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IBM System Storage[™] Portfolio Overview





Storage Trends and Directions





Solid-state storage interest is surging



The InfoPro Technology Heat Index[®]

Technology	Wave 8 Rank	Wave 9 Rank	Wave 10 Rank	Wave 11 Rank	Wave 12 Rank	Wave 13 Rank
Backup Data Reduction/Deduplication	14	1	1	1	1	1
Online Data Reduction/Deduplication	N/A	N/A	N/A	N/A	2	2
Solid-state Disk Drives (SSD)	21	25	N/A	23	10	3

Source: TheInfoPro Storage Study (Q4 2009): F1000 Sample. Wave 8, n=153; Wave 9, n=152; Wave 10, n=152; Wave 11, n=140; Wave 12, n=156; Wave 13, n=185.



Hard Disk Drives and NAND Flash Storage Comparison



Source: IBM Almaden Research, Steven R. Hetzler, Sep 2009



The solution: IBM System Storage Easy Tier

- Increase performance by up to 300%!
 - Solid state drives (SSD) provides breakthrough performance.
- Easy Tier maximizes performance gains while minimizing costs.
 - Relocating just 5% of data to SSDs with Easy Tier can reduce response time 78%!
- Easy Tier is easy.
 - Smart data placement is completely automated.
- Easy Tier is easy and efficient, unlike EMC FAST, which is neither easy nor fast.

Simplicity, flexibility, economy



Reduce Cost and Improve Service Levels



Smart data placement with Easy Tier

- First ever Storage Performance Council (SPC-1) benchmark submission with SATA and SSD technology
 - System configuration: 2.3 TB SSD + 96 TB SATA

Increase of 330%!



Easy Tier





IBM Solid State Drive (SSD) Strategy







Solid State as internal storage for the Server

Edge and DMZ servers outside corporate firewall

Fast re-boot

Save up to 1500 Watts per server rack (84 servers) with IBM BladeCenter SSD as a slower non-volatile store (NVS) cache

Offers performance acceleration of all I/O, or designated I/O

Managed using cache algorithms

SSD as resident disk external storage

For OLTP, ERP and other high requirements for IOPS

Can be used for business analytics



Cloud Computing – A Disruptive New Paradigm?



Source: National Institute of Standards and Technology (NIST)



The Evolution of IT Resource Virtualization



Virtualization is technology that makes one set of resources look and feel like another set of resources, preferably with more desirable characteristics

Why IBM System Storage?

- Heritage of Distinction
 - 50+ years in storage business
 - Innovation leadership Invented many of the storage technologies employed today

Leadership in Storage Today

- Over \$5 billion revenues
- Leading and growing market share
- Over 5,000 people
- In 170 countries
- Over 1,000 IBM Business Partners
- Research for a Bright Future
 - 15 development labs worldwide
 - Over \$500 million in R&D annually
 - More US patents than any other vendor
 - Acquiring new technologies to bolster in-house innovation



- #1 Total Storage Hardware
- #1 Total Disk
- #1 Tape
- #1 Storage Services
- #1 Archive & HSM solutions
- #1 Enterprise Content Management
- #2 WW external Disk
 - ▶ #1 in SW IOT
 - ▶ #1 in AP
 - #1 in 15 regions
- #2 Data protection & recovery
- Fastest growth in Storage SW

Source: IDC Storage Tracker, latest full year, 2006 Note: full year 2007 data not yet available

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IBM Disk Portfolio

Optimized for 'open systems'

Optimized for z/OS and IBM i

	Blo	File			
Enterprise	 DS8000 For clients requiring: Advanced disaster recovery with 3-way mirroring and System z GDPS support Continuous availability, no downtime for upgrades Best-in-class response time for OLTP or transaction workloads, flash optimization Single system capacity scalable to the PB range 	 XIV For clients requiring: Breakthrough ease of use and management High utilization with automated performance ("hot spot") management Virtually unlimited snapshots Advanced self-healing architecture 	 SONAS For clients requiring: Massive I/O, backup, or restores Consolidation, or scale large numbers of clusters N series For clients requiring: NAS storage 		
Midrange	 DS5000 For clients requiring: Good cost/performance, general-purpose storage Need to add capacity to existing configuration 10s of TB of capacity 	 Storwize V7000 For clients requiring: 10s of TB of rack-mounted storage with sophisticated software functions Breakthrough ease of use and management Non-disruptive migration from, or virtualization of, existing disk 	 Simple two-site high availability 		
Entry	 DS3000 For clients requiring: SMBs or branch office locations; 100s GB, up to low TB capacity 				
Storage Optimizers	 SVC, Easy Tier, ProtecTIER Dedupe, Information Archive, Storwize RT Compression For clients requiring optimization of storage costs: Storage technologies that add function, performance, ease of use, or efficiency to new or existing storage 				



IBM System Storage XIV Storage Subsystem

Tier 1 Storage – Midrange Price



Why XIV – Storage Reinvented

... Tier I Architecture at Competitive Prices

Simplify and Reduce Complexity!





Tiered Storage Solutions Can Add Cost and Complexity

- Traditional approach is to try to cope with storage pains by using multi-tiered storage
 - Tiered storage management and data classification can be costly and complex
 - Excessive data movements may create reliability and performance issues
 - -Utilization rates remain low, with limited ability to execute thin provisioning







Single Tier System

- High-end system at mid-range cost
- Avoids ILM and HSM overhead
 - Single storage solution for a mixture of workloads
 - No need to migrate data from one tier to another
 - System resources fairly allocated to benefit all applications
 - Higher Utilization than tiered system
- No need to classify applications into tiers
 - Same high-end reliability for all
 - Top performance available to all applications
- Interoperable with a rich set of platforms and applications







Traditional Enterprise Storage Solutions





IBM XIV Storage Architecture







IBM XIV hardware

- 15 modules with 12 drives per module
- 24 x 4Gb FC ports
- 6 x 1Gb iSCSI ports
- 240GB of memory (2 TB Models)
- 3 x uninterruptible power supplies
- 360TB Raw; 161TB Useable (2TB disks)
 - Global spare space full module plus 3 disks
 - 161TB = (360 24 6)/2 2.5 (internal use)

Minimize power usage, cooling and floor-space

- Power consumption of an XIV rack is 7.7KW
- 42W per raw TB today, 97W per useable TB
- IBM Service and Support
 - 1 year, 4 hour response, 24x7 Same Day On-Site Repair
 - IBM HW and SW Installation





IBM XIV Storage Supports Lower Total Costs

- Lower capital costs, no added charge for XIV software features mirroring, snapshot, data migration, management
- Less storage needed, thanks to:
 - Thin provisioning
 - Management efficiency
 - Differential snapshots
- Savings in power, cooling, and space with large capacity SATA drives
- Simple, intuitive management helps to manage more capacity with less staff
- Future ready architected for easy module replacement to enable capacity, performance, and power efficiency upgrades





IBM System Storage DS8000

Enterprise Storage



IBM System Storage DS8000

IBM's Flagship Storage for the World's Most Demanding Customers



IBM POWER and DS8000 Reliability and Resiliency

The IBM POWER processor has been behind the success of IBM enterprise storage beginning with the Enterprise Storage Server in 1999. *Benefit: a steady, 10-year lineage of RAS improvements!*





DS8000 family models

Two base models with scalable controllers and capacity

DS8700

- •POWER6 controllers (2-way and 4-way)
- •4 Gb/s and 2 Gb/s host and device adapters
- •3.5" Enterprise Fibre Channel drives
- •Up to 384 GB Cache





Storage efficiency with space-saving design

Saving money with high-density drives, enclosures, frames

- •Client feedback is very positive on space-saving design
 - •Small-form-factor drives
 - •High-density drive enclosures
 - •Almost double the drives in same frame footprint

•Benefits

•More effective consolidation can lower operating costs

- Support more workloads with smaller footprint
- •Reduce number of systems to manage
- •Reduce power and cooling costs





Extremely positive client feedback about substantial footprint reduction



IBM System Storage SAN Volume Controller

Enterprise storage virtualization



What is the SAN Volume Controller (SVC)





Heterogeneous Disk *≠* **Simple Management**





The IBM SAN Volume Controller Provides a More Flexible Storage Infrastructure





Improve Performance with SVC Cache and Striping

Cache

- 24GB per node cache means that many reads are handled by SVC directly
- All writes are cached, means write to same block is handled by SVC directly without destage



Striping

- Striping spreads IO workload across many disks, even across disk systems
- Can greatly reduce "hot spots" as I/O from different applications are spread across multiple disks



IBM Tops the SPC-1 and SPC-2 Performance Charts!





HDD Ranks Pools

Easy Tier Hybrid

Pools (SSD+HDD)

SVC 6.1 Enhancements Easy Tier

- Clients can manually and nondisruptively migrate full volumes across drive tiers and within a drive tier
 - -Migrate to new disk type
 - -Migrate to new RAID type
 - -Migrate to new drive speed
 - -Migrate to new striping method
- Automatically migrate sub-volume data to right tier
- Manually migrate full volumes nondisruptively



SSD Ranks Pools



IBM Storwize V7000 Storage Subsystem

A new paridigm in midrange storage



IBM Storwize V7000 disk system



- Enterprise functionality inherited directly from industry leading SVC solution
- High performance and built-in functionality for storage efficiency and data protection

Non-Disruptive migration and upgrades for high availability



Modularity and Advanced Software Functions

- Enclosures contain up to twelve 3.5" or twenty-four 2.5" drives in just 2U
- Control enclosure: dual active-active controllers and drives; Expansion enclosure: drives only
- Up to nine expansion enclosures attach to one control enclosure
- Mix drive sizes and HDD/SSD in enclosure
- Eight 8Gbps FC ports plus four 1Gbps iSCSI ports per controller pair; 16GB cache per controller pair

Modular Hardware Building Blocks in 2U



Software inherited from prior offerings plus enhancements

New advanced software functions

- New GUI (easy-to-use, web based)
- RAS services and diagnostics
- Additional host, controller and ISV interoperability
- Integration with IBM Systems Director
- Enhancements to TPC, FCM and TSM support

Proven IBM software functionalities

- Easy Tier (dynamic HDD/SSD management)
- RAID 0, 1, 5, 6, 10
- Storage virtualization (internal and external disks)
- Non-disruptive data migration
- Global & Metro Mirror
- FlashCopy up to 256 copies of each volume
- Thin provisioning



Start Small and Grow Easily

Drive choices

- 2.5-inch (SFF)
 - 300GB 10K RPM SAS
 - 450GB 10K RPM SAS
 - 600GB 10K RPM SAS
- 3.5-inch (LFF)
 - 2TB 7,200 RPM NL-SAS
- Solid-State (SFF)
 300GB SAS

Start small

One 24-bay control enclosure



Scale Up

Easily add up to 9 expansion enclosures

Expand capacity up to 240TB can be intermixed in a system

in an enclosure

Drive sizes can be intermixed



Availability:

Grow Big

November 12, 2010: Systems with up to five enclosures (up to 120 drives or 120TB) plus external storage March 2011: Systems with up to ten enclosures (up to 240 drives or 240TB) plus external storage



All Storwize V7000 storage is Virtualized





External Storage

pillar

- Storwize V7000 provides RAID protection of internal disk
 –RAID 0, 1, 5, 6 and 10 supported
- Storwize V7000 also virtualizes external Fibre Channel storage
 - -Extends life of existing storage assets
 - Protect investment in existing capacity
 - –Migrate data to internal or keep external
 - –Inherit rich Storwize v7000 functionality
 - -Improve availability by practically O IBM Corporation



Built-In Advanced Functions



With IBM Storwize V7000, many functions are included at no additional charge that you would pay for otherwise

- Thin Provisioning storage is not allocated until data is written
- Full Copy of volumes and space efficient snapshot offloads CPU resources from Hypervisor hosts
- Easy Tier[™] automated tiering between SSD and HDD storage
- Non-Disruptive data migration within and between internal and external storage



Analyst Quote

"This announcement is most complete, most interesting, and potentially most disruptive thing to come out of IBM's storage group in the past twenty years. I can't wait to see the IBM Storwize V7000 take shape in the market."

Steve Duplessie, Founder and Senior Analyst, ESG"

Maximize the value of your storage resources





IBM Storwize V7000

A New Era in Midrange Disk



IBM[®] System Storage[™] N series

Networked Storage



BM_® System Storage™ N series



*N5000 family is EOL, N5200 will be replaced by N6040, N5300 by N6060 and N5600 will be replaced by N6070



N series Software Portfolio

No-Charge Features

- 1. Data ONTAP
- 2. iSCSI
- 3. iSCSI Host Utility for UNIX, Windows & Linux
- 4. FTP
- 5. <u>Snapshot</u>
- 6. SnapMover (co-req MultiStore)
- 7. SyncMirror
- 8. FilerView
- 9. <u>FlexVol</u>
- 10. FlexShare
- 11. SecureAdmin
- 12. AutoSupport
- 13. Disk Sanitization
- 14. <u>RAID-DP</u>*
- 15. RAID-4*
- 16. <u>Advanced Single Instance</u> <u>Storage (A-SIS) Dedup</u>
- 17. System Manager New !!

- CIFS Protocol
 NFS Protocol
- 3. HTTP Protocol
- 4. FCP Protocol
- 5. Cluster Failover
- 6. FlexCache
- 7. FlexClone
- 8. MultiStore
- 9. <u>SnapMirror</u>
- 10. SnapRestore
- 11. SnapVault
- 12. Open Systems SnapVault
- 13. SnapLock Enterprise
- 14. SnapLock Compliance
- 15. SnapDrive for Windows
- 16. SnapDrive for Unix & Linux
- 17. NearStore feature
- 18. MetroCluster

Optional Features

- 1. SnapManager for SQL
- 2. SnapManager for Exchange
- 3. Single Mailbox Recovery for Exchange
- 4. SnapManager for Oracle
- 5. SnapManager for Microsoft Office SharePoint
- 6. SnapManager for SAP
- 7. SnapManager for Virtual Infrastructure
- 8. SnapValidator
- 9. FCP Host Utility for UNIX, Win & Linux
- 10. Operations Manager Core
- 11. Operations Manager SRM
- 12. Protection Manager
- 13. Provisioning Manager
- 14. Virtual File Manager (VFM) Enterprise**
- 15. Virtual File Manager (VFM) Migration**

* not available with gateways ** EOA 09/30/09



IBM Real-time Compression Appliance (RtCA)



Real-time Compression Appliance (RtCA)

- Real-time Compression reduces information "on the fly" as it is transmitted between application servers and storage devices.
- IBM Real-time Compression appliances integrate seamlessly into existing highly available storage configurations without requiring any changes to your current configuration. This allows continued access to data, helps eliminate costly downtime and preserves the inherent availability of the existing storage infrastructure
- Reduces NAS utilization by up to 80 percent without performance degradation from existing storage systems.
- Real-time data compression maintains storage performance and data integrity.
- Less data stored, accessed and cached means enhanced storage throughput and resource utilization.
- Overview video
- Additional information is available at <u>http://realtimecompression.com/</u>.





Storage for a Smarter Planet



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