EqualLogic PS Series Storage

Recognized virtualization leadership

Dell EqualLogic PS6010XVS

EqualLogic wins **best storage system** award for the second year in a row

"…this design brought improved performance that matched particularly well with the needs of virtualization."

-- InfoWorld, January 2011

Accelerate your storage performance
EqualLogic helps deliver reliable, cost effective interactions with your users

Dell Announces new EqualLogic offerings to help you:

Accelerate storage performance

Accelerate the performance of VMware®

Deliver outstanding data responsiveness

Scale without complexity

Automation of management tasks

Dell EqualLogic Software
New functionality for virtualization and data responsiveness

EqualLogic Firmware v5.0

- New features that help accelerate your storage performance

- New virtualization enhancements

EqualLogic Host Software for VMware®

- Multipath configuration enhancements

EqualLogic Host Software for Windows®

- Extended support for Microsoft® Hyper-V™

EqualLogic SAN Headquarters v2.1

- Support for thin clones and template volumes

- Experimental analysis of XVS configurations

- Report enhancements

New features in EqualLogic Firmware v5.0

Automated SSD Tiering
- Speed of SSD with the Capacity of HDDs
- Automated tiering, appears as single pool

Thin Clones
- Clones that leverage a "template volume" to reduce overall capacity utilization for commonly provisioned images

VM Aware Storage
- Accelerate the performance of VMware® with EqualLogic
- Native iSCSI multi-pathing for ESX

EqualLogic is changing the storage game for virtual servers

New hardware acceleration features
Dell EqualLogic integration with vStorage APIs

Support for VAAI offers...	...Enabling fast and efficient...

Support for VAAI offers...

- **Block Zeroing**
  Eliminate repetitive host writes with optimized array commands

- **Full copy**
  Leverage native array copy capability

- **Hardware assisted locking**
  Replace LUN locking with single block locks for better granularity

vmware·
VMware vSphere 4
DELL
VAAI

...Enabling fast and efficient...

- Migration of virtual machines

- Deployment of VMs from templates

- Cloning of VMs or templates

- VMFS clustered locking and metadata operations for VM files

- Writes to thin and fully provisioned virtual disks

- Creation of fault-tolerant VMs

DELL

Accelerate your VMware performance with EqualLogic

- ✓ Reduce the time to complete provisioning scenarios by up to 72%[†]

- ✓ Dramatically reduces SAN network traffic for the copy process by over 95%[†]

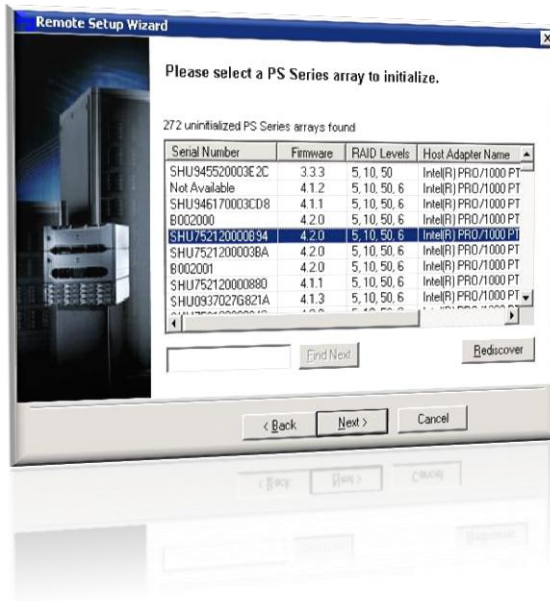- ✓ Dramatically reduce CPU utilization for the copy process by over 75%[†]

EqualLogic Host Software for Windows

EqualLogic Remote Setup Wizard

– New command line interface options

EqualLogic Auto-snapshot Manager/Microsoft® Edition

- Support for EqualLogic Firmware v5.0

  – Thin clone and template volumes

  – SAN Data Copy Offload

- Support for Cluster Shared Volumes

  – Snapshot/selective restore and snapshot scheduling of a Hyper-V™ VM

- HPC iSCSI Provider included

EqualLogic SAN Headquarters v2.1
Centralized event and performance monitoring

New in version 2.1

- Support for EqualLogic Firmware v5.0

  › Thin clone and template volumes

- Support for XVS configurations

  › Experimental analysis of XVS configuration

- Automatic notification of software updates

- Expanded reporting options

EqualLogic SAN Headquarters (SANHQ) is a single-view monitoring and reporting tool that gathers performance, capacity and event data across multiple groups of EqualLogic PS arrays, providing in-depth information for better planning

Please review release notes for details on all features and updates in SAN HQ v2.1 release

Dell EqualLogic PS6000XVS/PS6010XVS
Intuitive data availability for multi-tiered applications

Improves performance of multi-tiered workloads like virtual desktops
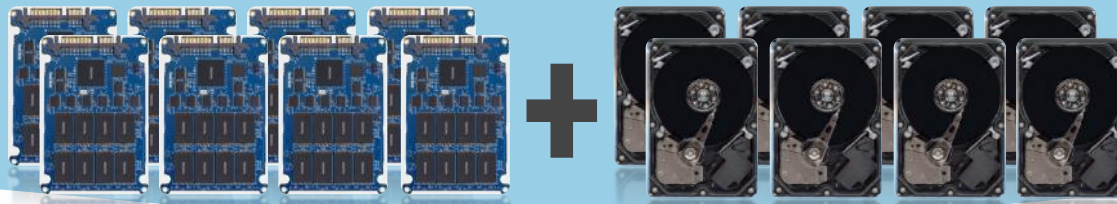
Reduces time to boot multiple VMs by up to 76%[†]

Dell EqualLogic PS6000XVS/PS6010XVS
Combining the low-latency SSD with high-performance SAS

SSD Speed & HDD Capacity

- Intelligent placement of data on the appropriate disk
  - Automatically analyzes I/O access patterns
  - Optimizes response by placing data on the appropriate disk

- Improves performance of multi-tiered workloads like virtual desktops - Reduces time to boot multiple VMs by up to 76%†

†Based on testing performed by Dell Labs in May 2010 comparing Dell EqualLogic Firmware v. 4.3 to Dell EqualLogic Firmware v. 5.0 with VMware API for Array Integration. Actual performance will vary based on configuration, usage and manufacturing variability.
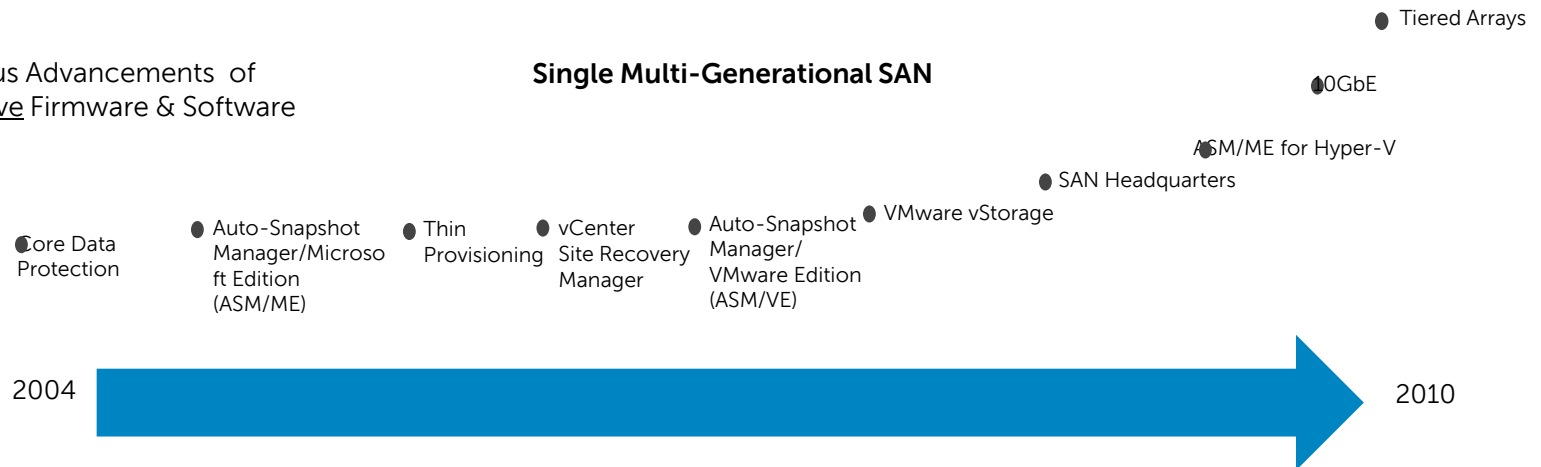
Continuous software advancements at no additional cost

Dell EqualLogic storage provides seamless SAN expansion

PS100 Series

PS3000 Series

PS5000 Series

PS4000 Series

PS6000 Series

PS6010 Series

PS6010XVS
PS6000 XVS

NEW

Continuous Advancements of
<u>All-inclusive</u> Firmware & Software

Single Multi-Generational SAN

● Tiered Arrays

● 10GbE

● ASM/ME for Hyper-V

● SAN Headquarters

● VMware vStorage

● Core Data Protection

● Auto-Snapshot Manager/Microsoft Edition (ASM/ME)

● Thin Provisioning

● vCenter Site Recovery Manager

● Auto-Snapshot Manager/ VMware Edition (ASM/VE)

2004 ➔ 2010

EqualLogic Product Detail

Dell EqualLogic Storage
Intelligent, seamlessly expandable virtualized iSCSI SAN

Virtual storage architecture enables:

- Perpetual self-optimization

  - Automated load balancing across disks, RAID sets, connections, cache and controllers

- All inclusive functionality

  - Comprehensive software portfolio included, no add-on licenses

  - Easy-to-use host integration tools

- Efficient Enterprise Scalability

  - Seamless scaling of both performance and capacity

  - Investment protection – no fork-lift upgrades

- Powerful & Simplified Management
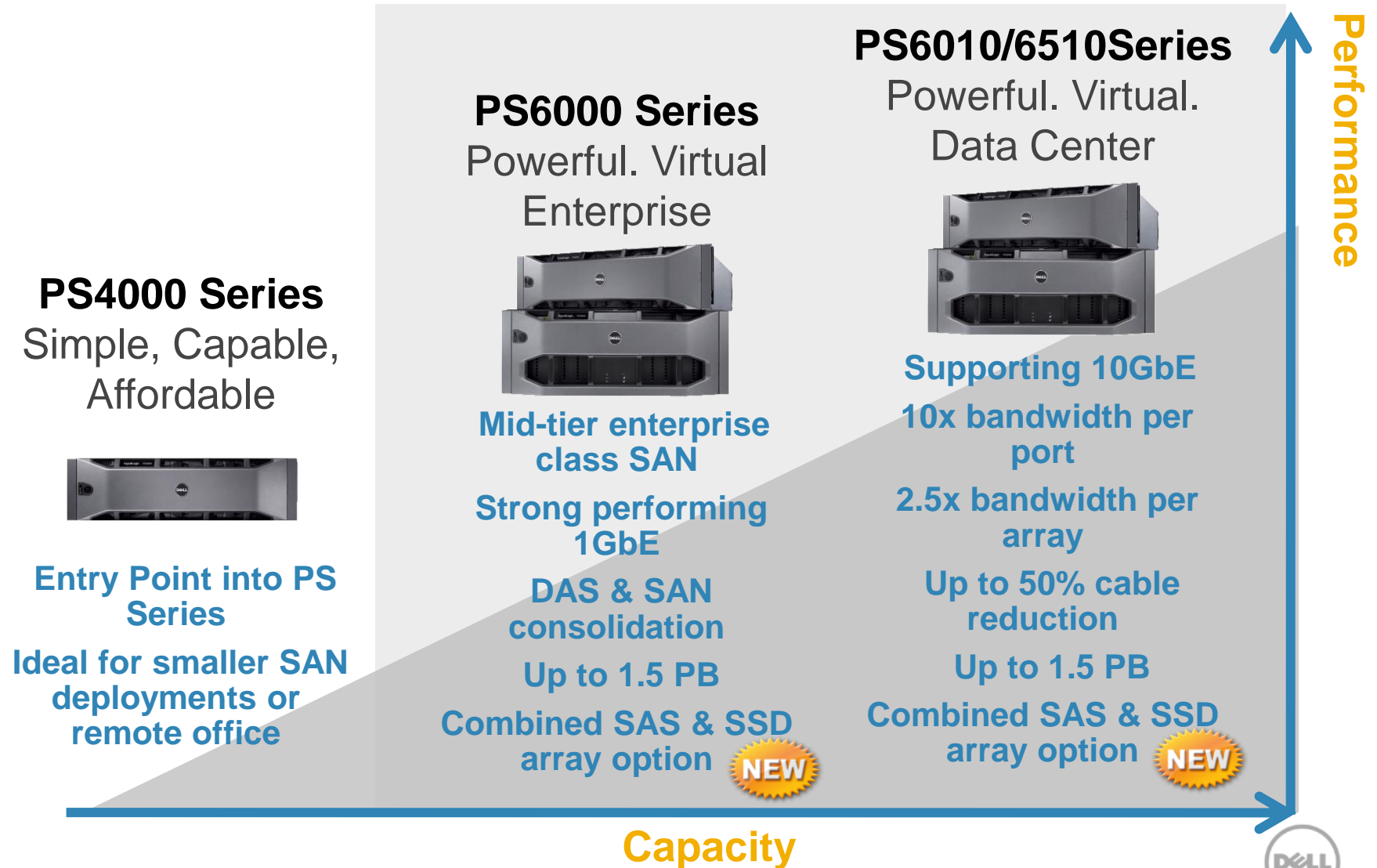
  - Intelligent, automated

  - Easy set-up

"EqualLogic can provide storage management manpower savings of 45 days/year "
- ESG

InfoWorld
2011
TECHNOLOGY
OF THE YEAR
AWARDS

Dell EqualLogic PS Series
Comprehensive storage solutions to meet your needs

PS6010/6510Series
Powerful. Virtual.
Data Center

PS6000 Series
Powerful. Virtual
Enterprise

PS4000 Series
Simple, Capable,
Affordable

Performance

Supporting 10GbE

10x bandwidth per port

2.5x bandwidth per array

Up to 50% cable reduction

Up to 1.5 PB

Combined SAS & SSD array option **NEW**

Mid-tier enterprise class SAN

Strong performing 1GbE

DAS & SAN consolidation

Up to 1.5 PB

Combined SAS & SSD array option **NEW**

Entry Point into PS Series

Ideal for smaller SAN deployments or remote office

Capacity

Dell EqualLogic
Remote Branch Office - SMB

The Dell EqualLogic PS4000 Series is designed for you!

Remote Offices

- Need to extend SAN storage and datacenter-class solutions like Virtualization and DR to branch facilities across your enterprise?

SMB SAN, Enterprise Features

- Getting started with SAN on a budget, but don't want to add complexity or sacrifice data protection, availability and performance?

Small Site Virtualization

- Looking to use VMware®, Hyper-V™ or Citrix® XenServer for small or branch offices?

Departmental IT Consolidation

- Consolidating departmental servers from DAS to SAN for easier data protection or virtualization?

Dell EqualLogic PS4000

Simple. Capable. Affordable.

PS4000 Series

All Inclusive Features, Affordable Price

Ideal iSCSI SAN for consolidation

Pay-as-You-Grow Scalability

Easy Set Up & Management

Virtual Storage for Virtual Servers

Self-optimized Performance

EqualLogic PS4000 Series
Simple. Capable. Affordable.

- Designed to install in minutes, "extremely simple to manage[1]"

- Virtual storage optimized for virtual servers

- Self-optimized performance and intelligent automation to reduce administration time & headaches

- All-inclusive software delivers enterprise data protection & management for any size business

- Pay-as-you-grow scalability with seamless growth to higher-end storage as your needs grow

[1]Source: Yankee Group, EqualLogic Customer Satisfaction Survey , March 2009.

EqualLogic PS4000 Series
Simple. Capable. Affordable.

PS4000XV Up to 9.6 TB 15,000 RPM SAS	High performance for demanding remote office applications
PS4000X Up to 9.6 TB 10,000 RPM SAS	Great balance of cost effective performance and capacity
PS4000E Up to 32 TB* 7,200 RPM SATA	Entry configuration for affordable capacity

*Maximum system capacity requires 2TB drives. Planned availability August 2010

PS4000 Hardware
Same End-to-End Reliability

- PS4000 Controller and Chassis

- Dual controller for full redundancy or single controller option

- 2 GB battery backed memory per controller
  (4 GB total with dual controllers)

- Two 1 Gigabit Ethernet Ports

- One 10/100 Ethernet management port

- Support for SATA or SAS drives

- 8- or 16-drive options

- Redundant power supplies and fans

Hotswap Drive Carriers

Redundant Power Supplies & Fans
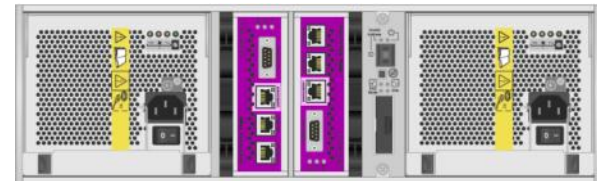
Dual Controllers, or Single Controller Option

Dell EqualLogic PS6000 Series
Helping you manage today's data center and IT challenges

Getting a grip on data growth

- Heavy sequential workloads such as decision support, data warehousing and streaming video can strain current storage systems

Managing overall costs /complexity

- Traditional Fibre Channel (FC) storage can be costly, complex and require specialized skills.

Multiple networks or technology

- Managing multiple SAN and LAN technologies is redundant and requires specialized education and staff

Back-up and recovery processes

- Customers need to improve back-up and recovery processes.

Dell EqualLogic PS6000 Series
Powerful. Virtual. Enterprise.

- Next-generation, scale-out storage architecture for datacenter virtualization & consolidation

- Highly scalable, high performance SAN
  - Up to 1.5 PB per group

- Designed for 99.999% availability & datacenter proven

- All-inclusive storage software for enterprise data protection and management solutions

- Storage for tomorrow's converged ethernet fabric, today
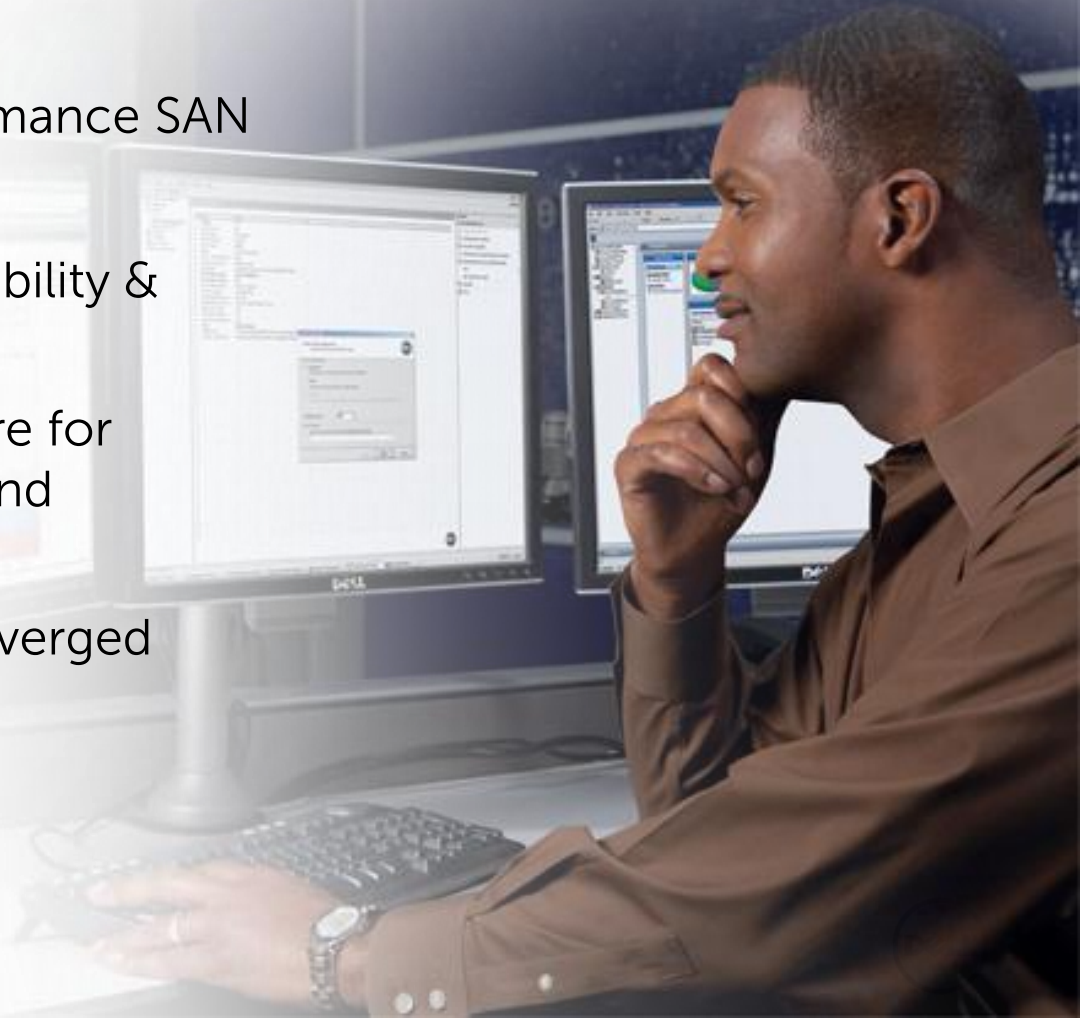
Dell EqualLogic PS6000 Series

Powerful. Virtual. Enterprise.

	PS6000S Up to 1.6 TB Solid State Disks (SSD)	High random read IOPS performance, low latency for the most demanding enterprise applications
	PS6000XV Up to 9.6 TB 15,000 RPM SAS	High performance for demanding enterprise applications
	PS6000X Up to 9.6 TB 10,000 RPM SAS	Balance of great performance and capacity for enterprise data centers
	PS6000E Up to 32 TB* 7,200 RPM SATA	High capacity configuration for data-intensive applications, highly consolidated environments

*Maximum system capacity requires 2TB drives. Planned availability August 2010

Dell EqualLogic PS6000 Series continued

Powerful. Virtual. Enterprise.

	PS6000XVS 4.4TB 8- 450GB 15,000RPM SAS + 8- 100GB SSD	Intelligent placement of data across SAS and SSD drives delivering outstanding data responsiveness – Ideal for virtual desktop deployments
	PS6500E Up to 96 TB 7,200 RPM SATA	High-density for huge capacity and scalability at best cost-per-gigabyte in PS Series
	PS6500X 28.8 TB 10,000 RPM SAS	Best combination of high-density and high-performance for business critical applications in environments where space and power must be managed

Dell EqualLogic PS6000 Series
Performance and end-to-end hardware reliability

- Fully redundant & hot swappable
  (5-9's Availability)
  - Controllers
  - 8 , 16 or 48 disk drives
  - Fans and power supplies

- High-end components
  - 4 active 1-GB Network Interfaces
  - Enterprise SATA, SAS or SSD drives
  - 4 GB battery-backed mirrored memory

Hotswap Drive Carriers

Redundant Power Supplies & Fans

Dual Controllers
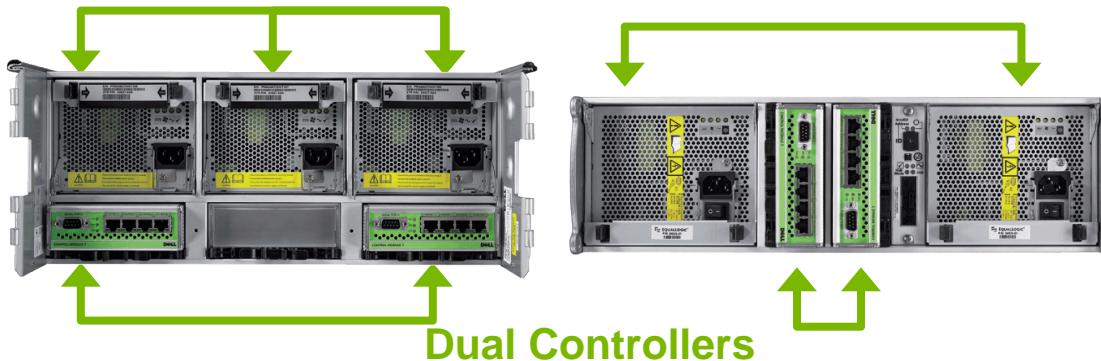
- Enclosure monitoring system
  - Component status
  - Disk drive health
  - Temperature

Dell EqualLogic PS6010 Series
Powerful. Virtual. Datacenter.

- Increasing storage performance in the enterprise; up to 10x the bandwidth per port and 2.5x the bandwidth per array

- Easier consolidation in data center and virtualization environments

- Continuing the economic value of EqualLogic – investment protection in your ecosystem

- End – to – End 10GbE Dell solution: PowerEdge™ Servers, PowerConnect™ networking and EqualLogic storage

- Enterprise Scalability: Up to 1.5 PB with 16 members per group

Dell EqualLogic PS6010/PS6510 Series

Value and performance of EqualLogic, now even stronger

PS6010/PS6510

Increased Storage Performance

Investment Protection in your Data Center

End to End 10GbE Dell Solution

Enterprise Scalability

Dell EqualLogic PS6010 Series
Powerful. Virtual. Datacenter.

	PS6010S Up to 1.6 TB Solid State Disks (SSD)	High random read IOPS performance, low latency for demanding enterprise applications
	PS6010XV Up to 9.6 TB 15,000 RPM 600GB SAS	Premium SAS performance for large – scale applications
	PS6010X Up to 9.6 TB 10,000 RPM SAS	Balance of great performance and capacity for enterprise data centers
	PS6010E Up to 32 TB* 7,200 RPM SATA	Great combination of performance and capacity for highly consolidated environments

*Maximum system capacity requires 2TB drives. Planned availability August 2010

Dell EqualLogic PS6010 Series continued

Powerful. Virtual. Datacenter.

	PS6010XVS 4.4TB 8- 450GB 15,000RPM SAS + 8- 100GB SSD	Intelligent placement of data across SAS and SSD drives delivering outstanding data responsiveness – Ideal for virtual desktop deployments
	PS6510E Up to 96 TB 7,200 RPM SATA	High-density for huge capacity and scalability at excellent value per-gigabyte, ideal for tiered storage applications needing high bandwidth
	PS6510X 28.8 TB 10,000 RPM SAS	Best combination of high-density and high-performance for business critical applications in environments where space and power must be managed

Dell EqualLogic PS6010 & PS6510 Series
End-to- end reliability, now even stronger

- Fully redundant & hot swappable (5-9's Availability)
  - Dual controllers
  - 8, 16 or 48 disk drives
  - Fans and power supplies

- High-end components
  - 2 active 10GbE Network Interfaces (SFP+)
  - 1 active 10/100 Management Port
  - Enterprise SATA,SAS or SSD drives
  - 4 GB battery-backed mirrored memory

Hotswap Drive Carriers

- Enclosure monitoring system
  - Component status
  - Disk drive health
  - Temperature

Redundant Power Supplies & Fans

Dual Controllers

Dell EqualLogic PS6500/PS6510 Series
Dell's hugely scalable pure-iSCSI SAN

- Scaled up PS Series Array
  - 3x scalability and over 2x density of 3U models
  - Compelling economics and features for primary or tiered storage
    - › PS6500E/PS6510E – 3x the capacity for 2x the price of PS6000E SATA arrays
    - › PS6500X /PS6510X– 3x the capacity of PS6000X SAS arrays combined with lower power and cooling requirements
    - › A more affordable PS Series option for nearline, archive or backup to disk apps.
  - Improved TCO, smaller (4U) footprint for denser installs, bigger installations: up to 1.5 PB per group
  - Same software features as the rest of the PS Series

PS Series– solid state disk
High end performance in PS series

Features & Benefits:

- Value-focused SSD offering: SSD performance for the price of a SATA array

- Great cost per gig for SSDs vs. traditional drive media

- Low latency with as much as 3x the IOPS of 15k rpm array*

- Exceptional random IOPS performance with very low latency

Use Cases:

- Segmenting specific latency-sensitive workloads (volumes) on SSD, with most capacity on other tiers

- Oracle® and SQL temp db databases

- Space-efficient virtual desktop deployments, e.g. VMware® View with linked clone technology

*Based on testing performed by Dell Labs in January 2009 comparing Dell EqualLogic PS6000 series arrays to PS5000 series.

EqualLogic software value

- Investment Protection
  - All-inclusive software
  - Incremental technology protection

- Consistent Performance
  - Optimization of resources across the SAN
  - Non-disruptive data movement

- Storage Infrastructure Flexibility
  - Add capacity to existing groups without disrupting critical business applications

- Data Protection
  - Comprehensive feature set including:
    › Space-efficient snapshots
    › Clones
    › Replication
    › Instant restore from snap
    › Fast failback

You bought a powerful SAN tool, and you expect all the tools you need to be in the box. Dell delivers with a valuable portfolio of storage software to support the family of EqualLogic storage arrays.
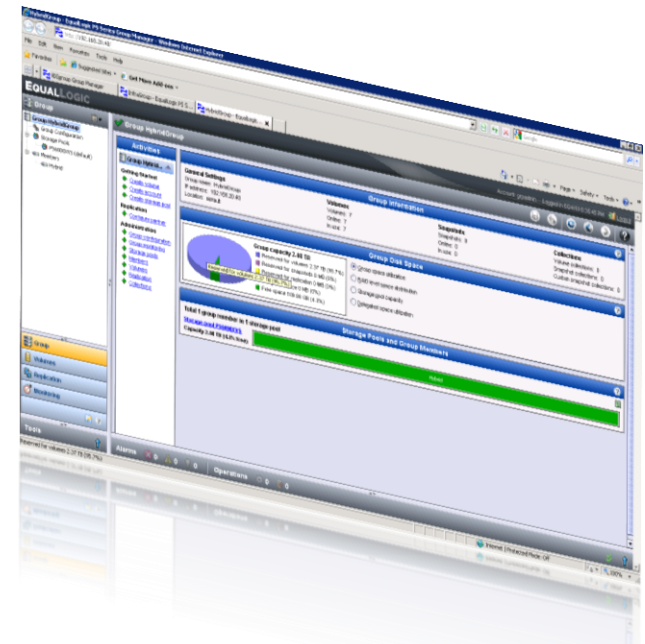
EqualLogic software portfolio

EqualLogic Host Software

EqualLogic Host Software for Windows®

- EqualLogic Auto-snapshot Manager/Microsoft Edition
- EqualLogic Multipath I/O Device Specific Module
- EqualLogic Volume Shadow Copy Service (VSS) and Virtual Disk Service (VDS) Provider Services.

EqualLogic Host Software for VMware®

- EqualLogic Auto-snapshot Manager/VMware Edition
- EqualLogic Storage Adapter for VMware Site Recovery Manager
- EqualLogic Multipath Extension Module for VMware ESC

Remote Setup Wizard

- MS Windows® Host based set-up
- Configure MPIO
- Configure VSS/VDS

EqualLogic SAN HQ

EqualLogic Array Software

CLI and Group Manager GUI

| Data Protection Availability and Recovery | Storage Virtualization | Array Management | Maintenance |

Enterprise Data Services

Peer Storage Architecture

EqualLogic Storage Array

EqualLogic Firmware v5.0
New features

Automated SSD Tiering
- Speed of SSD with the Capacity of HDDs
- Automated tiering, appears as single pool

Enhanced Security
- Role based management
- Support for SSH with new Python based Host Scripting Toolkit

Thin Clones
- Clones that leverage a "template volume" to reduce overall capacity utilization for commonly provisioned images
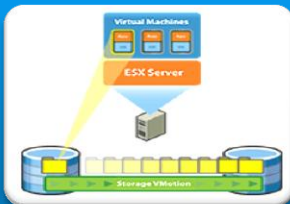
VM Aware Storage
- Integration with VMWare for Copy Offload and improve locking.

EqualLogic Firmware v5.0
New UI elements

Context sensitive help

Tree view modifiers

View selection buttons

Monitoring and event logs

Alarms and operations

EqualLogic Firmware v5.0
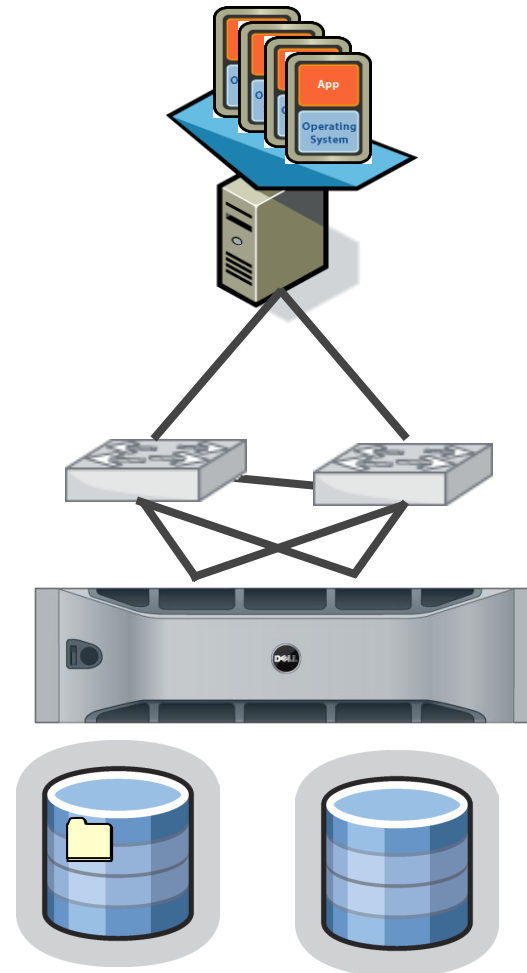Advanced data movement without vStorage APIs

- VMware® provides an extensive set of features to clone, move and copy data online

- Common administrative tasks: clone, deploy from template, storage vMotion, migrate – All require data movement between ESX and SAN

- Before vStorage APIs, work was tasked to the ESX servers

- ESX was unaware of built in intelligence in SAN
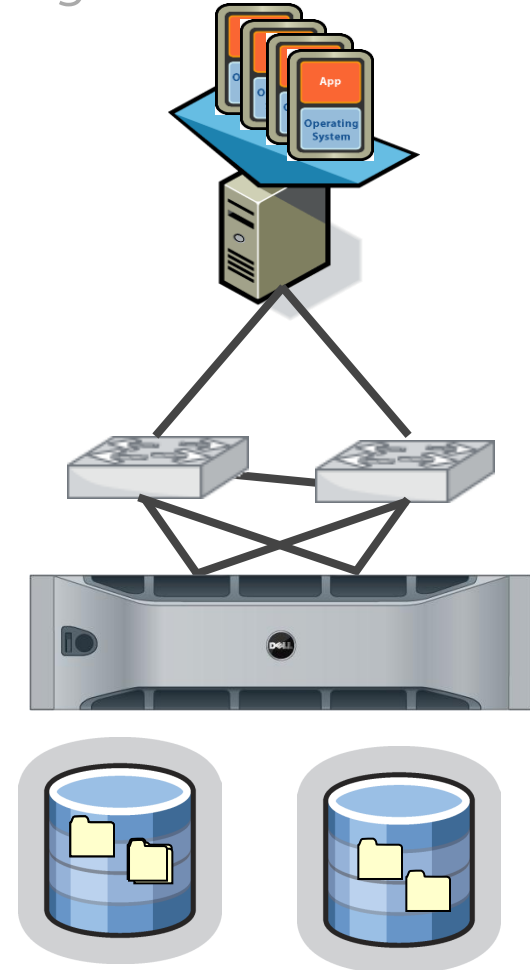
EqualLogic Firmware v5.0
## Cloning, storage vMotion with vStorage integration

- VMFS directs storage to move data directly

- Much less time!
  - › Up to 95% reduction*

- Dramatic reduction in load on:
  - › Servers
  - › Network
  - › Storage

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*Based on testing performed by Dell Labs in May 2010 comparing Dell EqualLogic Firmware v. 4.3 to Dell EqualLogic Firmware v. 5.0 with VMware API for Array Integration. Actual performance will vary based on configuration, usage and manufacturing variability

EqualLogic Firmware v5.0
Role-based management

- Volume administrator role added in v5.0
- Assign separate administrators for each pool/volume
  - Administrator can only change objects within authorized pools
- Supports multi-organization administration
- Enables ASP/ISP business models

Engineering

Finance

Sales
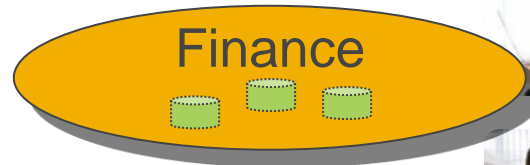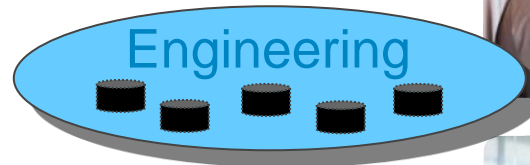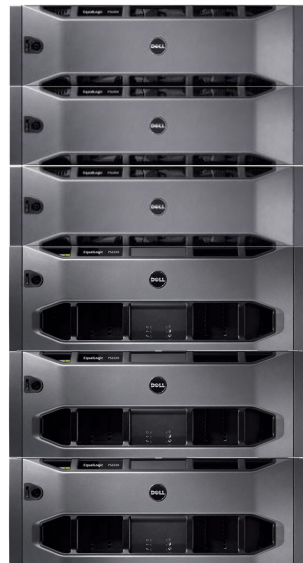
Single-view management
Single SAN manager – any size, any form

EqualLogic Group Manager — Simple Intuitive GUI

SAN Virtualizer

System Load Balancer

Volume Manager

Enclosure Monitoring System — in-depth SAN reporting

Storage Configuration Assistant — best practice hints and clues

Multiple Storage Pool Creation — online volume movement between pools

Data Replication Control

Rapid Provisioning
Reducing time to Storage Deployment

Instant Volume Creation
- Name
- Size
- Snapshot size
- Security

Online Volume Modification
- Clones
- Snapshot
- Replication
- Volume expansion

PS Series comprehensive data management
All-inclusive full-function software features

BASE SOFTWARE FEATURES

ADVANCED SOFTWARE FEATURES

Management

- ☑ Instant on 'set-up' manager
- ☑ Group manager
- ☑ Rapid provisioning
- ☑ Roles-based management

Data Protection and Availability

- ☑ RAID 5, 6, 10, and 50
- ☑ Automatic RAID placement
- ☑ Multi-path / IO support

Maintenance

- ☑ Phone home
- ☑ Enclosure monitoring system
- ☑ Performance monitoring

Storage Virtualization

- ☑ Complete SAN virtualization
- ☑ Thin provisioning
- ☑ Auto-load balancing
- ☑ Automatic storage pools & tiering
- ☑ Array evacuation

Data Protection and Recovery

- ☑ Writeable snapshots
- ☑ Multi-volume snapshots
- ☑ Instant restore / cloning
- ☑ Multi-way replication for disaster recovery

Multi-Group Monitoring

- ☑ SAN HeadQuarters (SAN HQ) event & performance monitoring

VMware vStorage Integration

- ☑ Full Copy – Accelerated Storage Copy Operations
- ☑ Hardware Assisted Locking
- ☑ Block Zeroing

Server Management Integration

- ☑ VSS and VDS Providers
- ☑ Automatic MPIO Connection Management
- ☑ EqualLogic Auto-Snapshot Manager/ Microsoft® Edition
- ☑ EqualLogic Auto-Snapshot Manager/ VMware® Edition 2.0
- ☑ EqualLogic Multipath Extension Module for VMware® ESX
- ☑ EqualLogic Storage Adapter for VMware® Site Recovery Manager

Dell Services Capabilities

Applications	Business Process	Consulting		Infrastructure				Support
Application Services	**Business Process Services**	**IT Consulting**	**Business Consulting**	**Infrastructure Managed Services**	**Cloud Services**	**Configuration & Deployment**		**Support Services**
Custom Development	Document Management	End User	Strategy & Transformation	End User	Virtual Desktop	End User		Hardware Warranty
Testing	Data Capture	Data Center	Organizational Change Management	Data Center	Virtual Data Center	Data Center		ProSupport
Applications Management	Knowledge based & Transaction Processing	Enterprise Architecture	Process Re-Engineering	Hosting	X-as-a- Service (Platform, IT Mgt S/W, Apps, Software)	Network		Accidental Damage
ERP and Industry Applications	Contact Center		Supply Chain Management	Information Assurance				Value-Added Services
Business Intelligence	Engineering Services		Customer Relationship Management	Network				
Modernization								

Dell has the experience to help
Solutions for intelligent data management

Consolidate
Support growing data requirements while controlling complexity

Optimize
Make the most of your storage investment by optimizing your infrastructure resources

Protect
Match requirements for availability, retention, and recovery to business needs

Take the first step
Data Management Consulting from Dell

Dell Storage Simplification Workshop

✓ Determine key challenges

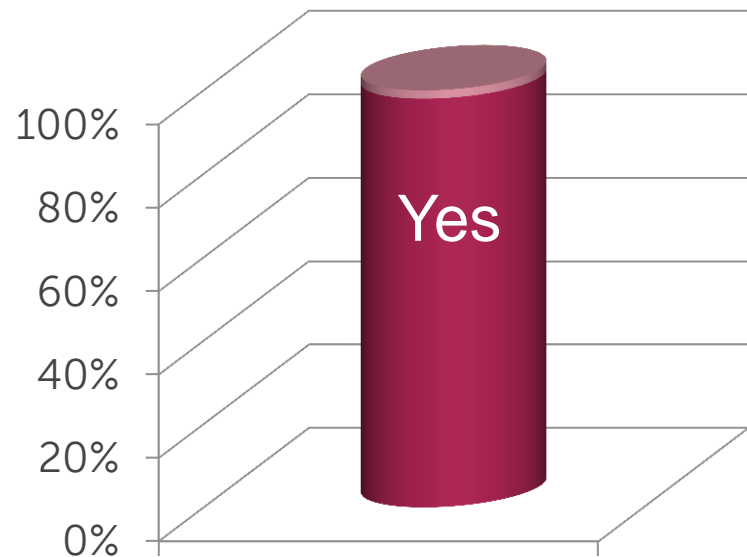✓ Connect storage and backup requirements to business needs

EqualLogic QuickStart

✓ A post implementation on site assistance

✓ Assistance in making full use of EqualLogic's advanced capabilities

Extraordinary customer satisfaction
98% of EqualLogic customers would recommend PS Series*

"Would you recommend an EqualLogic product to others?"

100%
80%
60%
40%
20%
0%

Yes

*Source: Yankee Group, EqualLogic Customer Satisfaction Survey, March 2009.