storage
- Share data across platforms by simply dragging and dropping files.

More on the Web

- LTFS Library Edition specifications
- LTFS info on PartnerWorld
- LTFS info on IBM.com
- LTFS competitive info on COMP
- LTFS blog search
- LTFS Twitter search

Linear Tape File System Enterprise Edition

IBM Linear Tape File System Enterprise Edition (LTFS EE) gives organizations an easy way to use cost-effective IBM tape drives and libraries within a tiered storage infrastructure. By using tape libraries instead of disks for Tier 2 and Tier 3 data storage—data that is stored for long-term retention—organizations can improve efficiency and reduce costs. In addition, LTFS EE seamlessly integrates with the scalability, manageability and performance of GPFS, an IBM enterprise file management platform that enables organizations to move beyond simply adding storage—to optimizing data management.

LTFS EE provides direct, intuitive and graphical access to data stored in IBM tape drives and libraries using Linear Tape-Open (LTO) Ultrium generation 6 or 5 tape cartridges, as well as IBM 3592 cartridges in libraries with IBM System Storage TS1140 Tape Drives. It eliminates the need for additional tape management and software to access data.

More on the Web

- LTFS Enterprise Edition specifications
- LTFS info on PartnerWorld
- LTFS info on IBM.com
- LTFS competitive info on COMP
- LTFS blog search
- LTFS Twitter search

With LTFS EE, accessing data stored on an IBM tape cartridge—instead of on disk—is transparent. GPFS keeps a pointer to the data on tape and, if requested, retrieves the data without user or operator intervention. By leveraging GPFS capabilities, LTFS EE enables high-performance and reliable access across the storage infrastructure. In turn, LTFS EE

allows GPFS installations to add extensive capacity with lower media, floor space, and power costs. And with policy-based migration, archive capacity can be expanded without impacting data availability.

Here are some quick LTFS Enterprise Edition facts:

- Simplify tape storage with IBM Linear Tape File System (LTFS) format, combined with the scalability, manageability and performance of IBM General Parallel File System (GPFS)
- Help reduce IT expenses by replacing tiered disk storage (Tier 2 and Tier 3) with IBM tape libraries
- Expand archive capacity simply by adding and provisioning media—without impacting the availability of data already in the pool.

7226 Multimedia Storage Enclosure

For organizations with rack-mount servers, the IBM 7226 Multimedia Storage Enclosure (Figure T.3) provides reliable and flexible data backup and security in the data center. With high-speed SAS, USB, and Fibre Channel interface options, as well as compatibility with a range of storage devices, 7226 Multimedia Storage Enclosure can help protect data on critical IBM Power Systems, POWER, BladeCenter, PureFlex, and other compatible OEM systems. High-density applications using half- high LTO Ultrium 6 and LTO Ultrium 5 SAS tape drives are available on IBM POWER7 Systems.

The 7226 system is a rack-mounted enclosure that features two drive bays that can hold one or two tape drives, one or two RDX removable disk drives, and up to four slim-design

DVD- RAM drives. These drives can be mixed in any combination of any available drive technology or electronic interface in a single 7226 Multimedia Storage Enclosure.

Here are some quick 7226 facts:

- Features a low-profile design for configuration with up to four storage devices in a 1U space in a 19-inch rack
- Offers Linear Tape-Open (LTO) Ultrium 6 (6.25 TB), LTO Ultrium 5 (3.0 TB), and DAT160 (160 GB) tape drives, DVD-RAM, or RDX removable disk drives

Specifications

Number of storage devices	4 maximum (assumes 4 DVD drives)
Electronics	Optional SAS or USB electronic bus
Typical compression	2:1 for tape drives and 3:1 for DVD optical drives; Compression on RDX disk drives is typically 2:1 and is supported by a Power Systems server
Color	Black
Warranty options	One year

- 7226 info on PartnerWorld
- 7226 info on IBM.com
- 7226 competitive info on COMP
- 7226 blog search
- 7226 Twitter search

Figure T.3. 7226 Multimedia Storage Enclosure at a glance (and links to more detail).

- Provides multiple options to connect to high-performance IBM POWER7, IBM POWER6, IBM POWER, IBM BladeCenter, IBM PureFlex, and other compatible original equipment manufacturer (OEM) systems
- Enables the performance and capacity enhancements of half-high LTO Ultrium 6 and 5 tape drives, with the additional versatility of RDX removable disk drives and DVD-RAM options.

TS1130 Tape Drive

The IBM System Storage TS1130 Tape Drive (Figure T.4) features storage capability to help you establish easy access to data, better security, long-term retention and data governance, and regulatory compliance. The TS1130 tape drive offers high-performance flexible data storage with support for data encryption. The TS1130 tape drive can help you protect your investments in tape automation by offering compatibility with existing automation. To further protect your investment, an upgrade model is available for your existing IBM System Storage TS1120 Tape Drives. And to support a heterogeneous server environment, the TS1130 offers multiplatform support.

The TS1130 Tape Drive supports IBM System Storage TS3400 and TS3500 Tape Libraries, IBM TotalStorage 3494 Tape Libraries, IBM Virtualization Engine TS7700, IBM racks that enable standalone installation, and IBM 3952 Tape Frames Model C20 (3952C20 frame) attached to a Sun 9310 library.

Here are some quick TS1130 facts:

- Provides information security with support for encryption and key management

Specifications

Recording technique	Linear Serpentine
Number of tracks	1152
Native capacity	1 TB (using JB/JX media), 640 GB (using JA/JW media), or 128 GB (using JJ/JR media)
Native sustained data rate	160 MBps (uncompressed)
Adaptive instantaneous data rates	163, 134, 109, 83, 56, 43 MBps for 3592 JB cartridges initialized in Gen 3 format; 150, 127, 104, 78, 52, 40 MBps for 3592 JB cartridges initialized in Gen 2 format; 71, 59, 47, 36, 24, 19, 13 MBps for 3592 JA cartridges initialized in Gen 1 format
Burst data rate	400 MBps
High-speed search (max)	12.4 mps
Warranty	One year

- TS1130 details on PartnerWorld
- TS1130 details on IBM.com
- TS1130 competitive info on COMP
- TS1130 blog search
- TS1130 Twitter search

Figure T.4. IBM System Storage TS1130 at a glance (and links to more detail).

- Optimizes information retention with support for existing IBM tape automation
- Supports write once read many (WORM) cartridges to help satisfy compliance requirements
- Offers high performance and high capacity for storage consolidation.

TS1140 Tape Drive

The IBM System Storage TS1140 Tape Drive (Figure T.5) features storage capabilities to help you establish easy, rapid access to data, better security, long-term retention and data governance, and regulatory compliance. The TS1140 tape drive offers high-performance flexible data storage with support for data encryption. The TS1140 tape drive can help you protect your investments in tape automation by offering compatibility with existing automation. To further protect your investment, an upgrade model is available for your existing IBM System Storage TS1130 Tape Drives. And to support a heterogeneous server environment, the TS1140 offers multiplatform support.

The TS1140 tape drive supports the IBM System Storage TS3500 Tape Library and IBM racks that enable stand-alone installation. The TS1140 features three options for Type C media. The 3592 Advanced data tape cartridge, JC, provides up to 4.0 TB native capacity, and up to 4.0 TB are provided by the 3592 Advanced WORM cartridge, JY. A limited capacity of up to 500 GB Economy cartridge, JK, offers fast access to data. The TS1140 tape drive can also read and write on pre-

Specifications

Recording technique	Linear Serpentine
Number of tracks	2560
Native capacity	4 TB (using JC/JY media), 1.6 TB (using JB/JX media), or 500 GB (using JK media)
Native sustained data rate	250 MBps
Adaptive data rates	13 speeds, from 76 MBps to 251 MBps for 3592 JC/JK/JY cartridges initialized in Gen 4 format 13 speeds, from 74 MBps to 203 MBps for 3592 JB/JX cartridges initialized in Gen 4 format 13 speeds, from 41 MBps to 163 MBps for 3592 JB/JX cartridges initialized in Gen 3 format 13 speeds, from 39 MBps to 151 MBps for 3592 JB/JX cartridges initialized in Gen 2 format 13 speeds, from 18 MBps to 72 MBps for 3592 JA/JJ/JR/JW cartridges initialized in Gen 1 format 13 speeds, from 36 MBps to 144 MBps for 3592 JA/JJ/JR/JW cartridges initialized in Gen 2 or Gen 3 format
Burst data rate	800 MBps
High-speed search	12.4 mps
Warranty	One year

- TS1140 details on PartnerWorld
- TS1140 details on IBM.com
- TS1140 competitive info on COMP
- TS1140 blog search
- TS1140 Twitter search

Figure T.5 IBM System Storage TS1140 Tape Drive at a glance (and links to more detail).

vious media, type B (JB and JX), and read only on type A (JA, JW, JJ, and JR).

To help optimize drive utilization and reduce infrastructure requirements, the TS1140 tape drives can be shared among supported open system hosts on a Storage Area Network (SAN).

Here are some quick TS1140 facts:

- Offers best-in-class high performance and high capacity tape processing for storage consolidation
- Helps enhance information security with support for encryption and key management
- Improves information retention with support for existing IBM tape automation
- Supports write once read many (WORM) cartridges to help satisfy compliance requirements.

TS2240 Tape Drive Express

The IBM System Storage TS2240 Tape Drive Express Model H4V (Figure T.6)—one of the entry-level IBM System Storage tape product family offerings—is the answer to growing storage requirements and shrinking backup windows. Incorporating the fourth generation of advanced Linear Tape-Open (LTO) technology, the TS2240 Tape Drive is suited for handling the backup, save and restore, and archival data storage needs of a wide range of small systems. In addition, the TS2240 provides up to 6 Gbps Serial Attached SCSI (SAS) connectivity and the security of LTO-based data encryption.

Specifications

Model and part number	Model Number; 3580 H4V, Part Number: 3580S4V
Tape drive type	IBM LTO Ultrium 4 half-height SAS tape drive V2
Physical capacity	Up to 1.6 TB per cartridge with 2:1 compression; 800 GB native
Number of tape drives	1
Number of tape cartridges	1
Data transfer rate	Up to 120 MB/sec native
Tape cartridges	IBM System Storage LTO Ultrium 800 GB Data Cartridge (95P4436), IBM System Storage LTO Ultrium 800 GB WORM Cartridge (95P4450)
Cleaning cartridge	IBM System Storage LTO Cleaning Cartridge (P/N 35L2086)
Warranty	Three-year customer replaceable unit (CRU) in most countries

- TS2240 Express details on PartnerWorld
- TS2240 Express details on IBM.com
- TS2240 Express competitive info on COMP
- TS2240 blog search
- TS2240 Twitter search

Figure T.6. IBM System Storage TS2240 Tape Drive Express at a glance (and links to more detail).

The System Storage TS2240 Tape Drive is an excellent tape storage solution for businesses requiring backup or low-cost, real-time archival storage of their data. The TS2240, with a half-height form factor, offers the same high capacity

of full-height LTO-4 tape drives. The TS2240 has a physical storage capacity of up to 1.6 TB (with 2:1 compression) in conjunction with the IBM System Storage LTO Ultrium 800 GB data cartridge, which provides up to twice the capacity of Ultrium 3 cartridges. The native data transfer performance of the TS2240 Tape Drive has increased over the previous LTO half-height generation to up to 120 MB/sec. The TS2240 Tape Drive continues to provide an excellent alternative to slower and smaller capacity 1/4-inch, 4 mm, and 8 mm digital linear tape (DLT or SDLT) drives.

Here are some quick TS2240 facts:

- Provides high-capacity tape storage in a small, half-height form factor to address backup and archiving requirements
- Offers highly secure data storage using available hardware encryption
- Provides a native data transfer rate of up to 120 MB/sec
- Designed for the midrange open systems environment
- Supports two TS2240 Model H4Vs side by side in a standard 19-inch rack using the optional rack mount shelf.

TS2250 Tape Drive Express

The IBM System Storage TS2250 Tape Drive Express (Figure T.7) is the entry-level tape product family offering. Incorporating the latest generation of the industry-leading linear tape-open (LTO) technology, the TS2250 Tape Drive is suited for handling backup, save and restore, and archival data storage needs with higher capacity and higher data transfer rates

Specifications

Available configurations	Model 3580 H5S—One IBM Ultrium 5 Tape Drive, 6 Gbps SAS interface PN 3580S5E
Tape drive type	IBM LTO Ultrium 5
Physical capacity	1.5 TB native; 3.0 TB with 2:1 compression
Number of tape drives	1
Number of tape cartridges	1
Data transfer rate	Up to 140 MBps native
Media type	IBM LTO 5 Data Cartridge IBM LTO Cleaning Cartridge
Warranty	Three-year, customer replaceable unit (CRU) in most countries

- TS2250 Express details on PartnerWorld
- TS2250 Express details on IBM.com
- TS2250 Express competitive info on COMP
- TS2250 blog search
- TS2250 Twitter search

Figure T.7. IBM System Storage TS2250 Tape Drive Express at a glance (and links to more detail).

than the previous generation. In addition, the IBM Ultrium 5 technology is designed to support media partitioning, and the new IBM Linear Tape File System technology. It also continues to support encryption of data and WORM media.

The IBM System Storage TS2250 Tape Drive is an excellent tape storage solution for businesses requiring backup and low-cost, archival storage of their data. The TS2250, with a half height form factor, offers more capacity than the full height LTO 4 tape drive in less space. The TS2250 provides a physical storage capacity of up to 3.0 TB (with 2:1 compression) in conjunction with the new IBM Ultrium 1.5 TB data cartridge, nearly double the capacity of previous Ultrium 4 cartridges. The data transfer performance of the TS2250 Tape Drive has increased over the previous LTO half height generation with a transfer rate of up to 140 MBps with 6 Gbps SAS interface connectivity. It also now offers two SAS and one Ethernet port per drive to improve availability.

Here are some quick TS2250 facts:

- Helps reduce costs with lower power consumption, consolidation, and space reduction
- Supports media partitioning on LTO Ultrium 5 Media and new IBM Linear Tape File System technology
- Nearly doubles the cartridge capacity of the previous generation in a small half height form factor
- Designed to address backup and archiving requirements with lower cost implementation.

TS2260 Tape Drive Express

The IBM System Storage TS2260 Tape Drive Express (Figure T.8) is the answer to growing storage requirements—and shrinking backup windows. Incorporating the latest generation of indus-

Specifications

Available configurations	Model 3580 H6S—One LTO Ultrium 6 Tape Drive, 6 Gbps SAS interface PN 3580S6E
Tape drive type	LTO Ultrium 6
Physical capacity	2.5 TB native; 6.25 TB with 2 5:1 compression
Number of tape drives	1
Number of tape cartridges	1
Data transfer rate	Up to 160 MBps native
Media type	Read and write: LTO Ultrium 6 2.5 TB data cartridge 2.5 TB WORM cartridge LTO Ultrium 5 1.5 TB data cartridge 1.5 TB WORM cartridge Read only: LTO Ultrium 4 800 GB data cartridge 800 GB WORM cartridge Also available: LTO Ultrium cleaning cartridges
Warranty	Three-year, customer replaceable unit (CRU) in most countries

- TS2260 Express details on PartnerWorld
- TS2260 Express details on IBM.com
- TS2260 Express competitive info on COMP
- TS2260 blog search
- TS2260 Twitter search

Figure T.8. IBM System Storage TS2260 Tape Drive Express at a glance (and links to more detail).

try-leading LTO technology, the TS2260 Tape Drive is suited for handling backup, save and restore, and archival data storage needs with higher capacity and higher data transfer rates than the previous generation. In addition, the LTO Ultrium 6 technology is designed to support media partitioning and the IBM Linear Tape File System Single Drive Edition. It also continues to support encryption of data and write once read many (WORM) media.

The IBM System Storage TS2260 Tape Drive is an excellent tape storage solution for organizations requiring backup and low-cost, archival storage of data. The TS2260, with a half-height form factor, offers more capacity than the full height LTO Ultrium 5 tape drive in less space. The TS2260 provides a physical storage capacity of up to 6.25 TB1 (with 2.5:1 compression). The data transfer performance has increased over the previous LTO Ultrium half-height generation with a transfer rate of up to 160 MBps with 6 Gbps SAS interface connectivity. It also offers two SAS and one Ethernet port per drive to improve availability.

Here are some quick TS2260 facts:

- Designed to provide long-term backup and archive storage data protection while lowering overall storage costs
- Easily access data stored on Linear Tape-Open (LTO) Ultrium 6 and 5 cartridges through the use of IBM Linear Tape File System technology
- Gain more energy efficiency than with previous generations
- Support media partitioning on LTO Ultrium 6 media and Linear Tape File System

- Double the compressed cartridge capacity with more than 40 percent better performance than LTO Ultrium generation 5 drive.

TS2340 Tape Drive Express

The IBM System Storage TS2340 Tape Drive Express (Figure T.9)—the entry-level IBM System Storage tape product family offering—is the answer to growing storage requirements and shrinking backup windows. Incorporating the fourth generation of advanced linear tape-open (LTO) technology, the TS2340 Tape Drive is suited for handling the backup, save and restore, and archival data storage needs of a wide range of small systems. In addition, the TS2340 provides added security features by supporting encryption of data with 3 Gbps SAS connectivity.

The IBM System Storage TS2340 Tape Drive is an excellent tape storage solution for businesses requiring backup or low-cost, real-time archival storage of their data within a small window of time—it offers high-capacity and performance to help address the most demanding requirements. The TS2340 has a physical storage capacity of up to 1.6 TB (with 2:1 compression) in conjunction with the new IBM Ultrium 800 GB data cartridge, which provides up to double the capacity of previous Ultrium 3 technology. Along with its higher capacity, the data transfer performance of the TS2340 Tape Drive has increased over the previous generation for a native data transfer rate of up to 120 MBps. The TS2340 Tape Drive continues to provide an excellent alternative to slower and smaller capacity 1/4-inch, 4 mm, and 8 mm DLT/SDLT tape drives.

Specifications

Available configurations	Model L43—One IBM Ultrium 4 Tape Drive, LVD Ultra160 SCSI attach Model S43—One IBM Ultrium 4 Tape Drive, 3 Gbps SAS attach
Tape drive type	IBM LTO Ultrium 4
Physical capacity	Up to 1.6 TB per cartridge with 2:1 compression; 800 GB native
Number of tape drives	1
Number of tape cartridges	1
Data transfer rate	Up to 120 MB/sec native
Media type	IBM LTO Ultrium 4 IBM TotalStorage LTO Ultrium 800 GB Data Cartridge (PN TBD) IBM TotalStorage LTO Cleaning Cartridge (PN TBD)
Warranty	Three-year, customer replaceable unit (CRU) in most countries

- TS2340 Express details on PartnerWorld
- TS2340 Express details on IBM.com
- TS2340 Express competitive info on COMP
- TS2340 blog search
- TS2340 Twitter search

Figure T.9. IBM System Storage TS2340 Tape Drive Express at a glance (and links to more detail).

Here are some quick TS2340 facts:

- Designed to provide high-capacity and performance to address the most demanding backup and archiving requirements
- Double the cartridge capacity of previous generation LTO drives

- Available hardware encryption designed to offer highly secure data storage along with high performance
- Native data transfer rate of up to 120 MBps
- Choice of SCSI or SAS interfaces.

TS2350 Tape Drive Express

The IBM System Storage TS2350 Tape Drive Express (Figure T.10)—part of the entry-level IBM System Storage tape product family—leverages the newest generation of linear tape-open (LTO) technology to help cost-effectively handle growing storage requirements.

The TS2350 Tape Drive is suited for handling backup, save and restore, and archival data storage needs with higher capacity and higher data transfer rate than previous generation. In addition, the IBM Ultrium 5 technology is designed to support media partitioning, and the new IBM Linear Tape File System technology. It also continues to support encryption of data and WORM media.

The TS2350 Tape Drive is an excellent tape storage solution for businesses requiring backup and archival storage of their data. The TS2350 offers high physical storage capacity of up to 3.0 TB (with 2:1 compression) in conjunction with the new IBM Ultrium 1.5 TB data cartridge, which provides nearly double the capacity of previous Ultrium 4 cartridges. The data transfer rate of the TS2350 Tape Drive has increased over the previous LTO generation to up to 140 MBps with 6 Gbps SAS interface connectivity. It also offers two SAS and one Ethernet port per drive to improve availability.

Here are some quick TS2350 facts:

- Helps reduce costs with lower power consumption, consolidation, and space reduction
- Supports media partitioning on LTO Ultrium 5 media and new IBM Linear Tape File System technology

Specifications

Available configurations	Model 3580 S53—One IBM Ultrium 5 Tape Drive, 6 Gbps SAS interface PN 3580S5
Tape drive type	IBM LTO Ultrium
Physical capacity	1.5 TB native; 3.0 TB with 2:1 compression
Number of tape drives	1
Number of tape cartridges	1
Data transfer rate	Up to 140 MBps native
Media type	IBM LTO 5 Data Cartridge IBM LTO Cleaning Cartridge
Warranty	Three-year, customer replaceable unit (CRU) in most countries

- TS2350 Express details on PartnerWorld
- TS2350 Express details on IBM.com
- TS2350 Express competitive info on COMP
- TS2350 blog search
- TS2350 Twitter search

Figure T.10. IBM System Storage TS2350 Tape Drive Express at a glance (and links to more detail).

- Nearly doubles the cartridge capacity of previous-generation LTO Ultrium 4 drives
- Designed to provide greater capacity and performance to address the most demanding backup and archiving requirements.

TS2360 Tape Drive Express

The IBM System Storage TS2360 Tape Drive Express (Figure T.11)—part of the entry-level IBM System Storage tape product family—supports the storage, security, and compliance requirements of today's organizations. The TS2360 leverages the newest generation of LTO Ultrium technology, helping to cost-effectively handle growing storage requirements.

The TS2360 Tape Drive Express is suited for handling backup, save and restore, and archival data storage needs with higher capacity and a higher data transfer rate than the previous generation. In addition, the LTO Ultrium 6 technology is designed to support media partitioning and Linear Tape File System Single Drive Edition. It also continues to support encryption of data and write once read many (WORM) media.

Here are some quick TS2360 facts:

- Helps reduce costs with lower power consumption, consolidation, and space reduction
- Supports media partitioning on Linear Tape-Open (LTO) Ultrium 6 media and IBM Linear Tape File System
- Double the compressed cartridge capacity and over 40 percent better performance compared to LTO Ultrium 5 drives

Specifications

Available configurations	Model 3580 S63—One IBM Ultrium 6 Tape Drive, 6 Gbps SAS interface PN 3580S6X
Tape drive type	LTO Ultrium 6
Physical capacity	2.5 TB native; 6.25 TB with 2:1 compression
Number of tape drives	1
Number of tape cartridges	1
Data transfer rate	Up to 160 MBps native
Media type	Read and write: LTO Ultrium 6 2.5 TB data cartridge 2.5 TB WORM cartridge LTO Ultrium 5 1.5 TB data cartridge 1.5 TB WORM cartridge Read only: LTO Ultrium 4 800 GB data cartridge 800 GB WORM cartridge Also available: IBM LTO Ultrium cleaning cartridges
Warranty	Three-year, customer replaceable unit (CRU) in most countries

- TS2360 Express details on PartnerWorld
- TS2360 Express details on IBM.com
- TS2360 Express competitive info on COMP
- TS2360 blog search
- TS2360 Twitter search

Figure T.11. IBM System Storage TS2360 Tape Drive Express at a glance (and links to more detail).

- Designed to provide greater capacity and performance to address the most demanding backup and archiving requirements
- More energy efficient than previous generations.

TS2900 Tape Autoloader Express

The IBM System Storage TS2900 Tape Autoloader Express (Figure T.12) is designed for entry-level automated backup for rack system and small-to-medium business environments. With a low profile, high density storage capacity, the TS2900 is ideally suited for backup and archival operations. The TS2900 is available with IBM HH LTO-6, HHLTO-5, HH LTO 4, or HH LTO 3 tape technology for a high-capacity, entry-priced tape storage solution.

The TS2900 is equipped with standard features designed to provide ease-of-use and secured data backup. Web-based remote management, a bar code reader, and a removable tape magazine help provide the autoloader flexibility in application. The TS2900 can be used in a rack system, or on a desktop next to a server in an office. These types of features help reduce the requirements of IT personnel staff, as well as help centralize backup in the data center. The TS2900 also is designed to support the encryption of sensitive user data in combination with HH LTO 6, HH LTO-5, or LTO-4 tape technology from IBM. With 6 Gbps SAS attach, the TS2900 is supported on IBM Power Systems, IBM System x, Intel, and other competitive open system server platforms.

Specifications

Drive options	Ultrium 4 Half-high: 6 Gbps SAS Ultrium 5 Half-high: 6 Gbps SAS Ultrium 6 Half-high: 6 Gbps SAS
Available models	LTO-4 3572 S4H (AAS - WW) 3572S4R (HVEC - WW) LTO-5 3572 S5H (AAS – AP, LA) 3572S5R (HVEC – WW) LTO-6 3572 S6H (AAS – AP, LA) 3572 S6R (HVEC – WW)
Deskside cover kit	PN 45E3789
Additional tape magazine	PN 45E3793
Rack mount kit	PN 45E3785
Number of tape drives	1
Tape cartridge capacity	9
I/O stations	1
Physical capacity	LTO 4: Up to 7.2 TB (14.4 TB with 2:1 compression) LTO 5: Up to 13.5 TB (27 TB with 2:1 compression) LTO 6: Up to 22.5 TB (56.25 TB with 2 5:1 compression)
Data transfer rate	LTO 4: Up to 120 MBps LTO 5: Up to 140 MBps LTO 6: Up to 160 MBps

- TS2900 Tape Autoloader Express details on PartnerWorld
- TS2900 Tape Autoloader Express details on IBM.com
- TS2900 Tape Autoloader Express competitive info on COMP
- TS2900 blog search
- TS2900 Twitter search

Figure T.12. IBM System Storage TS2900 Tape Autoloader Express at a glance (and links to more detail).

Here are some quick TS2900 facts:

- 1U slim profile designed for rack system environments for automated, high-capacity tape storage
- Features the newest generation of LTO with IBM Ultrium 6 half-height (HH) technology designed for reliable performance in small-to-medium open system environments
- Lowest entry price of any IBM tape automation offering IBM HH tape technology.

TS3100 Tape Library Express

The IBM System Storage TS3100 Tape Library Express model (Figure T.13) and its storage management applications are designed to address capacity, performance, data protection, reliability, availability, affordability, and application requirements. It is designed as a functionally rich entry tape-storage solution incorporating LTO tape technology. The IBM TS3100 Express model is an excellent solution for large-capacity or high-performance tape backup with or without random access. The TS3100 is also an excellent choice for tape automation for IBM Power Systems, IBM System x, and other open systems.

The IBM TS3100 Tape Library Express is well-suited for handling backup, save and restore, and archival data-storage needs for small to medium-size environments. With the use of one LTO full-height tape drive or up to two LTO half-height tape drives and 24 tape cartridge capacity, the IBM TS3100 is designed to take advantage of LTO technology to cost-effectively handle growing storage requirements.

Specifications

Drive Options	Ultrium 6 full-height: 8 Gbps Fibre Channel (FC # 8344) Ultrium 6 half-height: 6 Gbps SAS (FC # 8347); 8 Gbps Fibre Channel (FC # 8348) Ultrium 5 full-height: 6 Gbps SAS (FC #8245 or 46X2683); 8 Gbps Fibre Channel (FC #8244 or 46X2682) Ultrium 5 half-height: 6 Gbps SAS (FC #8247 or 46X2685); 8 Gbps Fibre Channel (FC #8248 or 46X2684) Ultrium 4 full height: LVD SCSI (FC #8143 or 95P5002), 3 Gbps SAS (FC #8145 or 95P5006); Fibre Channel (#8144 or 95P5004) Ultrium 4 half-height: 6 Gbps SAS (FC # 8149 or 46X7117), 8 Gbps FC (FC # 8148 or 46X6912)
Available models	TS3100 Tape Library Model L2U Driveless 3573 L2U (MTM), 3573 2UL (HVEC)
Ultrium tape catridges	LTO Ultrium 4 media: FC#8405; LTO Ultrium 5 media: FC#8505; LTO Ultrium 6 media: FC#8605
Ultrium cleaning cartridge	23R7008 or FC #8002
Tape drive type	LTO Ultrium 4 half-height and full-height; LTO Ultrium 5 half-height and full-height; LTO Ultrium 6 half-height and full-height
Number of drives	1–2
Number of tape cartridges	24
Physical capacity	Capacity per cartridge Up to 6.25 TB compressed 2.5:1 with LTO Ultrium 6; 2.5 TB native Up to 3 TB compressed 2:1 with LTO Ultrium 5; 1.5 TB native Up to 1.6 TB compressed 2:1 with LTO Ultrium 4; 800 GB native Library capacity Up to 150 TB compressed 2.5:1 with LTO Ultrium 6; 60 TB native Up to 72 TB compressed 2:1 with LTO Ultrium 5; 36 TB native Up to 38.4 TB compressed 2:1 with LTO Ultrium 4; 19.2 TB native
Data transfer rate	Up to 120 MBps native with LTO Ultrium 4 Up to 140 MBps native with LTO Ultrium 5 Up to 160 MBps native with LTO Ultrium 6

- TS3100 Express details on PartnerWorld
- TS3100 Express details on IBM.com
- TS3100 Express competitive info on COMP
- TS3100 blog search
- TS3100 Twitter search

Figure T.13. IBM System Storage TS3100 Tape Library Express at a glance (and links to more detail).

Here are some quick TS3100 facts:

- Designed to support the newest generation of LTO with one Ultrium LTO 6 full-height tape drive or up to two LTO Ultrium 6 half-height tape drives, as well as LTO Ultrium 5 and 4 tape drives using a 2U form factor to help increase capacity and performance
- Designed to support cost-effective backup, save and restore, and archival storage in sequential or random access mode with a standard bar-code reader
- Designed to offer outstanding capacity, performance, and reliability for midrange and network tape-storage environments in a 2U form factor with 24 data cartridge slots and a mail slot
- Remote library management through a standard Web interface supports flexibility and greater administrative control of storage operations.

TS3200 Tape Library Express

The IBM System Storage TS3200 Tape Library Express Model (Figure T.14) leverages the newest generation of LTO technology to help cost-effectively handle growing storage requirements. The TS3200 Express Model and its storage management applications are designed to address capacity, performance, data protection, reliability, affordability, and application requirements. It is designed as a functionally rich, high-capacity, entry-level tape-storage solution incorporating LTO Ultrium tape technology. The IBM TS3200 Express model is an excellent solution for large-capacity or high-performance

Specifications

Drive options	Ultrium 6 full-height: 8 Gbps Fibre Channel (FC#8344) Ultrium 6 half-height: 6 Gbps SAS (FC#8347); 8 Gbps Fibre Channel (FC#8348) Ultrium 5 Full Height: 6 Gbps SAS (FC#8245 or 46X2683); 8 Gbps Fibre Channel (FC#8244 or 46X2682) Ultrium 5 Half Height: 6 Gbps SAS (FC#8247 or 46X2685); 8 Gbps Fibre Channel (FC#8248 or 46X2684) Ultrium 4 Full Height: LVD SCSI (FC#8143 or 95P5002), 3 Gbps SAS (FC#8145 or 95P5006); 4 Gbps Fibre Channel (FC#8144 or 95P5004) Ultrium 4 Half Height: 6 Gbps SAS (FC#8149 or 46X7117), 8 Gbps FC (FC#8148 or 46X6912)
Available models	TS3200 Tape Library Model L4U Driveless: 3573 L4U (MTM), 35734UL (HVEC)
Ultrium tape cartridges	LTO Ultrium 4 media: FC#8405; LTO Ultrium 5 media: FC#8505; LTO Ultrium 6 media: FC#8605
Ultrium cleaning cartridge	23R7008 or FC#8002
Tape drive type	LTO Ultrium 4 full-height and half-height
Number of drives	1–4
Number of tape cartridges	48
Physical capacity	Cartridge capacity: 6.25 TB compressed 2.5:1 with LTO Ultrium 6; 2.5 TB native 3.0 TB compressed 2:1 with LTO Ultrium 5; 1.5 TB native 1.6 TB compressed 2:1 with LTO Ultrium 4; 800 GB native Library capacity: 300 TB compressed 2.5:1 with LTO Ultrium 6; 120 TB native 144 TB compressed 2:1 with LTO Ultrium 5; 72 TB native 76.8 TB compressed 2:1 with LTO Ultrium 4; 38.4 TB native
Data transfer rate	Up to 120 MBps native with LTO 4 Up to 140 MBps native with LTO 5 Up to 160 MBps native with LTO 6

- TS3200 Express details on PartnerWorld
- TS3200 Express details on IBM.com
- TS3200 Express competitive info on COMP
- TS3200 blog search
- TS3200 Twitter search

Figure T.14. IBM System Storage TS3200 Tape Library Express at a glance (and links to more detail).

tape backup with or without random access. The TS3200 is also an excellent choice for tape automation for IBM Power Systems, IBM System x, and other open systems.

The IBM TS3200 Tape Library Express is well-suited for handling the backup, restore, and archive data-storage needs of small to medium-size environments. With the use of up to two LTO full-height tape drives or up to four LTO half-height tape drives and 48 tape cartridge capacity, the IBM TS3200 model is designed to use LTO technology to cost-effectively handle growing storage requirements. The TS3200 Tape Library is configured with four removable cartridge magazines, two on the left side (24 data cartridge slots) and two on the right (24 data cartridge slots). Additionally, the lower left magazine includes a three-slot I/O station to help support continuous library operation while importing and exporting media. A bar-code reader is standard in the library, supporting the library's operation in sequential or random access mode. The TS3200 also comes standard with remote management capabilities to allow for remote administration of the tape library through a Web interface. Path failover, an optional feature, is designed to provide automatic control path failover to a preconfigured redundant control path in the event that a host adapter or control path drive is lost, without aborting the current job in process.

Here are some quick TS3200 facts:

- Designed to support the newest generation of LTO with up to two IBM Ultrium 6 full-height tape drives or up to four IBM Ultrium 6 half-height tape drives, as well as LTO generations 4 and 5 tape drives using a 4U form factor

- Designed to offer outstanding capacity, performance, and reliability for a cost-effective backup, restore, and archive for midrange storage environments
- Remote library management through a standard Web interface supports flexibility and greater administrative control of storage operations.

TS3310 Tape Library

The IBM System Storage TS3310 Tape Library (Figure T.15) is a modular, scalable tape library designed to address the tape storage needs of rapidly growing companies who find themselves space and resource constrained with tape backup and other tape applications.

Designed around a 5U high modular base library unit, the TS3310 can scale vertically with expansion for LTO tape cartridges, drives, and redundant power supplies.

The base library module, model L5B, is the entry point for the product family. It contains all of the necessary robotics and intelligence to manage the 5U high library system, which houses up to 41 cartridges—35 storage slots and six input/output (I/O) slots; and two LTO generation 6, generation 5, generation 4, and generation 3 tape drives.

The TS3310 model L5B can be expanded with the addition of expansion units, the model E9U.

Here are some quick TS3310 facts:

- Provides a modular, scalable tape library designed to grow as your needs grow
- Features desktop, desk-side, and rack-mounted configurations

Specifications

Model	3576 Model L5B	3576 model L5B and four E9U models
Configuration	Base library	Base library and 4 expansion units
LTO storage slots (max)	41	409
LTO I/O slots (max)	6	54
Maximum tape drives	2	18
Total physical capacity (2:1 compression)	Up to 256.24 TB	Up to 2.55 PB
Capacity on demand increments	N/A	46 cartridges
Maximum logical libraries	2	18

- TS3310 details on PartnerWorld
- TS3310 details on IBM.com
- TS3310 competitive info on COMP
- TS3310 blog search
- TS3310 Twitter search

Figure T.15. IBM System Storage TS3310 Tape Library at a glance (and links to more detail).

- Delivers optimal data storage efficiency with high cartridge density using standard or WORM LTO Ultrium data cartridges
- Can simplify user access to data stored on LTO Ultrium 6 and 5 cartridges through the use of IBM Linear Tape File System software
- Doubles the compressed cartridge capacity and provides over 40 percent better performance compared to 5th generation LTO Ultrium drives.

TS3500 Tape Library

The IBM System Storage TS3500 Tape Library (Figure T.16) continues to lead the industry in tape drive integration with features such as persistent worldwide name, multipath architecture, drive/media exception reporting, remote drive/media management, and host-based path failover. The L23 and D23 frames support the IBM System Storage TS1140, TS1130, TS1120, or IBM 3592 J1A tape drives. The L53 and D53 frames support LTO Ultrium 6 tape drives as well as previous-generation LTO Ultrium tape drives. L-frame models support improved cartridge handling, hot-swappable drive packaging, and the option of an additional 16-slot I/O station. The TS3500 model D23 and D53 frames can be attached to existing model L22 or D52 frames. Mixed media is supported by combining LTO Ultrium tape drives and the TS1140, TS1130, TS1120, or 3592 J1A tape drives within the TS3500 library, frame by frame.

Specifications

Library shuttle connector	IBM System Storage Tape Library Connector Model SC1
Tape drive types	TS1140, TS1130, TS1120 or 3592 tape crives or IBM LTO Ultrium 6, 5, 4, 3, 2 or 1 Tape Drives
Number of frames per library	One base frame, up to 15 expansion frames The TS3500 Model HA1 installation provides one of the two additional frames required as service bays in a dual-accessor library
Number of libraries per complex	Up to 15 libraries
Number of drives	Up to 12 per frame; Up to 192 per library string; Up to 2,700 per library complex
Number of tape cartridges	L23—up to 260 D23—up to 400 S24—up to 1,000 Total supported per library: >15,000 Total supported per complex: >225000 L53—up to 287 D53—up to 440 S54—up to 1,320 Total supported per library: >20,000 Total supported per complex: >300,000
Number of I/O slots	Up to 224 per library (16 I/O slots standard) Up to 3,360 per complex
Number of logical libraries	Maximum of 192 per library (up to number of drives installed) Maximum of 2,700 per complex

- TS3500 details on PartnerWorld
- TS3500 details on IBM.com
- TS3500 competitive info on COMP
- TS3500 blog search
- TS3500 Twitter search

Figure T.16. IBM System Storage TS3500 Tape Library at a glance (and links to more detail).

Here are some quick TS3500 facts:

- Support highly-scalable, automated data retention on tape using Linear Tape-Open (LTO) Ultrium and IBM 3592 tape drive families
- Deliver extreme scalability and capacity, growing from one to 16 frames per library and from one to 15 libraries per library complex
- Provide up to 900 PB of automated, low-cost storage under a single library image, improving floor space utilization and reducing storage cost per TB with IBM 3592 JC Enterprise Advanced Data Cartridges
- Enable data security and regulatory compliance via support for tape drive encryption and write-once-read-many (WORM) cartridges.

TS7620 ProtecTIER Deduplication Appliance Express

Designed for mid-size companies needing a more holistic approach to data protection, the IBM System Storage TS7620 ProtecTIER Deduplication Appliance Express (Figure T.17) leverages unique data deduplication technology to help solve critical backup and recovery challenges.

Available in two configuration options, the TS7620 ProtecTIER Deduplication Appliance Express is an integrated server and storage hardware platform that ships with IBM ProtecTIER deduplication software preinstalled. This solution has a preconfigured repository and can be configured with either a Virtual Tape Library or Symantec OpenStorage interface. The

- TS7620 specifications
- TS7620 details on PartnerWorld
- TS7620 details on IBM.com
- TS7620 competitive info on COMP
- TS7620 blog search
- TS7620 Twitter search

Figure T.17. IBM System Storage TS7620 ProtecTIER Deduplication Appliance Express (and links to more detail).

TS7620 ProtecTIER Deduplication Appliance Express provides the essential capacity, price/performance, reliability, availability and scalability features your business demands.

Here are some quick TS7620 facts:

- Improves backup and recovery performance with high-speed, disk-based data protection
- Accelerates recovery of critical data
- Optimizes storage infrastructure and helps reduce total cost of ownership (TCO)
- Helps achieve business resilience objectives without changing existing backup procedures and practices

- Leverages data deduplication technology to help solve backup and recovery challenges in mid-size environments.

TS7650G ProtecTIER Deduplication Gateway

The IBM System Storage TS7650G ProtecTIER Deduplication Gateway (Figure T.18) is designed to meet the disk-based data protection needs of the enterprise data center while enabling significant infrastructure cost reductions. The solution offers industry-leading inline deduplication performance and scalability up to 1 petabyte (PB) of physical storage capacity per system, and can provide up to 25 PB or more backup

- TS7650G specifications
- TS7650G details on PartnerWorld
- TS7650G details on IBM.com
- ProtecTIER competitive info on COMP
- TS7650G blog search
- TS7650G Twitter search

Figure T.18. IBM System Storage TS7650G ProtecTIER Deduplication Gateway (and links to more detail).

storage capacity. Combined with IBM or third-party storage, the TS7650G ProtecTIER Deduplication Gateway provides a powerful disk-based repository to improve the performance, retention, and availability of backup and archive data.

Here are some quick TS7650G facts:

- Improve backup and recovery and simplify disaster-recovery operations
- Lower operational costs and energy usage
- Manage more data with less infrastructure.

TS7700 Virtualization Engine

The IBM TS7700 Virtualization Engine (Figure T.19) comprises a family of mainframe virtual tape solutions that optimize data protection and business continuance for System z data. Through the use of virtualization and disk cache, the TS7700 family operates at disk speeds while maintaining compatibility with existing tape operations.

The TS7700 family of System z tape virtualization is offered in two models:

- IBM Virtualization Engine TS7720 contains only virtual tape drives creating virtual tape volumes within disk cache to provide high performance access for workloads that have the most demanding write and recall requirements. Virtualization Engine TS7720 features encryption capable high-capacity cache using 3 TB SAS disk drives with RAID 6 providing the ability to scale to very large capacities with the highest level of data protection.

- IBM Virtualization Engine TS7740 not only stores data on virtual tape volumes within a disk cache, but also writes data by policy to physical tape. It attaches to and leverages the performance and capacity of IBM System Storage TS1140 and earlier IBM 3592 model tape drives installed in IBM System Storage TS3500 Tape Libraries. This fully integrated tiered storage hierarchy of disk and tape takes advantage of both tape and disk technologies to deliver performance for active data and best economics for inactive and archive data. This model combines tape and disk to provide a flexible, policy-managed configuration that offers the benefits of both types of storage. Virtualization Engine TS7740 features encryption capable 600 GB SAS drives with RAID 6 protection.

- TS7700 specifications
- TS7700 details on PartnerWorld
- TS7700 details on IBM.com
- TS7700 competitive info on COMP
- TS7720 blog search
- TS7720 Twitter search
- TS7740 blog search
- TS7740 Twitter search

Figure T.19. IBM TS7700 Virtualization Engine (and links to more detail).

Here are some quick TS7700 facts:

- Gain innovative data protection and business continuance for IBM System z servers
- Keep data secure, continuously available, and easy to manage
- Improve the performance of backup and recovery operations
- Support disk or physical tape.

Storage Software

Bringing together the best in infrastructure management, virtualization, and productivity software, IBM storage software utilizes the best in storage technology to answer your information on demand needs. In this section, we examine some of the key storage software offerings.

More on the Web

- Browse all IBM storage software on IBM.com

SmartCloud Storage Access

IBM SmartCloud Storage family helps customers become cloud agile by improving agility, security, and functionality for storage—in the cloud. As part of this family, IBM offers IBM SmartCloud Storage Access, an easy-to-deploy, simple-to-use software solution that features a self-service portal for storage provisioning, monitoring, and reporting. It is designed to provide users with a self-service file-serving facility over the Internet. With a few clicks, users can create an account, provision storage, and start uploading files.

In addition, IBM SmartCloud Storage Access allows developers, application owners, and technical staff to quickly provision their own storage, such as for testing a new application or expanding the SAN capacity for a database application. Administrators can easily monitor and report storage usage for chargeback purposes. Plus, they can create different classes of storage for different users or departments within an organization. This allows for more efficient use of the underlying infrastructure.

More on the Web

- SmartCloud Storage Access info on PartnerWorld
- SmartCloud Storage Access info on IBM.com

Here are some quick SmartCloud Storage Access facts:

- Quickly implement a private cloud storage service
- Provision storage capacity on demand
- Easily store and access files
- Offer simple reporting, monitoring, and chargeback services
- Improve overall IT efficiency and service quality
- Increase end-user and administrator productivity
- Deploy with selected IBM storage area network (SAN) and network-attached storage (NAS) storage infrastructures
- Enable third-party developers to integrate applications using top-level Representational State Transfer (REST) application programming interface (API).

SmartCloud Virtual Storage Center

IBM SmartCloud Virtual Storage Center v5.2 enables IT storage managers to easily migrate to an agile, cloud-based, software-defined storage environment—and manage it effectively. This powerful solution enables organizations to optimize provisioning, capacity, availability, reporting, and management for virtualized storage.

IBM SmartCloud Virtual Storage Center includes core functionality from three top IBM offerings, including data and storage management from IBM Tivoli Storage Productivity Center, including its advanced functions; external virtualization found in IBM System Storage SAN Volume Controller and the IBM Storwize family; and application-aware snapshot backup and restore capabilities from IBM Tivoli Storage FlashCopy Manager.

More on the Web

- SmartCloud Virtual Storage Center info on PartnerWorld
- SmartCloud Virtual Storage Center info on IBM.com

IBM SmartCloud Virtual Storage Center enables all three smarter storage characteristics for existing storage infrastructures.

Here are some quick SmartCloud Virtual Storage Center facts:

- Migrate storage to an agile, cloud-based, software-defined environment without replacing existing storage systems
- Reduce unit cost for storage with automated analytics-driven data management that enables tiered storage optimization across the data center

- Boost availability and augment daily backups with advanced data protection capabilities
- Reduce administration complexity with the advanced IBM storage graphical user interface (GUI)
- Implement a robust management system to keep your storage infrastructure functioning smoothly
- Optimize storage provisioning, capacity utilization, availability, reporting, and management.

Tivoli Storage Manager

IBM Tivoli Storage Manager is a family of software offerings designed to help organizations manage and protect their data by simplifying backup administration, delivering more scalable solutions, and helping to reduce costs related to backup and recovery.

Backups can be managed by IBM Tivoli Storage Manager Operations Center or VMware vCenter. Tivoli Storage Manager Operations Center delivers breakthrough visibility and ease of use, reducing the level of expertise required. Restores are simplified with item-level and near-instant recovery for virtual machines and for Linux and Microsoft Windows servers and workstations.

More on the Web

- Tivoli Storage Manager info on PartnerWorld
- Tivoli Storage Manager overview on IBM.com

IBM Tivoli Storage Manager Suite for Unified Recovery helps clients get up and running fast, with simplified capacity-based licensing for Tivoli Storage Manager and popular

agents. Users can deploy advanced agents for virtual environments, databases, email, and enterprise resource planning as needed, with no additional licensing costs.

Here are some quick Tivoli Storage Manager facts:

- Simplify backup administration with advanced IBM Tivoli Storage Manager Operations Center dashboard and VMware vCenter plug-in
- Scale up to manage billions of objects per backup server, and scale down to support entry-level environments
- Reduce backup infrastructure costs up to 38 percent with proven efficiency capabilities built in
- Optimize data protection for virtual environments, core applications, remote facilities, and critical workstations
- Protect data with built-in multi-site replication and flexible restore capabilities.

Tivoli Storage Manager for Virtual Environments

IBM Tivoli Storage Manager for Virtual Environments provides an effective solution to this challenge. With it, the burden of running backups on a virtual machine is eliminated by offloading backup workloads from a VMware ESX or ESXi-

More on the Web

- Tivoli Storage Manager for Virtual Environments info on PartnerWorld
- Tivoli Storage Manager for Virtual Environments info on IBM.com

based server to a centralized vStorage backup server. The vStorage backup server, which itself may be run from within a virtual machine, takes full and incremental snapshots of virtual machines, processes backups without the disruption and overhead of running backup tasks from within each virtual machine, and sends the results to an IBM Tivoli Storage Manager (v5.5 or higher) server for management and distribution to the organization's backup storage pool.

Tivoli Storage Productivity Center

Tivoli Storage Productivity Center is a comprehensive, end-to-end storage infrastructure management solution that provides an easy-to-use, next-generation user interface that monitors, reports, and manages storage capacity, performance, devices, and replication services.

More on the Web

- Tivoli Productivity Center info on PartnerWorld
- Tivoli Productivity Center info on IBM.com
- Tivoli Productivity Center Information Center

Tivoli Storage Productivity Center provides a single point of control that helps administrators manage every aspect of the storage infrastructure—between the hosts, through the fabric, and down to the physical disks—across multi-site storage environments.

Here are some quick Tivoli Storage Productivity Center facts:

- Provide comprehensive visibility, control, and automation for heterogeneous storage environments
- Simplify provisioning by using intelligent presets and integrated best practices

- Enable context-sensitive performance management from within the storage management graphical user interface (GUI)
- Simplify data replication for copy management and disaster recovery
- Improve consistency and control for basic configuration and operations of storage systems, devices and storage-area network (SAN) fabrics.

Tivoli Storage FlashCopy Manager

IBM Tivoli Storage FlashCopy Manager software provides fast application-aware backups and restores leveraging advanced snapshot technologies in IBM storage systems.

More on the Web

- Tivoli Storage FlashCopy Manager info on PartnerWorld
- Tivoli Storage FlashCopy Manager info on IBM.com

Here are some quick Tivoli Storage FlashCopy manager facts:

- Perform near-instant application-aware snapshot backups, with minimal performance impact for IBM DB2, Oracle, SAP, Microsoft SQL Server and Exchange
- Improve application availability and service levels through high-performance, near-instant restore capabilities that reduce downtime
- Integrate with IBM Storwize family, IBM System Storage DS8000, IBM System Storage SAN Volume Controller, XIV Storage System, IBM N series, and NetApp on AIX, Solaris, Linux, and Microsoft Windows

- Create application-aware snapshots at remote sites using Metro or Global Mirror on SAN Volume Controller, Storwize family, or XIV
- Satisfy advanced data protection and data reduction needs with optional integration with IBM Tivoli Storage Manager
- Operating systems supported: Windows, AIX, Solaris, and Linux.

FastBack for Storwize V7000

IBM FastBack for Storwize V7000 is is a smarter data protection and near-instant recovery software solution for business-critical Windows and Linux servers connected to the Storwize V7000 storage platform. FastBack for Storwize V7000 includes nondisruptive block-level local backup and near instant recovery plus data deduplication and highly efficient IP-based replication for off-site disaster recovery and business resilience. It also includes granular recovery for Microsoft Exchange email objects, including messages, attachments, contacts, calendar entries, notes, tasks, and journals.

More on the Web

- FastBack for Storwize V7000 info on PartnerWorld
- FastBack for Storwize V7000 info on IBM.com

IBM FastBack for Storwize V7000 can replace the use of tape, especially in small or remote offices that may have a shortage of IT personnel. In larger offices and data centers, it can be integrated with your existing tape backup applications, such as IBM Tivoli Storage Manager, to provide an intermedi-

ary disk-based layer for significantly faster backup and recovery capabilities, while eliminating the need to shut down applications in order to run backup jobs.

Here are some quick FastBack for Storwize V7000 facts:

- Helps provide continuous data protection and recovery management for Microsoft Windows and Linux servers, both locally and replicated to a disaster recovery site
- Gets applications and users back up and running within minutes following any data loss, while full data recovery is performed in the background
- Helps eliminate the need for traditional backup windows by continuously capturing data changes at the block level
- Helps reduce storage and bandwidth requirements with block-level incremental backup, integrated data deduplication, and IP-based replication
- Schedules automated data transfers based on flexible, policy-based settings.

General Parallel File System

The IBM General Parallel File System (IBM GPFS) provides online storage management, scalable access, and integrated information lifecycle management tools that are capable of managing petabytes of data and billions of files. This high-performance, shared-disk file

More on the Web

- General Parallel File System info on PartnerWorld
- General Parallel File System info on IBM.com

management solution offers fast, reliable access to a common set of file-based data.

With GPFS, multiple systems and applications can share common pools of storage, which makes it possible to transparently administer the infrastructure without disrupting applications. This management flexibility reduces costs and improves energy efficiency. GPFS is platform-independent so it can run IBM System p and IBM System x platforms on non-IBM x86 clusters along with storage from other vendors.

Here are some fast GPFS facts:

- Provides seamless capacity expansion to handle the explosive growth of big data and digital information
- Improves efficiency through enterprise-wide, interdepartmental file sharing
- Offers proven commercial-grade reliability to eliminate production outages and eases information life cycle management with policy-driven automation
- Includes active file management to enable asynchronous access and control of local and remote files.

Storage and Data Services

As the volume of data grows continuously, you may need help storing and managing data for effective decision-making. IBM provides storage and data services that can help address your storage infrastructure needs, including assessment, planning, design, implementation, and management. With our storage expertise, time-tested methodologies, and effective tools, we

can help support your current and future storage and data requirements, while helping you achieve better business performance.

We can help enable business growth and innovation with more efficient storage and data services. Our feature-rich services help address your storage needs by proactively establishing a well-organized approach to your storage and data environment. Realize the benefits of an effective storage and information infrastructure by simplifying management of your storage and data environment. With our services, you can gain insight into how your business is using existing storage assets.

More on the Web

- Storage and data services info on IBM.com

We can provide a robust storage infrastructure as well as help improve the value of key data by reducing storage risks considerably.

Systems Lab Services and Training—Storage Consulting Services

IBM Systems Lab Services and Training infuses intelligence into how global information technology works. We help drive down costs by designing flexible infrastructures and better manage risk with advanced technical skills and our experience. We help optimize data center utilization and system solutions. We introduce innovative technologies as they emerge from IBM product development labs, as well as deliver the training needed to best use them.

Leverage our experience and knowledge to address the challenges of demands for service, inflexible infrastructures,

tight budgets, and incomplete, unreliable data. We collaborate with IBM service organizations like Global Technology Services, Global Business Services, Sales and Distribution, Software Group, as well as IBM Business Partners.

More on the Web

- Storage services info on IBM.com

Systems Lab Services and Training offers assistance to IBM Business Partners worldwide, delivering leading edge service and training to accelerate the adoption of IBM technologies. Working together, we can help:

- Grow sales and increase profits
- Improve client satisfaction and business scope
- Compete for more strategic opportunities and pursue larger clients
- Reduce risks working with new technologies
- Gain essential technical skills and expertise.

5

IBM System Networking

The combination of powerful systems for virtualization and converged networks will greatly optimize data center efficiency. However, it requires a closer collaboration in the entire solution stack, including network switching. For years, IBM has been a trusted vendor for enterprise-class servers, and we are now pleased to offer a broad range of networking switches.

More on the Web

- Overview of all IBM System Networking on IBM.com

The smarter data center with improved economics of IT can be achieved by connecting servers and storage with a high-speed and intelligent network fabric that is smarter, faster, greener, open and easy to manage.

IBM takes an open, standards-based approach to implement the latest advances in today's flat, converged data center network designs. IBM System Networking solutions enable clients to deploy a high-speed, low-latency Unified Fabric Architecture.

Advanced virtualization awareness reduces the cost and complexity of deploying physical and virtual data center infrastructure. Simplify management IBM data center networks are easy to deploy, maintain, scale and virtualize, delivering

the foundation of consolidated operations for dynamic infrastructure management.

System Networking Basics

Networking is an essential element in a dynamic infrastructure and an integral part of the strategy to reduce costs, improve services, and manage risk. Organizations must continue to focus on server and storage hardware optimization, technology enhancements, service management improvement, security, resiliency, and integration projects between IT and extended business assets. However, it is important to realize that the network is essential to support these initiatives and to ensure that the maximum benefit is derived.

Five important trends are reshaping today's data center networks:

1. Expanding system virtualization (e.g., VMware, Microsoft's Hyper-V, Xen, and KVM): Organizations of all sizes are enhancing their IT agility through the use of cloud-service architectures to enable rapid deployment of new services and to support rapid growth in any particular service. Additionally, organizations are improving their return on their IT investments through the use of virtualization to support server consolidation. It has been estimated that, in distributed computing environments, up to 85 percent of computing capacity sits idle. Server virtualization and consoliation, however, also consolidates network traffic, resulting in very different network traffic characteristics—driving up bandwidth requirements, starting at the server adapters, and continuing through network access and into the network core.

2. Increasing Virtual Machine (VM) mobility: Once virtualized systems have been implemented, it is only natural to want to take advantage of VM-mobility capabilities (such as VMware's VMotion) for higher service availability and performance. Because of the way IP routing protocols work, however, in order for a VM to successfully move from one system to another, both systems must be on the same IP "subnet," driving the need for fundamental changes to data center network designs—also called "flatter" networks. In addition, however, many organizations use Virtual LANs (VLANs), Access Control Lists (ACLs), and Quality of Service (QoS) settings in the network to enforce systems security and improve service performance. Consequently, when a VM moves, the network must be "VM aware" in order to move those network settings along with it.

3. Growth in distributed application models: Network traffic to and from transaction-based applications historically flowed into the data center directly to the server that would respond to the transaction and the response would flow straight back to the requester (often called "north/south" traffic). With today's distributed application environments such as Web services, service oriented architectures, and scale-out application environments, however, a single request can result in many sub-requests flowing back and forth between back-end systems ("east/west" traffic). It has been estimated that today 80 percent or more of data center traffic is east/west traffic. And, because that traffic is between computing systems, the overall responsiveness of the IT service is extremely sensitive to network latency. Consequently, in order

to deliver satisfactory IT services, organizations must focus on very-low-latency switching at the server network edge switches.

4. Pressure to support network convergence: Storage networks have grown to where the costs of running separate networks are significant—and an attractive target for IT operational cost-cutting initiatives. Likewise, "lossless" Ethernet technologies (e.g., data center bridging standards) are getting to the point that they can provide a viable converged alternative to separate storage and data networks. And, with the pressures to increase bandwidths—for both storage and data network—being driven by virtualization and consolidation, storage and data network convergence seems inevitable. Network upgrades, particularly for the server network edge switches, will be required in order to deliver those lossless Ethernet capabilities.

5. Increasing energy costs and constraints: Data center energy costs are significant and, in some cases, constraints on available power have prevented organizations from meeting growing IT service requirements. It has been estimated that networking equipment uses about one-sixth of a data center's overall power requirements, making energy efficiency a key requirement for all new networking equipment. In addition, many data centers are adopting "hot-aisle/cold-aisle layouts" in order to improve cooling efficiency; consequently, it is important to ensure that the air flow of networking switches matches that of the rest of the systems in the rack.

Seeing that those trends all intersect at the data center server-access switches and recognizing that those switches can either facilitate or inhibit success in responding to those trends, IBM has made a significant investment in its System Networking portfolio. IBM offers:

- A portfolio of server-access switches from IBM System Networking with 1 Gb, 10 Gb, and 40 Gb Ethernet, delivering:
  - Substantially better price/performance
  - Virtual Machine awareness through VMready technology
  - Low-latency
  - Lossless Ethernet support
  - Industry-leading energy efficiency
- Data center core and wide area network access switches
- Switches supporting Fiber Channel Over Ethernet and connectivity to the leading Fiber Channel SANs
- Campus networking switches with robust support for Power Over Ethernet (for devices such as IP telephones, wireless access points, and security cameras).

IBM System Networking Portfolio

IBM System Networking enables an open approach to data center networking, ensuring that clients can implement smarter computing solutions using best-in-class networking equipment. In this section, we explore the IBM System Net-

working portfolio, which includes advanced networking software and high performance switching hardware.

IBM VMready

IBM VMready is switch-resident software that reduces the complexity of configuring and managing virtual machines throughout the network, making it VM-Aware. The network can be configured and managed for thousands of virtual ports (v-ports), rather than just a few physical ports, without manual intervention.

With VMready, as VMs migrate across physical hosts, so do their network attributes automatically. VMready allows you to manage virtual machines as they are added, moved, and removed, while retaining the same ACLs, QoS, and VLAN attributes. VMready allows for a "define once, use many" configuration that evolves as the server and network topologies evolve.

More on the Web

- VMReady specifications
- VMready info on PartnerWorld
- VMready info on IBM.com

VMready works with all virtualization products, including VMware, Microsoft's Hyper-V, Xen, PowerVM, and KVM, without modification of Virtual Machine Hypervisors or Guest operating systems. Virtual Vision enables network virtualization between data centers.

IBM Distributed Virtual Switch 5000V

The IBM System Networking Distributed Virtual Switch (DVS) 5000V is an advanced, feature-rich distributed virtual switch for VMware environments with policy-based virtual machine

(VM) connectivity. The IBM DVS 5000V enables network administrators familiar with IBM System Networking switches to manage the IBM DVS 5000V just like IBM physical switches using advanced networking, troubleshooting, and management features so the virtual switch is no longer hidden and difficult to manage.

Support for Edge Virtual Bridging (EVB) based on the IEEE 802.1Qbg standard enables scalable, flexible management of networking configuration and policy requirements per VM and eliminates many of the networking challenges introduced with server virtualization. The IBM DVS 5000V works with VMware vSphere 5.0 and beyond and interoperates with any 802.1Qbg-compliant physical switch to enable switching of local VM traffic in the hypervisor or in the upstream physical switch. This provides a competitive advantage for IBM with VMware.

More on the Web

- IBM DVS 5000V info on PartnerWorld
- IBM DVS 5000V info on IBM.com

IBM Software Defined Network for Virtual Environments

IBM SDN for Virtual Environments (SDN VE) uses IBM's Distributed Overlay Virtual Ethernet (DOVE) technology to virtualize the networks you already have. IBM Software Defined Network for Virtual Environments creates a virtual network for virtual machines that is decoupled and isolated from the physical network, much like a virtual machine

More on the Web

- IBM SDN VE specifications
- IBM SDN VE info on PartnerWorld
- IBM SDN VE info on ibm.com

is decoupled and isolated from its host server hardware. This approach provides several advantages:

- Virtual networks can be created without any changes to the existing network.
- Since the physical network does not have to be changed, it can be wired once.
- Provisioning and administration can be simplified and automated.
- IP and MAC addresses can be reused permitting logical separation of networks for secure multi-tenancy or data center consolidation.

IBM Programmable Network Controller

The IBM Programmable Network Controller (IBM PNC) provides an OpenFlow-based network fabric with centralized control of network flows and unlimited virtual machine (VM) mobility—implemented in enterprise-class software. The controller is our first Software Defined Networking (SDN) offering, which is an emerging standard for building fast and intelligent networks.

With the Programmable Network Controller data flow control is abstracted from static individual switches to dynamic programmable network-level control. Administrators can quickly create and control virtual networks for each application environment or network service. They can scale highly virtualized application infrastructures, multi-tenant networks on public or private clouds.

By implementing the network fabric's packet forwarding control logic in a software-defined controller, the IBM PNC centralizes the logic that is traditionally embedded in the control plane function of Ethernet switches and routers. Unlike conventional switches that are statically configured once and then must be configured whenever application workloads change or traffic patterns fluctuate, administrators can use the IBM PNC to dynamically direct traffic across multiple switches throughout one or more data centers.

More on the Web

- IBM PNC specifications
- IBM PNC info on PartnerWorld
- IBM PNC info on IBM.com

IBM RackSwitch Portfolio

Data centers can standardize on a unified and affordable rack-level, or top of rack, network infrastructure to provision and scale out Web 2.0 environments, high-performance clusters, and virtualized data centers. IBM's Ethernet RackSwitch family is designed to bring speed and intelligence to the edge of your network; where it's closer to your business, users, and innovations. IBM's top of rack products are lossless, low latency, and low power.

More on the Web

- System Networking RackSwitch Sales Kit
- System Networking RackSwitch info on IBM.com

IBM RackSwitch G8000

The IBM System Networking RackSwitch G8000 (Figure B.1) is an Ethernet switch specifically designed for the data center, providing a virtualized, cooler, and simpler network solution.

The G8000 is virtualized—for the first time providing rack-level virtualization of networking interfaces for a rack full of server and storage systems—decoupling the scaling of networking and computing capacity via on-switch VMready software. VMready enables the movement of virtual machines—providing matching movement of VLAN assignments, ACLs, and other networking and security settings. VMready works with all leading VM providers.

The G8000 is cooler—implementing a choice of directional cooling options to maximize data center layout and provisioning. Its superior airflow design complements the hot-aisle and cold-aisle data center cooling model.

Here are some quick G8000 facts:

- 44 x 1 GbE RJ45 ports, four 1 GbE SFP ports and up to four optional 10 GbE SFP+ or CX4 ports
- Low 120 W power draw and variable speed fans help reduce power consumption. DC power model is also available.
- Network virtualization—IBM VMready automatically detects virtual machine movement from one physical server to another.

- G8000 specifications
- G8000 info on PartnerWorld
- G8000 info on IBM.com

Figure B.1. IBM System Networking RackSwitch G8000 (and links to more detail).

IBM RackSwitch G8052

The IBM System Networking RackSwitch G8052 (Figure B.2) is an Ethernet switch specifically designed for the data center, providing a virtualized, cool, and easy network solution.

The RackSwitch G8052 is virtualized—supporting IBM VM-ready technology, an innovative, standards-based solution to manage virtual machines (VMs) in small to large-scale data center and cloud environments. VMready works with all leading VM providers.

The RackSwitch G8052 is cool—implementing a choice of directional cooling to maximize data center layout and provisioning. Its superior airflow design complements the hot-aisle and cold-aisle data center cooling model.

The RackSwitch G8052 is easy—with server-oriented provisioning via point-and-click management interfaces, along with the optional System Networking Switch Center software package for updating large groups of switches.

Here are some quick G8052 Facts:

- 48 × 1 GbE RJ45 ports and four standard 10 GbE SFP+ ports

- G8052 specifications
- G8052 info on PartnerWorld
- G8052 info on IBM.com

Figure B.2. IBM BNT RackSwitch G8052 (and links to more detail).

- Choice of airflow direction, allowing for significant savings in cooling costs
- Low 130 W power rating and variable speed fans help reduce power consumption
- Network virtualization—VMready automatically detects virtual machine movement from one physical server to another.

IBM RackSwitch G8124E

The IBM RackSwitch G8124E (Figure B.3) is a 10 Gigabit Ethernet switch specifically designed for the data center, providing a virtualized, cooler, and easier network solution. The G8124E offers twenty-four 10 Gigabit Ethernet ports in a high-density, 1U footprint. Designed with top performance in mind, the RackSwitch G8124E provides line-rate, high-bandwidth switching, filtering, and traffic queuing without delaying data and large data-center grade buffers to keep traffic moving.

The G8124E is virtualized—providing rack-level virtualization of networking interfaces. VMready software enables movement of virtual machines—providing matching movement of VLAN assignments, ACLs, and other networking and security settings. VMready works with all leading VM providers, such as VMware, KVM, Citrix, Xen, IBM PowerVM, and Microsoft Hyper-V. The G8124E also supports Virtual Fabric, which allows for the carving up of a physical NIC into 2–8 virtual NICs (vNICs) and creates a virtual pipe between the adapter and the switch (using the IBM Networking OS) for improved performance, availability, and security, while reducing cost and complexity.

- G8124E specifications
- G8124E info on PartnerWorld
- G8124E info on IBM.com

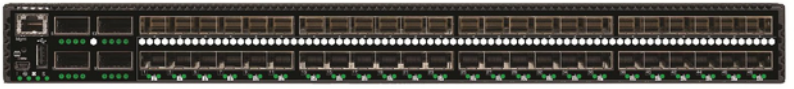
Figure B.3. IBM BNT RackSwitch G8124 (and links to more detail).

Here are some quick G8124 Facts:

- Twenty-four SFP+ ports that operate at 10 Gigabit or 1 Gigabit Ethernet speeds
- Optimal for high-performance computing and applications requiring high bandwidth and low latency
- All ports are non-blocking 10 Gigabit Ethernet with deterministic latency of 570 nanoseconds
- IBM VMready helps reduce configuration complexity and improves security levels in virtualized environments with VM mobility
- Virtual Fabric capability allows for the carving up of a physical NIC into multiple virtual NICs.

IBM RackSwitch G8264

The IBM RackSwitch G8264 (Figure B.4) is ideal for today's big data, cloud, and optimized workloads. It is an enterprise-class and full-featured data-center switch that deliv-



- G8264 specifications
- G8264 info on PartnerWorld
- G8264 info on IBM.com

Figure B.4. IBM BNT RackSwitch G8264 (and links to more detail).

ers line-rate, high-bandwidth switching, filtering, and traffic queuing without delaying data. Large data-center grade buffers keep traffic moving. Redundant power and fans along with numerous high availability features equips the switch for business-sensitive traffic. The G8264 supports IBM VMready technology, an innovative, standards-based solution to manage virtual machines (VMs) in small to large-scale data center and cloud environments.

The RackSwitch G8264 is ideal for latency-sensitive applications such as high performance computing clusters and financial applications and is a key piece when connecting multiple chassis together with Pure System Solutions. The G8264 supports stacking for up to eight switches for simplified switch management as well as IBM Virtual Fabric to enable clients to diminish the number of I/O adapters buy creating virtual NICs out of a 10 Gb adapter, helping reduce cost and complexity. The G8264 supports the newest protocols—including Data Center Bridging/Converged Enhanced Ethernet (DCB/CEE) for support of Fibre Channel over Ethernet (FCoE), in addition to iSCSI and NAS.

Here are some quick G8264 facts:

- Optimized for applications requiring high bandwidth and low latency
- Supports Virtual Fabric and OpenFlow
- Up to sixty-four 10 Gb SFP+ ports in a 1U form factor
- Future-proofed with four 40 Gb QSFP+ ports
- Stacking—A single switch image and configuration file can be used for up to eight switches, sharing only one IP address and one management interface.

IBM RackSwitch G8264T

The RackSwitch G8264T (Figure B.5) is ideal for clients looking to expand into 10 Gb environments without compromising their data center's overall TCO. It provides flexible connectivity for high-speed server and storage devices across distances up to 100m at a low cost.

The G8264T is an enterprise-class and full-featured data-center switch that delivers line-rate, high-bandwidth switching, filtering, and traffic queuing without delaying data. Large data-center grade buffers keep traffic moving. Redundant power and fans along with numerous high availability features equips the switch for business-sensitive traffic. The G8264T supports IBM VMready technology, an innovative, standards-based solution to manage virtual machines (VMs) in small to large-scale data center and cloud environments.

- G8264T specifications
- G8264T info on PartnerWorld
- G8264T info on IBM.com

Figure B.5. IBM RackSwitch G8264T (and links to more detail).

Here are some quick G8264T facts:

- Forty-eight 10GBase-T/1000Base-T RJ45 connections plus four 40 Gb QSFP+ connections in a 1U form factor
- Flexible and low-cost connectivity option for 10 Gb environments supporting distances up to 100 meters
- Supports OpenFlow and IBM VMready.

IBM RackSwitch G8264CS

The G8264CS (Figure B.6) offers the benefits of a converged infrastructure today, while providing flexibility for future growth and expansion. This switch is ideal for clients looking to connect via their existing SAN infrastructure, as well as clients wanting native Fibre Channel connectivity, in addition to support for protocols like Ethernet, FCoE, and iSCSI.

The G8264CS simplifies deployment with its innovative IBM Omni Port technology. Omni Ports give clients the flexibility to choose 10 Gb Ethernet, 4/8 Gb Fibre Channel, or both,

for upstream connections, and in FC mode Omni Ports provide convenient access to FC storage. G8264CS's Omni Port technology helps consolidate enterprise storage, networking, data, and management onto a simple to manage single fabric and reduces costs associated with energy and cooling, management and maintenance, and capital costs.

Here are some quick GS8264CS facts:

- Lossless Ethernet, Fibre Channel, and Fibre Channel over Ethernet (FCoE) in one switch
- Extreme flexibility with IBM Omni Ports that support 10 Gb Ethernet and/or 4/8 Gb Fibre Channel connections
- Ideal for clients looking to aggregate FC/FCoE converged traffic with ability to connect to existing SANs
- Proven IBM end-to-end convergence testing delivering easy interoperability throughout network.

- GS264CS specifications
- G8264CS info on PartnerWorld
- G8264CS info on IBM.com

Figure B.6. IBM RackSwitch G8264CS (and links to more detail).

IBM RackSwitch G8316

The IBM System Networking RackSwitch G8316 (Figure B.7) is a 40 Gigabit Ethernet (GbE) aggregation switch designed for the data center, providing speed, intelligence, and interoperability on a proven platform.

The RackSwitch G8316 offers up to 16×40 GbE ports, which can also be used as a high-density 10 GbE switch using break-out cables (up to 64x10 GbE ports), with 1.28 Tbps—in a 1U foot-print. The G8316 provides a cost-efficient way to aggregate multiple racks of servers compared to other expensive core switches, while allowing massive scalability for your data center network. It is an ideal aggregation layer switch when used with the 10/40 GbE IBM RackSwitch G8264 at the access layer.

Designed with top performance in mind, the RackSwitch G8316 provides line-rate, high-bandwidth switching, filtering, and traffic queuing without delaying data. Large data center grade buffers keep traffic moving. Hot-swappable, redundant power and fans, along with numerous high-availability features enable the RackSwitch G8316 to be available for business-sensitive traffic.

Here are some quick G8316 facts:

- Optimized for applications requiring high bandwidth and low latency
- Sixteen 40 Gb QSFP+ ports in a 1U form factor
- Up to sixty-four 10 Gb SFP+ ports to form a high-density 10 Gb cluster

- G8316 specifications
- G8316 info on PartnerWorld
- G8316 info on IBM.com

Figure B.7. IBM System Networking RackSwitch G8316 (and links to more detail).

- Powerful control plane providing higher performance to aggregate multiple racks of servers
- 1.28 Tbps non-blocking throughput.

IBM Flex System Fabric

IBM can help you reduce cost, complexity, and risk with IBM Flex System Fabric—a portfolio of high performance networking products that can help simplify connectivity of your LAN and SAN infrastructure. The portfolio includes support for Ethernet, Fibre Channel over Ethernet (FCoE), and even Fibre Channel protocols. Flex System Fabric also supports extraordinary convergence of NAS, iSCSI, and even FCoE where the Fibre Channel can be broken out directly in the chassis or upstream in the network. The portfolio offers easy standards-based interoperability with

More on the Web

- Flex System Fabric

your existing networking environment, including Cisco, Brocade, Juniper, and other networking infrastructures.

SI4093 System Interconnect Module

The IBM Flex System Fabric SI4093 System Interconnect Module (Figure F.1) enables a simplified integration of the IBM Flex System into your existing networking infrastructure. The default configuration of the SI4093 requires no management for most data center environments, eliminating the need to configure each device or individual ports, thus reducing the number of management points. The device provides a low latency, loop-free interface that does not rely upon spanning tree protocols, thereby removing one of the greatest deployment and management complexities of a traditional switch. The SI4093 offers administrators a simplified deployment experience while maintaining the performance of intra-chassis connectivity, yet provides the simplicity of a single aggregated connection to the upstream network.

Here are some quick SI4093 facts:

- Preconfigured device designed for easy network connectivity to reduce deployment time
- Reduces management complexity without compromising performance
- Investment protection with "pay-as-you-grow" scalability with the ability to turn on additional 10 Gb or 40 Gb ports
- Easy interoperability with multi-vendor network infrastructures

- SI4093 System Interconnect Module details on PartnerWorld
- SI4093 System Interconnect Module info on IBM.com
- SI4093 Scalable Switch competitive info on COMP

Figure F.1. IBM Flex System Fabric SI4093 System Interconnect Module (and links to more detail).

- Reduce networking CAPEX by up to 60 percent when compared with a pass-thru module.

EN4093R 10 Gb Scalable Switch

The IBM Flex System Fabric EN4093R 10 Gb Scalable Switch (Figure F.2) provides unmatched scalability and performance, while also delivering innovations to help address a number of networking concerns today and providing capabilities that will help you prepare for the future.

With the growth of virtualization and the evolution of cloud, many of today's applications require low latency and high

bandwidth performance. The Flex System Fabric EN4093R is the first blade switch to support sub microsecond latency and up to 1.28 Tbps, while also delivering full line rate performance, making it ideal for managing dynamic workloads across your network. In addition, the switch provides a rich Layer 2 and Layer 3 feature set that is ideal for many of today's data centers, plus offers industry-leading uplink bandwidth by being the first blade switch to support 40 Gb uplinks.

Here are some quick EN4093R 10 Gb Scalable Switch facts:

- "Pay-as-you-grow" scalability with the ability to turn on additional 10 Gb or 40 Gb ports

- EN4093R 10 Gb Scalable Switch details on PartnerWorld
- EN4093R 10 Gb Scalable Switch info on IBM.com
- EN4093R 10 Gb Scalable Switch competitive info on COMP

Figure F.2. IBM Flex System Fabric EN4093R 10 Gb Scalable Switch (and links to more detail).

- Reduce cost and complexity via network convergence, stacking, and Virtual Fabric
- Performance and low latency with 1.28 Tbps and less than 1 microsecond latency
- Investment protection when migrating from 1 Gb to 10 Gb and to a converged network
- Designed for FCoE as a transit switch, where FC is broken out further upstream in the network.

EN2092 1 Gb Ethernet Scalable Switch

The IBM Flex System EN2092 1 Gb Ethernet Scalable Switch (Figure F.3) provides outstanding flexibility allowing you to buy one switch today and enhance its functionality in the future. The scalable architecture allows you to support 2-port or 4-port 1 Gb adapters with this switch. The EN2092 supports up to 28 server ports and up to twenty 1 Gb uplinks and four 10 Gb uplinks. Designed with top performance in mind, the EN2092 provides high availability with legendary IBM quality and switch failover capability.

This switch is an exceptionally flexible integrated switch with extreme scalability and performance, while also delivering best-in-class networking innovations to help you address today's networking requirements. It also provides advanced capabilities to address future needs.

Here are some quick 1 Gb Scalable Switch facts:

- "Pay-as-you-grow" scalability with the ability to turn on additional 1 Gb ports or 10 Gb capacity

- 1 Gb Scalable Switch details on PartnerWorld
- 1 Gb Scalable Switch details on IBM.com
- 1 Gb Scalable Switch competitive info on COMP

Figure F.3. IBM Flex System EN2092 1 Gb Ethernet Scalable Switch (and links to more detail).

- Simpler management with IBM's innovative VMready virtualization-aware networking for automated Virtual Machine mobility
- Investment protection for your 1 Gb or 10 Gb network infrastructure
- Integrated network management allowing network administrators to manage servers, storage and networks together as one logical unit.

SAN Fabric

The growing importance of storage is fueling a model for storage infrastructures in which storage devices are not attached to a specific server but rather make up an independent storage area network, or SAN. The storage devices (disk arrays,

tape drives, SVC, etc.) residing in a SAN are shared among a group of servers that reside on the same network.

In addition to storage devices and servers, IBM sells switches, directors, and routers used to build SAN fabrics. In this section, we look at these SAN fabric products. IBM SAN products and solutions provide integrated SMB and enterprise SAN solutions with multiple local, campus, metropolitan, and global storage networking options.

More on the Web

- SAN Fabric info on IBM.com

SAN Fabric for Entry-Level Workloads

Here is a list of SAN fabric products designed for entry-level workloads. Click on the links and you will jump to the section of this ebook that describes the product.

- SAN24B-5
- SAN24B-4 Express
- Cisco MDS 9124 Express
- Cisco 9148

More on the Web

- SAN fabric for entry-level workloads

SAN Fabric for Mid-Size Workloads

Here is a list of SAN fabric products designed for mid-size workloads. Click on the links and you will jump to the section of this ebook that describes the product.

- SAN48B-5
- SAN80B-4
- SAN96B-5
- Cisco MDS 9148

More on the Web

- SAN fabric for mid-size workloads

SAN Fabric for Enterprise Workloads

Here is a list of SAN fabric products designed for large enterprise workloads. Click on the links and you will jump to the section of this ebook that describes the product.

More on the Web

- SAN fabric for enterprise workloads

- SAN384B-2 and SAN768B-2
- Cisco MDS 9500 series Multilayer Directors
- Cisco MDS 9710 Multilayer Director

SAN Specialty Switches

We also offer the following SAN Specialty Switches. These SAN specialty switches deliver capabilities ranging from connecting heterogeneous SAN fabrics, to enabling distance extension using Fibre Channel over IP, to converging SAN and Ethernet traffic on a single platform. Click on the links and you will jump to the section of this ebook that describes the product.

More on the Web

- SAN Specialty Switches

- SAN06B-R
- SAN32B-E4
- Brocade VDX 6730 Converged Switch for IBM
- Cisco MDS 9222i

SAN b-type Switches

The IBM System Storage SAN b-type family provides entry, midrange and specialty switches and enterprise directors.

SAN24B-4 Express

The IBM System Storage SAN24B-4 Express fabric switch (Figure S.1) is designed specifically to address the needs of small- to medium-sized storage area network (SAN) environments. It can be used to create a wide range of high-performance SAN solutions, from simple, single-switch configurations to larger, multi-switch configurations that support fabric connectivity and advanced business continuity capabilities. Infrastructure simplification solutions for IBM System x, IBM BladeCenter and IBM Power Systems servers include storage consolidation and high availability server clustering with System Storage disk storage arrays. Business continuity solutions include data protection with System Storage tape libraries and devices and IBM Tivoli Storage Manager data protection software.

Here are some quick SAN24B-4 Express facts:

- Benefit from easy-to-install and easy-to-use features designed specifically for small- to medium-sized environments
- Reach new performance levels with 8 Gbps Fibre Channel technology
- Scale from 8 to 16 to 24 ports with Ports on Demand
- Protect existing 4, 2, and 1 Gbps infrastructure investments while positioning for future technologies
- Use as the foundation for new infrastructure simplification and business continuity solutions for servers running Microsoft Windows, UNIX, Linux, and IBM AIX and OS/400 operating systems.

- SAN24B-4 specifications
- SAN24B-4 Express info on PartnerWorld
- SAN24B-4 Express info on IBM.com

Figure S.1. IBM System Storage SAN24B-4 Express (and links to more detail).

SAN24B-5

The IBM System Networking SAN24B-5 switch (Figure S.2) is designed to provide outstanding price and performance value, combining flexibility, simplicity, 16 Gbps Fibre Channel technology and enterprise-class functionality in an entry-level switch. The SAN24B-5 is configurable in 12 or 24 ports and supports 2, 4, 8, or 16 Gbps speeds in an efficiently designed 1U form factor. Base unit includes one (249824G/2498-X24) or two (2498-F24) integrated power supplies and fans. A second power supply provides additional redundancy for increased resiliency.

Here are some quick SAN24B-5 facts:

- Gain flexibility, simplicity and enterprise-class functionality in a 24-port, 1U form factor, entry-level switch
- Scale from 12 to 24 ports using ports-on-demand capabilities
- Maximize resiliency with non-disruptive software upgrades and redundant power supply

- SAN24B-5 specifications
- SAN24B-5 Express info on PartnerWorld
- SAN24B-5 Express info on IBM.com

Figure S.2. IBM System Storage SAN24B-5 Express (and links to more detail).

- Streamline deployment and troubleshooting time with dynamic fabric provisioning, critical monitoring and advanced diagnostic features
- Simplify server connectivity and SAN scalability with dual functionality as either a full-fabric SAN switch or an N_Port ID virtualization (NPIV)-enabled access gateway.

SAN48B-5

The IBM System Storage SAN48B-5 SAN switch (Figure S.3) works (SANs) is designed to meet the demands of hyper-scale private or hybrid cloud storage environments by delivering 16 Gbps Fibre Channel technology and capabilities that support highly virtualized environments. To enable greater flexibility and investment protection, SAN48B-5 is configurable in 24, 36, or 48 ports and supports 2, 4, 8, 10, or 16 Gbps speeds in an efficiently designed 1U package. This switch—now enhanced with enterprise connectivity options

- SAN48B-5 specifications
- SAN48B-5 info on PartnerWorld
- SAN48B-5 info on IBM.com

Figure S.3. IBM System Storage SAN48B-5 16 Gbps SAN fabric switch (and links to more detail).

that add support for IBM FICON connectivity—can provide a highly reliable infrastructure when used with fast, scalable IBM System z servers.

Here are some quick SAN48B-5 facts:

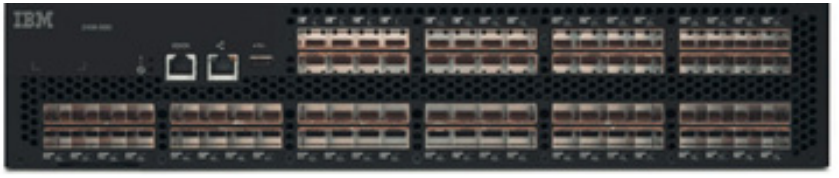
- Gain great flexibility for diverse deployment strategies with the Gen 5 Fibre Channel switch, which delivers 16 Gbps performance with up to 48 ports in an energy-efficient, 1U form factor
- Leverage Ports on Demand (PoD) capabilities to achieve fast, easy, and cost-effective scaling from 24 to 48 ports in 12-port increments
- Maximize availability with nondisruptive software upgrades and redundant, hot-pluggable components.

SAN80B-4

The IBM System Storage SAN80B-4 SAN fabric switch (Figure S.4) provides 48, 64, or 80 active ports and is designed for high performance with 8 Gbps link speeds and backward compatibility to support links running at 4, 2, and 1 Gbps link speeds. High availability features make it suitable for use as a core switch in midrange environments or as an edge switch in enterprise environments where a wide range of SAN infrastructure simplification and business continuity configurations are possible. IBM POWER Systems, System x, System z, and many non-IBM disk and tape devices are supported in many common operating system environments. Optional features provide specialized distance extension, dynamic routing between separate or heterogeneous fabrics, link trunking, FICON, Server Application Optimization (SAO), performance monitoring, and advanced security capabilities.

Here are some quick SAN80B-4 facts:

- High port density design with up to 80 ports in an efficient, compact 2U height helps save rack space
- Robust midrange and enterprise SAN fabric switch for IBM POWER Systems, System x, System z, and other server environments
- Provides new levels of performance with 8 Gbps Fibre Channel (FC) technology
- Ports-on-Demand scalability supports non-disruptive capacity activation from 48 to 64 to 80 ports



- SAN80B-4 specifications
- SAN80B-4 info on PartnerWorld
- SAN80B-4 info on IBM.com

Figure S.4. IBM System Storage SAN80B-4 fabric switch (and links to more detail).

- Designed to support high availability with redundant, hot-swappable fans and power supplies and non-disruptive software upgrades.

SAN96B-5

The IBM System Networking SAN96B-5 switch (Figure S.5) is a high-density, purpose-built, foundational building block for large and growing storage area network (SAN) infrastructures. It is designed to provide highly resilient, scalable and simplified network infrastructure for storage. By delivering market-leading, Gen 5 Fibre Channel technology and capabilities with 16 Gbps performance, SAN96B-5 meets the demands of growing, dynamic workloads; evolving, virtualized data-centers; and highly virtualized, private and hybrid cloud storage environments.

SAN96B-5 provides industry-leading scalability, reliability and performance in a flexible, easy-to-deploy enterprise-class switch that enables greater data center consolidation,

- SAN96B-5 specifications
- SAN96B-5 info on PartnerWorld
- SAN96B-5 info on IBM.com

Figure S.5. IBM System Storage SAN96B-5 SAN fabric switch (and links to more detail).

operational efficiency and business continuity. In addition to increased throughput, it helps improve bandwidth utilization, security, and network visibility and management through in-flight data compression, encryption and advanced diagnostics. This is an ideal switch for bandwidth-intensive workloads that require a large number of ports.

Here are some quick SAN96B-5 facts:

- Support highly virtualized private and hybrid cloud storage environments and data center consolidation with high scalability in an ultra-dense, Gen 5 Fibre Channel 96-port switch
- Enable "pay-as-you-grow" flexibility—from 48 to 96 ports—using the Ports on Demand (PoD) feature with speeds up to 16 Gbps
- Provide data center-to-data center security and bandwidth savings with up to eight in-flight encryption and compression ports

- Help maximize application uptime and performance while reducing overall operational expenses with ClearLink diagnostic technology (D_Ports).

b-type Specialty Switches

In this section, we explore b-type specialty switches.

SAN06B-R

The IBM System Storage SAN06B-R extension switch (Figure S.6) accelerates and optimizes replication, backup, and migration over any distance using next-generation Fibre Channel and Fibre Channel over IP (FCIP) networking technology. It combines industry leading performance and reliability, "pay-as-you-grow" scalability, and flexible deployment options to address the most demanding disaster recovery, compliance, and data mobility requirements.

A wide range of IBM System Storage mid-range and enterprise storage area network (SAN) infrastructure simplification and business continuity solutions can be created with the IBM System Storage SAN06B-R extension switch. Infrastructure simplification solutions for the IBM Power Systems and System x families include disaster tolerance over metropolitan and global IP networks with IBM System Storage disk arrays, tape libraries, and IBM Tivoli Storage Manager data protection software. Support for System z servers is provided via the optional 8 Gbps Advanced Extension, IBM FICON Accelerator and FICON CUP Activation features.

- SAN06B-R specifications
- SAN06B-R info on PartnerWorld
- SAN06B-R info on IBM.com

Figure S.6. IBM System Storage SAN06B-R Extension Switch (and links to more detail).

Here are some quick SAN06B-R facts:

- Designed for high performance to maximize replication with up to sixteen 8 Gbps Fibre Channel (FC) ports and six 1 Gigabit Ethernet (GbE) ports for faster data replication, backup and recovery.
- Utilizes existing IP-based Metropolitan Area Network (MAN) or Wide Area Network (WAN) infrastructures for cost-effective replication, backup, and recovery
- "Pay-as-you-grow" scalability
- FCIP trunking enables logical high-bandwidth FCIP tunnels spanning multiple physical ports to maximize bandwidth and WAN link resiliency.
- Enhanced Compression Architecture provides multiple modes to optimize compression ratios for various throughput requirements.

- Adaptive Rate Limiting dynamically adjusts bandwidth between minimum and maximum rate limits to optimize bandwidth utilization and sharing.
- FCIP Quality of Service (QoS) is available on all b-type platforms that support 8 Gbps link speeds, provides high, medium- and low-priority handling of initiator-target flows within the same FCIP tunnel for transmission over the WAN.
- FICON Accelerator uses advanced networking technologies, data management techniques and protocol intelligence to accelerate FICON Global Mirror, formerly XRC and tape read/write operations over distances well beyond 300 Km.
- Storage-optimized TCP optimizes TCP window size and flow control, accelerating TCP transport for storage applications.
- Integrated IBM System Storage SAN b-type switch management helps simplify installation and administration and helps provide fabric investment protection.
- Integration with IBM System Storage Data Center Fabric Manager (DCFM) simplifies configuration.

SAN32B-E4

The IBM System Storage SAN32B-E4 Encryption Switch (Figure S.7) is a high-performance stand-alone device designed for protecting data-at-rest in mission-critical environments. In addition to helping IT organizations achieve compliance with regulatory mandates and meeting industry standards for data confidentiality, the SAN32B-E4 Encryption Switch also protects them against potential litigation and liability following a reported breach.

- SAN32B-E4 specifications
- SAN32B-E4 info on PartnerWorld
- SAN32B-E4 info on IBM.com

Figure S.7. IBM System Storage SAN32B-E4 Encryption Switch (and links to more detail).

Data is one of the most highly valued resources in a competitive business environment. Protecting that data, controlling access to it, and verifying its authenticity while maintaining its availability are priorities in our security-conscious world. Increasing regulatory requirements are also helping to drive the need for the adequate security of data. Encryption is a powerful and widely used technology that helps protect data from loss and inadvertent or deliberate compromise.

In the context of data center fabric security, IBM provides advanced encryption services for storage area networks (SANs) with the IBM System Storage SAN32B-E4 Encryption Switch. The switch is a high-speed, highly reliable hardware device that delivers fabric-based encryption services to protect data assets either selectively or on a comprehensive basis. The 8 Gbps SAN32B-E4 Fibre Channel Encryption Switch scales non-disruptively, providing from 48 up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand perfor-

mance. It also provides compression services at speeds of up to 48 Gbps for tape storage systems. Moreover, it is tightly integrated with one of the industry-leading, enterprise-class key management systems, the IBM Tivoli Key Lifecycle Manager (TKLM), which can scale to support key life-cycle services across distributed environments.

Here are some quick SAN32B-E4 facts:

- Enforce data confidentiality and privacy requirements using high-performance, scalable fabric-based encryption
- Centralize administration of data-at-rest encryption services to ensure data protection on both disk and tape
- Reduce operational costs and simplify management through the IBM Tivoli Key Lifecycle Manager solution
- Meet regulatory mandates for securing data while maintaining application performance with on-demand encryption and compression processing power
- Industry-standard AES-256 encryption algorithms for both disk and tape in a centralized security platform for SAN environments
- High-performance encryption processing at up to 96 Gbps to support heterogeneous enterprise data centers
- Plug-in encryption services available to all host servers, including virtual machines, attached to data center fabrics
- Frame redirection technology to enable easy, non-intrusive deployment of fabric-based security services.

Brocade VDX 6730 Converged Switch

Seeking better ways to build clouds and virtualized data centers, today's IT organizations are turning to high performance networking solutions that increase flexibility through leading-edge technologies. Whether organizations want to enhance their classic hierarchical network architectures or deploy flatter scale-out fabrics for virtualized data centers, the Brocade VDX 6730 Converged Switches for IBM (Figure S.8) deliver the innovative technology to enhance and simplify their networks.

IBM is partnering with Brocade, an industry-leading SAN Switch provider, to deliver converged data center solutions. Converging FC storage and regular Ethernet traffic on one platform allows administrators to reduce the number of adapters, simplify management and protect storage investments by utilizing the existing SAN infrastructure. IBM delivers interoperability by providing end-to-end FCoE testing with the latest System x servers, Brocade VDX 6730 Converged switches, IBM System Storage SAN b-type and Brocade SAN switches and IBM Storage.

Here are some quick BROCADE VDX 6730 facts:

- 1U Brocade VDX 6730-32 with 24 x 10 GbE LAN ports and 8 x 8 Gbps native FC ports (FC transceivers shipped standard)
- 2U Brocade VDX 6730-76 with 60 10 GbE LAN ports and 16x 8 Gbps native FC ports (FC transceivers shipped standard)
- 10 Gigabit Ethernet (GbE) FCoE switch with LAN and native Fibre Channel ports

- Brocade VDX 6730 specifications
- Brocade VDX 6730 info on PartnerWorld
- Brocade VDX 6730 info on IBM.com

Figure S.8. The Brocade VDX 6730 Converged Switch for IBM (and links to more detail).

- Supports multiple protocols including Fibre Channel over Ethernet (FCoE), iSCSI, and NAS
- Streamlines management by utilizing Brocade Network Advisor and available integration with IBM System Director
- Ideal for customers looking to connect to existing Brocade SANs.

SAN b-type Directors

In this section, we explore SAN b-type directors.

SAN384B-2 and SAN768B-2

The IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones (Figure S.9) are among the industry's most powerful Fibre Channel switching infrastructure offerings. They provide reliable, scalable, high-performance foundations for mission-critical storage. These fabric backbones also deliver enterprise connectivity options to add support for IBM FICON

connectivity, offering a high-performing and reliable FICON infrastructure with fast and scalable IBM System z servers.

Designed to increase business agility while providing non-stop access to information and reducing infrastructure and administrative costs, SAN768B-2 and SAN384B-2 Gen 5 Fibre Channel fabric backbones deliver a new level of scalability and advanced capabilities to this robust, reliable, high-performance technology

Here are some quick SAN384B-2 and SAN768B-2 facts:

- Unleash the full potential of private or hybrid cloud storage with outstanding scalability, performance and reliability

- SAN384B-2/SAN768B-2 specifications
- SAN384B-2 info on PartnerWorld
- SAN768B-2 info on PartnerWorld
- SAN384B-2/SAN768B-2 info on IBM.com

Figure S.9. IBM System Storage SAN384B and SAN768B (and links to more detail).

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management and costs
- Simplify and centralize end-to-end storage area network (SAN) management with comprehensive diagnostics, monitoring and automation
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption
- Maximize performance for I/O- and bandwidth-intensive applications.

Cisco MDS

The Cisco MDS family provides a full suite of switches, directors, and specialty switches.

Cisco MDS 9100 series Switches

In this section, we explore Cisco MDS 9100 series switches.

Cisco MDS 9124 Express

The Cisco MDS 9124 Express for IBM System Storage (Figure S.10) is designed to address the needs of small and mid-size organizations with a wide range of SAN capabilities. It can be used as part of a SAN solution with simple, single-switch configurations as well as larger, multi-switch configurations to support fabric connectivity and advanced business continuity capabilities. Fabric connectivity capabilities can be the basis for infrastructure simplification solutions for IBM System i, IBM Power Systems and IBM System x server and

- Cisco MDS 9124 specifications
- Cisco MDS 9124 info on PartnerWorld
- Cisco MDS 9124 info on IBM.com

Figure S.10. Cisco MDS 9124 Express for IBM System Storage (and links to more detail).

storage consolidation, and high-availability server clustering with System Storage disk storage arrays. Business continuity capabilities can help organizations protect valuable data with System Storage tape libraries and devices and IBM Tivoli Storage Manager data-protection software.

Here are some fast Cisco MDS 9124 facts:

- Provide a foundation for new infrastructure simplification and business continuity solutions for servers running Microsoft Windows, UNIX, Linux, IBM AIX, IBM Virtual I/O, and IBM i operating systems
- Gain high-performance 1, 2 and 4 GB-per-second links with pay-as-you-grow scalability
- Ensure high availability with hot-swappable, dual power supplies and nondisruptive firmware upgrades
- Support scalability and consistent service as the storage area network (SAN) grows

- Deliver added intelligence and business value with Enterprise Package and Data Center Network Manager advanced features.

Cisco MDS 9148

The Cisco MDS 9148 for IBM System Storage Multilayer Fabric Switch (2417-C48) is designed to provide an affordable, highly capable and scalable storage networking solution for small, midrange and large enterprise customers (Figure S.11). The switch provides line-rate 8 Gbps ports with high-performance, high-density, and enterprise-class availability. The switch is designed to offer outstanding value by providing flexibility, high availability, security and ease of use at an affordable price in a compact, one rack-unit (1RU) form factor. With the ability to expand from 16 to 48 ports in eight-port increments, the Cisco MDS 9148 can be used as the foundation for small, stand-alone SANs, as a top-of-rack switch, or as an edge switch in larger, core-edge storage area network (SAN) infrastructures.

- Cisco MDS 9148 specifications
- Cisco MDS 9148 info on PartnerWorld
- Cisco MDS 9148 info on IBM.com

Figure S.11. Cisco MDS 9148 for IBM System Storage (and links to more detail).

The Cisco MDS 9148 Multilayer Fabric Switch is designed to support quick configuration with zero-touch plug-and-play features and task wizards that allow it to be deployed quickly and easily in networks of any size. Powered by Cisco MDS 9000 NX-OS Software, it includes advanced storage networking features and functions and is compatible with Cisco MDS 9000 Series Multilayer Directors and Switches, providing transparent, end-to-end service delivery in core-edge deployments.

Here are some fast Cisco MDS 9148 facts:

- Extraordinary price/performance with up to forty eight 8 Gbps line rate ports in a compact 1 RU platform.
- Scales from 16 ports to 48 ports in eight-port increments.
- Redundant power supplies and fans and other availability features help minimize downtime and improve business resiliency.
- Built-in management, operational and configuration tools and plug-and-play features support quick deployment and easy end-to-end SAN management.
- All-in-one licensing with no hidden charges.

Cisco MDS Specialty Switches

In this section, we will explore Cisco MDS specialty switches.

Cisco MDS 9222i

A wide range of IBM System Storage medium-size and enterprise storage area network (SAN) IT simplification and busi-

ness continuity solutions can be created with the Cisco MDS 9222i for IBM System Storage multiservice modular switch (Figure S.12). Infrastructure simplification solutions for the IBM Power Systems, System i, System p, System x, and System z families of servers include storage consolidation and high-availability server clustering with IBM System Storage disk storage arrays. Business continuity solutions include data protection with IBM System Storage tape libraries and devices and IBM Tivoli Storage Manager data protection software; and disaster protection with IBM System Storage disk metro and global mirroring disaster recovery solutions.

Here are some quick MDS 9222i facts:

- Multiservice design for high performance business continuity solutions with Windows, UNIX, Linux, NetWare, IBM OS/400 and IBM z/OS servers
- Storage media encryption (SME) for secure encryption of data stored on heterogeneous tapes, virtual tape libraries, and disk arrays
- Cost-effective "green" switch design requires up to 27 percent less power per port
- Modular design provides "pay-as-you-grow" scalability and configuration flexibility
- Excellent availability with redundant, hot swappable components and non-disruptive firmware upgrades
- Intelligent network services such as Virtual SAN (VSAN) capability for SAN consolidation into virtual SAN islands on a single physical fabric

- Cisco MDS 9222i specifications
- Cisco MDS 9222i info on PartnerWorld
- Cisco MDS 9222i info on IBM.com

Figure S.12. Cisco MDS 9222i for IBM System Storage (and links to more detail).

- Enterprise, Mainframe and Data Center Network Manager (DCNM) Advanced Packages provide added intelligence and value.

Cisco MDS 9500 series Multilayer Directors

In this section, we explore Cisco MDS 9500 series directors.

Cisco MDS 9506, 9509, and 9513

The Cisco MDS 9500 Series Multilayer Directors for IBM System Storage (Figure S.13) are director-class storage area networking (SAN) switches designed for deployment in scalable enterprise and service provider clouds to enable flexibility, resiliency, and reliability. Layering a comprehensive set of intelligent features onto a high-performance, protocol-independent switch fabric, the MDS 9500 Series Multilayer Directors address the critical requirements of large virtualized data center storage environments such as high availability, secu-

(a) (b) (c)

- Cisco MDS 9500 series Multilayer Director specifications
- Cisco MDS 9500 Series Multilayer Directors info on Partnerworld
- Cisco MDS 9500 Series Multilayer Directors info on IBM.com

Figure S.13. a) Cisco MDS 9506 for IBM System Storage, b) Cisco MDS 9509 for IBM System Storage, c) Cisco MDS 9513 for IBM System Storage (and links to more detail).

rity, scalability, ease-of-management, and simple integration of new technologies for extremely flexible data center SAN solutions.

Sharing the same operating system and management interface with other Cisco data center switches, the MDS 9500 Directors can help enable smooth deployment of unified fabrics with high-performance Fibre Channel and FCoE connectivity for low total cost of ownership (TCO). Compatible with all generations of Cisco MDS 9000 Family Fibre Channel Switching Modules, the MDS 9500 Series Multilayer Directors can help provide outstanding investment protection.

The Cisco MDS 9513 offers up to 528 1, 2, 4, and 8 Gbps autosensing Fibre Channel ports and up to 264 10 Gbps Fibre Channel ports in an 11-slot modular chassis. The MDS 9513 provides up to 1056 Fibre Channel ports in a single rack.

The Cisco MDS 9509 offers up to 432 1, 2, 4, and 8 Gbps autosensing Fibre Channel ports and up to 216 10 Gbps Fibre Channel ports in a nine-slot modular chassis. The MDS 9509 provides up to 864 Fibre Channel ports in a single rack.

The Cisco MDS 9506 provides up to 288 1, 2, 4, and 8 Gbps autosensing Fibre Channel ports and up to 144 10 Gbps Fibre Channel ports in a six-slot modular chassis.

Here are some quick MDS 9500 director facts:

- Offers scalability to 192, 336 and 528 maximum Fibre Channel port count at 1, 2, 4, 8, and 10 Gbps Fibre Channel speed
- Multilayer architecture transparently integrates Fibre Channel, Fibre Channel over Ethernet (FCoE), IBM FICON, Internet Small Computer System Interface (iSCSI), and Fibre Channel over IP (FCIP) in one system
- 32- and 48-port 8 Gbps Advanced Fibre Channel switching modules designed to allow a port to be configured as either 1, 2, 4, 8 or 10 Gbps, consolidating all ports into the same Fibre Channel switching module
- High-performance Inter-Switch Links (ISLs) that provide additional availability at the fabric level; PortChannel capability allows users to aggregate up to 16 physical links into one logical bundle

- Supports all generations of Cisco MDS 9000 Family switching modules, providing outstanding investment protection
- Delivers comprehensive security and unified SAN management
- Includes Virtual SAN (VSAN) capability for SAN consolidation into virtual SAN islands on a single physical fabric.

Cisco MDS 9710 Multilayer Director

Cisco MDS 9710 Multilayer Director for IBM System Networking (Figure S.14) enables not only enterprise clouds—but business transformation.

- Cisco MDS 9710 Multilayer Director specifications
- Cisco MDS 9710 Multilayer Director info on Partnerworld
- Cisco MDS 9710 Multilayer Director info on IBM.com

Figure S.14. Cisco MDS 9710 Multilayer Director (and links to more detail).

Layering a comprehensive set of intelligent features over a high performance, protocol-independent switch fabric, MDS 9710 addresses the rigorous requirements of large, virtualized data-center storage environments with features such as high availability, extreme scalability, flexibility, security, and ease of management. Importantly, it enables the transparent integration of new technologies into the data center to provide highly flexible SAN solutions.

With the exponential growth of data in today's business environments, organizations must deploy large-scale SANs in the most efficient and cost-effective way possible.

Here are some quick Cisco MDS 9710 facts:

- Add next-generation capabilities to help future-proof the data center for cloud and massive amounts of data
- Meet scalability requirements while managing total cost of ownership (TCO) by scaling up to 384 Fibre Channel ports per chassis at 2, 4, 8, 10, and 16 Gbps at full line-rate speed
- Attain high availability with fully redundant components, including fabric cards, supervisors, and power supplies
- Benefit from intelligent network features such as virtual storage area network (SAN) technology, access control lists (ACLs), intelligent frame processing, and fabric-wide quality of service (QoS).

About the Editor

Jim Hoskins is the founder of Maximum Press, a premier publisher of books, ebooks, and rich media that help businesses apply technology profitably. Jim has been involved with computer technology design, implementation, and education for over 25 years. He is the author of many articles and books covering a wide range of technology and Internet business topics. Jim spent a decade with IBM designing computer systems and directly helping businesses of all sizes design and implement real-world solutions. He is the author/editor of the popular *Exploring IBM* series, which has sold over 350,000 copies in 12 languages. Jim has a degree in electrical engineering from the University of Florida and resides in Gulf Breeze, Florida, with his wife and five children. You can reach Jim via email at jimh@maxpress.com.