

IBM System Storage DS5000

Increase Applications Performances

with Optimized Total Cost of Ownership



Did you know ... ?

- DS4000 is #1 in IBM Mid-range Storage
 - #1 in revenue - \$4.1B shipped
 - #1 in install over 100,000 systems
- IBM has the most comprehensive storage portfolio in the industry
 - Tivoli TSM, Fastback, SVC, ProtecTier, Partnerships, Services
- LSI manufactures the DS3000, D4000 & DS5000 ranges
- Breadth of application support - VMware, Oracle, Exchange, SQL Server, Hyper-V, SAP, others
- IBM DS3/4/5000 overlay sales team
 - World-wide DS 3/4/5000-only sales force (“sell-with”) at your call

DS 5000

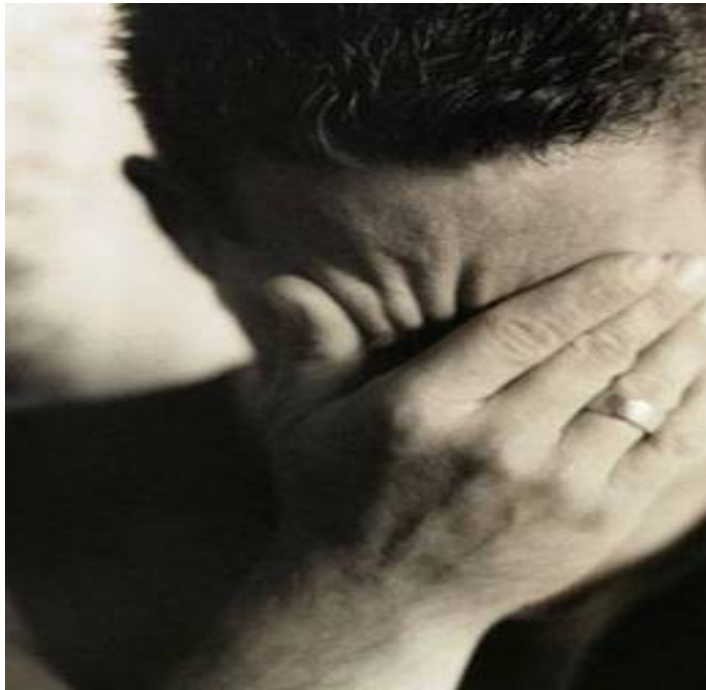


Delivers real value to you and your customers

Agenda

- Virtualization – the right technology for a tough economy
- DS5000 Enhancements
- Benefits of IBM Midrange Storage and VMware Virtualization
- How does DS5000 makes VMware better

The IT Dilemma



I am supposed to still do the same job, but with less budget and headcount?!?

Five Top Spending Priorities for Hard Times

1. Storage: Disks and Management Software
2. Business Intelligence: Niche Analytics
3. Virtualization: Optimizing Resources
4. Security: Data End Points
5. Cloud Computing: Business Solutions



http://www.infoworld.com/article/08/11/19/47FE-five-recession-proof-technologies_1.html

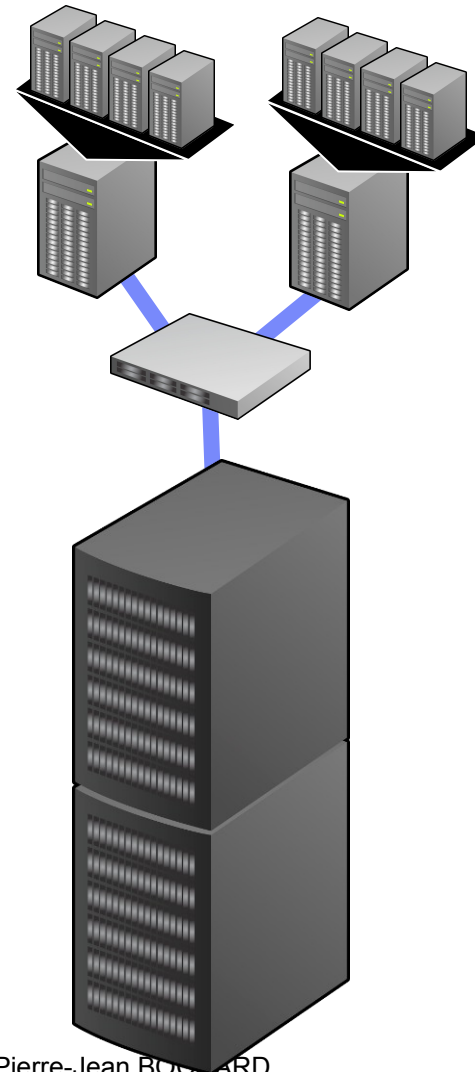
InfoWorld article – November 2008: based on Forrester, Gartner, IDC

Virtualization is on the rise

- More than 85% of today's virtual servers support production workloads
- Server utilization rates can be increased by 45-75%
- Server rebuild can be reduced from 20-40 hours to 15-30 min.
- \$20 billion will be spent on server virtualization in 2010, up 68% in 5 years
- Local storage generally moves to networked storage

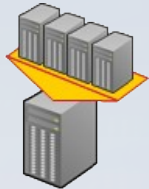
Server Virtualization Requires a Dynamic Storage Infrastructure

- Multiple servers create a large aggregate workload with diverse requirements
 - Individual servers want the performance of dedicated storage
- Capacity scales exponentially
 - Near-continuous growth
- Continuous availability is a must
 - Keeping applications online
- Configuration flexibility is a must
 - Diverse LUN requirements
- Tiered storage lowers costs
 - Match requirements with drive type

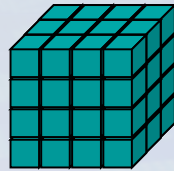


DS5000 – Affordable IBM System Storage Solutions

Virtualization



*Data
Warehouse*



Email



Database



Server Consolidation
Storage Consolidation
Database, DW
Instant Recovery
Deduplication



VMware
SVC
Oracle
IBM FastBack
IBM ProtecTIER

DS5000 + solutions

Bigger, Faster, More Secure!

DS5000 Enhancements

Initial release

- 4 Gb/s FC interfaces
- Up to 256 FC/SATA drives

10.50 release

- 4 or 8 Gb/s FC interfaces
- Up to 448 FC/FDE/SATA drives (DS5300)
- + ▪ Encryption Services

- Sixteen 4 Gbps FC drive interfaces
- 8 / 16 GB of dedicated data cache
 - Destaged to flash drive
 - Dedicated mirroring channels
- Enclosure-level drive intermix
- Up to 512 partitions
- FlashCopy, Volume Copy, ERM
- 7th generation ASIC
 - RAID 0, 1, 10, 3, 5, 6

DS5000 Enhancements!

Bigger

- DS5300 support for 448 disk drives lowers TCO in large consolidation projects by up to 70% and improves productivity in large VMware solutions

Faster

- “Blazing Fast” 8 Gbps host interface cards for DS5100 and DS5300 can lower costs by up to 45% over equivalent 4 Gbps solutions

More Secure

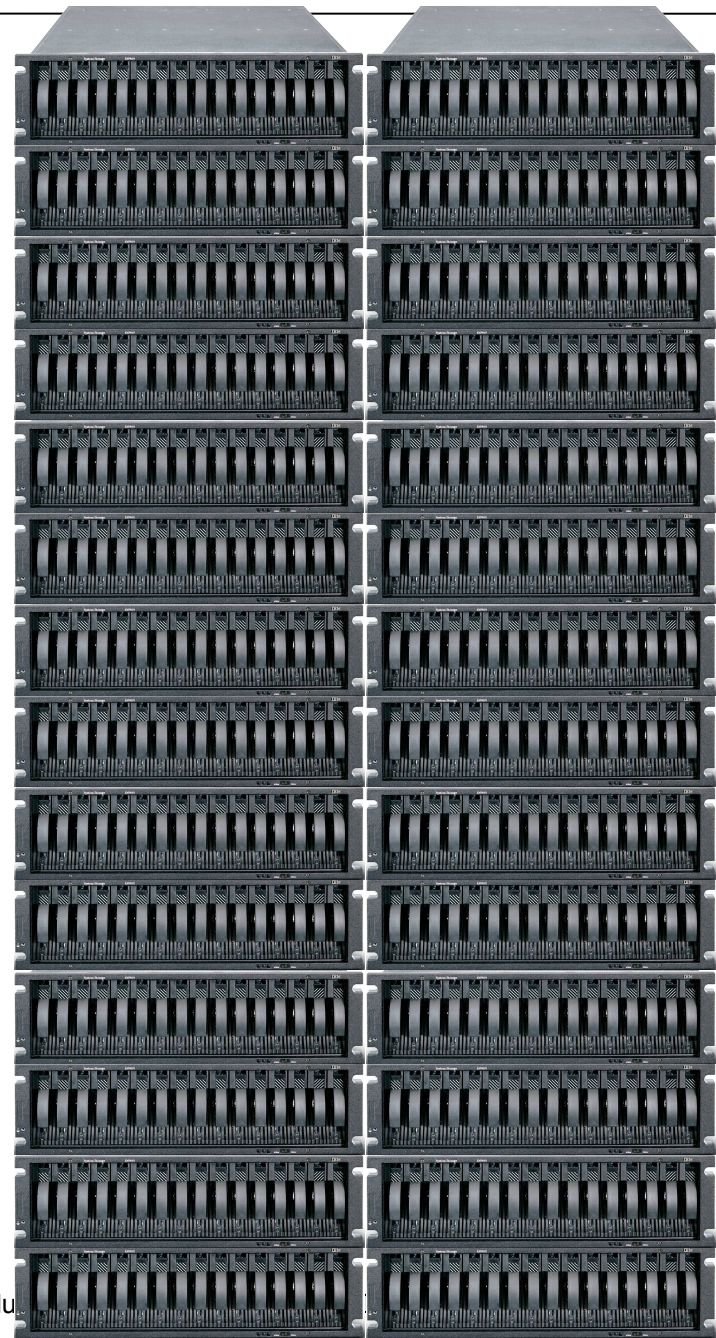
- Innovative self-encrypting disk solution for midmarket clients takes the worry out of exposing sensitive data on drives that are returned for repair, retired, or repurposed. Data is automatically protected against unauthorized access.



Bigger! 448 Drives

Support for 448 FC/FDE/SATA drives

- Up to 448 TB of raw capacity for data-intensive applications and large secondary storage requirements
- Simplify storage management by consolidating more data in one place
- Great for tiered storage implementations
 - Spindles for transactional applications and capacity for secondary storage



Bigger! Faster! Reducing The Cost Of Consolidation

- Storage consolidation reduces operational expenditures



Six DS4500s

- ~ 28TB on 10K FC drives
- ~ 156 TB on SATA I drives



DS5300

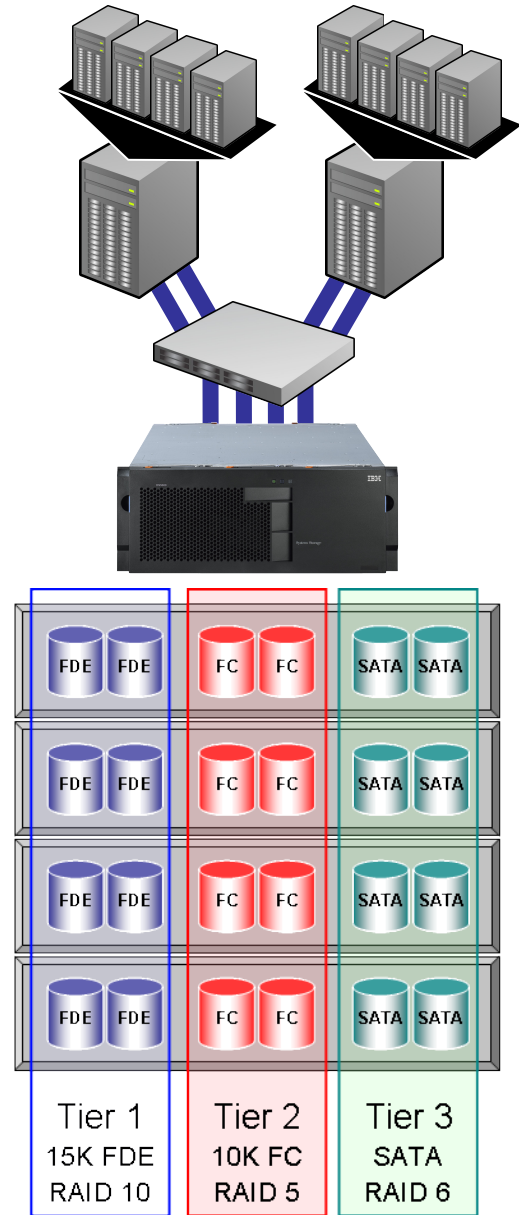
- 30 TB on 15K FC
- 160 TB on SATA II

- Up to 70% reduction in power and cooling requirements
- Up to 74% reduction in rack space
- Up to 50% fewer switch ports

Bigger! Faster! Reducing The Cost Of Consolidation

- System-based tiers
 - Tier 1 – OLTP, ERP, Email
 - Tier 2 – Engineering; Development
 - Tier 3 – Archives, backups, user files

- Unparalleled configuration flexibility
 - Tune any attribute to meet any server / application need
 - Drives can be relocated with data intact as requirements change
 - Industry unique dynamic capabilities for on-the-fly reconfigurations



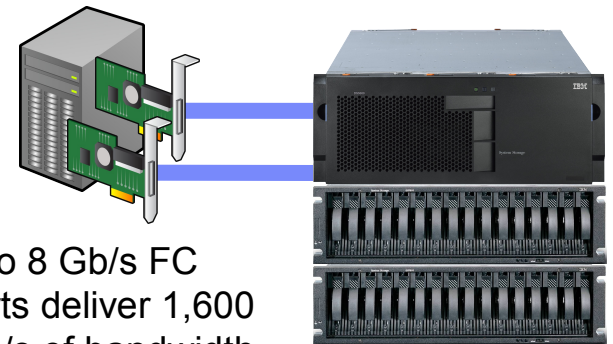
Faster!

8 Gb/s FC Host Card

- Faster applications
 - 100% throughput improvement (per channel) for data-intensive applications, such as data warehouse (OLAP) and HPC
 - 15% IOPS and latency improvement for transactional applications (OLTP)

- Backwards and forwards investment protection
 - Auto-negotiates 2, 4 and 8 Gb/s FC
 - Utilize existing infrastructure while creating a foundation for the future
 - 8 Gb/s FC enables longer useful life going forward

- Infrastructure simplification
- Bandwidth for virtualization



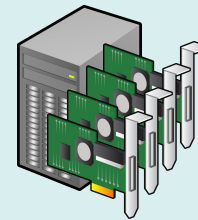
Two 8 Gb/s FC ports deliver 1,600 MB/s of bandwidth

Faster! – 8 Gb/s FC Host Card Infrastructure Simplification

Fewer channels/ports lowers acquisition and operational costs

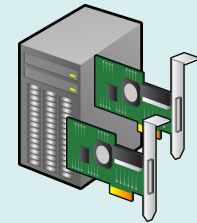
Server Perspective

- 8 Gb/s FC delivers comparable performance with a 45% decrease in hardware costs
 - HBA and switch ports



4 Gb/s FC

vs.



8 Gb/s FC

Storage Perspective

- 8 Gb/s FC HBAs and storage host interfaces (HICs) deliver comparable performance with a 39% decrease in hardware costs
 - HBAs, switch ports, storage HICs



4 Gb/s FC

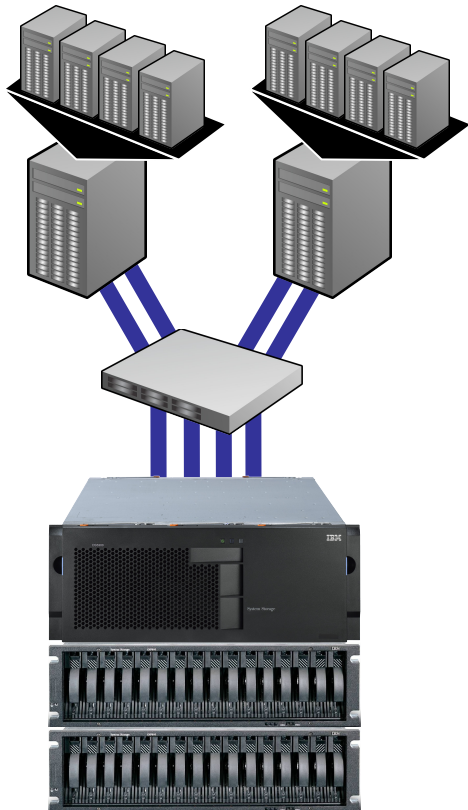
vs.



8 Gb/s FC

Faster! – 8 Gb/s FC Host Card Bandwidth For Consolidation / Virtualization

- 8 Gb/s FC interfaces provide the bandwidth needed to satisfy the large aggregate workloads created by consolidation



Everything completes twice as fast

- Datasets load faster
- Backup jobs complete faster
- Restores complete faster
- Remote mirrors synch faster

Crucial for mixed workloads

- Speed for transactional
- Bandwidth for sequential





Data At Rest Is Data At Risk

- Data security continues to grow in importance
 - Common component of the corporate landscape due to necessity, regulatory compliance drivers and safe harbor laws
 - Frequency of data breaches is on the rise

- Inevitably, all drives are out of the administrator's control and vulnerable to a breach
 - Repurposing, decommissioning, disposal, servicing or theft

- Protecting data at rest is the top priority
 - Data spends most of its life at rest
 - Effectively covers many data exposures and vulnerabilities all at once

Negative Implications of a data breach

- Loss of customers and revenue
- Unplanned expenses to remedy a breach
- Legal implications, penalties and fines
- Negative press and tarnished reputation
- Lost goodwill and undermining of other corporate relationships

Costs of a data breach

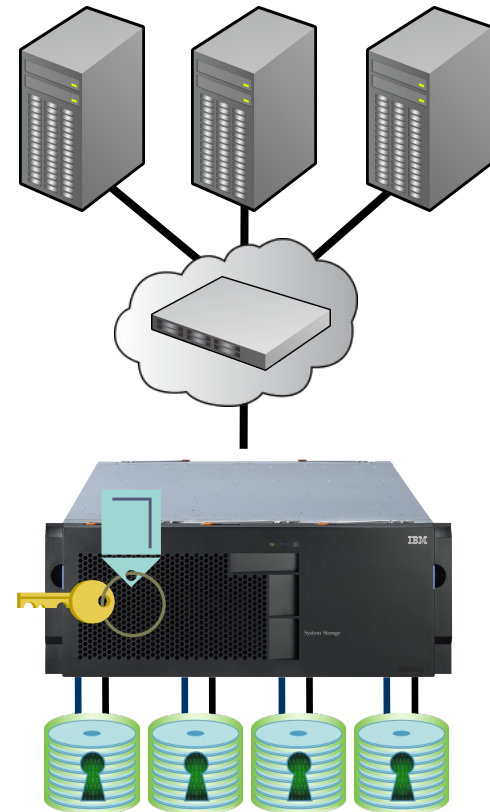
- Up to \$202 per exposed record
- Average cost was more than \$6.6 million
- Ranged from \$613K to almost \$32 million

More Secure! DS5000 Encryption Services

Comprehensive security for data-at-rest

- Full Disk Encryption (FDE)
 - Encryption takes place at the drive level
- Robust management tools
 - Integrated local key management

- DS5000 only
 - Drives supported: 4Gbps FDE 15K FC
146GB, 300GB, and 450GB



More Secure! DS5000 Encryption Benefits

- Bullet-proof security throughout the drive's lifecycle
 - Unparalleled security assurance with government-grade encryption
 - Instant secure erase for a higher security level than other common methods
 - Automatically protects data on drives returned for repair, retired, or repurposed

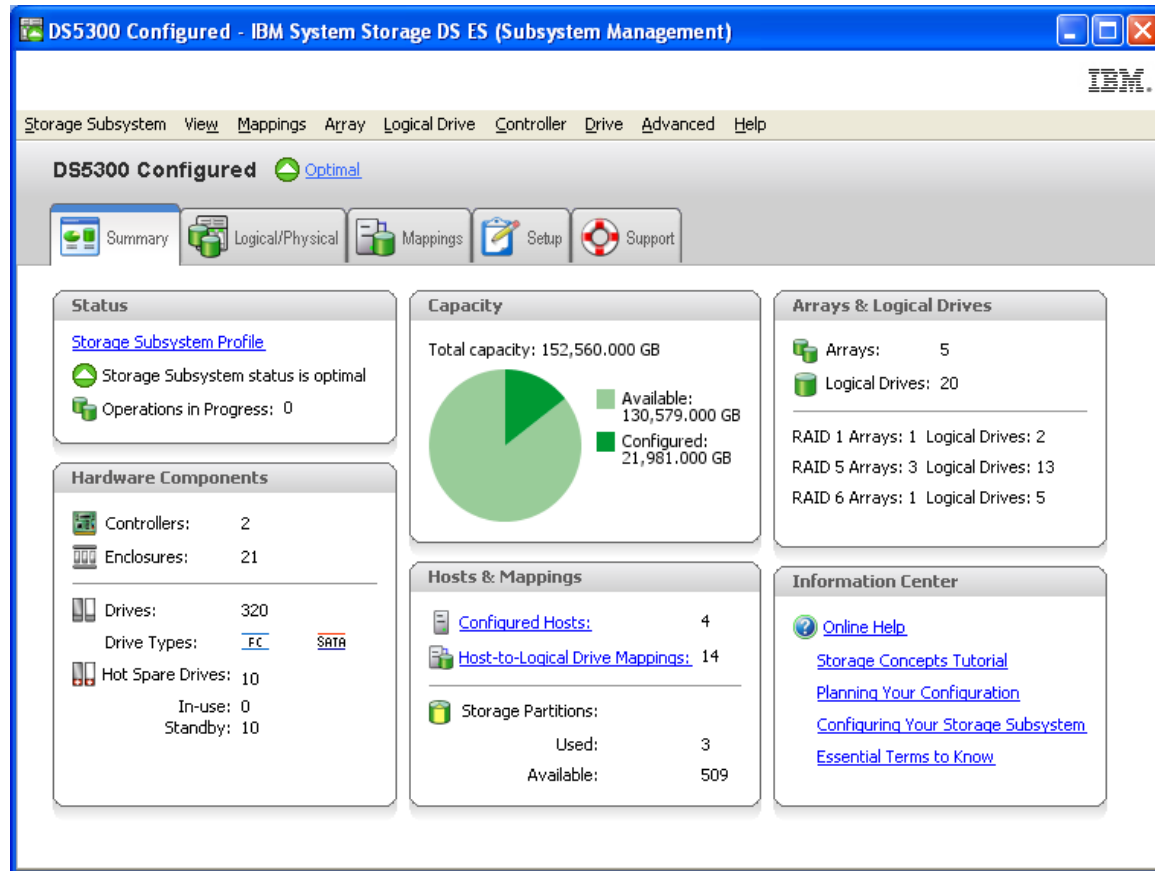
- High performance
 - Drive-based encryption engine maintains our exceptional performance

- Robust yet easy-to-understand management
 - FDE key management is transparent to day-to-day storage administration, making FDE drives as easy to manage as traditional drives
 - A single DS5000 system can support all tiers and classifications of data
 - No application/operating system changes or modifications required



DS Storage Manager – New GUI

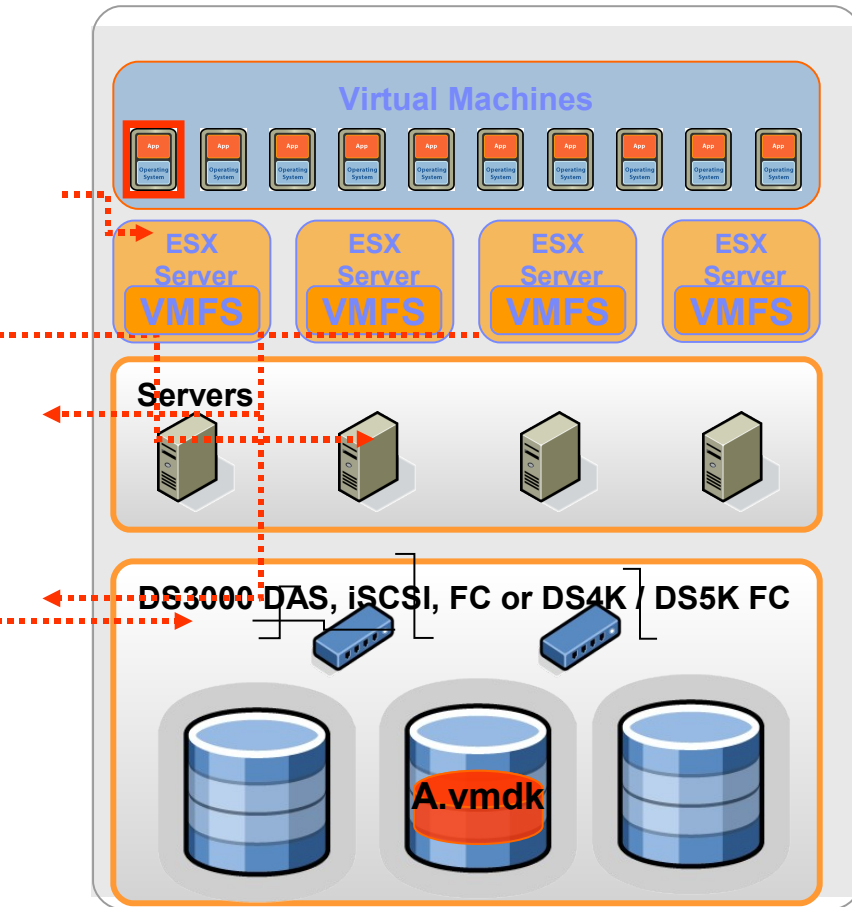
- Intuitive DS Storage Manager software maximizes TB per administrator for lower management costs
- Merging best features of DS3000 and DS4/5000 GUIs
- Power and intuitive
 - Robust functionality for storage administrators (object-based)
 - Wizard driven for part-time administrator (task-based)
- DS5000, DS4800, DS4700



The screenshot displays the IBM System Storage DS ES (Subsystem Management) GUI for a DS5300 Configured system. The interface is organized into several panels:

- Status:** Shows the storage subsystem status as optimal and 0 operations in progress.
- Capacity:** A pie chart indicates a total capacity of 152,560.000 GB, with 130,579.000 GB available and 21,981.000 GB configured.
- Arrays & Logical Drives:** Lists 5 arrays and 20 logical drives, including RAID 1 (1 array, 2 logical drives), RAID 5 (3 arrays, 13 logical drives), and RAID 6 (1 array, 5 logical drives).
- Hardware Components:** Lists 2 controllers, 21 enclosures, 320 drives (FC and SATA), and 10 hot spare drives (0 in-use, 10 standby).
- Hosts & Mappings:** Shows 4 configured hosts, 14 host-to-logical drive mappings, and 3 used storage partitions out of 509 available.
- Information Center:** Provides links to online help, storage concepts tutorial, planning your configuration, configuring your storage subsystem, and essential terms to know.

Compelling Benefits of Storage Consolidation with VMware Simplify Storage Management



- Extends the key benefits of server virtualization
 - Lower Costs
 - Asset utilization through storage consolidation
 - “pay as you grow” flexibility with dynamic features
- Enables
 - Simplified data management
 - Faster backup & recovery
 - Better storage resiliency
 - Affordable disaster recovery with automated failover

Why Disaster Recovery Matters

Business without continuity plan = business at risk

- Every year, one out of 500 data centers will experience a severe disaster (*McGladrey and Pullen*)
- 43% of companies experiencing disasters never re-open, and 29% close within two years (*McGladrey and Pullen*)
- **93% of businesses that lost their data center for 10 days went bankrupt within one year** (*National Archives & Records Administration*)

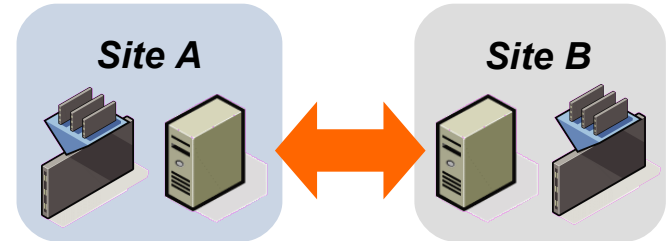
Standards for availability are rising

- Faster pace of business ⇒ more critical change
- Intense competitive environment requires high SLA
- Number and severity of threats increasing
- SOX, industry specific compliance laws and regulations

Challenges of disaster recovery with physical infrastructure

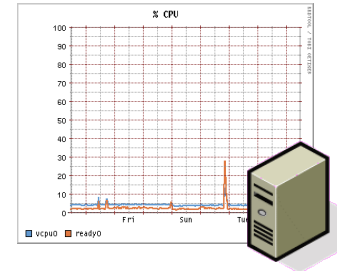
Require identical hardware for recovery

- Because of hardware dependencies
- Double costs, increases complexity



Idle hardware

- Need standby hardware for faster RTO
- Repurposing servers at time of disaster is labor-intensive and time-consuming



Slow, complex recovery process

- Different solutions for different availability tiers
- Separate procedures for system and data disks
- Separate procedures for desktop PC's
- Multi-step recovery processes



Advantages of Virtual Disaster Recovery

- Virtual machines are portable
- Virtual hardware can be automatically configured
- Test and failover can be automated (minimizes human error)
- The need for idle hardware is reduced
- Costs are lowered, and the quality of service is raised

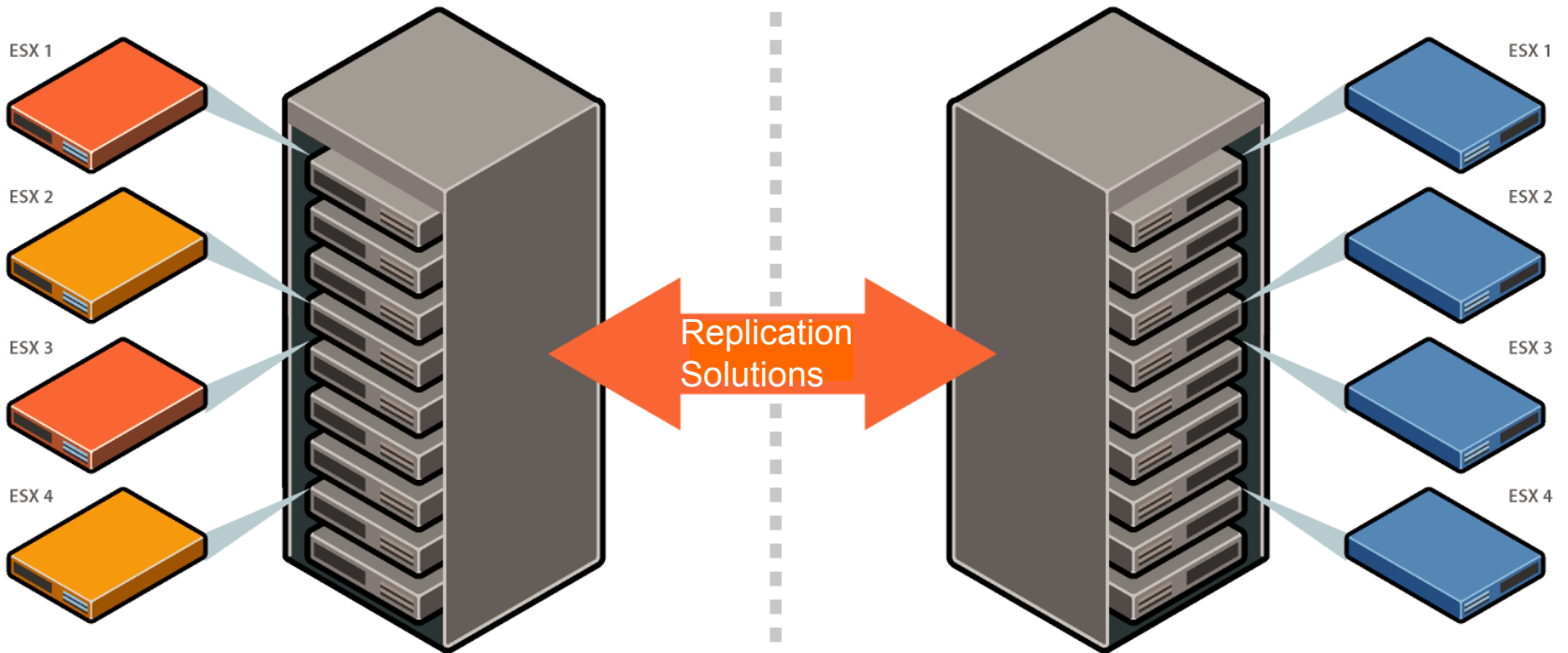


Datacenter Disaster Recovery in under 17 minutes

Large Chemical Company

Kingsport, TN Datacenter

Johnson City, TN Datacenter



IBM System X Servers

Production Environment:
400+ VM's on
68 Physical ESX Servers

Back-Up/DR Environment:
400+ VM's on
50 Physical ESX Servers

IBM System X Servers

The Consolidation Business Challenge

- Meeting Service Level Agreements
- Storage performance
- Need to reduce storage cost
- Best Practices for installing and configuring storage
- Backup and Recovery in a Virtualized Environment
- Affordable Disaster Recovery



How does the DS5000 make VMware better?

- **Real-world Balanced Performance:** Highest Virtual Machine Scalability of any mid-range platform
- **Non-disruptive Flexibility:** Dynamic Features
 - Tune and configure applications and virtual machines on-the-fly
- **Best Data Protection:** RAID6 and Redundant everything!
Protects against double disk failure at half the cost of RAID 10
 - 10 to 1 server consolidation = 10x the data makes VMware data protection critical
 - RAID 6 hardware implementation with virtually the same performance as RAID 5
- **Integrated Backup & Recovery:** VCB (VMware Consolidated Backup) solutions with all major backup vendors
 - Quick Recovery of virtual machines and files
 - Lowest TCO data protection, integrates with existing backup investment & operations
- **Affordable Disaster Recovery:** Integrated, automated failover solution using Site Recovery Manager (SRM) and IBM Copy Services
 - Enterprise-class functionality at mid-range prices



Best in Class - Performance, Availability and Cost

The Storage Performance Council offers VMware-relevant Benchmarks



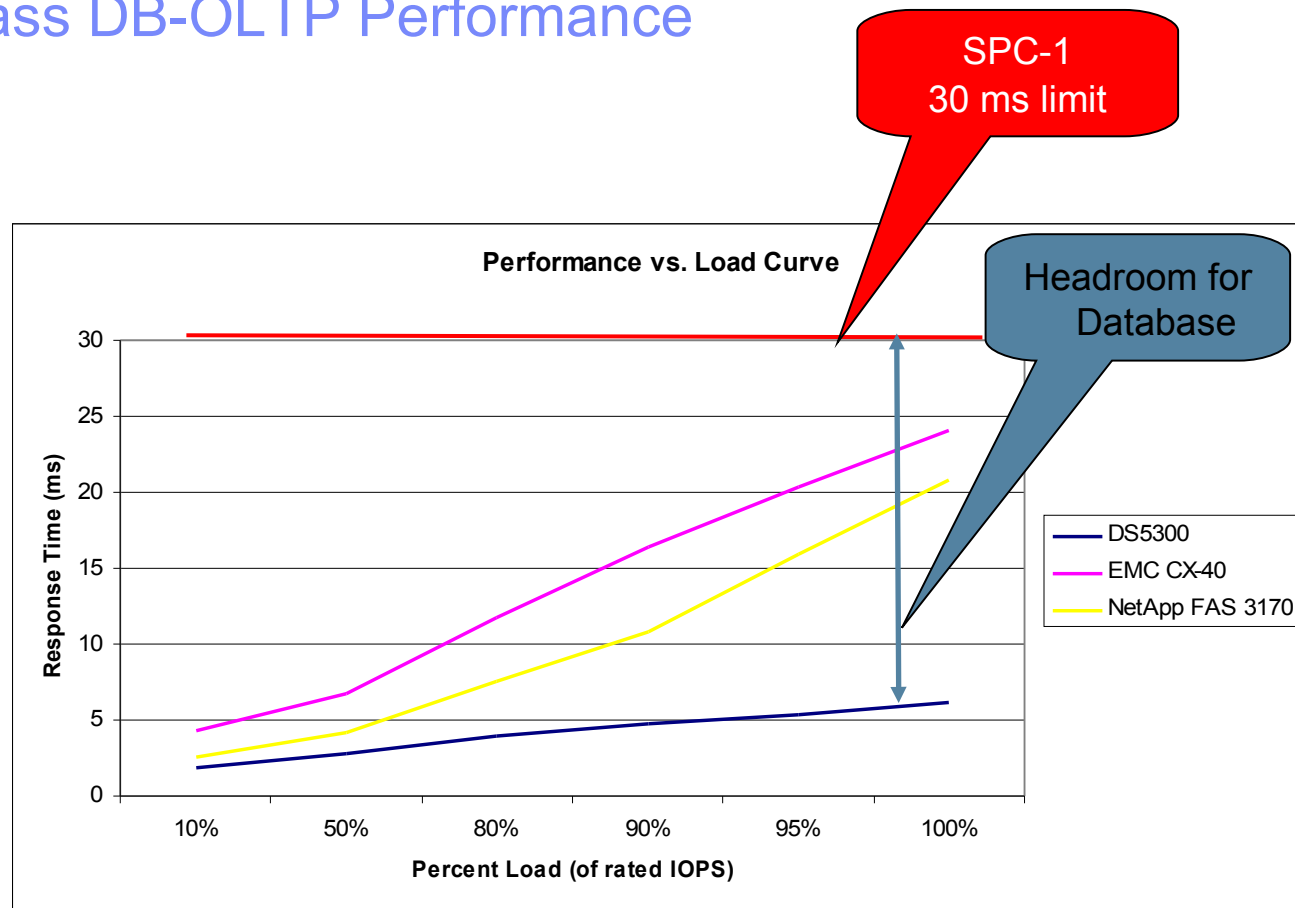
- SPC Benchmark 1 (*SPC-1*)
 - Predominately **random I/O** operations and require both queries as well as update operations.
 - E.g. **OLTP**, **database** operations, and **mail** server applications
- SPC Benchmark 2 (*SPC-2*)
 - Predominately **large I/Os** organized into one or more concurrent sequential patterns
 - E.g. **OLAP**, Large File Processing, Large Database Queries, **Video** (VoD)
- The SPC is independent
 - “The Storage Performance Council (SPC) is a **non-profit corporation** founded to define, standardize, and promote storage subsystem benchmarks as well as to disseminate **objective, verifiable performance data** to the computer industry and its customers”
 - <http://www.storageperformance.org/home>

SPC is relevant, independent and objective

DS5000 - Best in Class DB-OLTP Performance

- SPC-1 IOPS™
 - 58,158.69

- SPC-1 Testing
 - 256 – 146.8 GB 15K RPM Disk Drives
 - September 2008

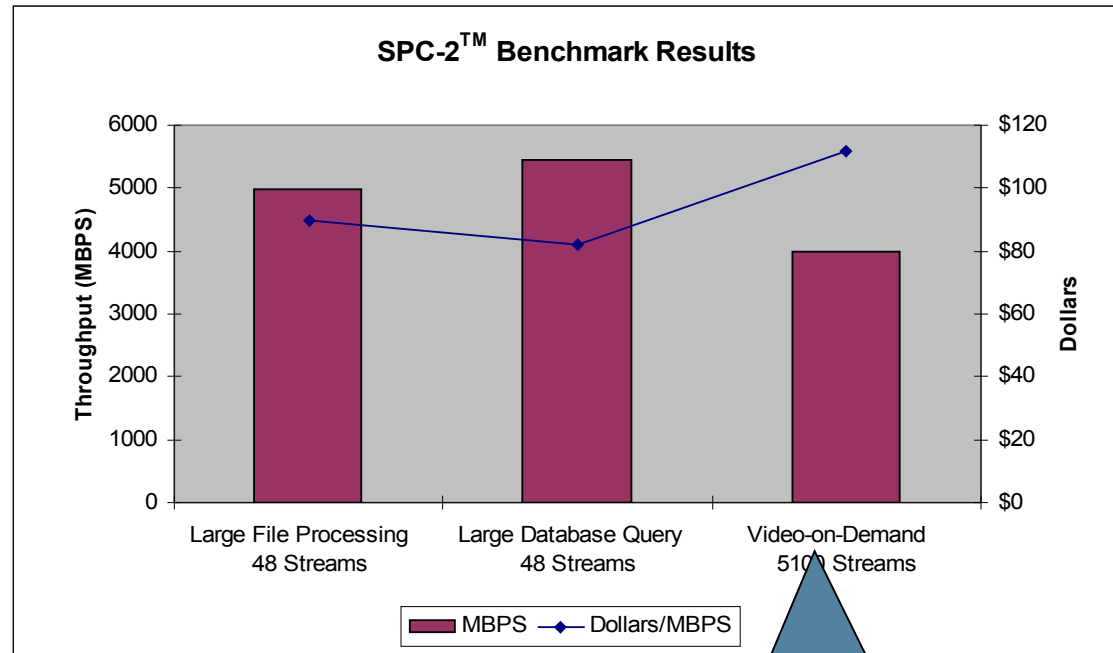


Response Time Does Not Degrade Under Load

DS5000 Best in Class Throughput & OLAP

- SPC-2 MBPS™
 - 4,818.43

- SPC-2 Testing
 - 128 – 146.8 GB 15K RPM disk drives
 - September 2008



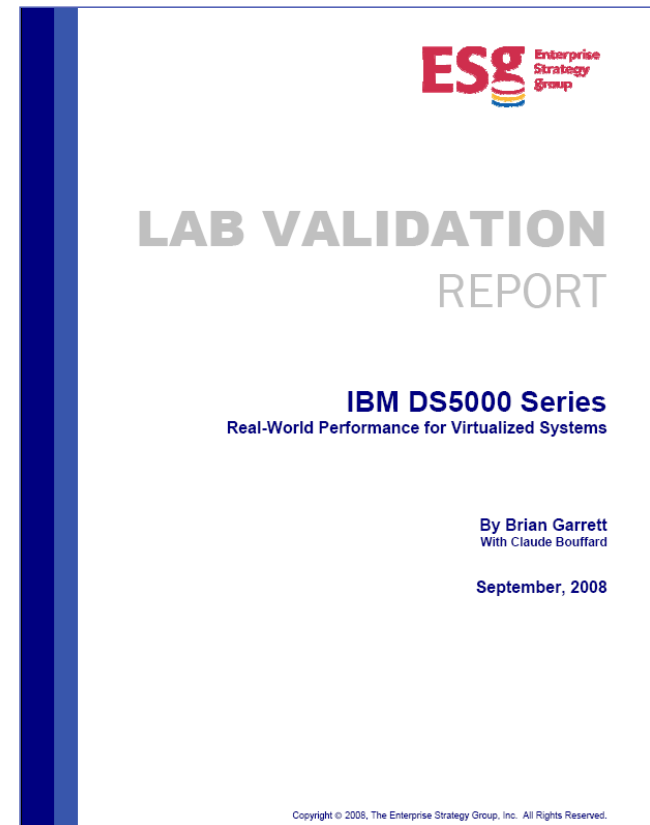
SPC-2 is a composite of these 3 workloads



EMC & NetApp do not publish SPC-2 results

DS5000 Delivers Proven Performance for Mixed Workloads

- **More bandwidth for virtualized servers**
 - Aggregate workload can overload 4 Gb/s FC
- **First concurrent mixed-workload storage test for a virtual environment**
 - Email – 17,512 Exchange mailboxes
 - Database – 9,164 IOPS
 - Data warehouse – 880 MB/s
 - Web Server – 4,551 IOPS
 - Backup Job – 425 MBPS
- **Time is Money**
 - **Email response time \leq 16 ms,**
under 20 ms max recommended by MS
 - **Database response time \leq 5ms**



IBM and VMware SRM Disaster Recovery

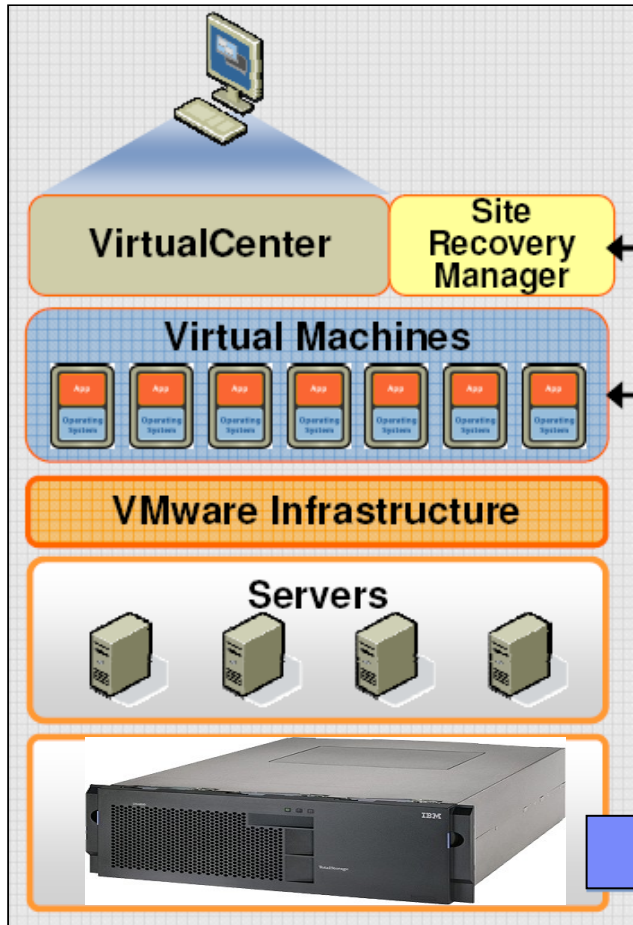
- Simplifies and automates disaster recovery workflows:
 - Setup, testing, failover, failback
- Turns manual recovery runbooks into automated recovery plans
- Provides central management of recovery plans from VirtualCenter
- Asynchronous and synchronous modes
 - RTO Recovery Time Objective
 - RPO Recovery Point Objective
 - Bandwidth



Enables Affordable, Automated Disaster Recovery and Business Continuity

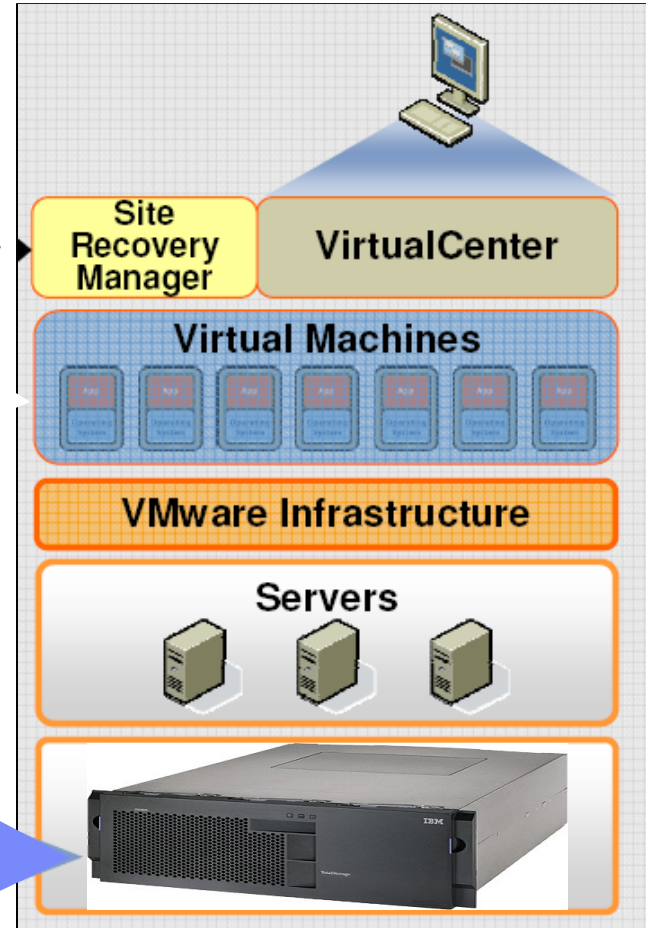
DS4/5000 Disaster Recovery Solution

Production



DS4000 / DS5000

Disaster Recovery



DS4000 / DS5000

Site Recovery Manager

Protected Virtual Machines



IBM Enhanced Remote Mirroring & FlashCopy

DS5000

Real-world Disaster Recovery Solution

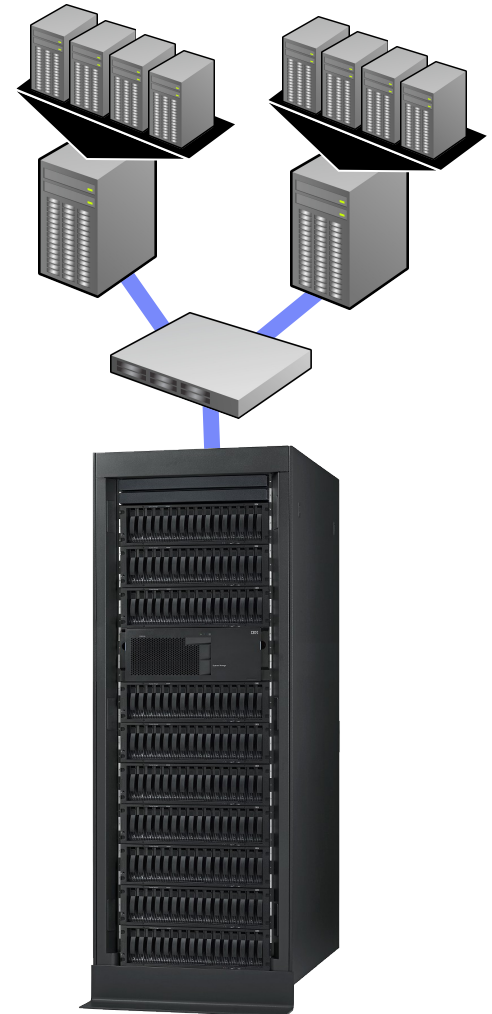
- First Real-world Disaster Recovery storage test for a virtual environment
 - IBM, VMware and ESG jointly
- IBM System X servers with DS4000 and DS5000
- Demonstrates automatic failover and recovery for Oracle
- Confirms performance efficiency, automated ease of use and failover reliability



Oracle Services & Data Recovered in Less than 12 Minutes

DS5000 – Dynamic, Flexible Storage Architecture

- Performance necessary for increasing number of applications
 - Balanced – excels at mixed IOPS and MB/s workloads
 - Sustainable – handles concurrent workloads
 - Scalable – matches growth
- Configuration flexibility supports tiered storage and custom LUN tuning for optimal configurations
 - Reduce costs without sacrificing performance or availability
- Architected to provide the highest reliability and availability
 - Eliminating the cost of downtime
- Online scalability up to 448 TB supports larger consolidation
 - Greater environmental, maintenance and floor-space savings



DS5000

One of the Lowest Cost Solutions

- Performance means efficiency, response times tell the story
 - Time is Money
- IBM Storage Manager is included with every system
- Host Multi-pathing software included in system price
- Intermix high performance and high capacity drive in the same tray
 - No need to purchase additional trays for this
- No additional fees for software maintenance
 - One maintenance charge per storage system
- Copy Services
 - Volume Copy, FlashCopy and Enhanced Remote Mirroring are sold one-time license (system) basis, not by host-tiered or capacity
- Best Investment Protection – DS4000 to DS5000
 - Data-in-place upgrades, flexible host interconnects

One of the Lowest TCO Storage Systems

Thank You

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