

INSIDE THE **EQUALLOGIC[®] PS** **SERIES iSCSI** **STORAGE** **ARRAYS**

Built on a patented peer storage architecture, the EqualLogic PS Series of Internet SCSI (iSCSI) storage arrays offer high performance, reliability, intelligent automation, and seamless virtualization of a single pool of storage to enable simplified enterprise storage deployment and management, and comprehensive data protection.



EQUALLOGIC

Storage management is at the center of an increasingly complex IT problem. Applications continually demand more from their storage systems—as performance, capacity, availability, backup, and disaster recovery needs intensify, so do expectations of the servers and storage that support them. As a result, IT professionals need a storage solution that integrates a full complement of high-end management capabilities, includes data protection, and operates intelligently. They need a reliable storage system that expands transparently and provides consistent data availability regardless of the server configuration, OS, or application.

The EqualLogic PS Series of Internet SCSI (iSCSI) storage arrays offers a fundamental change in the way enterprises think about purchasing and managing storage. Built on a patented peer storage architecture, these solutions offer enterprise-class performance and reliability, intelligent automation, and seamless virtualization of a single pool of storage for simplified storage management. The PS Series combines an intelligent, automated management framework and a comprehensive set of enterprise data services with a fault-tolerant hardware architecture that supports many major operating systems. It delivers a modular and cost-effective solution that can be deployed in appropriate increments for small and medium businesses, while also being cost-effective for large enterprises requiring high-end capacity and performance.

STORAGE MANAGEMENT IS AT THE CENTER OF AN INCREASINGLY COMPLEX IT PROBLEM

PEER STORAGE ARCHITECTURE

The EqualLogic PS Series is based on the unique peer storage architecture. In this context, peer describes the collaboration and equal partnership of a single, simple architecture; components and arrays function as peers, working together to share resources, evenly distribute loads, and collaborate to help optimize application performance and provide comprehensive data protection.

The result is an intelligent storage array that can deliver rapid installation, simple

management, and seamless expansion. Using patented page-based data mover technology, members in a storage area network (SAN) work together to automatically manage data, load balance across resources, and expand to meet growing storage needs. Because they share this architecture, enterprises can use PS Series arrays as modular building blocks for simple SAN expansion (see Figure 1). This architecture provides the basis for numerous features and capabilities, including peer deployment, control, provisioning, protection, and integration (see Figure 2).

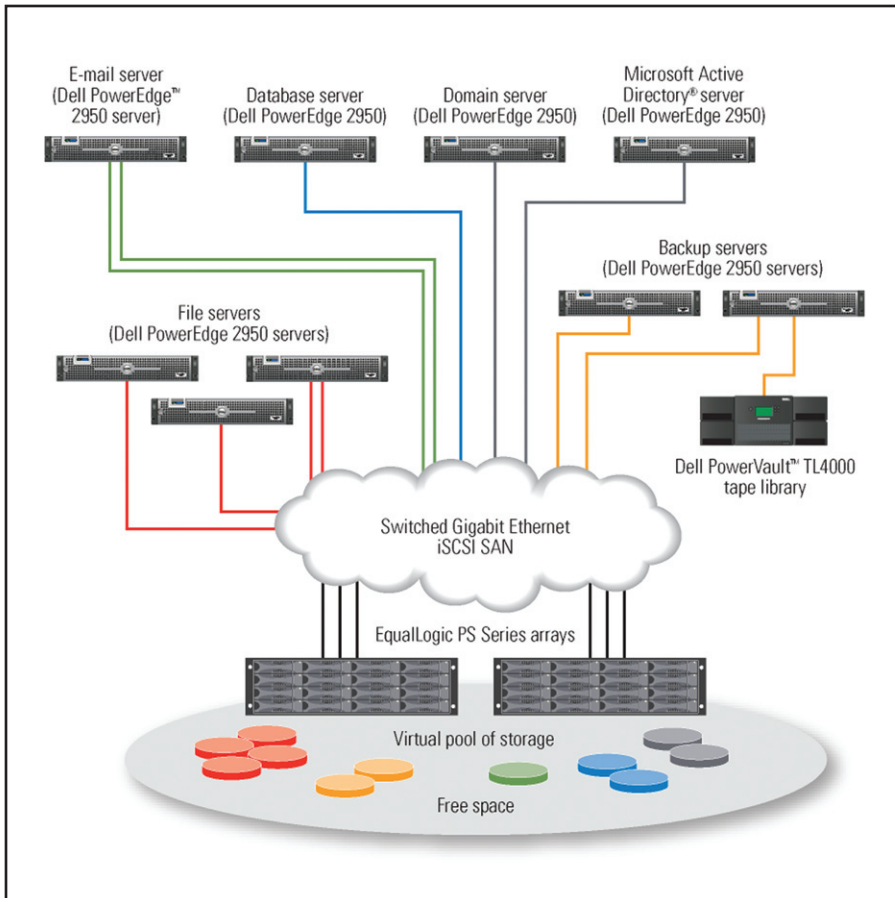


Figure 1. Grouping multiple EqualLogic PS Series arrays helps increase capacity and performance linearly—without increasing management complexity

**PEER
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AVAILABILITY**

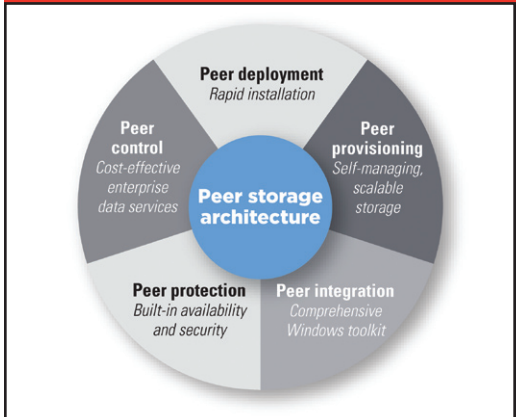


Figure 2. EqualLogic PS Series enterprise-class features are based on the patented peer storage architecture

Peer deployment is a SAN configuration technology that can sense network topology, automatically build RAID sets, and conduct a system health check to help ensure that components are fully functional. Peer deployment enables IT staff to potentially install, configure, and deploy most EqualLogic arrays in minutes.

Peer control offers virtualized storage management with a single view. PS Series arrays are designed to be self-managing; the system is designed to continuously monitor storage resources and automatically load balance data across controllers, network connections, and disk drives to help deliver optimal performance. Peer control automates key functions for configuration, management, storage pooling, and data distribution, helping minimize the complexity of storage administration.

Peer provisioning enables administrators to dynamically provision resources to meet application requirements—including not only disk space, but also connectivity, security, performance, and data protection. When application requirements change, the storage configuration can change seamlessly. Peer provisioning is designed

to simplify expansion while systems remain online; new arrays can be automatically added to the group and automatically connect to the SAN. Expansion is linear, enabling administrators to scale not only disk drives but also controllers, ports, cache and performance as the environment grows. Peer provisioning enables enterprises to purchase storage on demand, which facilitates efficient use of both capital and storage resources. Advanced thin provisioning capabilities are included, giving administrators additional flexibility in providing storage to applications. Administrators can also allocate virtual storage to volumes up to preset limits and add physical capacity on demand. In both physical and virtual server environments, cloned volumes can be rapidly assigned to different servers to help meet changing needs.

Peer protection starts with a robust design that avoids single points of failure and is designed to provide greater than 99.999 percent availability. It also includes built-in features such as application-aware snapshots for quick recovery and remote replication for disaster protection.

“THE EQUALLOGIC PS SERIES HAS BUILT-IN STORAGE FEATURES PREVIOUSLY AVAILABLE ONLY TO TOP-TIER DATA CENTERS, ENABLING BEST-PRACTICE STORAGE FOR ORGANIZATIONS OF ALL SIZES.”

These features enable administrators to quickly create an end-to-end solution that can help provide comprehensive protection against multiple types of failure or outage.

Peer integration provides a comprehensive software toolkit to facilitate the deployment, ongoing management, and protection of EqualLogic SANs in Microsoft® Windows® OS environments. As a Microsoft Windows Simple SAN designated solution, the EqualLogic PS Series is proven, interoperable and easy to set up and manage for Windows platforms. EqualLogic Auto-Snapshot Manager provides a feature-rich tool to help protect and recover data for Windows applications.

The EqualLogic peer storage architecture makes enterprise-class performance, scalability, and reliability possible in an intelligent, automated management framework that helps eliminate tedious administrative tasks while enabling easy best-practices storage management.

MODULAR DESIGN WITH ENTERPRISE RELIABILITY

EqualLogic PS Series arrays have a modular design that allows enterprises to purchase only the storage they need, when they need it—helping prevent both underutilization and over-provisioning. Its peer storage architecture uses industry-standard protocols, disk drives, and network interfaces to provide cost-effective connections and high-performance access to data across heterogeneous environments, including Microsoft Windows, Novell® NetWare®, Novell® SUSE® Linux® Enterprise Server, Red Hat® Enterprise Linux, other Linux distributions, SLM Solaris™, UNIX®, HP-UX, Mac OS® X, IBM® AIX®, and VMware® ESX Server environments.

Designed to meet and exceed the rugged requirements of the data center, EqualLogic engineered fault tolerance into the PS Series hardware design. Its components are fully redundant and hot swappable with dual controllers, standard dual fan trays, and dual power supplies standard. The hot-swappable controller module features high-performance dual-core 64-bit processors with a high-speed HyperTransport™ I/O bus and twin 64-bit double data rate (DDR) channels. Each control module is equipped with 1GB of high-speed battery-backed DRAM. Each disk drive is interconnected with its own independent, hot-swappable serial channel and secured mechanically with an inertial dampening chassis that helps eliminate drive vibrations. Self-tuning controller caches are battery-backed and mirrored across controllers to help protect these components without compromising performance.

EqualLogic PS Series arrays support Serial Attached SCSI (SAS) and Serial ATA (SATA) disk drives with a variety of performance and capacity options. Enterprise-class RAID protection governs hot-swappable disk

drives, including RAID-5, RAID-10, and RAID-50 support; hot sparing; automatic rebuilds; accelerated rebuild times; advanced stripe integrity algorithms; online RAID set expansion; geometry transformation; and patent-pending predictive media-error detection and correction. Not only can administrators service the arrays without taking them offline, but the PS Series array isolates faults to help prevent cascading failures or loss of protection during service. The result is a high level of data protection and performance even during service procedures. The redundancy of the design eliminates single points of failure, helping to provide greater than 99.999 percent availability.

PEER DEPLOYMENT: RAPID INSTALLATION

EqualLogic PS Series arrays can potentially be fully functional within minutes of opening the shipping box. Built into the array is an automatic sensing and configuration technology that helps eliminate complex and cumbersome manual tasks, enabling a quick start. Once it identifies the network topology, this intelligence checks component functionality and automatically builds RAID sets. With a few simple steps and without special expertise, administrators can deploy an enterprise-class SAN seamlessly, without downtime. This capability helps eliminate the complex manual configuration of other SANs, allowing administrators to focus on servers and applications.

PEER CONTROL: COST-EFFECTIVE ENTERPRISE DATA SERVICES

Administrators can manage PS Series arrays in a SAN through a single interface—the PS Group Manager (see Figure 3). This Web browser-based Graphical User Interface (GUI) helps eliminate the need for a dedicated management workstation or server and allows administrators to remotely manage virtually any aspect of their EqualLogic iSCSI-based SAN. In addition to using the Web interface, administrators can also manage PS Series arrays using a scriptable command-line interface over Secure Shell (SSH) and Telnet. Built-in monitoring and notifications provide e-mail, syslog support, and comprehensive Simple Network Management Protocol (SNMP) monitoring and traps—all standard features.

PS GROUP MANAGER

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VOLUME SNAPSHOTS

PS Series arrays provide space-efficient snapshots that support up to 512 snapshots per volume, thousands of snapshots per array, and read-only as well as read/write snapshots. Snapshots can be used for quick recovery and offloading backup operations. PS Series arrays implement safe snapshot recovery in which data is not discarded unintentionally, helping provide the flexibility to implement true enterprise IT storage.

AUTOMATIC LOAD BALANCING

The EqualLogic approach to optimizing performance is simple: maximize the horsepower of all available components in the SAN. Because of the unique peer storage architecture used by EqualLogic PS Series arrays, instead of relying solely on individual components to deliver high performance, peer control leverages all relevant components. It automatically load balances to seamlessly spread data across active storage resources, helping maximize performance by intelligently optimizing the available network connections, cache, controllers, and drives. Through this optimization, each PS Series array can support high transactional workloads and database applications. When multiple arrays are added together the PS Series quickly scales, with performance growing linearly with each additional array.

TIERING AND POOLING

The EqualLogic tiering capability enables administrators to prioritize applications within a SAN by placing them on separate storage resources, each optimally configured for the required service level of the application. Administrators can configure separate storage pools within a single SAN to help build an efficient, flexible, easy-to-manage storage environment. Using this “SAN within a SAN,” administrators can gain the advantages of consolidation, but can also easily separate workloads as needed: by application, by service level, by disk type, by cost, or even by department within the organization. Because online data movement is built into all PS Series arrays, administrators can adjust application resources and move data between different pools of storage without downtime or disruption.

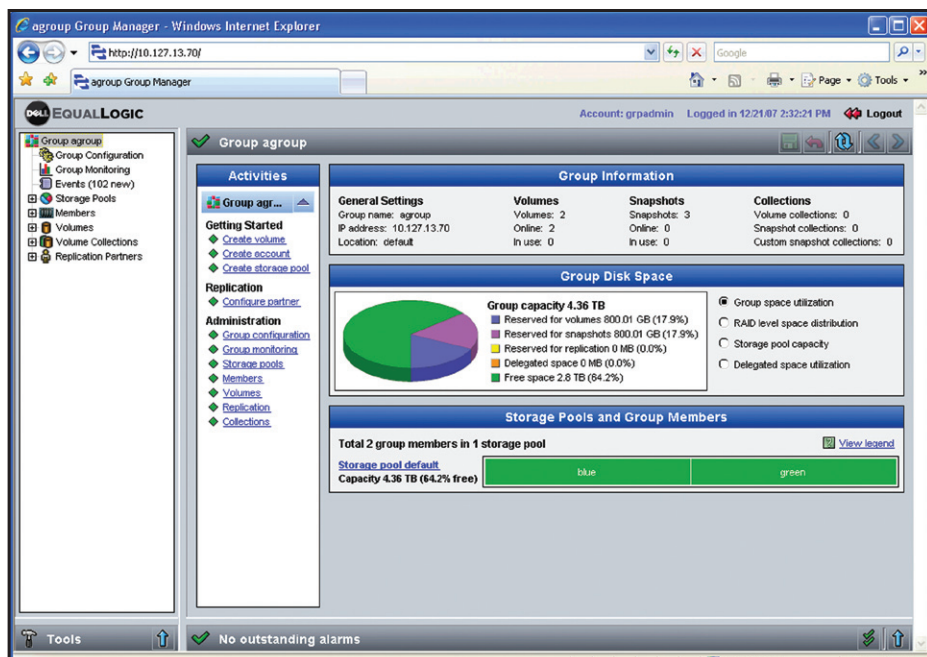


Figure 3. The EqualLogic PS Group Manager interface helps simplify storage management across PS Series arrays

PEER PROVISIONING: SELF-MANAGING, SCALABLE STORAGE

The intelligence of peer provisioning combined with the modular design of PS Series arrays enable administrators to quickly and easily expand storage capacity without affecting data availability. They can start with a single storage array—then, when their storage, performance, and network requirements grow, they can add more members to help increase capacity, performance, and network bandwidth automatically and linearly. Configuring one or more EqualLogic PS Series arrays as a PS Group enables administrators to manage the arrays as a single system with a shared pool of storage. EqualLogic peer provisioning automates the key functions needed to configure, manage, and scale storage, helping eliminate much of the complexity of storage administration. Each group member is automatically configured and participates in balancing the load, distributing data, and tracking host access to data, without requiring user intervention—helping keep storage management simple, regardless of scale.

The power of peer provisioning also enables a key feature: on-demand growth. Because capacity expansion in PS Series arrays is nondisruptive, administrators can add storage resources while applications remain online. As a result, purchase only the storage you need, when you need it—help prevent both underutilization and over provisioning and avoid future downtime. With a PS Series SAN, enterprises can purchase the storage capacity they need today, and plan for future storage growth knowing that when they need to expand, they can do so easily and without taking the system offline. In addition, PS Series arrays are designed to fully integrate with Microsoft Virtual Disk Service (VDS), enabling application-level provisioning by supporting applications.

Thin provisioning is an important advanced feature of peer provisioning that enables the automatic addition of physical capacity on demand up to preset limits. Advanced thin provisioning helps make buy-as-you-grow storage management and virtualization seamless for servers and applications. When administrators create a volume, they can size it for the long-term needs of the application without initially allocating the full amount of physical storage. Instead, as the application needs additional storage, capacity is allocated to the volume from a free pool. The EqualLogic implementation of thin provisioning provides enhanced flexibility and safety controls—with proactive, user-defined threshold alarms and controls, administrators can depend on automatic space allocation without worrying about reaching allocation limits or unexpected depletion of physical storage.

Peer provisioning can offer significant economic benefits to enterprises of all sizes, because they can purchase physical storage when they actually need it. These benefits include increased asset utilization, reduced management costs, reduced floor space footprint, reduced power and cooling costs, and smart, efficient capital expenditures.

PEER PROTECTION: BUILT-IN AVAILABILITY AND SECURITY

Peer protection encompasses comprehensive system monitoring and high-availability features such as E-mail Home, multipath I/O, and Auto-Replication that help provide comprehensive protection against system failures or outages.

COMPREHENSIVE SYSTEM MONITORING

EqualLogic system monitoring capabilities are designed to provide administrators with a comprehensive view of the health and status of their SAN. Within the PS Group Manager, administrators can view the status of individual SAN components such as drives, power supplies, and controllers, as well as the overall system. PS Series arrays also include the Auto-Stat Disk Monitoring System (ADMS), which proactively scans disk drives in the background to help detect media anomalies and correct them. Combined with automatic sparing and spare utilization, this feature helps enhance protection and ensure optimal disk performance.

E-MAIL HOME

To help ensure the availability of systems and data, PS Series arrays come standard with group event notification methods (e-mail, syslog, and SNMP), but also allow administrators to enable E-mail Home functionality. E-mail Home can automatically contact EqualLogic customer support if a hardware component such as a disk, control module, fan tray, or power supply fails, or if the firmware on a PS Series array is updated. E-mail Home functionality enables EqualLogic to rapidly respond to issues and assist administrators.

MULTIPATH I/O

EqualLogic multipath I/O provides high availability and performance load balancing across multiple network ports (host bus adapters and/or network interface cards) for Windows, Linux, UNIX and VMware environments. By leveraging the ease and cost-effectiveness of Ethernet, multipath I/O helps remove single points of failure between the server and the storage.

AUTO-REPLICATION

EqualLogic Auto-Replication remotely replicates data from one PS Group to another over a standard IP network over long distances, helping provide high levels of data protection and disaster tolerance. Auto-Replication offers the advantages of geographic isolation—a critical component in any true disaster recovery plan—without the traditional complexity. Administrators can quickly and easily configure volumes for replication, letting the PS Series arrays manage the underlying hardware resource complexity. A catalog of recovery points is maintained at each disaster recovery site, providing multiple points of recovery from which

“A CATALOG OF RECOVERY POINTS IS MAINTAINED AT EACH DISASTER RECOVERY SITE, PROVIDING MULTIPLE POINTS OF RECOVERY FROM WHICH TO CHOOSE IN THE EVENT OF A DISASTER.”

“PEER INTEGRATION HELPS SIMPLIFY THE DEPLOYMENT OF SHARED SAN STORAGE IN WINDOWS-BASED APPLICATION ENVIRONMENTS, HELPING ELIMINATE THE WORRIES OF TIME-CONSUMING STORAGE MANAGEMENT.”

to choose in the event of a disaster—a choice that helps protect against “cascading” failures such as software viruses.

Making a disaster recovery site operational is simple, even if the primary site already stores terabytes of data. EqualLogic PS Series arrays enable administrators to perform an initial manual sync by copying primary site data to transportable media, physically shipping the media to the remote site, unloading the data, and then starting up the automatic replication. Automatic failover and failback functions enable nondisruptive testing of the disaster recovery deployment in addition to facilitating continuous access to data. Auto-Replication is completely array based, helping free IT administrators from the arduous task of managing host-based software as well as the economic burden of host software licenses.

PEER INTEGRATION: COMPREHENSIVE WINDOWS TOOLKIT

Peer integration facilitates the deployment, ongoing management, and protection of EqualLogic SANs in Microsoft Windows environments. As a Microsoft Simple SAN solution, the PS Series is certified as interoperable and easy to setup and manage for Windows platforms.

REMOTE SETUP WIZARD

Each PS Series array comes with the EqualLogic Remote Setup wizard, an easy-to-use tool that can transform the way administrators set up their SANs. From a Windows-based system, administrators can potentially have a PS Series array up and running in just minutes. Configuration of Microsoft Multipath I/O (MPIO) between Windows-based servers and an EqualLogic SAN—a multistep operation with the basic Microsoft iSCSI driver—can be vastly simplified with the Remote Setup wizard. This tool helps shorten configuration time and

ensure that multipath I/O has been configured properly, helping maximize availability and performance. When administrators need more capacity or performance, they can also use the Remote Setup wizard to add members to their existing SAN.

AUTO-SNAPSHOT MANAGER FOR WINDOWS

EqualLogic Auto-Snapshot Manager is a feature-rich application for protecting and recovering Windows application data, including protection for systems using Windows NT File System (NTFS) and Microsoft SQL Server® databases. Auto-Snapshot Manager, included with all PS Series arrays, is an intuitive, easy-to-use Graphic User Interface (GUI) that creates “clean” file system and SQL Server database snapshots, clones, and remote replicas. Integration with Microsoft Volume Shadow Copy Service (VSS) provides hardware-based snapshots with full or differential copies. A scheduler with e-mail notification options is included to help simplify maintenance operations. In the event that a file system or SQL Server database recovery is necessary, Auto-Snapshot Manager provides several quick restore options to help maximize the availability of critical data and applications.

Auto-Snapshot Manager is designed to allow administrators to safely take snapshots of, back up, and restore their Microsoft Windows Server® 2003 OS-based applications with advanced third-party backup software modules by supporting VSS and VDS interfaces. This capability helps eliminate the extensive system configuration and scripting that other systems may require for snapshot-based backups.

Peer integration helps simplify the deployment of shared SAN storage in Windows-based application environments, helping eliminate the worries of time-consuming storage management and free up time to focus on delivering enhanced Windows-based business solutions.

FLEXIBILITY WITH LOW TOTAL COST OF OWNERSHIP

The EqualLogic PS Series represents an advancement in storage economics, from purchase and setup to operation and upgrades. Unlike traditional SANs, the EqualLogic PS Series comes complete with the software and applications expected from an enterprise-level SAN, at no additional charge—there is no additional software to install or service costs to incur to initiate the data management and protection features for this enterprise-class SAN. EqualLogic arrays scale on demand and online, helping enterprises increase their storage resources without disrupting the application environment or budget. This packaging model, combined with the ease of use and automated intelligence of PS Series arrays, enables EqualLogic systems to provide a significant return on investment.

Whether used to consolidate a direct attach storage infrastructure, migrate data from an existing SAN, streamline data protection processes, or just add capacity, the EqualLogic PS Series offers a family of high-performance, self-managing storage arrays designed to meet the requirements of SAN or network-attached storage environments for organizations of all sizes. Based on the patented peer storage architecture, the PS Series of storage arrays is designed to be comprehensively interoperable and upgradable, seamlessly scaling arrays without disrupting application or data availability.

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