



Guidelines for Replacing a PS Series Group with an SC Series Array

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Revisions

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Executive summary

Many Dell customers have purchased the PS Series over the years and have used it successfully to support the storage needs of their business. As Dell moves toward a consolidated product family based on the SC Series, customers with PS Series products that are reaching the end of their service life can choose to replace them with a new PS Series, or they can alternately choose to migrate to a Dell Storage SC Series array and continue to successfully support the storage needs of their business. Dell has published a number of documents that discuss using both platforms in the same iSCSI SAN as well as migration of data, however, the differences between the scale-out architecture of the PS Series and the federated scale-up architecture of the SC Series can make a direct comparison difficult. This document provides some guidelines for selecting an appropriate SC Series array to replace a PS Series group.



1 Understanding PS Series and the SC Series

Both the PS Series and SC Series storage families provide high performance virtualized block storage for mainstream business SAN applications. Many of the features are similar, with support for snapshots, replication, and application consistent data protection. Terminology differences sometimes make it challenging to understand the similarities. The document *PS to SC Series Terminology Dictionary* posted on Dell TechCenter (http://en.community.dell.com/techcenter/extras/m/white_papers/20441741) is a cross reference intended to help bridge this gap. There are also a number of differences, however, that must be understood when determining which SC Series solution would best fit the needs of a PS Series customer.

1.1 Design Principles of the PS Series

The PS Series uses a scale-out architecture that was designed to scale capacity and performance together in a linear manner in order to balance multiple front-end workloads with available backend resources.

- Simplicity is a fundamental design principal – automate what can be automated and choose defaults that are applicable to many use cases where possible
- Multiple load balancers provide the best utilization of available resources
- Separated network and storage processing stacks are optimized for scalability
- All-inclusive licensing is a fundamental design principal and differentiator
- Expanding storage includes controllers with CPU and memory allowing for less burden on a single set of controllers

1.2 Design Principles of the SC Series

The SC Series was designed as a solution to the inefficient storage of traditional SAN arrays. It leverages advanced virtualization techniques to separate the management of data from the storage hardware resources and to provide a platform that optimizes the use of the storage hardware through effective data tiering and thin provisioning capabilities.

- Virtualization of drives as well as RAID levels
- Thin everything (volumes, snapshots, replicas, etc.)
- Data tiering within the volume
- Ease of use provided with wizards for administration
- Perpetual licensing decouples hardware from software and is a differentiator

1.3 PS Series and SC Series product similarities

There are many similarities between the SC Series and PS Series products. Some of these include:

- Virtualized storage: Both products use a page architecture so the hosts are not aware of the underlying disks
- Innovative licensing to provide superior value

- Management tools simplify the provisioning of storage and provide metrics on usage and performance
- Both products are scalable from modest implementations of 6 drives to over 1000 drives
- Support for FluidFS NAS: There are FS Series products for both PS Series and SC Series
- Tools for advanced application data protection and recovery
- Volume snapshots and clones
- Synchronous and point-in-time replication supported
- Automated data tiering
- Flexible configuration with all HDD, all SSD, and hybrid configurations
- Able to migrate data from one set of isolated resources to another seamlessly; PS Series peering moves data between pools and SC Series federation moves data between arrays

1.4 PS Series and SC Series product differences

Despite the similarities in capabilities at a high level, there are a number of implementation details that are platform specific that help to give each of the products their own unique characteristics. These include:

Function	PS Series	SC Series
Architecture	Scale-Out	Scale Up with Federation
Capacity Expansion	Add Members to the Group, connection via Ethernet	Add disk shelves to the array, connection via SAS
I/O and CPU Expansion	Add Members to the Group, connection via Ethernet	Add a new SC Series to the SAN, migrate via Federation
RAID	Static	Dynamic
Page Size	Fixed, 15MB	User defined at system setup, default 2 MB
Licensing	All-Inclusive with each array	Feature based, perpetual
Management Tools	Installed/managed independently	Consolidated into a single interface
Multiple System Management	Each Group is managed separately but monitored in a single pane of glass	All arrays are managed and monitored in a single pane of glass
Protocols	Single (iSCSI)	Multi (Fibre Channel, iSCSI, FCoE)
Data Protection and Recovery	Automated protection and recovery with wizards	Automated protection, user scripted recovery
Thin Provisioning	Default is thick provision, thin is an option that can be invoked at any time	Default is thin provision, thick is an option that can be invoked only at volume creation
Synchronous Replication	Within a PS Series Group, between Pools, no auto-failover	Between SC Series arrays, with auto-failover
Point-in-time Replication	Bidirectional, 1 source to 1 target only	Multi-point (1:many) and Multi-hop
Replication Time Estimate Tool	No	Yes
Proactive Tiering	Hybrid models only	All flash, all HDD and hybrid
Compression	Cold snapshots and replicas	Cold snapshots, replicas and cold data



2 Planning for a transition from PS Series to SC Series

Planning to transition from PS Series to SC Series arrays can appear daunting. Often, the best way to approach this is to use a phased approach, migrating one application or one PS Series group at a time. In addition, there are many ways to migrate the data and the best method for one application may not be the best for another. Some things to keep in mind are:

- Migration does not require an all-or-nothing approach
 - New workloads can be set up on SC Series, existing workloads can continue to utilize PS Series
 - Workloads can be migrated one at a time from PS Series to SC Series
- Migration Can follow the path that best fits the application
 - Many applications have native tools (such as Storage VMotion, Exchange DAG, or SQL Always-On with Availability Groups) that can be used to transfer workloads
 - Others, such as large file shares, may benefit from Thin Import
 - Additional options are available
- Migration can occur on the customer time-line
 - With continued support of the PS Series from Dell, there is no need to rush

Note: Dell Services or your Dell reseller may be engaged to help plan and execute a storage migration from PS Series to SC Series arrays.



3 Sizing an SC Series solution

The evolution in technology that has occurred since older PS Series arrays were deployed as well as the different architecture of the SC Series may complicate the choice of the best SC Series solution. In the simplest terms, assuming that there is no change in the workloads or data storage needs of your business, the replacement SC Series array may simply have the same number and type of disks as your current system. However, this simplistic approach does not account for SC Series features that are not present in PS Series, such as the improved storage efficiencies that the SC Series tiering can provide. In general, when sizing an SC Series configuration, you should first determine what your needs will be and then engage a Dell Storage specialist or reseller to help size the best solution for your individual situation.

When determining what you need should consider the following items:

- Look at what you have
 - SAN HQ can provide guidance on the current PS Series SAN including latency, capacity used, IOPS, R/W ratio, block size, active vs. inactive data amounts
 - A Dell Storage specialist can use DPACK to provide information about the use of storage from the server perspective
- Evaluate the features you need
 - SC4020, SC8000 and SC9000 have a richer feature set versus the SCv2020 and SCv2080
- Determine the fit
 - If most of the capacity is used, consider increasing capacity in the replacement
 - If latency is high, consider improving performance with faster or more drives
- Consider historical and expected growth
 - Consider a purchase that fits at least two years growth
- Consider the architecture
 - A single SC Series with JBODs can replace several PS Series, for example a single PS Series pool
 - Multiple PS Series pools in a group can be emulated with SC Series Federation

Once you have determined the requirements, an SC Series solution is typically sized with 2 or 3 tiers of storage, however, very simple environments may only use a single tier. Often, the top tier will be sized for 80% of the I/O and 20% of the capacity. However specific customer needs may dictate a deviation from this starting point. These tiers may consist of SSD and/or HDD. For example, in an all SSD solution, Tier 1 might consist of a write-intensive SSD, while Tier 2 might contain a read-intensive SSD. This solution might be further expanded with a third tier consisting of 7.2K HDD for storage of cold data. Alternatively, a solution consisting of only HDD might have a 15K Tier 1, a 10K Tier2, and a 7.2K Tier 3. The actual possible combinations are numerous and are best selected by consulting with a Dell Storage specialist or reseller.



4 Example PS Series to SC Series solutions

The following four examples showcase a wide variety of scenarios where a PS Series solution can be converted to an SC Series solution. Some of the variables considered are business size, application performance, capacity, current and future use, and SC Series features. In many cases, the growing data capacity requirements result in a larger number of drives in the new solution. These are merely examples, and other configurations could also be used to reach a similar capacity and performance profile.

4.1 Small business with basic storage needs

Many customers need basic data protection and have modest performance requirements that were met with entry level Dell Storage products like the PS4100. These customers, however, can have significant data growth. Fortunately, the improvements in technology that have occurred since their last storage purchase often permit them to continue to buy products in the entry category that may have been considered more advanced only a few years ago.

This sample customer has a current PS Series SAN consisting of a single PS4100 with 12x 2TB 7.2K drives configured in RAID 6. The SAN holds all of the business applications and the only data protection requirements, beyond normal high availability afforded them by redundant hardware components and RAID, is snapshots. The summary of their needs is:

- Current PS Series SAN: 1x PS4100 R6, 12x 2TB 7.2K drives
- Application: All applications for an SMB
- Features needed: Snapshots
- IOPS needed: 800
- Read/Write: 60/40
- Block Size: 16K
- Latency: <10ms
- Capacity needed for next 2 years: 30TB

An analysis of this customer's needs shows that IOPS requirements are low and the current latency is acceptable, thus a similar number of 7.2K spindles will suffice. However, the capacity will grow significantly so larger drives are needed. Since minimal enterprise data protection needed, the SCv2xxx family is a good fit for this customer.

Recommended replacement: 1x SCv2000 with an SC100 shelf, 16x 4TB 7.2K HDD in a single tier:

BEFORE



AFTER



4.2 Small to mid-size business with basic storage needs

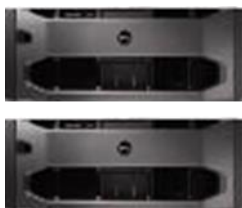
Some businesses require a large storage capacity to hold data that is infrequently accessed. These customers may have selected dense PS Series solutions, such as the PS6500 to serve as a large data repository for scanned documents, engineering diagrams, or infrequently accessed media. The sample customer in this scenario has selected a pair of PS6500 arrays, and combined them in a single pool to provide high capacity at a low cost per gigabyte. The data protection required by this customer is limited to snapshots, and the IOPS required are relatively low. The customer requirements are:

- Current PS Series SAN: 2x PS6500 with 48x 2TB 7.2K drives each (96x total drives) configured in RAID 6, in a single pool
- Application: Large data repository
- Features needed: Snapshots
- IOPS needed: 1000
- Read/Write: 90/10
- Block Size: 32K
- Latency: <10ms
- Capacity needed for next two years: 250TB, all low activity

Because the IOPS requirements is low and the current latency is acceptable, a similar number of 7.2K spindles would suffice. However, the required capacity will grow significantly so larger drives are needed. The minimal enterprise data protection needed makes the SCv2xxx family a good fit. Advances in dense chassis technology permits two arrays to be replaced with one.

Recommended replacement: 1x SCv2080 with 84x 6TB 7.2K HDD in a single tier:

BEFORE



AFTER



4.3 Mid-size business with high performance requirements

It is not uncommon for larger businesses to have databases with high performance requirements, particularly when performing data warehouse activities or end-of-month closing of the financials. The scenario shown below is that of a customer with such a need. This customer's database has high IOPS, but at a small block size. The existing solution designed using 15K SAS drives met their needs at the time that the solution was deployed, but has since struggled to keep up with the I/O demands as the business has grown. The need to retire the aging equipment has provided an opportunity to leverage the technological advances provided by the emergence of affordable SSD technology. The customer requirements are:

- Current PS Series SAN: 2x PS6110 with 24x 300GB 15K drives each (48x total drives) configured in RAID50, in a single pool
- Application: SQL OLTP plus data warehouse
- Features needed: Application consistent snapshots, multiple tiers
- IOPS needed: 7500+
- Read/Write: 70/30
- Block Size: 8K
- Latency: 15ms; large searches can exceed 20ms
- Capacity needed for next 2 years: 16TB, 2TB active, 14TB inactive

An analysis of their needs indicates that the IOPS requirements are high, and latency of the existing solution is approaching 20ms which is affecting application response making the customer a good candidate for flash optimized solution. Based on the current business projections, the expectation is that capacity will double and robust enterprise data protection including application consistent snapshots is needed. This combination of criteria indicates that an SC4020 flash optimized solution is a good fit.

Recommended replacement: 1x SC4020 flash optimized with one tier of flash, 14x 1.9TB RI SSD. Also required is Application Protection Manager software:

BEFORE



AFTER



4.4 Large business with high performance and security requirements

Customers with large, mission critical systems have a combination of performance, availability and security requirements that exceed those of a typical business application, requiring the top products on the market. This scenario is one of a financial services organization, managing billions of dollars in assets, requiring a good response time and high levels of security. The solution that has served them well is a PS Series Group with two pools, one performance oriented and one capacity oriented. A total of four PS6110 arrays with SED drives have supported the organization successfully, but it is time to retire these systems. The company is also upgrading their data protection by adding a disaster recovery site. The customer requirements are:

- Current PS Series SAN: 2x PS6110 with 24x 600GB 15K SED drives each (48x total drives) configured in RAID10 placed in the "Performance" pool and 2x PS6110 with 24x 2TB 7.2K SED drives each (48 total drives) configured in RAID6 placed in the "Capacity" pool
- Application: Financial Services – mixed SQL, Exchange and Files
- Features needed: Application consistent snapshots, replication
- IOPS needed: 5000
- Read/Write: 50/50
- Block Size: 16K
- Latency: 10ms
- Capacity needed for next 2 years: 150TB, 30TB active, 120TB inactive

An analysis of their needs indicates that the IOPS requirements are moderately high, and that the latency is acceptable. Based on the current business projections, the expectation is that capacity will grow by about 20% and robust enterprise data protection including replication is needed. The tiered nature of the data takes advantage of a key strength of the SC Series platform, data progression. Due to the sensitive nature of the data, SED drives are also required to ensure that no data can be extracted from a drive if it is returned to the vendor under warranty or somehow otherwise lost or stolen. This combination of criteria indicates that an SC9000 with SED drives is an appropriate solution.

Recommended replacement: 1x SC9000 with 65x 1.2TB 10K SED HDD for Tier1 plus 48x 4TB 7.2K SED HDD for Tier2 and a similar system for DR. Also required is Data Progression, Fast Track and Replication software:

BEFORE



AFTER



A Additional resources

Support.dell.com is focused on meeting your needs with proven services and support.

DellTechCenter.com is an IT Community where you can connect with Dell customers and Dell employees for the purpose of sharing knowledge, best practices, and information about Dell products and installations.

Referenced or recommended technical information

- PS to SC Series Terminology Dictionary
http://en.community.dell.com/techcenter/extras/m/white_papers/20441741
- Best Practices for Sharing an iSCSI SAN Infrastructure with Dell PS Series and Dell SC Series Storage using Dedicated Hosts
http://en.community.dell.com/techcenter/extras/m/white_papers/20440908
- Best Practices for Sharing an iSCSI SAN Infrastructure with Dell PS Series and Dell SC Series Storage using a Windows Host
http://en.community.dell.com/techcenter/extras/m/white_papers/20441042
- Best Practices for Sharing an iSCSI SAN Infrastructure with Dell PS Series and Dell SC Series Storage using an ESXi Host
http://en.community.dell.com/techcenter/extras/m/white_papers/20441671
- Best Practices for Sharing an iSCSI SAN Infrastructure with Dell PS Series and Dell SC Series Storage using a Linux Host
http://en.community.dell.com/techcenter/extras/m/white_papers/20441488
- PS Series to SC Series Storage Data Migration using Thin Import
http://en.community.dell.com/techcenter/extras/m/white_papers/20441668

Many other PS Series papers are found on the Dell Tech Center at

<http://en.community.dell.com/techcenter/storage/w/wiki/2660.equallogic-technical-content>

Many other SC Series papers are found on the Dell Tech Center at

<http://en.community.dell.com/techcenter/storage/w/wiki/5018.sc-series-technical-documents>

