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 to enable simplified enterprise storage deployment, ease of management, and comprehensive data protection.

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**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; arrays are designed to 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 patent-pending 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).
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, 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 optional dual controllers, standard dual fan trays, and dual power supplies. The hot-swappable controller module features high-performance dual-core 64-bit processors with a high-speed I/O bus and twin 64-bit double data rate (DDR) channels. Each control module is equipped with 1 GB of high-speed battery-backed DRAM. Each disk drive is interconnected with its own independent, hot-swappable serial channel and connected 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 system isolates faults to help prevent cascading failures or loss of protection during service. The result is high levels of data protection and performance even during service procedures. The redundancy of the design helps eliminate single points of failure and provide enterprise-level availability and reliability.

**PEER DEPLOYMENT: RAPID INSTALLATION**

Peer deployment is an automatic sensing and SAN configuration technology in EqualLogic PS Series arrays designed to eliminate complex and cumbersome manual tasks. It can enable administrators to set up and deploy PS Series arrays within minutes of opening the shipping box.

Once the array has identified the network topology, the peer deployment intelligence conducts a system health check to help ensure that components are fully functional, 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**

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

The PS Series includes built-in storage features previously available only to top-tier data centers, enabling best-practice storage for organizations of all sizes. In addition to automatic load balancing, the arrays include enterprise software features such as automatic snapshot management, automatic replication, volume cloning, volume management, storage virtualization, thin provisioning, SAN boot capability, role-based administrative management, historical performance trending and reporting, tiering and pooling, and multipath I/O with no additional licensing fees or host-based software to implement.

**PS Group Manager**

Administrators can manage PS Series arrays in a SAN through a single interface—the PS Group Manager (see Figure 3). This Web browser-based 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.

**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.

**PEER PROVISIONING: SELF-MANAGING, SCALABLE STORAGE**

In combination with the modular design of PS Series arrays, 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.

The intelligence of peer provisioning enables 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. Expansion is linear, enabling administrators to scale not only disk drives but also controllers, ports, and cache, and performance can potentially increase as the environment grows.

Configuring one or more EqualLogic PS Series arrays as a PS Group also 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 enables a key feature of PS Series arrays: on-demand growth. Because capacity expansion in PS Series arrays is designed to be nondisruptive, administrators can add storage resources while applications remain online. As a result, enterprises do not need to tie up capital by over-provisioning—leaving underutilized storage assets—as IT managers often do to help 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 interrupting performance.

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**

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.

"The PS Series includes built-in storage features previously available only to top-tier data centers, enabling best-practice storage for organizations of all sizes."
PEER PROTECTION: BUILT-IN AVAILABILITY AND SECURITY

Peer protection starts with a robust design that helps avoid single points of failure and provide enterprise-level availability and reliability, including built-in PS Series features such as application-aware snapshots for quick recovery and remote replication for disaster protection. It 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. 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.

Comprehensive system monitoring

EqualLogic system monitoring capabilities 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 of use 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 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 provides a comprehensive software toolkit to facilitate the deployment, ongoing management, and protection of EqualLogic SANs in Microsoft Windows environments. As a Microsoft Simple SAN solution, the PS Series is certified to be interoperable and easy to set up and manage for Windows platforms. The EqualLogic Remote Setup Wizard facilitates rapid SAN configuration in these environments, while EqualLogic Auto-Snapshot Manager provides a feature-rich tool to help protect and recover data for Windows applications.

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 have a PS Series array up and running in just minutes. Configuration of multipath I/O 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.

“EqualLogic system monitoring capabilities provide administrators with a comprehensive view of the health and status of their SAN.”
"Peer integration helps simplify the deployment of shared SAN storage in Windows-based application environments, helping eliminate the worries of time-consuming storage management."

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 enterprise-class software features and applications 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 high 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.

John Joseph is vice president of marketing of the Dell EqualLogic storage business. He has worked in the computer industry for 22 years, for the last 5 years leading the EqualLogic marketing team. John has a B.S. in Mechanical Engineering from Worcester Polytechnic Institute and an M.B.A. from Clark University.

Eric Schott is a senior director of product management for the Dell EqualLogic product family, where he is responsible for strategy and planning for iSCSI storage networking products. Eric has more than 25 years of experience developing enterprise technology products; has extensive expertise in storage, real-time systems, log-based file systems, volume managers, and cluster products; and frequently contributes to articles in leading publications and speaks at key industry events.

Kevin Wittmer is director of product marketing for the Dell EqualLogic product family. He has more than 21 years of experience developing and bringing to market enterprise storage products. He is currently the vice chair for the Storage Networking Industry Association (SNIA) IP Storage Forum board of directors, and previously served on the board of directors for the SATA International Organization (SATA-IO). Kevin has a B.S. in Electrical Engineering from Rensselaer Polytechnic Institute and an M.S.E.E. and M.B.A. from Worcester Polytechnic Institute.

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