Sun Storage 6180 Array

Just the Facts.

Last update: 10/20/2009

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Figure 1. Sun Storage 6180 Array

Introduction

The Sun Storage 6180 array is designed to provide midrange customer with the performance, reliability, and functionality enterprise customers are accustomed to – at an affordable price. Its core features and dynamic flexibility make it a great fit for a wide range of requirements, providing confidence and exceptional return on investment.

The Sun Storage 6180 modular architecture and unparalleled efficiencies help lower acquisition and operational costs as performance and configuration requirements can be met with minimal raw capacity. And when it's time to expand, the Sun Storage 6180 can add incremental capacity with no downtime. Whether it's supporting a growing database with transactional I/O, or a server virtualization implementation with a diverse workload, the Sun Storage 6180's balanced performance is there for the challenge – ensuring your applications are responsive.

Sun Microsystems has a long history of designing a highly reliable, flexible and available storage systems, and the Storage 6180 is no exception. The Sun Storage 6180 Array is a modular, rack ready and scalable array designed specifically to grow with your applications, lowering acquisition and expansion costs. The NEBS Level-3 certified Sun Storage 6180 Array offers 8 gigabits-per-second (Gb/sec) Fibre Channel (FC) host interfaces designed for both direct attached and SAN attached storage. The Sun Storage 6180 consists of a minimum of one controller tray with the ability to add up to 3 or 6 additional CSM200 expansions trays depending on configuration. The Storage 6180 controller tray (1 x 1) offers 4 GB of cache per array, two host ports options (4 or 8 per array) and can accommodate 16 drives per tray with maximum scalability of up to 64 disk drives with 4 host ports or 112 disk drives with 8 host ports. In addition, the system features a fully redundant architecture with drive intermixing (FC or SATA-II disk drives) in the same drive enclosure for primary and secondary storage requirements. With redundant components, automated path failover and extensive online configuration, re-configuration, dynamic expansion and maintenance capabilities, the Sun Storage 6180 Array is designed to ensure your data is available 24x7x365.

Key Features
Common Array Manager- Storage Profiles- 1024 Volumes.

The Sun Storage 6180 array offers a number of innovative features to address real-world IT problems.

1. Sun Storage 6180 Array Features:

- − Dual active, hot-swappable RAID controllers in a 3RU chassis
- − 4 GB of battery-backed cache
- − Dedicated cache mirroring channels
- − Persistent cache backup in the event of a power outage

- Two standard configurations:
    1) 6180 Diskless Chassis - 4GB Cache and 4 Host Ports – configurable with 5 - 16 HDD
    2) 6180 Diskless Chassis – 4GB Cache and 8 Host Ports – configurable with 5 – 16 HDD

- Up to 6 CSM200 expansion trays per system
    1) 4GB Cache and 4 Host Ports – up to 3 CSM200 expansion trays
    2) 4GB Cache and 8 Host Ports – up to 6 CSM200 expansion trays

- Scales from 5 drives to 112 drives (1.5 TB to 224TB*)
    1) 4GB Cache and 4 Host Ports – 5 to 64 drives (1.5 TB to 128 TB*)
    2) 4GB Cache and 8 Host Ports – 5 to 112 drives (1.5 TB to 224 TB*)

    (*2 TB 7.2K SATA drives available November, 2009, prior to release maximum capacity is 112 TB with 1 TB 7.2K)

- Five to 16 hard disk drives per 6180 controller or CSM200 expansion tray

- Eight 8 Gb/s FC host ports

- Host side support for point-to-point, arbitrated loop, and switched fabric

- Backwards compatibility – auto-negotiates 8, 4 and 2 Gb/s SAN's

- Support for RAID 0, 1, 3, 5, 6 (p+q), and 10

- Optional storage domains (up to 128) enable storage consolidation in multi-platform environments

- Maximum 112 drives per virtual disk (RAID 0 and 10)

- Storage profiles, built-in best practices wizard enables the administrator to quickly provision storage by application

- Performance tracking tool provides real-time information on over 30 of the most critical performance measurements

- Centralized administration, manages many Sun Storage 6180 arrays from anywhere via a browser or command-line interface (CLI) interface

- Dynamic re-configuration enables: capacity and volume expansion, RAID and segment size migration, virtual disk re-configuration, and firmware upgrades

- Support for server-attach and SAN-attach

- High-speed hardware XOR engine generates RAID parity calculations

- Modular *pay-as-you-grow* scalability enables optimal just-in-time purchasing

- Rack mountable in the Sun Rack II (1200 or 1000), Sun Rack I (900 or 1000), F40 and other standard 19in racks

2. Robust Data Protection

The Sun Storage 6180 array delivers premium feature software that maximize application availability and provide advanced data protection.

- *Sun Storage Storage Domain software* allows a single storage system to function as multiple, logical storage systems — enabling storage consolidation in heterogeneous environments

- *Sun Storage Local Copy Software* (DataSnapshot and Volume Copy) allows customers to makeboth full and shadow copies of their data for operations like backup and application testing.

- *Sun Storage Data Replicator software* enables real-time synchronous or asynchronous data replication to either local campus or metro or remote data centers to protect mission-critical information. Up-to-date copies of critical data can be maintained at multiple sites, which is particularly useful in creating business continuity solutions and disaster planning scenarios.

3. Simplified, Application-Oriented Management

The Sun Storage 6180 array's application-oriented management helps save time, while protecting the integrity and performance of business-critical applications. The Sun Storage Common Array Manager (CAM) software makes it easy to manage numerous arrays, and storage profiles enable administrators to quickly and predictably provision storage to precise application demands. In addition, the built-in performance tracking utility helps optimize application performance and minimize downtime through predictive, preemptive maintenance and automated diagnostics for proactive health monitoring.

4. Round-the-Clock Availability

The Sun Storage 6180 array's robust, highly available, fully redundant architecture is designed to keep applications up and running around the clock, thanks to extensive RAS features, such as online administration and re-configuration, redundant hot-swappable components, automated path failover, and non-disruptive controller firmware upgrades. Switching technology (SBOD) provides point-to-point connections of the drives in the expansion trays. Individually isolated drives enable improved diagnostics and faster problem resolution.

Key Messages for the Sun Storage 6180 Array

1. Trusted Storage

Sun has a long history of designing highly reliable and available storage system, and the 6180 is no exception. Architected to provide the highest reliability and availability, the 6180 storage system offers redundant components, automated I/O path failover, and extensive online configuration, reconfiguration and maintenance capabilities to ensure your data is available 24x7x365. The 6180 ensures stored data is protected as well. Self-encrypting drives* secure data at rest with no performance penalty, DACstore technology stores configuration metadata on each drive, RAID 6 technology guards against concurrent drive failures and errors, and persistent cache backup to ensure any data in cache is capture and safe in the event of a power outage. All of these features combine to create a system you can trust your data to. (*FDE available Q1 2010)

2. Next-Generation 8 Gb/s FC Interface

Facing relentless data growth and shrinking budgets, companies continue to look for ways to reduce costs through efficiencies. 8 Gb/s FC allows companies to reduce the number of HBAs per server and the number of overall ports in their FC SAN infrastructure without sacrificing performance, thus saving acquisition and operational costs.

Additionally, the 6180's auto-negotiating 8 Gb/s Fibre Channel interfaces allow it to seamlessly integrate

into an existing 2 Gb/s or 4 Gb/s infrastructure, while providing the buyer with investment protection going forward when the SAN inevitably becomes 8 Gb/s.

3. Investment Protection

The Sun Storage 6180 array delivers flexibility and investment protection with data-in-place, on-line upgradeability across the entire Sun Storage Modular Line. The Sun Storage 6180 array allows customers to scale up and across all the way to the flagship Sun Storage 6780 Array with data-in-tact without wasting time and money with over-the-SAN migration Support for previous generations of SAN infrastructure and expansion trays let enterprises reuse and re-purpose storage investments as their business needs change. Multi-dimensional scalability allows the Sun Storage 6180 to adapt when requirements change, ensuring it will continue to deliver the performance, capacity and connectivity required going forward.

4. Lower Cost of Ownership

The 6180 is well adept at meeting the performance and configuration demands of consolidation with minimum raw capacity – thus lowering acquisition and operational costs. Its exceptional per drive performance, configuration efficiency and enclosure-based FC/SATA drive intermixing result in lower drive and enclosure requirements. Seamless pay-as-you-grow scalability addresses growth as requirements change. And intuitive CAM software maximizes terabytes per administrator for lower management costs. These features add up to significantly lower capital expenditures (total cost of acquisition) and operational expenditures (total cost of ownership).

What's more, the aggregate workload created by server virtualization demands a lot of bandwidth between the server and the storage system, often creating a dilemma for administrators: install enough HBAs to meet the requirement, or sacrifice performance to save valuable I/O slots. The 6180's 8 Gb/s FC interfaces enable administrators to satisfy both requirements at once by reducing the number of HBAs required to meet bandwidth demands, while saving valuable I/O slots in the server.

5. Feature-Rich Management

As data continues to grow, companies must be able to efficiently manage their storage while minimizing TCO. The Sun Storage Common Array Manager software for the Sun Storage 6180 array lowers storage management costs with centralized management, run-anywhere flexibility, a single interface across all the entire Sun Storage Modular Line with optional fully integrated data services such as storage domains, data snapshot, data volume copy, and data mirror features. The Sun Storage Common Array Manager software improves storage utilization with increased configuration flexibility, incremental capacity and performance scaling, storage consolidation, and capacity-efficient data services.

6. Consolidating Storage for Many Heterogeneous Server Operating Systems

With support for the Solaris™ Operating System (OS), Windows, Linux, IBM-AIX, HP-UX, Netware and VMWare, the Sun Storage 6180 array can support diverse computing environments with heterogeneous servers. Consolidate onto a single storage platform for ease of management.

Product Family Placement

The Sun Storage 6180 array belongs to the Sun Storage Modular Line. The Sun Storage Modular Line changes the *rip-and-replace paradigm* prevalent in the storage industry by creating an investment protection centric storage solutions to drive top-line revenue growth, reduced operational risks and provide cost containment in our customer's next generation data center.

The Sun Storage Modular Line core family traits are:

1) Improve productivity – drive top line growth

- Real-world performance drives faster applications for improved productivity
- More performance per drive = less cost for power, cooling, acquisition, service and management
- On-the-fly re-configurations with data protection and a HA architecture maximize business opportunities

2) Scale without Sacrifice

- Efficient Disk IOPS that scale linearly (ERP, OTLP, Databases)
- Balanced Performance excels at IOPS and MB/s (Data Warehousing, Mixed Workloads, Consolidation)
- CLIPP – Best in Class Investment Protection (Data-in-Place Migration, Transfer Licenses, Field Replaceable Host Interface Cards)

3) Deploy with Confidence

- Proven Bullet-Proof Storage Solutions
- Sun Certified and Tested
- Deployed in Leading Enterprises, Applications, and Operating System environments

The Sun Storage Modular Line currently contains three product families:

- Sun Storage 6100 Product Family:
    - Sun Storage 6180
- Sun Storage 6500 Product Family:
    - Sun Storage 6580
- Sun Storage 6700 Product Family:
    - Sun Storage 6780

Positioning For the Sun Storage 6500 Family

The Sun Storage 6500 family array, which consists of the Sun Storage 6580 is an ideal choice for midrange businesses and enterprises looking for cost conscious transactional applications. The mid-range storage segment focuses on customer requirements for storage systems that offer a cost-effective combination of data availability, performance, and modular scalability. Products in this segment are high-density, high-availability data storage systems that are well suited for business-critical environments with modular, networked architectural designs.

The Storage 6580 array highlights are:

- High Availability Architecture
    - Design permits non-disruptive capacity additions
    - Ability to change volume characteristics on the fly to optimize protection and minimize risk
    - Powerful dual controllers, 8 Gb/s host side interfaces and 4 Gb/s drive side interfaces stand up to the most rigorous computing demands

- On-line, Data-in-Place Functionality

    − The Storage 6580 support 256 disk drives, is upgradeable and is compatible with other member of the Storage 6000 Modular family.

    − Users can mix Fibre Channel and SATA drives to design a tiered storage environment with centralized management and integrated data services for business continuity.

- Simplified Management and Configuration

    − A common storage module used across the Storage modular family enables users to pay as they grow and to protect IT investments.

    − Automated configuration uses pre-defined application profiles to enable precise, predictable, and repeatable results

    − Data protection software enables replication, snapshot and volume copy

Positioning For the Sun Storage 6700 Family

The Sun Storage 6780 Array is designed to help customers keep pace with rapid data growth while enabling them to efficiently scale their existing IT infrastructure--without sacrificing their initial Sun Storage 6000 investment.

The 6780 is positioned above the 6500 line with more performance, scalability & flexibility and provides 2x the IOPS, 2-4x the cache and 4x the throughput performance over the 6500 class of arrays. Customers utilizing competing products from HP, EMC, IBM and Dell, will also be able to seamlessly transition to the 6780 Array.

The 6780 array highlights are:

- Easy to Deploy - Reduces the time associated with deploying and provisioning storage by using the common management software across entire Sun disk portfolio for immediate deployment and reduced administration training.

- Non-Disruptive Flexibility – The architecture of the 6000 Modular storage family allow IT managers to easily expand, change, and move storage to scale capacity and performance without the application downtime.

- High Availability Systems – The advanced data protection and software options of the 6780 create new level of enterprise data protection.

- Lower Overall Costs – The 6780 makes it easier and more cost effective to manage increasing storage requirements with fewer resources and reduced budgets.

- Best-in-Class Investment Protection – The 6780 allows existing 6000 modular trays to be re-deployed to maximize investment protection.

Summary Comparison

	Sun Storage 6100 Family	Sun Storage 6100 Family	Sun Storage 6500 Family	Sun Storage 6700 Family
	6180 – 4 Host Ports	**6180 – 4 Host Ports**	**6580 Array**	**6780 Array**
Controller Cards	Dual Fibre Channel RAID Controller			Dual or Quad Fibre Channel RAID Controllers
Cache Size	4 GB		8 & 16 GB	8 GB, 16 GB, 32 GB*
Maximum Drives	64	112	256	448
Expansion Trays	Up to 3 expansion trays	Up to 6 expansion trays	Up to 16 expansion trays	Up to 28 expansion trays
Capacity Expansion	1.5TB to 128TB*	1.5TB to 224TB*	1.5TB GB to 512TB*	1.5TB to 896 TB*
Host Ports	Four 8 Gb/s FC	Eight 8 Gb/s FC	Eight 4 or 8 Gb/s FC	Eight or Sixteen 4 or 8 Gb/s FC or 10 Gb/s iSCSI*
Drive Options	FC, SATA			
RAID Level	0, 1, 3, 5, 6 (p+q), and 10			
Management	Application-oriented			
Storage Domains	Up to 128		Up to 512	
Data Snapshot	Up to 8 per volume – 512 per array		Up to 8 per volume – 1,024 per array	
Data Volume Copy	Up to 8 per volume - 1,024 per array		Up to 8 per volume – 2,048 per array	
Data Replicator	Up to 64 volumes		Up to 128 volumes	
Target Audience	Small SMB – Small Enterprise		Medium SMB – Medium Enterprise	Larger SMB – Large Enterprise
Designed for HPC	No		No	Yes
Designed for consolidating multiple applications	No		Yes	Yes
Warranty	3 years			

*2 TB Available November, 2009. Until 2TB release, maximum capacity with 1 TB 7.2K SATA drives
**Available Q2 2010

Selling Highlights

Product Availability

Key schedule dates for the Sun StorageTek 6180 array are:

Event	Date
Sun Product Introduction (Presto)	October 13, 2009
WebDesk Orderability	October 13, 2009
Public Announcement	October 12, 2009
Revenue Release (RR)	Sun Storage 6180 array — 4 GB/8 Host Ports: October 9, 2009
	Sun Storage 6180 array — 4 GB/4 Host Ports: October 30, 2009
General Availability (GA)	Sun Storage 6180 array — 4 GB/8 Host Ports: October 9, 2009
	Sun Storage 6180 array — 4 GB/4 Host Ports: October 30, 2009

Market Value Proposition

The Sun Storage 6180 Array provides the power to achieve better performance with fewer drives - lowering acquisition, support and operational costs. Furthermore, it protects your storage investments by scaling and integrating seamlessly all the way up to the flagship Sun Storage 6780 Array. Plus, like its trusted predecessors, the Sun Storage 6180 array uses proven architecture that ensures data integrity and availability - giving you the power to achieve all your datacenter needs with confidence.

The Sun Storage 6180 delivers the following value propositions:

1. **Improve Productivity & Drive Top-Line Growth** - In addition to financial savings from simplified management and reduced acquisition, support and operating costs, the Sun Storage 6180 Array helps you save space and cut data center energy consumption. Superior per-drive performance and a compact footprint mean you use fewer drives and fewer trays without impairing data access. You save on space, energy and cooling costs as a result. Plus, the ability to mix drive types in the same enclosure saves space and extends the lifetime value of your storage investments.

2. **Scale without Sacrifice** - The Sun Storage 6180 array delivers continous investment protection with data-in-place, on-line upgradeability across the entire Sun Storage Modular Line. The Sun Storage 6180 array allows customers to scale up and across all the way to the flagship Sun Storage 6780 Array with data-in-tact without wasting time and money with over-the-SAN migration. Support for previous generations of SAN infrastructure and expansion trays let enterprises reuse and re-purpose storage investments as their business needs change.

3. **Deploy with Confidence** - Some of the world's leading companies rely on Sun Modular storage to protect their data and the Storage 6180 will be no exception. The 6180 is architected to provide the highest reliability and availability offering redundant components, automated I/O path failover, and extensive online configuration, reconfiguration and maintenance capabilities to ensure your data is available 24x7x365. The 6180 also ensures stored data is always protected. DACstore technology stores configuration metadata on each drive, RAID 6 technology guards against concurrent drive failures and errors, and persistent cache backup to ensure any data in cache is captured and safe in the event of a power outage. All of these features combine to create a system you can trust your data to.

Target Users

The primary customers for the Sun Storage 6180 arrays are Sun network storage direct accounts, storage-only resellers, solution resellers, OEMs, distributors, and system integrators. The Sun StorageTek 6180 array meets the needs of a variety of users, as shown in the table below.

Individual User	Buying Influence Needs
Systems Administrator	Easy-to-use management GUI with highly flexible options for controlling and monitoring storage.
IT Manager, IT Director	Identifies need, can influence or make purchasing decision.
CIO	Involved in platform, infrastructure strategy decisions; definitely influences or makes purchasing decision.
CFO	Budget allocation, can influence or make purchasing decision.
CEO	Involved in business-level problem and/or competitiveness enhancements.
Developer	Standards compliance for implementation of FC-AL products.
MIS Manager	Flexible, configurable, scalable architecture.
Operations	High availability coupled with high performance, allowing efficient system operation.
End-User	The ability to access and retrieve needed data in a timely manner.
Line of Business Manager	Has specific application requirements for Customer of the IT Director and IT Manager. Pushes for unlimited storage for applications and sometimes influences the IT Director and staff to over provision. Need to help the IT Director to satisfy end-users in their organization more effectively and efficiently.

Target Markets

This newest member of the Sun Modular Storage family is for customer's looking seeking to support business-critical applications and for Service Providers looking for a cost-effective, easy-to-use enterprise-class platform with the ability to confidently handle large data sets.

Target Markets for the Sun Storage 6180 array are:

- Small to medium business (SMB) and enterprises (SME)
- Retail
- Healthcare / medical
- Manufacturing (Industrial Sector)
- Insurance
- Government

Target Applications

Below is an example of the applications the Sun Storage 6180 array is suitable for and key features to highlight:

Applications	Key Features to Highlight
Business Critical Application	● The 6180's bullet-proof reliability, support for self-encrypting drives* and exceptional uptime make it ideally-suited for business-critical applications where data must be protected and available when needed all at an entry level price *FDE available Q2 2010
Consolidation/Virtualization	● The 6180's balanced performance, 8 Gb/s FC interfaces, and unparalleled configuration flexibly make it ideally suited for consolidation and virtualization implementations where an individual storage system supports diverse workloads and application requirements
Transactional Workloads	● The 6180's efficient IOPS are well suited for transactional workloads (OLTP, email) that are the core of a every company's critical applications
Data Warehousing	● The 6180's solid throughput and 8 Gb/s FC interfaces are well suited for data warehousing environments where individual storage system must process large amounts of data.
Secondary Storage	● The 6180's RAID 6 and SATA drive support enables large amounts of data to be cost-effectively stored with confidence it's fully protected.
Data Protection	● Almost all businesses today require continuous uptime. With advanced data services, the Sun Storage 6180 array enables businesses to cost-effectively meet these critical requirements while enhancing their backup operations. The Sun Storage 6180 array is ideally suited for businesses seeking a cost-effective, high-availability array with integrated data services.

Enabling Technology

Technology Overview

The Sun Storage 6180 array is a modular, rack ready, highly scalable, high performance system with integrated premium feature software. The Sun Storage 6180 array consists of an integrated controller tray (1 x 1) with dual-active FC RAID controllers in a 3 RU enclosure, 4GB of cache, four or eight 8Gb/s FC host ports and configurable with 5 to 16 hard disk drives. The Sun Storage 6180 controller tray supports Common Storage Module 200 (CSM200) expansion trays. You cannot connect any other type of drive tray to the controller tray. Up to 6 CSM200 expansion trays (0 x 6) can be dynamically added to the base controller tray to create a maximum configuration with 112 drives (for 4 host ports configurations – up to 3 CSM200 expansion trays (0x3) – maximum configuration with 64 drives). CSM200 expansion trays (0 x 1) can support both FC and SATA drives. Four Gb/s Fibre Channel drives (146 GB, 15K RPM. 300 GB 15K RPM, 450 GB 15K RPM, 600 15K RPM*) can be added per tray to improve performance and increase capacity, while SATA drives (500 GB 7.2K RPM, 1 TB 7.2K RPM, 2TB 7.2K RPM*) can be utilized for secondary storage requirements. The Sun Storage 6180 array's ability to concurrently support FC and SATA drives allows for implementation of a single storage solution for both near-line and primary storage. (*600GB FC and 2TB SATA drives available post GA).

8 Gb/s Fibre Channel Technology

8 Gb/s FC systems are ideally suited for applications that need to quickly transfer large amounts of data, such as remote replication across a SAN, streaming video on demand, medical imaging, data mining, data warehousing, and large databases supporting OLTP. Additionally, large increases in online data, driven by applications that utilize radio frequency ID (RFID), can leverage the benefits of 8 Gb/s FC technology.

The benefits of 8 Gb/s technology include:

- Faster communication between servers and storage

- The ability to more rapidly transfer data from storage to server or restore data from online backup media

- Higher reliability as a result of a reduced number of connections

- Investment protection due to backward compatibility with 2 Gb/s and 4 Gb/s components

Faster communications between servers and storage, and within the storage system itself can have benefits in the following markets:

- **Tiered storage** — more organizations are starting to deploy storage tiers to reduce storage costs, which means that data needs to be routinely migrated from primary (tier 1) storage to secondary (tier 2) storage across the storage network. Depending on the amount of data, this can be time-consuming. 8 Gb/s FC provides a massive pipe that allows data to be quickly moved from one storage system to another, enabling transfers to happen at twice the speed of 4 Gb/s FC technology.

- **Data replication** — data replication is an ideal mechanism to provide data protection against disasters, whether deployed on a campus or over a wide area network (WAN). Replicated data is the same at the remote site and can be used in a variety of ways such as data restoration, mining, analysis, testing, and remote backup. Depending on the application, synchronizing the local and remote sites can require a large portion of bandwidth on the SAN or WAN. 8 Gb/s FC offers a high-bandwidth infrastructure that is ideally suited for campus replication over a SAN, enabling data to be synchronized and restored at twice the speed of 4 Gb/s FC.

- **Streaming video** — large block, sequential I/O applications that include content creation and delivery, modeling, rendering, and publishing can benefit from the additional bandwidth provided by 8 Gb/s FC.

- **Large data analysis** — a 8 Gb/s FC storage can enable companies to accelerate and scale simulation, visualization, modeling, and rendering applications.

- **Database in memory** — enterprises running database-in-memory applications need to have very large data sets in memory. Loading and refreshing these data sets is a time-critical process. With 8 Gb/s storage systems, data can be loaded from storage in half the time.

- **Faster data recovery** — as most IT managers know, recovering data takes longer than backing it up. With 7x24x365 operations and stringent service level agreements (SLAs), the time it takes to recover is becoming more important every day. Storage based on 8 Gb/s FC can deliver the performance required to shorten recovery time.

- **Data warehousing** — data warehouses require both high bandwidth and high random I/O performance. The balanced performance of 8 Gb/s FC offers the highest level of performance in both bandwidth and IOPS.

Sun Storage Common Array Manager Software

The Sun Storage 6180 array comes with the Sun Storage Common Array Manager software, which is common across the Sun Storage Modular Line. The Sun Storage Common Array Manager software helps reduce complexity and lowers storage management costs with centralized management, run-anywhere flexibility, a single interface across many Sun Storage 6180 arrays and fully integrated Storage Automated Diagnostic Environment software plus integrated management for all of the optional data services software. The Sun Storage Common Array Manager software improves storage utilization through configuration flexibility, incremental capacity and performance scaling, storage consolidation, and capacity-efficient data services. This robust array management software helps enable an organization to easily scale storage resources without increasing administration costs or complexity.

The Sun Storage Common Array Manager software controls the Sun Storage 6180 array and provides administrators a powerful, yet easy to use management interface. With the Sun Storage Common Array Manager software, all administrative tasks, including configuration, re-configuration, expansion, maintenance, and performance tracking can be performed with no system downtime and no interruption to system I/O. The Sun Storage Common Array Manager software's configuration flexibility includes the ability to mix drive types (capacities and RPM speeds), RAID levels, segment sizes, virtual disk sizes, volume characteristics, and cache policies all within a single storage system. And, its centralized administration and run-anywhere GUI enables management of all Sun Storage 6180 arrays from any location on the network — regardless of host platforms.

The Storage Automated Diagnostic Environment component of the Sun Storage Common Array Manager software offers proactive health checking, intelligent diagnosis, fault isolation, event notification, and fault management reporting for the Sun Storage 6180 array from a single management console. This software helps improve the time to recover and increases infrastructure uptime, thus contributing to overall improved application service levels.

Sun Storage Premium Feature Software

The Sun Storage Common Array Manager software's robust data services extend the functionality of Sun Storage Common Array Manager software — creating even more powerful storage. Storage domains allows a single storage system to function as multiple, logical storage systems — enabling storage consolidation in heterogeneous environments. Local Copy features (Data Snapshot and Volume Copy) allows customers to make both full and shadow copies of their data for operations like backup and application testing allow for This unique entity can be assigned to any host and used for application testing, development, information analysis, or data mining. The Sun Storage Data Replicator software

enables real-time synchronous or asynchronous data replication to either local campus, metro, or remote data centers to protect a company's mission-critical information. Organizations can maintain up-to-date copies of critical data at multiple sites, which is particularly useful in creating business continuity solutions and disaster planning scenarios.

Compatibility

In addition to premium feature software, the Sun Storage 6180 array also offers a wide support of various operating platforms for heterogeneous data center environments. The supported operating platforms include: Solaris 9, and 10 Operating Systems, Microsoft Windows Server 2003 & 2008, RedHat Linux, SUSE Linux, VMWare ESX, IBM AIX, HP-UX, and NetWare.

For the most updated compatibility matrix for the Sun Storage 6180 array, refer to the online Interop Tool at: https://interop.central.sun.com/interop/interop

Or contact Sales Support (sales.support@sun.com)for more information.

System Architecture

Overview

The Sun Storage 6180 array continues the Sun storage heritage of a modular, building block design enabling lower acquisition and expansion cost while maintaining maximum flexibility. The Sun Storage 6180 modular design avoids over-configuration – creating an affordable entry-point – without sacrificing future scalability. And when requirements change, the modular "pay-as-you-grow" scalability keeps expansion costs down through optimal "just-in-time" purchasing.

The Sun Storage 6180 array consists of two primary components, the controller tray (1 x 1), and expansion trays (0 x 1). Custom configurations can be built to address specific performance or capacity requirements. Each of the primary components is fully fault tolerant with automated I/O path failover and redundant, hot-swappable components to help ensure the highest availability.

Sun Storage 6180 Array Controller Tray

Hardware Overview

The Sun Storage 6180 array controller tray houses the dual-active, intelligent array controllers and supports five to sixteen FC, FDE*, and/or SATA drives (FDE available Q22010). Redundant controllers and a OS-dependent failover driver provides automated I/O path protection and helps ensure continued data access. In the event of a component failure anywhere in the data path between server and disk drives, I/O is re-routed down the surviving path for uninterrupted access to the data and application availability.

The Sun Storage 6180 array supports SAN attachment as well as direct host connections (point-to point). The Storage 6180's four or eight 8 Gb/s host interfaces are capable The 8 Gb/s interfaces auto-negotiate 8, 4 and 2 Gb/s FC link speeds, enabling the Storage 6180 array system to easily integrate into existing infrastructures. In addition the Storage 6180 has has four 4 Gb/s drive-side interfaces (two per controller), which are configured as redundant FC switched loops to the first 16 drives and any additional drive modules. All four channels are active for an aggregate drive-side bandwidth of 1,600 MB/s. The Storage 6180 array supports up to 112 FC, FDE* or SATA drives in six CSM200 expansion trays (4 host port configurations support 64 drives in 3 CSM200 expansion trays) (FDE available Q22010)..

The Storage 6180 array has four Ethernet ports (two per controller). One port per controller is for managing the 6180 array over the network through the Common Array Manager software. A second port per controller is available for advanced diagnostics by service personnel and is isolated to prevent exposure to the customer's LAN. Additionally, each controller has a serial interface connector for troubleshooting and running diagnostics.

The Sun Storage 6180 controllers which insert from the rear of the module, support all external connections – including host, drive expansion, Ethernet and serial. Additionally, the controller houses the cache battery, power supplies and cooling fans which are all hot-swappable, field replaceable (FRU) components (the battery is classified as a customer replaceable unit, CRU).

Figure 2. Sun Storage 6180 Array Controller Tray
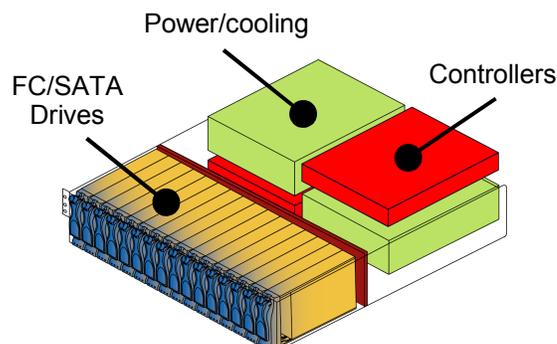
Controller Architecture

Sun's storage technology heritage dates back more than a quarter century. This relentless expertise is the foundation of our current controller and firmware technology --- a culmination of 20 years of design knowledge and firmware development focused entirely on open systems and high-speed, disk-based performance.

The Storage 6180 's controller integrates high-speed, industry-standard components with robust firmware to deliver enterprise-class functionality and exceptional performance at lower cost points. The Storage 6180 controller's core processor provides built-in hardware XOR / p+q for high-speed RAID parity calculations – enabling it to easily handle random, small-block I/O and deliver exceptional I/O per second performance to transaction-based applications. And the 6180 controller takes full advantage of its 8 Gb/s FC interfaces and high-speed PCI Express buses to provide exceptional throughput to bandwidth-intensive applications.
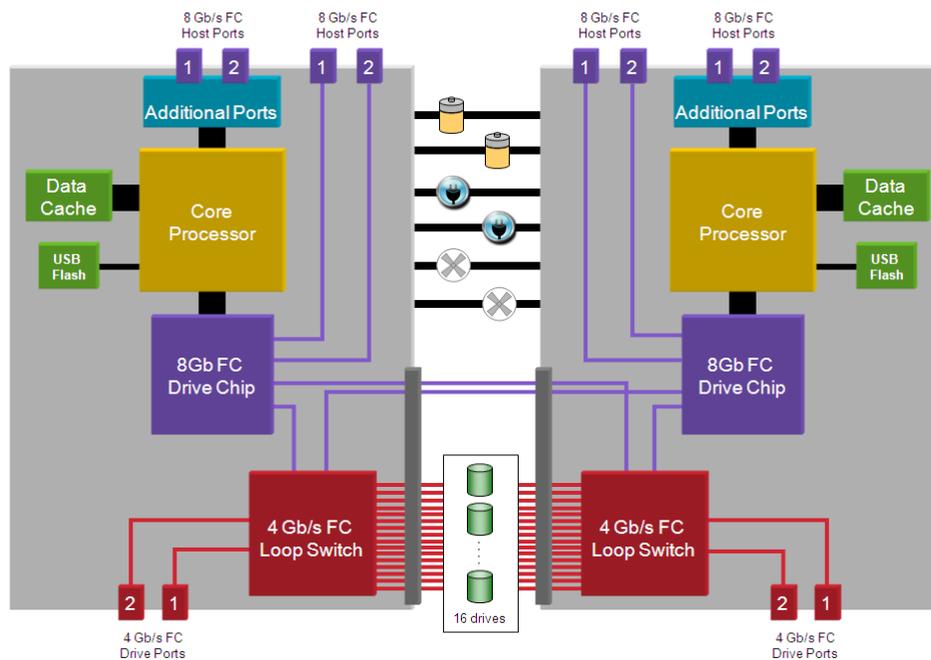
Figure 3. Sun Storage 6180 — 4GB Cache -8 Host Port FC RAID Controller Card

On the drive side, each Sun Storage 6180 controller has two 4 Gb/s FC drive I/O ports (four drive channels per storage system). Integrated FC loop switches connect the drive-side FC interface chips in each controller – creating dual drives loop that provide both controllers redundant access to all attached disk drives. (See diagram 4) This implementation allows each controller to access all sixteen internal drives and four external drive loops for maximum performance and availability. The Storage 6180 controller's integrated flash memory provides persistent cache backup in the event of a power outage.
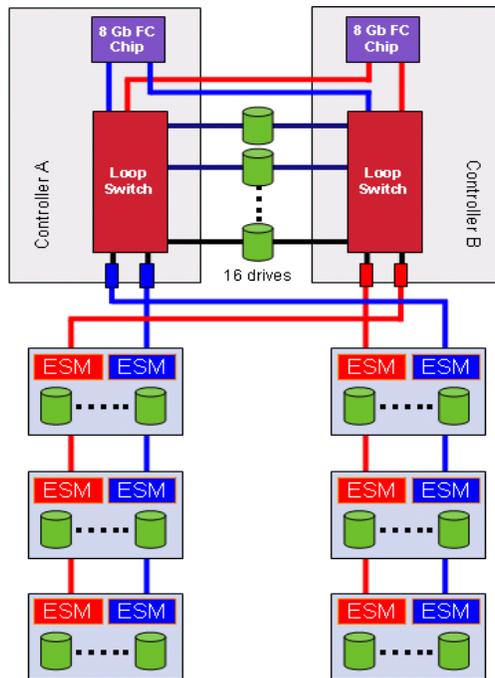
Figure 4. Sun Storage 6180 — 4 Gb/s Drive Channels

Cache Design

The Sun Storage 6180 array's RAID and cache algorithms are designed to provide the best possible performance without the need for extremely large cache. This is accomplished with a cache management design that has been developed and perfected over the past 15 years. The use of large cache in storage has long been driven by the unique requirements of mainframe environments. Open systems servers, however, are seldom able to make good use of large storage cache. Their applications, which typically involve high-levels of random I/O activity, are increasingly unlikely to experience disk subsystem *cache hits*. In fact, large-cache *monolithic* systems can substantially increase the cost of the storage without providing any significant performance benefit. The Sun Storage 6180 array is designed from the outset for open system I/O requirements — recognizing that disk performance is vastly more important than cache performance in these environments. Open systems servers feature their own large, well-managed, on-board caches, and gain more benefit from an efficient storage controller design that maximizes disk performance than from additional cache.

Cache Usage

The Sun Storage 6180 array dynamically utilizes cache for both read and write caching. This allows for more efficient use of available cache by automatically adapting its utilization to match the I/O requests from hosts as the needs of the applications change during the computing day. This adaptability is one reason that the Sun Storage 6180 array can sustain higher levels of real-world performance than many monolithic and modular systems with larger caches.

Write Policy

The Sun Storage 6180 array offers both write-back and write-through caching options to optimize performance or protection. The write policy determines whether I/O completion is signaled when data is transferred to the cache or when data is written to disk. With write-back caching, the write request is

signaled complete as soon as the data is in cache, and actual writing to disk occurs at a later time. Write-through caching signals the completion of a write request when the data is safely stored on disk. Write-back caching creates significantly higher write performance for most applications, and any potential risk is eliminated as the Sun Storage 6180 array cache is mirrored and battery backed up — helping to ensure that it is protected at all times.

Write Cache

The Sun StorageTek 6180 array's cache algorithms are designed to provide the lowest latency I/O access possible when securing the user's data in storage system cache. And, the Sun Storage 6180 array makes its cache ready to receive the next write request from the host by efficiently writing cached data to disk in a manner that minimizes disk I/O. By identifying high locality of reference for write data in its cache, the Sun Storage 6180 array is able to group all data in a RAID stripe and minimize the amount of time required to write data to disk, thus eliminating the need for disk read operations in the computation of parity in RAID 5. This helps ensure that disk utilization is minimized for a particular usage pattern, allowing maximum I/O throughput per spindle available.

Cache Protection

Cache mirroring protects unwritten data during a controller or cache memory failure. When cache mirroring is enabled, data that writes to the cache memory of one controller also writes to the cache memory of the other controller. Therefore, if one controller fails, the other can complete all outstanding write operations. This cache parameter is set on a per volume basis. The Sun Storage 6180 also protects your data in cache during a power outage. This is accomplished by using a combination of the independent batteries and the permanent cache storage functionality. If the Storage 6180 controller module loses power for any reasons the batteries will maintain power to the controller boards long enough for the software to move all data in cache to a permanent storage device. The permanent storage device is an enterprise quality USB drive on the board that will be sized to ensure it has enough capacity to hold all cache data. Once power is restored to the controller it will retrieve the data in it's permanent storage device and flush it to disk. The Storage 6180 controller module will continuously monitor the battery and if a fault occurs the controller will operate in write mode to ensure no data is lost.

Cache Flushing

To prevent data loss or corruption, the controller periodically writes unwritten data residing in its cache to disk (flushes the cache) based on one of two factors:

- A time-based flush writes cache data to disk after a user-defined period of time (in seconds). This value can range from immediate to infinite, with a value of 10 seconds or less recommended for optimal data protection.

- A threshold-based flush occurs when the amount of unwritten data in cache reaches a certain level, called a start percentage. The controller writes cache data to disk until the amount of data in cache drops to a stop percentage level. For example, the controller can start flushing the cache when the cache reaches 80 percent full, and stop flushing the cache when the cache reaches 20 percent full. The start and stop percentage levels are user-defined to maximize data protection and/or performance.

Immediate Volume Availability

Immediate Volume Availability allows reads and writes immediately after a *Create Volume* command is issued for RAID 1, 3, 5, 1+0 and 6. The logical unit is available for normal I/O requests immediately after a *good status* is returned to the host in response to the Create Volume command. Immediate Volume Availability eliminates the need for formats (write zeroes), both within the controller and from the host. This feature initializes the first and the last 10 MB of the volume to zero. This is done to help ensure that any file-system information that might have been stored on this logical unit disk previously is

no longer valid. A read from another area on the volume that was not previously written returns un-initialized data (not zeroes). Thus, the host cannot expect unwritten data to equate to zeroes. If this data must be zeroes then Immediate Volume Availability must be disabled or a new *Format* command must be issued after the redundancy initialization completes.

After initializing the two 10 MB regions of the volume, the controller returns *good* status to the *Create Volume* command. The controller then initiates background redundancy initialization to establish good parity for the volume. The rate of the initialization is controlled by the reconstruction parameters supplied in the *Create Volume* command. If the host sends a *Format* command to a volume on which redundancy initialization is either pending or in progress, a *good* status is returned in response to that *Format* command without initiating a write zeroes task. Should a *Format* command arrive after redundancy initialization completes, a write zeroes task is performed.

Sun Storage Common Storage Module (CSM200) Expansion Tray

With an imbedded *loop switch*, redundant dual-active drive loop access, and dual-ported FC or SATA drives, the Sun Storage CSM200expansion tray is more than *just-a-bunch-of-disks*. Combined, these advanced features deliver maximum performance and help to ensure complete accessibility to all drives in the event of a loop or cable failure. For maximum investment protection, the CSM 200 expansion modules are the same trays utilized in the entire Storage 6000 family.

Like the Sun Storage 6180 controller tray, all of the primary components in the 4 Gb/s expansion tray are hot-swappable. This includes the FC or SATA disk drives, cooling fans, power supplies, and I/O modules (IOMs). The IOMs deliver online information about component status, such as temperature, fan speed, or faults, to the storage management software and provide the ability to cascade multiple drive modules to a single array module.

The expansion tray accommodates up to 16 low-profile FC or SATA disk drives in a 3U enclosure, enabling the Sun Storage 6180 array to maximize spindle density and capacity in a minimum amount of space. A single 19-inch, 42 RU cabinet can support up to 13 CSM200 Expansion (plus one 6180 Controller Tray) for 196 spindles in a single data center floor tile. And, as the Sun Storage 6180 array supports a range of drive capacities and rotational speeds, both spindle density (dollars per IOPS per square foot) and storage capacity (dollars per MB per square foot) can be maximized in a single system.
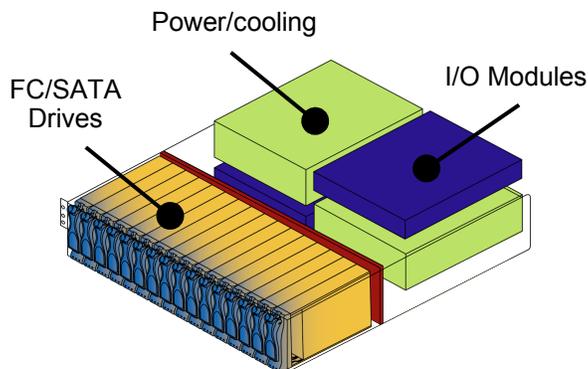
Figure 5. Sun Storage CSM200 Expansion Tray

Switched Architecture

Both the Sun Storage 6180 controller tray and expansion trays have an imbedded loop switch that isolates each drive on a private loop with the controller or I/O module (IOM), enabling direct and detailed communication with each individual drive. This new, advanced technology introduces a number

of customer and Sun Service advantages, such as improved diagnostics, lower latency, linear scalability, and preventative maintenance.

Improved Diagnostics for Less Time in Degraded Mode

The embedded loop switch creates what is essentially a private FC arbitrated loop with each individual drive. Drive isolation eliminates the risk of a single drive disrupting the loop and potentially causing other drives to fail on the loop (referred to as fault propagation). Drive isolation also enables diagnostics to be performed on an individual drive level, simplifying analysis of drive and loop problems. The longer it takes to identify and diagnose a problem drive, the longer the overall storage system performance is degraded. In loop-based drive enclosures, where multiple drives are operating on a given loop, it can be extremely difficult to identify which drive is faulty. The Sun Storage 6180 array's switched enclosures' drive isolation and direct communication with each individual drive, which allows for more detailed diagnostic information to be gathered, greatly simplifies analysis of drive and loop problems, enabling problem drives to be located and remedied faster.

Lower Latency and Linear Scaling for More Responsive Applications

With loop-based enclosures, each drive is a node on the drive loop. Large loops create a longer and slower I/O path from a controller to a drive and back to the controller. The Sun Storage 6180 array's switched drive module adds only one node (the controller and/or I/O module) to each redundant drive loop, and its drives are just one point-to-point step away from the now shorter and quicker loop. Fewer nodes and faster communication significantly lowers the latency and provides linearly scalable performance for more responsive applications. Additionally, the Sun Storage 6180 array's switched enclosures' ability to acquire detailed diagnostic information enables more effective performance tuning. A loop-based drive enclosure adds 15 nodes to each redundant drive loop (one IOM and 14 drives). Large loops create a longer and slower I/O path from a controller to a drive and back to the controller. The Sun Storage 6180 array's switched enclosure add only one node (the controller or IOM) to each redundant drive loops, a 93 percent reduction.

Preventive Maintenance

The Sun Storage 6180 array's switched enclosures put all drives through an insertion test (port test before insert, or PTBI) before they are added to the FC loop. The intent is to identify faulty drives before they can disrupt the loop. PTBI causes a drive that is added to the loop to be loop initialization primatived (LIP'd) and then looped back to itself. The switched drive module monitors the drive for 5 seconds, and if the loop remains up, the drive is LIP'd again and allowed to join the loop.

DACstore

The Sun Storage 6780 array stores configuration metadata in a private 512 MB region on every configured drive called the DACstore. The DACstore area contains drive state and status information, volume state and status information, and controller and subsystem information. The DACstore on each drive stores that drive's state and status, the worldwide name of its volume group, the volumes it contains, and the definitions for those volumes. Additionally, one drive in each volume group (with a minimum of three in each storage system) stores the controller- and subsystem-level information.

Storing metadata in the nonvolatile DACstore provides higher availability and enables easier re-configuration and migration. As the system configuration data resides on every configured drive, controllers and/or multiple drives can be removed or swapped without losing the system configuration. Drives can be relocated within the storage system to improve channel utilization/protection or even migrated as a complete volume group into another storage system. And in both instances, all configuration metadata and user data remains intact on the drives.

SATA Drives

All advanced technology attachment (ATA) drives are **_not_** the same, and all storage systems based on ATA drives are **_not_** the same. The Sun Storage 6180 array with SATA drives are designed for midrange and enterprise application environments that need lower cost storage, but cannot give up the availability, manageability, data integrity, and software/hardware features achieved with FC based storage systems. The robust RAID controller firmware and enclosure technology enable higher performance, availability, and manageability — creating robust SATA storage solutions that are truly enterprise class.

SATA and FC drives have very different characteristics — from performance, to reliability, to price. FC drives are still the best choice for applications that are high use, high workload, require high reliability, and high performance. However, SATA drives are optimal for a range of throughput-intensive applications where the activity consists of large block writes and occasional reads, as opposed to heavy block-level activity. SATA drives are best suited for the following applications:

- Bandwidth streaming applications (such as seismic processing)
- Certain business applications with low or limited IOPS performance
- Near-line secondary storage
- Disaster recovery typical site
- Reference data
- Tape cache
- Fixed content to manage retention data
- Hierarchical storage management

SATA drives deliver about one-half the performance of FC with the same number of drives and are unacceptable for applications requiring anywhere from adequate to maximum IOPS performance. SATA drives are a good fit for bandwidth applications as they can provide enough throughput to maximize a controller's MB/s performance. To achieve this, however, it does take about a third more SATA drives as Fibre Channel.

The SATA drive bracket is designed with a unique SATA interface card, which enables SATA drives to emulate the FC interface, providing the following key features and functionality:

- **Availability** — SATA disk drives are single-ported and lack true multipathing and multi-initiator capabilities. The SATA interface card provides the dual-link capability and switching functionality needed to achieve dual-active redundant I/O paths.

- **Connectivity** — Enables a SATA drive bracket, with the same form factor as the FC drive bracket, to be connected to the Sun Storage 6780 array controller enclosure and 4 Gb/s expansion tray midplane.

- **Usability** — The SATA interface card provides the SATA drives with basic FC-like functionality not otherwise available, enabling them to be managed like FC drives. These drive services include command queuing, a drive activity LED (external to the drive), unique worldwide name, drive signing, controlled drive spin up and down, and redundant drive loop diagnostics.

Battery

The controller tray includes a lithium ion battery for long battery life. The battery requires no scheduled maintenance during the 3 year warranty. command queuing, a drive activity LED (external to the drive), unique worldwide name, drive signing, controlled drive spin up and down, and redundant drive loop diagnostics.

Configuration

Additional trademark features of the Sun Storage 6180 array are flexibility and pay-as-you-grow scalability. Its unequaled flexibility includes the ability to mix drive types (FC and SATA, capacities, and/or rpm speeds), RAID levels, segment sizes, virtual disk sizes, volume characteristics, and cache policies all within a single storage system. The Sun Storage 6180 array allows dynamic reconfiguration of the following parameters: capacity expansion, volume expansion, RAID migration, segment size migration, virtual disk reconfiguration, and firmware upgrades. This configuration flexibility enables a single storage system to support multiple, heterogeneous servers with vastly different performance and/or capacity demands and varying workloads. And, the Sun Storage 6180 array delivers scaling flexibility as it can provide online expansion from 730 GB to over 112 TB (224TB with 2 TB available November, 2009) — one drive at a time or a fully-populated 16-drive expansion tray at a time.

Cabling

Each Sun Storage 6180 array controller tray and expansion tray fiber port and all fiber interface cables support full-duplex serial communications, meaning data is transmitted in two directions simultaneously. Therefore, a single cable from one component to another creates a complete fiber loop.

The Sun Storage 6180 array controller tray provides eight optical Small Form-factor Pluggable (SFP) connections (four per FC RAID controller card) for host or SAN connectivity and four copper connections (two per FC RAID controller card) for attaching to the expansion tray(s). Each SFP or copper interconnect interface delivers a theoretical maximum of 400 MB/s of bandwidth, enabling the Sun Storage 6180 array controller tray to deliver a theoretical maximum of 3200 MB/s of host-side bandwidth and 1600 MB/s of drive-side bandwidth.

Four FC 4 Gb/s Back
End Disk Channels

Four or Eight
8 Gb/s FC Host Ports
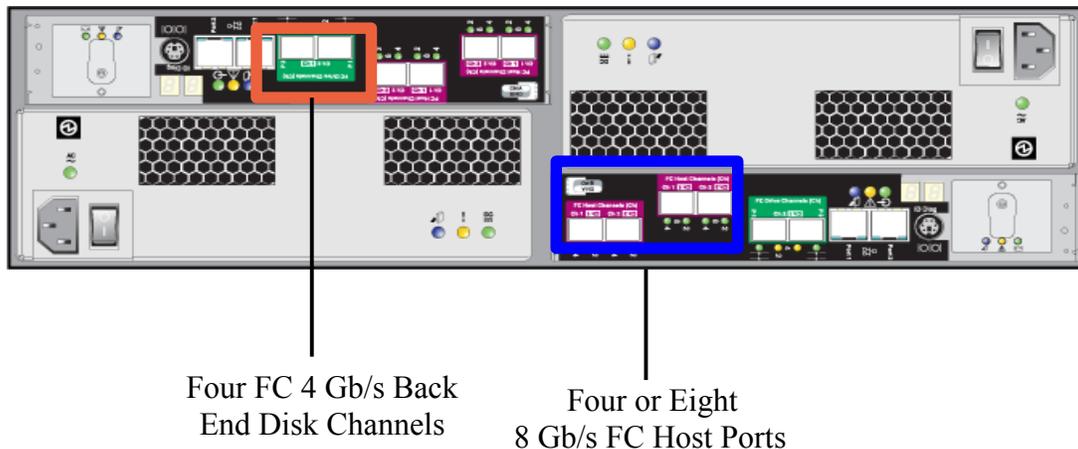
Figure 6. Sun Storage 6180 Controller Tray - Rear View

When attaching the Sun Storage 6180 array to a host or SAN, I/O paths to each controller should be established for redundancy. One connection to the FC RAID controller A and the other connection to the FC RAID controller B helps ensures data availability in the event of a path failure.
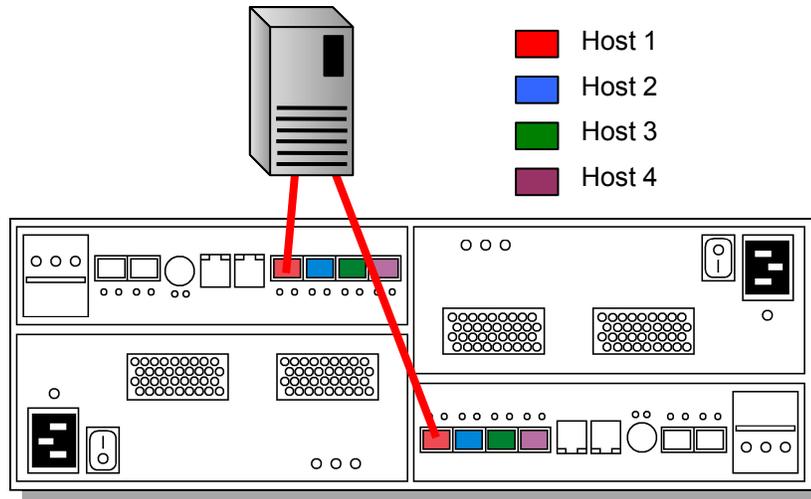
Figure 7. Sun Storage 6180 Array Host Connections

Expansion trays have redundant, dual-active drive loops running to the dual-ported FC disk drives or SATA disk drives. Each 4 Gb/s drive loop comes *in* through one port on the I/O module and goes *out* through the other — if additional expansion trays are attached.
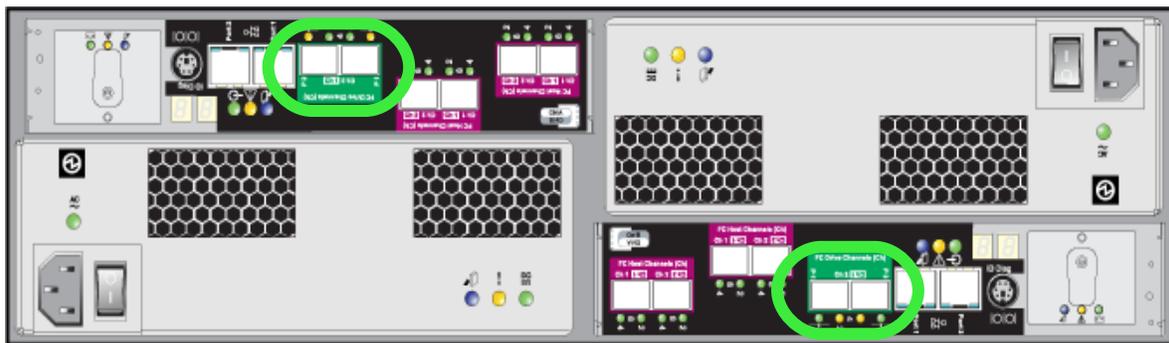
Figure 8. Sun Storage CSM200 Array Expansion Tray — Rear View

Expansion trays are configured with redundant, dual-active loops from the Sun Storage 6180 array controller tray. This again helps to ensure data access in the event of a path loop or power failure. Each FC RAID controller card has access to all four drive channels for the highest performance and availability.

The Sun Storage 6180 array controller trays are configured with a top-down/bottom-up cabling scheme. This helps to ensure data access to surviving drive modules even in the unlikely event that a full drive module is unavailable.

All controller tray optical SFP and IOMs interconnect connections are designed with port bypass technology. Port bypass technology maintains fiber loop integrity when new FC connections are made

— or if existing ones are removed — by automatically opening and closing ports as needed. This means a second host can be added, or SAN connections can be reconfigured, without affecting I/O of the existing attached host. And, full drive modules can be added or removed without interrupting access to data.
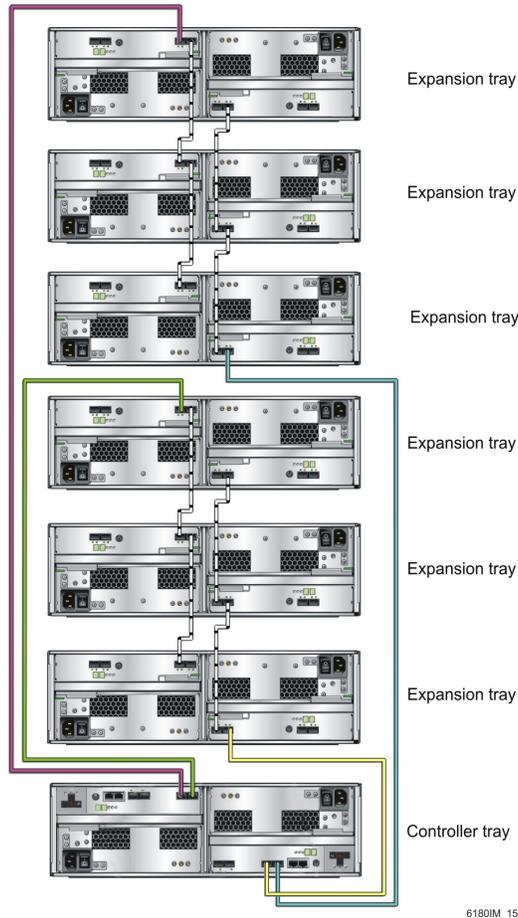
Figure 9. Sun Storage 6180 and CSM200 Cabling

Configuration Flexibility

The Sun StorageTek Common Array Manager software's unequaled configuration flexibility enables customized performance tuning, maximum capacity utilization, and the highest data protection. With Sun StorageTek Common Array Manager software a single Sun Storage 6180 array can concurrently support multiple RAID levels (0, 1, 3, 5, 1+0 and 6), mixing drive technologies, capacities and rotational speeds, multiple and various virtual disk sizes (up to 30 drives), and one or more volumes per virtual disk. Additionally, each volume supports individualized configuration settings, including controller ownership, segment size, modification priority, and all cache policies. And, all options can by dynamically configured and re-configured ensuring data is always accessible.

This industry-leading flexibility enables the Sun StorageTek Common Array Manager software to best match application data availability, performance, or capacity requirements. This is especially important in consolidated environments where multiple servers, each with varying and potentially drastically

different performance demands, are sharing a single storage system. While every environment is different and has different priorities in regards to performance, data availability, and capacity utilization, it is possible to outline some best practice guidelines centered on drive types and RAID levels.

Disk drive type — every Sun Storage 6180 array supports both fat (high capacity) and fast (high rotational speed) disk drives. The Sun StorageTek Common Array Manager software enables these different drive types to concurrently reside in a single storage system enabling high-capacity and high-performance applications to co-exist in the same installation.   The table below provides the formatted capacity per drive and per tray using those drives.

Applications such as databases, OLTP, messaging servers, and Web servers with random, small-block I/O requiring high IOPS performance are best served by a large number of high-spin drives. The Sun Storage 6180 array has four fast drive offerings:

- 146 GB 15K RPM — FC
- 300 GB 15K RPM — FC
- 450 GB 15K RPM — FC
- 600 GB 15K RPM— FC (available December, 2009)

Applications such as video streaming, multi-media, seismic processing, and high performance computing with sequential, large-block I/O requiring high throughput (MB/s) are satisfied with a smaller number of high-capacity disk drives. The Sun Storage 6180 array has three fat drive offerings:

- 500 GB 7.2K RPM — SATA
- 1 TB 7.2K RPM — SATA
- 2 TB 7.2K RPM — SATA (available November, 2009)

Selecting RAID configurations is equally critical for each application to meet desired data availability, performance, or capacity requirements. And, like drive types and configuration settings, the Sun Storage Common Array Manager software supports intermixing RAID configurations to provide maximum flexibility and utilization. RAID 5 is generally considered the best balance of cost, performance, and availability. The table below outlines the trade-offs of the various supported RAID configurations.

	RAID-0	RAID-1 and 10	RAID-3	RAID-5	RAID 6
Description	Data is striped across multiple drives.	Data is mirrored to another drive.	Data is distributed across multiple drives. Parity information is written to one disk in the group.	Drives operated independently with data and parity blocks distributed across all drives in the group.	Data is striped across several physical drives and dual parity is used to store and recover data.
Minimum Number of Drives	1	2	3	3	4
Maximum Number of Drives	448	448	30	30	30
Usable capacity as a percentage of raw capacity	100%	50%	66.67% to 96.67%	66.67% to 96.67%	50%-88%
Application	IOPS	MB/s	IOPS	MB/s	IOPS	MB/s	MB/s

	RAID-0	RAID-1 and 10	RAID-3	RAID-5	RAID 6
Advantages	Performance due to parallel operation of the access.	Performance as multiple requests can be fulfilled simultaneously.	High performance for large, sequentially accessed files. Parity utilizes small portion of raw capacity.	Good for reads, small IOPS, many concurrent IOPS and random I/Os. Parity utilizes small portion of raw capacity.	It tolerates the failure of two drives in an array, providing better fault tolerance than RAID 5.
Disadvantages	No redundancy. One drive fails, data is lost.	Storage costs are doubled	Degraded performance with 8-9 I/O threads, random IOPS, smaller more numerous IOPS.	Writes are particularly demanding.	Poor write performance, due to dual parity and overhead and complexity

Management Software

The Sun Storage Common Array Manager software is the primary interface for configuring and managing the array. The management software consists of a suite of tools that are installed on an external management host. The management software runs on the following platforms:

- Solaris 8, 9, 10, and x64
- Microsoft Windows 2008 Standard Server, Enterprise Server, Web and Core Editions SP2, Hyper-V
- Microsoft Windows 2003 Server Standard, Enterprise Editions
- HP-UX 11.23, 11.31
- AIX 5.3, 6.1
- Red Hat Linux AS/AP/WS Enterprise Edition 4U7, 5U3
- SuSE Linux v10 SP2, SLES11
- VMWare ESX 3.5 update 4, 4.0

The management software enables the storage administrator to manage the Sun Storage 6180 array from any system with a Web browser that is on the same network as the management host.

For latest supported browsers, see the *Sun Storage 6180 Array Release Notes*.

The Sun StorageTek Common Array Manager software provisions and maintains the storage for data hosts:

- *Common arrays* are collections of volumes that share a profile defining the common configuration of the volumes. Storage profiles define the characteristics of a common array. The administrator can choose one from the set of pre-configured profiles or create a new one.
- *Volumes* are divisions of a common array, consisting of virtual disks, representing the storage space that is used by the data hosts in the environment.
- *Virtual disks*, also called RAID sets, are collections of locations in the memory of more than one physical disk. The storage array handles a virtual disk as if it were an actual disk.
- *Host groups* are a collection of hosts that share access to the same volumes.

- *Snapshots* are copies of the data in a volume at a specific moment. Snapshots offer a high-availability alternative to backups because the the array can remain online to create the snapshot, and the snapshots take less less space than the original data.

- *Volume copies* are copies of the complete contents of one data volume that are located on another data volume on the same array.

Volumes

The Sun Storage 6180 array's physical disks are managed as a pool of storage space for creating volumes. A volume is a logical structure on a storage system and is created by slicing a virtual disk into a stripe set with a defined capacity. Volumes are containers into which applications, databases, and file systems can put data. Volumes are created from the virtual disks, based on the characteristics of the common array associated with the virtual disks. Based on user's specifications, the array automatically allocates a virtual disk that can satisfy the volume configuration requirements.

With the Sun StorageTek Common Array Manager software, each virtual disk supports up to 256 volumes, with a maximum of 1024 volumes per Sun Storage 6180 array. During or after standard volume creation, a host or host group can be mapped to the volume in order to give the host or host group read and write privileges to the volume. Each host, including any host that is a member of a host group, must be assigned one or more initiators before the host or host group can be mapped to the volume. There are several different types of volumes:

- *Standard volume* — A standard volume is a logical structure created on a storage array for data storage. When a volume is created, initially it is a standard volume. Standard volumes are the typical volumes that users access from data hosts.

- *Source volume* — A standard volume becomes a source volume when it participates in a volume copy operation as the source of the data to be copied to a target volume. The source and target volumes maintain their association through a copy pair. When the copy pair is removed, the source volume reverts back to a standard volume.

- *Target volume* — A standard volume becomes a target volume when it participates in a volume copy operation as the recipient of the data from a source volume. The source and target volumes maintain their association through a copy pair. When the copy pair is removed, the target volume reverts back to a standard volume.

- *Snapshot volume* — A snapshot volume is a point-in-time image of a standard volume. The management software creates a snapshot volume when the snapshot feature is utilized. The standard volume on which a snapshot is based is also known as the base or primary volume.

- *Reserve volume* — A snapshot reserve volume is automatically created when a snapshot is created. The reserve volume stores information about the data that has changed since the volume snapshot was created. When a snapshot is deleted, the management software also deletes its associated reserve volume.

A volume can be created on a virtual disk as long as the RAID level, the number of disks, and the disk type (FC or SATA) of the virtual disk matches the storage profile associated with the volume's pool. The virtual disk must also have enough capacity for the volume. The administrator chooses the method of determining which virtual disk is used to create the volume.

The following options are available:

- *Automatic* — The Sun StorageTek Common Array Manager software automatically searches for and selects a virtual disk that matches the necessary criteria. If none are available, it creates a new virtual disk if enough space is available.

- *Create volume on an existing virtual disk* — The administrator manually selects the virtual disks on which to create the volume from the list of all available virtual disks. It is important to ensure that the number of disks selected have enough capacity for the volume.

- *Create a new virtual disk* — The administrator creates a new virtual disk on which to create the volume. It is important to ensure that the number of disks selected have enough capacity for the volume.

A volume can be added to an existing storage domain, including the default storage domain, or a new one can be created by mapping the volume to a host or host group. A storage domain is a logical entity used to partition storage that allows a host or host group to have read and write access to the volume. The default storage domain contains all hosts and host groups without explicit mappings and enables them to share access to all volumes that are not explicitly mapped.

Storage Profiles

A storage profile is set of attributes that can be applied to a common array to allocate storage, instead of having to set each attribute individually. The system has a predefined set of storage profiles. The administrator can choose a profile suitable for the application that is using the storage or create a custom profile. The Sun Storage 6180 array has a default storage profile with RAID-5 storage characteristics that is suitable for many storage applications. The default pool uses the default profile. If none of these profiles is suitable, a new storage profile can be created. Each storage profile has the following settings.

Parameter	Value or Variable Type	Description
Name	Up to 32 characters	Unique identifier for the storage profile.
RAID Level	0, 1, 3, 5 RAID level	Configured across all disks within a virtual disk.
Segment Size	8 KB, 16 KB, 32 KB, 64 KB, 128 KB, 256 KB, 512 KB	Segment size is the portion of a disk allocated to a virtual disk stripe.
Readahead	Enabled or Disabled	Read-ahead mode of the array. Cache read-ahead enables the controller to copy additional data blocks into cache while the controller reads and copies host requested data blocks from disk into cache.
Disk Type	ANY, FC, or SATA	Disk type.
Number of Disks	Up to 30 drives	The number of disks to be grouped together in a virtual disk. For example, if a common array is created with a profile that has the number of disks parameter set to a number, all virtual disks that are part of that common array must have the same number of disks. If the number of disks parameter is set to the *Variable* value, the administrator is prompted for the number of disks when storage is added to the pool.

Virtual Disks

A virtual disk is a set of drives that the controller logically groups together to provide one or more volumes to an application host. Each virtual disk has an assigned RAID level, and typically all the drives in a virtual disk are the same capacity. Virtual disks can be created using drives of different capacities, however, the usable capacities of all the drives in that virtual disk are adjusted down to the disk drive of the smallest capacity.

The drives that make up a virtual disk can be selected manually or automatically, and can reside in a single drive module or across multiple drive modules. When using the automatic configuration option,

virtual disks are configured to balance the load across as many drive channels and drive modules as possible. This helps ensure maximum protection and optimum performance.

While multiple RAID levels can be intermixed in a single Sun Storage 6180 array, each virtual disk has a single, assigned RAID level and can comprise up to 30 drives. This RAID level can be dynamically migrated through the Sun StorageTek Common Array Manager software. The software also provides the ability to dynamically add additional drives, up to two at a time, to existing virtual disks. Existing volumes are then re-striped across all drives in the newly expanded virtual disk. And, like RAID level migration, this occurs while the virtual disk and all its volumes remain online and accessible for I/O.

Virtual disks are created and removed indirectly through the process of creating or deleting volumes or snapshots. RAID systems provide storage by making the data on many small disks readily available to file servers, hosts, or the network as a single array. RAID systems use two or more drives in combination for fault tolerance and performance. One of the factors in data throughput and availability is how the data is stored within the array, that is, the array's RAID level. In the Sun Storage 6180 array, disk drives within a tray are grouped together into RAID sets, also called virtual disks, according to RAID level.

The Sun Storage 6180 array supports the following RAID levels

- **RAID-0** — Stripes data across multiple disks, but without redundancy. This improves performance but does not deliver fault tolerance.

- **RAID-1** — Mirrors a disk so that all data is copied to a separate disk.

- **RAID-3** — Stripes data at the byte level across multiple disks while writing the stripe parity to a parity disk. Provides high throughput for a single streamed file. Checks parity on reads.

- **RAID-5** — Stripes data at the byte level, and provides stripe error correction (parity checking) information. For this level, the minimum number of drives is three. RAID-5 results in excellent performance and good fault tolerance. Parity checking specifies that when the RAID controller writes information onto disks, it also writes redundant information, called parity bits. If a disk fails, the parity information enables the RAID controller to re-create the lost information as it is requested. Since the parity information is spread across multiple disks, only a percentage of the disks is used for parity information, which improves the efficiency of available storage space.

- **RAID- 6** — Data is striped on a block level across a set of drives, just like in RAID 5, and a second set of parity is calculated and written across all the drives; RAID 6 provides for an extremely high data fault tolerance and can sustain multiple simultaneous drive failures.

- RAID 10 — RAID 10 is implemented as a striped array whose segments are RAID 1 arrays. RAID 10 has the same fault tolerance as RAID level 1 and has the same overhead for fault-tolerance as mirroring along.

Storage Pools

A storage environment can be divided into storage pools. Each pool is associated to a profile that allows the storage pool to meet specific input/output (I/O) requirements. Each array has a default pool that uses the default profile, which implements RAID-5 storage characteristics. The default pool satisfies most common storage requirements. The array also provides a set of storage profiles that satisfy certain I/O requirements which are optimal for the type of application to which they refer. If none of the factory profiles are suitable for an application's needs, a custom storage profile can be created. When a new storage pool is created, a specific profile is assigned to it. Removing a storage pool destroys all stored data in the pool and removes all volumes that are members of the pool. The data can be restored from backup after new storage pools are added, but it is far easier to avoid the difficulty in the first place.

Remote CLI Client

The Sun Storage 6180 array can also be configured and managed using the remote command line interface (CLI)client. The CLI provides the same control and monitoring capability as the Web browser, and it is also scriptable for running frequently performed tasks. The remote CLI client is available for the Solaris OS, Windows, and several other operating systems. See the *Sun Storage 6180 Array Release Notes* for details on the supported operating system platforms.

Configuration Metadata

The Sun Storage 6180 array controllers store configuration metadata in a private 512 MB region on every configured drive. This private metadata area contains drive state and status information, volume state and status information, and controller and subsystem information. In addition, it also stores a drive's state and status, the worldwide name (WWN) of its virtual disk, the volumes it contains, and the definitions for those volumes. Finally, one drive in each virtual disk (with a minimum of three in each storage system) stores the controller- and subsystem-level information.

Storing metadata in the nonvolatile private metadata area provides the highest availability and enables easier re-configurations and migrations. As system configuration data resides on every configured drive, controllers and/or multiple drives can be removed or swapped without losing the system configuration. Drives can be relocated within the storage system to improve channel utilization and protection or even migrated as a complete virtual disk into another storage system. And, in both instances, all configuration metadata and user data remains intact on the drives.

Online Administration

The Sun Storage 6180 array enables nearly all storage management tasks to be performed while the storage remains online with complete read/write data access. This allows storage administrators to make configuration changes, conduct maintenance, or expand the storage capacity without disrupting I/O to its attached hosts. The online capabilities include:

- *Dynamic capacity expansion (DCE)* — DCE enables the capacity and number of drives to be increased for a given virtual disk. Up to two drives at a time can be added to existing virtual disks, the existing volumes are then striped across the full set of drives now comprising the virtual disk.

- *Dynamic volume expansion (DVE)* — This feature allows the capacity of an existing volume to be expanded by using the free capacity on an existing virtual disk. **Note**: Increasing the capacity of a standard volume is only supported on certain operating systems.

- *Dynamic RAID level migration (DRM)* — Changes the RAID level of a virtual disk. **Note**: The virtual disk must have enough capacity and the appropriate number of drives to support the new RAID level.

- *Dynamic segment size migration (DSS)* — A default segment size is set during volume creation, based on the virtual disk RAID level and the volume usage specified. These two parameters should optimize the segment size appropriately for the environment. If, when monitoring the storage system , it reflects less than optimal performance, the segment size of a given volume can be changed.

- *Dynamic defragmentation* — This feature rearranges volumes and consolidates free capacity within a virtual disk, resulting in optimized access patterns for existing and newly created volumes.

- *Virtual disk/volume configuration* — HotScale technology enables new drive modules to be added to the Sun Storage 6180 array, virtual disks to be configured, and volumes to be created without disrupting access to existing data. Once a newly created volume is defined, Sun StorageTek Common Array Manager software's immediate LUN availability and *hot add* features enable it to instantly be mapped and accessed by a host(s).

- *Performance monitoring* — The Sun StorageTek Common Array Manager software for the Sun Storage 6180 array enables the storage system performance to be monitored in real-time to assist in performance tuning decisions.

- *Non-disruptive controller firmware upgrades* — The controller firmware can be upgraded with no interruption to data access. The new firmware is transferred to the first controller, its flash memory is updated, and the controller is rebooted. The firmware is then passed from the first controller to the second, and the process is repeated. With a multi-path driver installed, access to storage system volumes is maintained throughout the process.

Performance Tracking Utility

The Sun StorageTek Common Array Manager software provides quick performance health statistics, which allows fine tuning of attributes to reach the optional configuration for precise application needs. Since performance degradation is often a precursor to component or system downtime, performance tracking enables predictive, preemptive maintenance. The Performance Monitor data table tracks the following parameters by device (Sun Storage 6180 array controllers, volumes, and storage system totals):

Performance Metric	Definition
Total IOPS	The total number of I/Os handled by the component per second
Run Average Total IOPS	The average total number of I/Os handled by the component over the entire performance sampling period
Peak Total IOPS	Highest total IOPS over polling period
Read Percentage	The percentage of read operations handled by the component between two sampling periods (T1, T2)
Write Percentage	The percentage of write operations handled by the component between two sampling periods (T1, T2)
Cache Read Hit Percentage	The percentage of cache read hit operations handled by the component between two sampling periods (T1, T2)
Total Data Transferred (KB/s)	Total data transferred by component (reads/writes)
KB/s Read	Total data read in KB per second
Run Average KB/s Read	The average total data read in KB per second by the component over the entire performance sampling period
Peak KB/s Read	Highest KB/s read over polling period
KB/s Written	Total data written in KB per second
Run Average KB/s Written	The average total data written in KB per second by the component over the entire performance sampling period
Peak KB/s Written	Highest KB/s written over polling period
Average Read Size (Bytes)	The average read size for a component for a single sampling period
Average Write Size (Bytes)	The average write size for a component for a single sampling period

Global Hot Spares

If a drive fails in the Sun Storage 6180 array, the controller uses redundancy data to reconstruct the data onto a hot spare drive. The hot spare is automatically substituted for the failed drive without requiring user intervention. And, when the failed drive is physically replaced, the data from the hot spare is automatically copied back to the replacement drive. The system supports unlimited global hot spare drives, and each can be a spare for any disk in the array however Global Hot Spare drives won't spare for drives of a different type (i.e. a SATA drive won't spare for a FC drive and vise versa).

A hot-spare is a drive, containing no data, that acts as a standby in the storage array in case a drive fails in a RAID-1, RAID-3, RAID-5, RAID-6, or RAID-10 volume. The hot-spare adds another level of redundancy to the storage array. Generally, the drive assigned as a hot spare should have a capacity that is equal to or greater than the capacity of the largest drive on the storage array. If a hot spare is available when a drive fails, the hot spare is automatically substituted for the failed drive, without user intervention. Upon physical replacement of the failed drive, the data from the hot spare is copied back to the replacement drive. This is called copyback. If a hot spare drive is not available, a failed disk drive can still be replaced while the storage array is operating. If the drive is part of a RAID-1, RAID-3, RAID-5, RAID-6, or RAID-10 virtual disk, the controller uses redundancy data to automatically reconstruct the data onto the replacement drive. This is called reconstruction.

Multipathing

With multipathing, also called multipath failover, an array or network can detect when an adapter has failed and automatically switch access to an alternate adapter. Multipathing enables high-availability configuration because it helps to ensure that the data path remains active. Multipathing also helps increase performance to multi-controller disk arrays by spreading I/O between multiple paths into the array. Within the array, common arrays use multipathing by default. To complete the data path, data hosts also need the ability to multipath. Therefore, all data hosts need one of the following software products:

- Sun StorageTek Traffic Manager software
- MPxIO, part of the Sun StorageTek SAN Foundation software and integrated into the Solaris 10 OS
- VERITAS Volume Manager with Dynamic Multipathing (DMP)
- See the online Interoperability Tool (https://interop.central.sun.com/interop/interop) for the latest information.

Storage Domains – Highly Recommended

The Sun StorageTek Common Array Manager software's Storage Domain feature enables a single Sun Storage 6180 array to be logically partitioned and function as up to 112 virtual arrays (64 virtual arrays for a 4 host port system). A storage domain is a logical entity consisting of one or more storage system volumes that are accessed by a single host or shared among hosts that are part of a host group. A storage partition is created when the administrator defines a single host or a collection of hosts, called a host group, and then defines a volume-to-LUN mapping. This mapping defines what host or host group have access to a particular volume in the storage system. Hosts and host groups can only access data through assigned volume-to-LUN mappings. Partition access is maintained at the controller level, for complete data integrity in multi-host, multi-OS environments.

Volume-to-LUN mapping creates valuable flexibility for the storage administrator as any available volume can be mapped to any attached server. So, while the individual servers see a virtual array that consists of only their LUNs/volumes, the volumes can be intermixed throughout the storage system within one or more virtual disks. Logical partitioning combined with the Sun StorageTek Common Array Manager software's configuration capabilities enables administrators to choose from a range of volumes with different characteristics to meet a server's exact needs for a given LUN. Each volume can have unique configuration settings and reside on different drive types with different RAID levels. This flexibility enables a range of hosts with different capacity, performance, or data protection demands to effectively share a single Sun Storage 6180 array. Storage domain and upgrade licenses are available as optional premium features.

Figure 10. Sun Storage Domains

Heterogeneous Hosts

The heterogeneous hosts feature allows the firmware on each controller in the storage system to tailor its behavior (such as LUN reporting and error conditions) to the needs of the host operating system. This provides each individual host the view of the storage system that it would experience if it had exclusive access to the array.

In a heterogeneous environment, the administrator must set each host type to the appropriate operating system during host port definition. The host type can be completely different operating systems, such as the Solaris OS and Windows 2003, or variants of the same operating system, e.g., clustered and non-clustered. Each storage host port can be configured for multiple host types enabling complete flexibility for heterogeneous consolidation. Heterogeneous host settings are only available when storage domain is enabled.

Sun StorageTek Data Snapshot Software — Optional

Sun StorageTek Data Snapshot software for the Sun Storage 6180 arrays provides an additional level of data protection and the means to improve the utilization of production data..
It enables non-production servers to access an up-to-date copy of production data for a variety of applications — including backup, application testing, or data mining — while the production data remains online and user-accessible.

A snapshot volume is a point-in-time image of a volume that provides an immediate, space-efficient, logical copy of a volume. It is an immediate, space-efficient, logical copy of a volume. The snapshot volume appears and functions as a standard volume, enabling it to be used as a backup source, restoration point, information analysis / manipulation base, development environment, and other applications that benefit from a volume copy. Snapshots are created instantaneously and require only a small amount of disk space. Snapshot volumes appear and function as normal volumes. A snapshot volume is a point-in-time (PiT) image of a volume with all of the read, write, and copy capabilities of the original volume.

Sun StorageTek Data Snapshot software uses an innovative copy-on-write technology to maintain the logical snapshot volume while minimizing disk utilization. When the snapshot is *taken* the controller suspends I/O to the base volume for a few seconds while it creates a physical volume — called the repository volume — to store snapshot metadata and copy-on-write data. When a data block on the base

volume is modified, a copy-on-write occurs, copying the contents of blocks that are to be modified into the repository volume for safekeeping. This repository volume combined with the original base volume create the logical snapshot volume.

Since the only data blocks that are physically stored in the repository volume are those that have changed since the time of the snapshot, the snapshot technology uses less disk space than a full physical copy. The repository volume is typically 20 percent of the base volume, but varies depending on the amount of changes to the data. The longer a snapshot is active, the larger the repository is needed. The Sun StorageTek Data Snapshot software for the Sun Storage 6180 arrays provides notification when the repository volume nears a user-specified threshold (a percentage of its full capacity). And at any time, the Sun StorageTek Common Array Manager software's Dynamic Volume Expansion feature can be used to dynamically expand the repository volume. Sun StorageTek Data Snapshot software allows up to 8 copy-on-write snaps per volume and up to 512 copies per Sun Storage 6180 array.
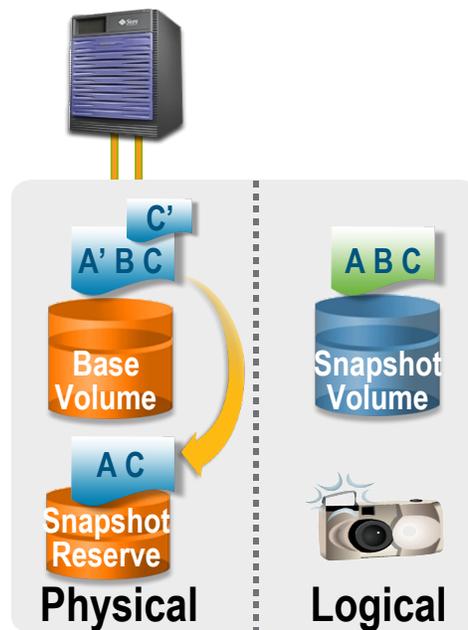
Figure 11. Sun Storage Data Snapshot Software

Key Features and Benefits

- **Up to eight snapshots per volume**
    - Better protection — Support for multiple copies of data volumes allows frequent and regular snapshots to be used to protect against data loss from an operational problem.
    - Protects data by providing up to four readily available online copies that reduces restore time.
- **Rapid availability**
    - Snapshot creation within seconds — Sun StorageTek Data Snapshot software can create a snapshot volume in seconds, which avoids the lengthy time required to do a full disk-to-disk copy or tape backup and then restore. Fast creation of snapshots means less waiting to use them.
    - Improves employee productivity by having an immediate copy. No more waiting for large volumes of data to copy, snapshot is nearly instantaneous.
- **Read and write support for snapshots**

- – Support all application needs — read and write access to snapshots means that virtually any type of testing or analysis can be applied to using snapshots without jeopardizing primary production data. While the snapshot version of data can be modified by a secondary application, the primary data volume continues to be used and modified by the original application server.

- – Provides more rapid application development by immediately creating a test environment and capitalizing on the ability to write to the snapshot image.

- **Space saving design**

  - – Maintain multiple copies with minimal extra disk expense — the copy-on-write design allows multiple versions of data to be protected with minimal disk space consumption. As a result, Sun StorageTek Data Snapshot software may require only 5 to 100 percent of additional capacity for four snapshots instead of the 400 percent (for four copies) of additional capacity that would be required with full volume copies.

Sun StorageTek Data Volume Copy Software — Optional

Sun StorageTek Data Volume Copy software provides administrators with another tool to effectively manage information growth and maximize the utilization of Sun Storage 6180 arrays. It creates a complete physical copy, or a clone, of a volume within a storage system. The clone volume is a unique entity that can be assigned to any host and used by applications requiring a point-in-time (PiT) copy of production data — such as backup, application testing or development, information analysis, or data mining — without affecting the performance of the production volume.

The software is configured and accessed via easy-to-use wizards or command line interface. It supports up to eight concurrent copies within a single storage system. Sun StorageTek Data Mirror software is a background operation with five user-defined priority settings, enabling administrators to minimize either copy time or the overall I/O impact to the storage system. And as the software is controller-based, it requires no host interaction or CPU cycles, minimizing the impact to applications and the storage infrastructure.

Sun StorageTek Data Volume Copy software can be used in conjunction with Sun StorageTek Data Snapshot software — which creates a PIT image of a volume while maintaining read and write access — enabling a complete PIT clone to be created without interrupting the I/O activity of the production volume. Additionally, Sun StorageTek Data Volume Copy software can be used to redistribute data — moving volumes from older, slower disk drives to newer, faster, or higher capacity drives — to optimize application performance and/or capacity utilization.
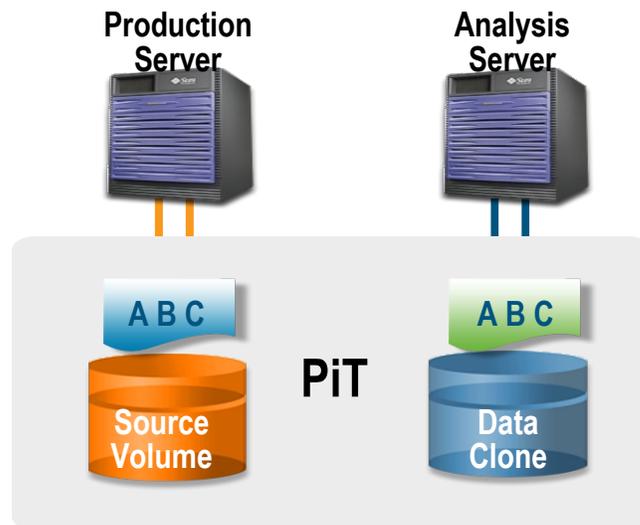
Figure 12. Sun StorageTek Data Volume Copy Software

Key Features and Benefits

- **Redistribute data**
  - Move volumes from older, slower disk drives to faster, higher capacity disk drives to optimize application performance and capacity utilization.

- **Support up to 8 active copies per volume**
  - Each clone volume is an independent entity that can be assigned to any host and used by any application requiring a point-in-time complete copy of data such as backup, application testing and development, or information analysis and data mining without affecting production volume performance.

- **User -defined priority settings**
  - Sun StorageTek Data Volume Copy software is a background operation with five priority settings enabling administrators to minimize either copy time or I/O impact to the system as business conditions and requirements dictate.

- **Controller-based**
  - Sun StorageTek Data Volume Copy software requires no host interaction or CPU cycles – minimizing impact to applications and the storage infrastructure.

Target Applications for Both Sun StorageTek Data Snapshot and Data Volume Copy Software

Sun StorageTek Data Snapshot and Data Volume Copy software enable companies to improve business operations by copying data sets to enable them to run more applications in parallel and create more frequent recovery points. The result can be an improved return on information. The value realized depends on how they are using it and is summarized in the following example applications.

- *Reducing Backup Windows* — Backups are a critical aspect of any business continuity strategy. However, backup windows are shrinking while the amount of information that needs to be protected

is rapidly expanding. Backing up snapshots and/or clones, rather than online data, enables critical online transactions to keep running during the backup process.

- *New Application Development and Testing* — Many enterprise systems are being re-engineered today to respond more efficiently to the networked business environment. Sun StorageTek Data Snapshot and Data Volume Copy software can enhance these efforts by enabling business applications to be tested on real, up-to-date data. This technology helps to accelerate new application development and helps to promote faster time-to-market.

- *Analyzing Up-to-Date Information* — Businesses are constantly seeking new approaches to gain a competitive marketplace advantage. The faster they can convert data to information, the quicker they can make critical decisions. Sun StorageTek Data Snapshot and Data Volume Copy software can be used to enable businesses to analyze more current information, leading to faster and better business decisions. One way to frequently analyze up-to-date information is to take a snapshot of an online database and then use that snapshot as the data set for a decision support application.

- *Reducing the Window for Data Loss* — Sun StorageTek Data Snapshot and Data Volume Copy software can be used to reduce the window for data loss in the event of a database or file system corruption.   For example, while a typical backup policy might provide for a nightly backup, creating two snapshots a day can reduce the potential window for data loss from 24 hours to 12 hours. The lighter impact of snapshots can enable more frequent copies and result in a better level of data protection, availability, and recovery point objective (RPO).

Sun StorageTek Data Replicator Software — Optional

Sun StorageTek Data Replicator software enables real-time synchronous or asynchronous data replication to either local campus or metro or remote data centers to protect a company's mission critical information. Sun StorageTek Data Replicator software provides volume-level replication, which enables volume replication between physically separate Sun Storage 6180 arrays in real time. Organizations can keep up-to-date copies of critical data at multiple sites, which is particularly useful in creating business continuity solutions and disaster planning scenarios.

A basic replication configuration consists of two peer sites (primary and secondary) and their associated volumes. The primary volume is the volume at the main or primary site that is replicated while the volume at the destination site is referred to as the secondary volume. A replication set consists of a group of primary volumes and their associated secondary volumes at the remote site. A volume can only be replicated to a single remote site.

The software transports data between the two Sun StorageTek 6180 arrays by means of synchronous or asynchronous replication mode using a dedicated FC connection. The replication network can be either FC or TCP/IP with conversion equipment or over public or private telecommunications infrastructures. These features provide the capability to replicate between sites located throughout the world and enable data to write transparently to both primary and secondary sites either simultaneously (synchronous) or with a managed delay (asynchronous).

If there is a break in the network or if the secondary volume is unavailable, the software automatically switches to suspended mode, in which it ceases replication and tracks changes to the primary volume in a separate volume know as a replication repository. When the link is restored, the software uses the information in the replication repository volume to re-synchronize the volumes and returns to replicating the data.

Sun StorageTek Data Replicator software supports write order consistency, where multiple volumes are combined to preserve write order, shown in Figure 13. Each Sun Storage 6180 array supports one consistency group. The value of write order consistency is that the remote volumes, replicated using asynchronous mode, are in a re-startable consistent state regardless of how far behind the data transfer to the remote volumes lags.

Sun StorageTek Data Replicator software can also be used to restore data from a secondary volume to a primary volume by reversing the roles of the primary and secondary volumes. Role reversal is a failover technique in which a primary volume failure causes the secondary volume to assume the role for the primary volume. The application software accesses the secondary volume directly until the failure at the primary volume is corrected. Once the primary volume is brought online again, any data changes that occurred can write back to the primary volume.
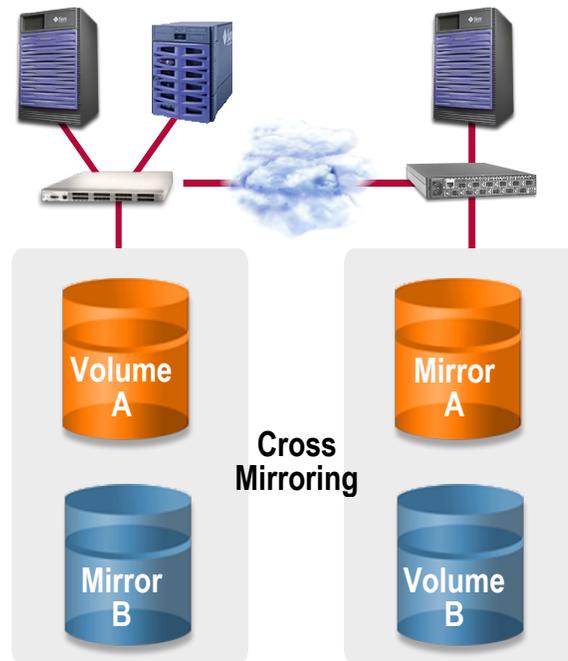
Figure 13. Sun StorageTek Data Replicator Software

Key Features and Benefits

- **Enterprise-wide data protection**
  - Supports data center, campus, Metropolitan Area Network (MAN), and Wide Area Network (WAN) replication

- **Synchronous and asynchronous replication modes**
  - Synchronous provides zero data loss remote replication
  - Asynchronous enables economical and long distance remote replication
  - Supports synchronous and asynchronous modes over both IP and Fibre Channel links
  - Replication distances can range from building to building within a campus or between sites over long distances

- **Write-order consistency across volumes**
  - Preserves write transaction order across remote volumes
  - Protects against data corruption
  - Enables remote volumes to be immediately used as restartable volumes in the event of a primary site failure
  - Replicated data can be used for application testing, data mining, or back-up to tape.

- **Role reversal**

— Use role reversal to make the secondary site the new primary site

— Allows a secondary site to be assigned as primary while the primary site is rolled back to a known, corruption-free point in time

- **Dynamic mode switching**
  - Switch from synchronous to asynchronous replication without suspending the remotely replicated volumes accommodates changing application and bandwidth requirements without sacrificing protection

- **Many-to-one support**
  - Multiple remote systems can replicate to a single system for centralized data protection, mining, or backups

Target Applications for Sun StorageTek Data Replicator Software

Sun StorageTek Data Replicator enables companies to improve their business operations by replicating data sets to a remote and physically separate locations. The result can be protected or improved business operations. The value realized is summarized in the following example applications.

- *Business and Data Continuance* — Business/data continuance uses remote replication to make a secondary site available as a primary site in the event of an disaster or unplanned outage at the primary site. Both synchronous and asynchronous replication are used in business/data continuance implementations, selected by the distance between the replication sites and the amount of data loss an enterprise is willing to sustain in the event of an outage.

- *Content Distribution* — Many enterprises duplicate data from a central core site to another remote site for the purpose of updating the information repository at that site to reflect current changes to the data. An example would be product price lists that are distributed from a central corporate site to a geographically remote site on a daily basis.

- *New Application Development and Testing* — Many enterprise systems are being re-engineered today to respond more efficiently to the networked business environment . Sun StorageTek Data Replicator software can enhance these efforts by enabling business applications to be tested on real, up-to-date data. This technology helps to accelerate new application development and helps to promote faster time-to-market.

- *Analyzing Up-to-Date Information* — Businesses constantly seek new approaches to gain a competitive marketplace advantage. The faster they can convert data to information, the quicker they can make critical decisions. Sun StorageTek Data Replicator software can be used to enable businesses to analyze more current information, leading to faster and better business decisions. One way to frequently analyze up-to-date information is to take a snapshot of an online database and then use that snapshot as the data set for a decision support application.

Features, Functions, and Benefits

Feature	Function	Benefit
Next-Generation 8 Gb/s Fibre Channel Interfaces	• Investment Protection • Infrastructure Simplification • Increased Bandwidth Capacity	• 100% throughput improvement (per channel) for data-intensive applications, such as data warehouse (OLAP) and HPC • 20%+ IOPS and latency improvement for transactional applications (OLTP) • Backward compatibility with existing FC installations (2Gb/s and 4 Gb/s), protecting infrastructure investments. • Fewer HBA/Switch channels/ports lowers acquisition and operational costs (as much as 45%)
Built-in efficiencies	• Scalability • Efficient Utilization • Performance Value	• Modular design avoids over-configuration for an affordable entry-point while offering seamless "pay-as-you-grow" scalability as requirements change. • Efficient utilization lowers raw capacity requirement, and support for intermixing high performance and high capacity drives enables tiered storage. • Exceptional per drive performance creates performance value by getting the most performance out of the fewest drives.
Sun StorageTek Common Array Manager software	• Manage multiple arrays or other storage systems from the same family from a common browser-based console. • Simplifies storage management. • Enables common management interface across the Sun StorageTek 6000 family.	• Saves time. No need to go from one management interface to another when managing multiple Sun modular arrays. No need to retrain staff from one array model to the other or when upgrading. • Helps ensure maximum utilization of storage capacity and complete control over rapidly growing storage environments.
Support for self-encrypting drives	• Data Protection	• Comprehensive protection for data-at-rest ensures data is secured throughout the drive's lifecycle without sacrificing storage system performance or ease of use

Feature	Function	Benefit
Support for high-performance FC and high-capacity SATA disk drives	• Expansion trays with FC drives can be added to improve performance and increase capacity. For secondary storage requirements, expansion trays with SATA drives can be integrated to create a cost-effective solution.	• Enables a single Sun Storage 6180 array to satisfy primary and secondary storage requirements.
Up to 112 intermixed drives	• Enables tiered storage	• Ability to intermix FC, FDE and SATA disk drives enables tiered storage • FC disk is allocated to applications that demand high performance and have high I/O rates and less-expensive SATA disks are allocated to applications that require less performance • Enclosure-based intermixing maximizes efficiency
Dynamic Expansion Capabilities	• Additional capacity • Eliminated application interruptions	• Designed to offer the ability to bring unused storage online for a new host group or an existing volume to provide additional capacity on demand • Designed to eliminate application interruptions due to growth, reconfigurations or tuning
Up to 128 partitions	• Reduced Management Costs	• Enough partitions to effectively support medium scale consolidation or virtualization environments; thus helping to reduce hardware and storage management costs
Fully-integrated replication features	• Data Protection	• Multiple options allows administrators to best fit their replication needs • Local or remote copies can be used for file restoration, backups, application testing, data mining or disaster recovery
Support for heterogeneous, open operating systems	• Support Microsoft Windows, UNIX and Linux systems	• Enables the 6180 array to operate in any and all open system environments
Custom XOR engine for RAID parity calculations	• Exceptional disk based performance	• Efficiently handles compute-intensive parity calculations enabling exceptional disk-based performance that's ideally-suited for RAID 5 and RAID 6 configurations

Feature	Function	Benefit
Support for multiple RAID levels; including RAID 6	● High availability ● Flexibility	● Designed to support high availability and security for mission-critical data ● Designed to offer flexibility to configure the system to address varying service levels
Redundant, hot-swappable components	● Data Availability	● Designed to maintain data availability by allowing components to be replaced without stopping I/O
Persistent cache backup	● Data Protection	● Ensures any data in cache is capture and safe in the event of a power outage .

Best Practices for the Sun Storage 6180 Array

Planning and Acquisition

If possible, it's best to have a proper understanding of the applications and the expectations for them before the purchase of storage resources in order to assure a satisfactory outcome. This is especially true of the Sun Storage 6180 array, which offers such broad configuration flexibility and adaptability. Properly understanding the applications is not always possible, however, either because of severe budgetary limitations or other factors, such as management mandates for storage consolidation and/or the pre-assignment of redeployed hardware that "will just have to do the job." In the latter case, planning may not help much when there are few options. The former situation, however, does allow business and technical trade-offs to be considered that can provide better results when the available resources are selected on the basis of what is required for the application.

Best Practices Require That the Application(s) be Well Understood

Two typical classification methods are based on the access patterns for the data.

- Transaction processing is the interactive online communication with record-oriented data.
    - Sample applications might be order entry or an airline reservation system.
    - Transaction processing characteristically employs short records or *blocks*, asynchronously and randomly accessed.
    - Performance is measured in terms of I/O operations per second, or IOPS.
- Data streaming reflects the continuous ingest, processing, or output of data.
    - Sample applications might be satellite data collection or media serving.
    - Data streaming more classically utilizes very large data blocks that are sequentially accessed.
    - Performance is measured in terms of Mbytes transferred per second, or MB/s.
- Some applications require a combination of the above two patterns, and the Sun Storage 6180 array is well suited to both transactional and streaming data patterns, as long as the storage system is configured to best address the performance characteristics of each.

Performance enhancement of intelligent RAID-based systems like the Sun Storage 6180 array is best achieved by leveraging parallel and overlapped operations, which overall appear to exceed the basic I/O operating specifications of the actual hardware. This is normally possible by taking advantage of dual controllers, each with large, flexible cache buffers, multiple independent channels, numerous drive spindles across which the data is striped, and dynamically managed I/O queues that utilize access optimization algorithms.

How Many Drives are Required?

The design of the Sun Storage 6180 array provides the user with a very scalable storage system that can be predictably configured for most applications. The reason for this is that in addition to its explicit objective of maximum availability, the RAID architecture provides exceptional parallelism and extensive overlap of I/O operations, as described above, in addition to the use of intrinsically fast components. The Sun Storage 6180 array also boasts an extremely low access time to data. A transaction processing application designed around a relational database normally requires several random accesses for modest amounts of data with each access. Overall performance of this application is said to IOPS bound, because input/output overhead is a function of transaction rate, but could possibly be enhanced through performance optimization techniques described in this document.

While numerous factors come into play, the most common is that the more disk drive spindles the database can be spread across, the faster the access time to a particular record. For planning purposes, if the number of IOPS the target application uses now is known, it is possible to estimate the future IOPS requirement based on business growth.

Although the typical 15K rpm Fibre Channel disk drive is capable of some 350 IOPS per spindle in a benchmark environment, 200 to 250 IOPS per spindle is a better sizing parameter for *real world* environments. This figure is based on SPC-1 benchmark testing (www.storageperformance.org). **Therefore the optimized IOPS rate divided by 200 or 250 should provide a first cut estimate of the number of disk drives needed to achieve top target transactional performance.**

This drive count should then be bumped up to address the additional requirements for *parity,* growth ,and spare disks in a RAID system. 200 to 250 is merely an estimate: 15K rpm drives are about 15 percent faster than traditional 10K rpm drives, and so provide a higher IOPS level.

Try to plan a storage solution around a key application. Remember that the notion of buying the largest drive size because it provides more storage capacity might be false economy. If the application demands a maximum level of performance, select the higher spindle count but with lower capacities. (In those situations where a user decides to employ one of several mechanisms for data/business protection, such as snapshot or remote replication, the incremental drive requirement for those functions should be taken into consideration separately.)

Other applications, such as data acquisition for signal processing are bandwidth-oriented. There are few accesses except for very large blocks of data, primarily sequentially ordered. IOPS are not as significant as the continuous streaming of large volumes of data, referred to as bandwidth or throughput-oriented. Performance requirements in this case are measured in terms of Mbytes per second. **For planning purposes with these types of applications, 4 Gb/s Fibre Channel technology can support 50 MB/s bandwidth.** Divide the expected bandwidth by that number to obtain the minimum base number of disks required. Round up for parity, growth, and slower than 15K rpm spindle speeds.

Which RAID Level is Best for the Application?

RAID level for one or all volume groups affects cost, performance, and data recovery.

- **RAID 0** uses the least amount of storage, requiring no capacity for redundancy or parity protection, since this level does not provide these functions.
    - It appears to be the cheapest solution because it requires no extra hardware for data protection or recovery, not taking into account the cost of recovery from data loss due to operator error, hardware malfunction, or other backup recovery.
    - RAID 0 also appears to be a high performance solution, since there is no lost overhead due to managing redundancy, although the cost of data recovery includes some lost production time associated with lost data recovery.
    - RAID 0 is rarely selected as the level of choice for important business or technical data.
- **RAID levels 1 or 1+0** require the most storage, which is more than twice the minimum capacity of the actual data requirements, and therefore the most expensive.
    - Using two complete copies of a volume, data recovery is not only thorough, but data access operates very quickly, since the controller has the choice of accessing data records from either set, it is more likely to select the closer one.
    - Recovery from data or hardware loss is relatively fast, since the *failed* set can be rapidly recopied from the surviving mirror twin without requiring mathematical recalculations.
- **RAID 5 or 3** is some capacity compromise among the RAID levels mentioned above, since it requires a parity drive for each volume group of between 2 and 29 data drives.

- Failed devices or data errors can be recovered through mathematical analysis of the surviving data.
- Low parity ratios (such as 4+1) result in lower savings, but faster recovery times. Higher parity ratios (such as 15+1) are less costly than lower ratio solutions, but require a substantially greater error recovery time.
- Bear in mind the earlier discussion about higher drive spindle counts having a positive influence on IOPS performance. At the LUN or RAID group level, the greater the spindle count, the higher the expected level of IOPS performance.
- RAID groups within the same system or application do not have to use the same RAID level, and do not require the same spindle counts, or parity ratios, or block sizes.
- I/O for most applications is skewed much more heavily toward reads than writes. Applications that exhibit more of a write bias, such as greater than 20 to 25 percent write operations, might be better suited to RAID 1 or 1+0.

The process of rationalizing the *business* decision of which RAID level and parity level to choose for the various logical storage volumes should be well thought out and based on the requirements of the application and the organization. The advantage of the Sun Storage 6180 array management software it is flexible. Changing RAID levels, drive counts, parity ratios, volume group size, etc., can be dynamically performed from one value to another, without interrupting normal application processing or database access — a clear advantage over alternative designs.

How Many Disk Drives Should Be In A Volume Group?

For transaction processing or IOPS-heavy applications, use some of the guidelines already discussed:

1. Pick a RAID level reasonable for the expected activity.

    a. (For this example, start with a moderate RAID 5)

2. Pick a drive type and capacity

    a. (146 GB 10K rpm FC disk drives)

3. Pick a parity drive ratio

    a. (7 data drives + 1 parity drive is a good ratio)

4. Quick check:

    a. Database requirement = about 1 TB, including planned growth

    b. 7 times 146 GB drives = 1022 GB = ~1 TB

    c. Plus 1 parity drive adds up to 8 drives, which equals ½ of a drive rack

    d. Define Volume Group as 8 drives (7data = 1 parity)

    e. This volume group should be capable of sustaining at least 2000 random IOPS.

If this sample system behaved more like a streaming (high bandwidth) application, the 7+1 volume group could sustain over 300 MB/s sustained throughput.

Another guideline to keep in mind for Volume Groups is that the number of data spindles in the data volume group should be able to accommodate the maximum size of a data stripe. In other words, the maximum size of the data stripe should be the equal to or greater than the segment size multiplied by the number of data disk spindles reserved for that volume group.

RAID Topology

Most applications require several to numerous data *segments*. The segment can be either a small volume or, if the volume is significantly large based on the mathematical rules provided in the above section, each and every portion of a volume group distributed among the different spindles can also be referred to as a segment. When segments for the same application require access concurrently during normal operation, some performance benefit can be achieved if those segments are allocated to spindles in as many different drive enclosures as possible. This is sometimes referred to as *vertical striping*, as contrasted with segments striped to or from spindles within the same drive enclosure. The simple explanation for this is that striping benefits from overlapped I/O, but cannot benefit when there are conflicts for the same resource. Therefore, reduce all obvious points of conflicts for the same resource.

Controller Cache Parameters

Better I/O efficiency is achieved if the I/O block size for controller cache is equal to the stripe size of the I/O record. IOPS applications typically have smaller block sizes than bandwidth data. If this is the case, try to select the block size as a simple multiple or factor of the stripe size.

Server Hardware — Bus Bandwidth and Host Bus Adapters (HBAs)

An important limiting factor in I/O performance is the I/O capability of the server hosting the application. The aggregate bandwidth of the server to the storage subsystem is measured in MB/s, and consists of the total capability of the buses to which the storage system is connected. For example, a 64-bit PCI bus clocked at 133 MHz has a maximum bandwidth of 133*106 cycles/second * 8 bytes/cycle = 1064*106 bytes/s ~= 1 GB/s.

Multiple HBAs on this bus share a single source of I/O bandwidth, and each HBA can have multiple FC ports, which typically operate at 1 Gb/s, 2 Gb/s, or 4 Gb/s (100, 200, or 400 MB/s respectively). Therefore, the ability to drive a storage subsystem can be throttled by either the server bus or the HBAs.

When a server is configured, or whenever I/O performance is analyzed, it is important to understand how much server bandwidth is available and which devices share that bandwidth. If the aggregate maximum bandwidth of the HBAs exceed that of the server, then the server can become a throughput bottleneck. If the aggregate throughput is lower, however, it might be possible to increase the throughput of an application by adding additional HBAs to the server, or replacing lower performance HBAs with faster ones, or reassigning the fastest HBAs to the applications that can take advantage of their higher performance.

As always, use HBAs that are consistent with the compatibility lists published in the What Works With What (WWWW).

Command Tag Queuing (CTQ)

Command Tag Queuing refers to the controller's ability to line up (queue) multiple SCSI commands for a single LUN and execute them in an optimized order that minimizes rotational and seek latencies. Although CTQ might not help in some instances, e.g., single-threaded I/O, it does not hinder performance and therefore is generally recommended. CTQ is enabled by default on the Sun Storage 6180 array, but it must also be enabled on the HBA (see HBA vendor documentation) and in the host OS. The capability of a single host varies by OS type, but a general formula for calculating CTQ is:

OS CTQ depth setting = maximum OS queue depth (<255) /total # LUNs.

If the HBA has a lower CTQ capacity than the above calculation result, it limits the actual setting. The method for setting CTQ varies by OS type. Refer to the OS `man` page for the following commands and parameters for detailed information.

- Solaris — **sd_max_throttle** in `/etc/system`

- HP-UX (11.0) — `scsictl` command

- HP-UX (11i) — **scsi_max_depth** dynamic parameter added; use `kmtune` command

- AIX — **lsattr -E -l hdisk*n*** to view LUN setting and **chdev -l hdisk*n* -a q_type=simple -a queue_depth=***NewValue* to change queue depth for a LUN. The **-T** and –**P** flags control when the change is effective and its permanence.

- IRIX — for each LUN, use the **fx** command (e.g., **fx −x "dksc 6,2,2"**) following the menus down to **/label/set/param,** where options are provided for Enable/Disable and for CTQ depth.

- Linux OS — default is viewed/set in generic `sg` driver at **/proc/scsi/sg** HBA parameter is set in HBA driver configuration file, e.g., `lpfc.conf`

- Windows — edit registry settings per HBA vendor documentation

Fibre Channel Switch Fabric

Use any FC switch settings recommended for a particular storage system model and release level, which are available from the supplier of the storage system. For example, on Brocade switches, verify the *In-Order Delivery* parameter is enabled. Understand the paths from servers to storage and in a multi-switch SAN fabric, where I/O traverses ISLs (Inter-switch link), ensure that sufficient ISL bandwidth is configured.

Data Services Performance Enhancement

Sun StorageTek Data Snapshot Software

For optimal performance when using the Sun StorageTek Data Snapshot software:

- Locate repository volumes on separate disks from production LUNs, to isolate repository writes and minimize the copy-on-write penalty.

- Try to schedule read I/Os to the snapshot volume at off-peak times when I/O activity on the source LUN is lower.

Sun StorageTek Data Volume Copy Software

The Sun StorageTek Data Volume Copy software uses optimized large blocks to complete the volume copy as quickly as possible, so little tuning is required other than setting the copy priority to the highest level.

Best practices for using volume copy include:

- Disable all snapshot volumes associated with a base volume before selecting it as a volume copy target volume.

Sun StorageTek Data Replicator Software

For optimal performance when using the Sun StorageTek Data Replicator software:

- Upgrade both storage subsystems to the latest firmware levels available.

- Locate repository volumes on RAID-1 volumes separated from production volumes to isolate writes and help optimize performance.

- In general, use more disks in the target LUN Volume Group, e.g., 8+1 instead of 4+1.
- For the target LUN, enable Write Caching, but disable Write Cache Mirroring.
- For the source LUN, enable Read Caching.
- Use the highest priority level for synchronization for optimal remote volume mirroring performance, assuming that the impact on host I/O performance is acceptable.
- For optimal performance, enable the *In Order Delivery* option on Brocade switches.

In Summary

Optimizing a storage system is much like tuning up any other kind of system comprised of multiple individual and interrelated sub-functions and subsystems. It can be accomplished with a good understanding of how all of the pieces fit together to the point that it appears to be an optimum solution.

A new storage system is much like starting with a new desk: it's clean, free of clutter with lots of space to store new things and easily find them again. Over time the clear, empty spaces start to fill up, and stacks of similar things become fragmented into multiple batches that can become easily separated, causing the efficiency in accessing data to consistently diminish. Using these best practices can set the stage for a more effective and efficient storage management paradigm for longer term efficiency.

Reliability, Availability, and Serviceability (RAS)

Reliability

Reliability features of the Sun Storage 6180 array include the following:

- No single point of failure
- Passive midplane (except for FRU-ID EEPROM)
- Automatic sector reallocation on RAID controller
- Sixteen SCA-2 drive connectors
- I2C for components management and fault detection
- Path fail over (PFO) protection — coverage for I/O module pulls, hardware, or firmware failure
- Path fail back protection — PFB — after a PFO the ability to add a new I/O module back into the tray
- Global hot spare (unlimited)
- Link redundancy chip and 8- to 10-bit encoding on FC-AL loops
- ECC on data cache
- Hardware support for parity for RISC RAM
- Cooling fan module pro-actively adjusts fan speed based on temperature monitoring
- Temperature sensors located closer to heat spots to provide accurate temperature measurements
- RAID set / disk scrubbing
- Global hot spare (array or dedicated hot spare)
- IO module loop back diagnostic
- IO module FC loop down detection (backend loop down detection)
- IO statistics

Availability

Availability features of the Sun Storage 6180 array include the following:

- Dual-active FC RAID controllers with cache mirroring
- Dual-active drive channels
- Dual hot-swappable redundant 600W power supplies and fan modules with individual power cord
- All FRUs are hot swappable
- Write through / write back with mirroring
- Global hot spare with automatic drive failure detection and rebuild using global hot spare drives
- Persistent cache backup in the event of a power outage
- Fast on-the-fly background volume (RAID Set) initialization
- Dynamic re-configuration: virtual disk strip size, RAID migration, volume create/delete, de-fragmentation, online controller firmware upgrade, expansion trays addition
- Persistent group reservation (supporting industry-standard SCSI-3 persistent reserve commands)
- Array-based CLI, host-based GUI/CLI management software

Serviceability

Serviceability features of the Sun Storage 6180 array include the following:

- Low FRU count — the drives, FC RAID controllers with integrated back-up battery or I/O modules, cooling fan modules, and power supplies — can be hot-swapped with no tools required
- Failed FRU ID
- Host-based phone home capability
- Auto disk recognition
- Advanced run time diagnostics
- Background media scan
- Quick snap locking mechanisms for easy insertion and extraction of disks and other FRUs

Specifications

Specifications for the Sun Storage 6180 array controller tray with 16 hard disk drives:

Feature	Specification
Physical Planning	
Dimensions	12.95cm (5.1 in) x 44.7 cm (17.6 in.) x 57.15cm (22.5 in)
Maximum Weight	42.18kg (93 lbs)
Environmental (Operating)	
Temperature	50°F to 104°F (10°C to 40°C)
Relative Humidity	20% to 80% noncondensing
Altitude	100 feet (30.5 meters) below sea level to 9,840 feet (3,000 meters)
Shock	10g, 11 ms half sine
Vibration	Random vibration to specified power spectral density
Heat Output	Expansion module: 444 W (1,517 BTU/hr.)
Environmental (Non-Operating)	
Temperature (Storage)	14°F to 122°F (–10°C to 50°C)
Temperature (Transit)	–4°F to 140°F (–10°C to 45°C)
Humidity (Storage)	10% - 90%, Max Dew Point is 26° C (79° F), 10% per hour Gradient
Humidity (Transit)	5% - 95%, Max Dew Point is 26° C (79° F), 10% per hour Gradient
Altitude	100 feet (30.5 meters) below sea level to 9,840 feet (3,000 meters)
Shock	20 G, 8.0 m/s square wave in each direction along x, y, and z axis
Vibration	.5 G, 5 to 150 to 5 Hz sinusoidal
Power Requirements	
AC Power	50/60 Hz, 3.90 A max. operating @ 115 VAC, 2.06A max. operating @ 230 VAX (90 to 264 VAC range)
DC Power	17 A max. operating (-36 to -72 V DC Range)
Standards Compliance	
Safety and Emissions	IEC 60950, EN 60950, UL/CSA 60950, FCC Part 15 (47CFR15B), CISPR 22 (EN55022 — RF Radiated and Conducted Emissions), IEC 61000-3-2, IEC 61000-3-3
Immunity	CISPR 24 (EN55024), IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-11

System Requirements

Supported Operating System

- Solaris™ Operating System 10
- Microsoft Windows 2008 Standard Server, Enterprise Server, Web and Core Editions SP2, Hyper-V
- Microsoft Windows 2003 Server Standard, Enterprise Editions
- HP-UX 11.23, 11.31
- IBM AIX 5.3, 6.1
- Red Hat Linux Enterprise edition v. 4U7, v. 5U3
- SUSE Linux v10 SP2, SLES 11
- VMWare ESX 3.4U4, 4.0

Sun Storage Interop Tool

The Sun Storage 6180 array is fully supported with major host operating systems and multi-path drivers. For details, please refer to Sun Storage Interop Tool at:

https://interop.central.sun.com/interop/interop

Supported Sun Software

- Legato NetWorker v. 7.3
- Sun Cluster v. 3.0, 3.1
- Sun StorageTek QFS v. 4.0 min.
- Sun StorageTek SAM-FS v. 4.0 min.
- Sun StorageTek Availability Suite v. 3.2 min.
- Sun StorageTek Enterprise Backup v. 7.3
- Solstice DiskSuite 4.2.1 (in conjunction with the Solaris 8 OS)
- Solaris Volume Manager Embedded in the Solaris 9 and 10 Oss
- VERITAS Storage Foundation (VxVM/VxFS) v. 5.0
- VERITAS Cluster Server (VCS) v. 5.0
- VERITAS NetBackup v. 6.0 or higher

System Configuration and Management

Sun StorageTek Common Array Manager

Sun StorageTek Common Array Manager software for the Sun Storage 6180 array provides a powerful, yet easy to use, Java™ platform based GUI for administering the Sun Storage 6180 arrays. Sun StorageTek Common Array Manager software enables online administration, a consistent interface across all operating systems, and the ability to monitor and manage one or all Sun Storage 6180 arrays from any location on the network.

Centralized Administration

Sun StorageTek Common Array Manager software enables all Sun Storage 6180 arrays to be managed from a single interface at one or more locations on the network. Its browser user interface (BUI) provides a comprehensive view of all storage systems in the management domain. From the BUI, new storage systems can be manually or automatically detected and added. Each storage system is managed through a Storage Window. The console is specific to an individual storage system, however multiple Storage Windows can be launched from the Array Summary Window to simultaneously manage multiple storage systems.

Array Summary Window

The Array Summary Window is a browser based GUI used to configure and maintain the Sun Storage 6180 arrays. The Array Summary Window allows auto discovery and manual registration of the different Sun Storage 6180 arrays. In additional, it displays detailed information for the array, such as: name, health, type, firmware version, total capacity, available capacity, and network address.

Storage Window

The Storage Window displays the application-oriented storage profiles, logical components (volumes and virtual disk, pools, and data services), and physical components (initiators, host groups, hosts, trays, and drives) for each Sun Storage 6180 array. All storage management operations for a selected storage system or for selected components within a storage system are launched from the appropriate Storage Window menu.

Diagnostics

The Sun StorageTek Common Array Manager software offers proactive health checking, intelligent diagnosis, fault isolation event notification, and fault management reporting for the Sun Storage 6180 array from a single management console. This software helps improve recoverability and increase infrastructure uptime, thus contributing to overall improved application service levels. More specifically, it provides the following functionality:

- Collects health, configuration, and other non-customer-related data

- Evaluates statistical error reports

- Notifies designated parties about events, when action is required

- Step-by-step instructions to add expansion trays to the Sun Storage 6180 array

- Monitors host message files for errors in order to obtain status information about the Sun Storage 6180 arrays

- Makes decisions on actionable service issues

- Troubleshooting and fault isolation of the Sun Storage 6180 array

- Provides mechanisms for service personnel to remotely access the system to gather additional data, perform maintenance, perform upgrades, and invoke diagnostics

- Guides service personnel through FRU isolation, replacement, and validation

- Device revision checking for firmware of the Sun Storage 6180 array

Management Host System Requirements

The external management host where the management software resides has the following system requirements:

- Platform: SPARC server or workstation

- Operating system: Solaris 10

- Disk space: 500 Mbytes (includes 300 MB in the `/opt` directory and 200 MB in the `/var` directory)

- Minimum system memory (two arrays, two users): 512 MB

- Recommended system memory: 1 GB

- Client memory: 256 KB

Supported browsers:

- Netscape Navigator 7.0

- Microsoft Internet Explorer 5.0

- Mozilla 1.2.1

Ordering Information

Ordering information and part numbers for the Sun Storage 6180 are provided in this section. Also, more detailed instructions for using WebDesk can be found in the Sun Storage 6180 Quick Start Guide (SunWin #570702).

Shipping Configurations

- 6180 Controller tray (1 x 1) includes the following:

    - Dual FC RAID controller card with 4GB of cache

    - Four or Eight shortwave SFPs for host connections

        - Minimum of 5 drives per tray, maximum of 16 drives per tray

        - FC 4 Gb/s hard disk drives: 300 GB 15K RPM, 450 GB 15K RPM, 600 GB 15K RPM*

        - SATA-II 3 Gb/s hard disk drives: 500 GB 7.2K RPM, 1 TB 7.2K RPM, 2 TB 7.2K RPM*

    - Two 5-meter LC-LC Fibre Channel cables

    - Two (2) 6-meter RJ45-RJ45 Ethernet cables

    - Two (2) 2-meter 6-Pin MiniDin to RJ45 serial cables

    - Sun Storage 6180 Getting Started Guide

    - Please note: a server required to host Common Array Management software and the cables needed to connect the management server to the 6180 controller are not included.

- CSM200 Expansion trays (0 x 1) includes the following:

    - Dual I/O modules per tray

    - Two 2-meter optical interconnect cables

    - Minimum of 5 drives per tray, maximum of 16 drives per tray

      - FC 4 Gb/s hard disk drives: 300GB 15K RPM, 450GB 15K RPM, 600GB 15K RPM*

      - SATA-II 3 Gb/s hard disk drives: 500GB 7.2K RPM, 1 TB 7.2K RPM, 2TB 7.2K**

    - Diskless trays available with 6 disk drive minimum purchase

- Available as rack ready configurations

- Optional Rack Rail Kits based on rack (please see part numbers below)

- Optional Premium Feature Software:

  - Sun Storage Storage Domain Right-to-Use and Upgrade Licenses

  - Sun Storage Local Coy Right-to-Use Licenses

  - Sun Storage Data Replicator Software Right-to-Use License

Marketing Part Numbering Scheme

Example part number = TB6180R11A2-0

X = X-option or no X for factory configured

T = Storage family product

B = Product Versions: A — Sun Storage 6180 array with 8 Host Ports
                                             B — Sun Storage 6180 array with 4 Host Ports

6180 = Product class/model number: 6180 — Sun Storage 6180 array

R = System packaging: R — Rack ready (with shipping box)

11 = Quantity of control tray/array group, where first digit is the total number of control trays in an array group, second digit is the total number of trays in an array group:

> 01 = 0x1 or 0 controller tray, 1 expansion tray — 1 tray total
>
> 11 = 1x1 or an array with 1 total tray — 1 controller tray, 0 expansion trays
>
> 12 = 1x2 or an array with 2 total trays — 1 controller tray, 1 expansion trays
>
> 13 = 1x3 or an array with 3 total trays — 1 controller tray, 2 expansion trays
>
> 14 = 1x4 or an array with 4 total trays — 1 controller tray, 3 expansion trays
>
> 15 = 1x5 or an array with 5 total trays — 1 controller tray, 4 expansion trays
>
> 16 = 1x6 or an array with 6 total trays — 1 controller tray, 5 expansion trays
>
> 17 = 1x7 or an array with 7 total trays — 1 controller tray, 6 expansion trays

A = Power source: A — AC; D — DC

2 = Quantity of controller boards per controller tray

– = Hard disk drive types: - = diskless chassis
                                    A = 500 GB 7200 rpm, 3 Gb/s, SATA-II drive

                                    C = 146 GB 15,000 rpm, 4 Gb/s, FC-AL drive

                                    J = 300 GB 15,000 rpm, 4 Gb/s, FC-AL drive

                                    K = 600 GB 15,000 rpm, 4 Gb/s, FC-AL drive (available Dec. 2009)

                                    N = 1 TB 7,200 rpm, 3 Gb/s, SATA-II drive
                                    P = 450 GB 15,000 rpm, 4Gb/s , FC-AL drive

                                    T= 2 TB 7,200 rpm, 3 Gb/s, SATA-II drive(available Nov., 2009)

0 = RAW, UNFORMATTED capacity in GB unless otherwise noted:

                      0 = diskless chassis, no capacity

                      1500 = 1500 GB raw capacity

                      16TB = 16 TB raw capacity

Configuration Matrix / Marketing Part Numbers

Ordering Details and Marketing Part Numbers

Orders for the Sun Storage 6180 arrays must be placed through Web Desk Configurator.

1. Select from pre-built Sun Storage 6180 configuration or diskless chassis (minimum 5 disk drive purchase required)

2. Select additional CSM200 expansion trays (Optional)

3. Select Premium Feature Software (Optional)

4. Select rack rails (if needed)

5. Select Additional Options

6. Select Sun Services including Warranties and Installation

All 6180 and CSM200 components rack ready for installation in an existing rack. Must be racked and cabled in the field.

Step 1: Choose Option 1 or 2 below:

Option 1: Pre-Built X-Option Rack Ready Storage 6180 Configuration

Marketing Part Number	Description
Sun Storage 6180 array — 4 GB cache controller trays with 8 Host Ports, 1x1 — X-option rack-ready with 16 drives per tray	
XTA6180R11A2J4800	RoHS-5, Sun Storage 6180 system with 4GB cache and 8 host ports, Rack-Ready Controller Tray, 4800GB, 16 * 300GB 15Krpm 4 Gb/s FC-AL Drives, 2 * 2 GB-cache memory FC RAID Controller cards, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansion trays and 8 * 8 Gb/s FC host ports with shortwave SFPs, 2 * 5M fibre optic cables, 2 * 6M ethernet cables and management software, 3 yr on-site warranty included (Standard Configuration)*

* Please note: XTA6180R11A2J4800 revenue release 11/10/09

Option 2: Rack Ready Storage 6180 Diskless Chassis

Marketing Part Number	Description
Sun Storage 6180 array — Sun Storage 6180 diskless chassis with 4 GB cache, 4 host ports or 8 Host Ports and AC or DC Power	
TB6180R11A2-0	RoHS-5, Sun Storage 6180 array with 4GB cache and 4 *FC host ports, Rack-Ready Controller Tray - Diskless Chassis, 0GB, 0 drives; Includes: 2 * 2GB-cache memory FC RAID Controller cards, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansion trays and 4 * 8 Gb/s host ports with shortwave SFPs, 2 * 5M fibre optic cables, 2 * 6M ethernet cables and management software, 3 yr on-site warranty included (For factory integration only)
TA6180R11A2-0	RoHS-5, Sun Storage 6180 array with 4GB cache and 8 * FC host ports, Rack-Ready Controller Tray - Diskless Chassis, 0GB, 0 drives; Includes: 2 * 2GB-cache memory FC RAID Controller cards, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansion trays and 8 * 8 Gb/s host ports with shortwave SFPs, 2 * 5M fibre optic cables, 2 * 6M ethernet cables and management software, 3 yr on-site warranty included (For factory integration only)

Marketing Part Number	Description
TB6180R11D2-0	RoHS-5, Sun Storage 6180 array with 4GB cache and 4 * FC host ports, Rack-Ready Controller Tray - Diskless Chassis, 0GB, 0 drives; Includes: 2 * 2GB-cache memory FC RAID Controller cards, 2 * redundant DC power supplies and cooling fans, 2 * FC ports for expansion trays and 4 * 8 Gb/s host ports with shortwave SFPs, 2 * 5M fibre optic cables, 2 * 6M ethernet cables and management software, 3 yr on-site warranty included (For factory integration only)
TA6180R11A2-0	RoHS-5, Sun Storage 6180 array with 4GB cache and 8 * FC host ports, Rack-Ready Controller Tray - Diskless Chassis, 0GB, 0 drives; Includes: 2 * 2GB-cache memory FC RAID Controller cards, 2 * redundant DC power supplies and cooling fans, 2 * FC ports for expansion trays and 8 * 8 Gb/s host ports with shortwave SFPs, 2 * 5M fibre optic cables, 2 * 6M ethernet cables and management software, 3 yr on-site warranty included (For factory integration only)

Must purchase a minimum of 5 Hard Disk Drives with each Diskless Chassis

Marketing Part Number	Description
Sun Storage 6180 array — Sun Storage 6180 diskless chassis with 4 GB cache, 4 host ports or 8 Host Ports and AC or DC Power	
XTC-FC1CF-146G15K	RoHS-6 compliant, 146 GB 15K RPM FC-AL drive
XTC-FC1CF-300G15K	RoHS-6 compliant, 300 GB 15K RPM FC-AL drive
XTC-FC1CF-450G15K	RoHS-6 compliant, 450 GB 15K RPM FC-AL drive
XTC-FC1CF-600G15K	RoHS-6 compliant, 600 GB 15K RPM FC-AL drive (available December, 2009)
XTC-ST1CF-500G7K	RoHS-6 compliant, 500 GB 7.2K RPM SATA drive
XTC-ST1CF-1TB7KZ	RoHS-6 compliant, 1 TB 7.2K RPM SATA drive
XTC-ST1CF-2TB7KZ	RoHS-6 compliant, 2 TB 7.2K RPM SATA drive (available November, 2009)

Step 2: Rack Ready CSM200 Expansion Trays

Marketing Part Number	Description
X-Option CSM200 Expansion Trays — Rack-Ready with 5 drives per tray (minimum configurations). Maximum 6 CSM200 Expansion Trays per 6180 Controller Tray with 8 host ports and 3 CSM200 Expansion Trays with 6180 Controller Tray with 4 Host Ports. Need to order appropriate Rack Rail Kit. Quantity 1 per tray. See Rack Ready – Additional Options section for part numbers.	
XTCCSM2R01D0C730Z	RoHS-5, Sun StorageTek (tm) CSM200, Rack-Ready Expansion Tray, 730GB, 5 * 146GB 15Krpm 4Gb FC-AL Drives, 2 * I/O Modules, 2 * redundant DC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with LC-LC FC cables.
XTCCSM2R01A0A2500Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 2500GB, 5 * 500GB 7.2Krpm SATA-II Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables.
XTCCSM2R01D0J1500Z	RoHS-5, Sun StorageTek (tm) CSM200, Rack-Ready Expansion Tray, 1500GB, 5 * 300GB 15Krpm 4Gb FC-AL Drives, 2 * I/O Modules, 2 * redundant DC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with LC-LC FC cables.

Marketing Part Number	Description
X-Option CSM200 Expansion Trays — Rack-Ready with 5 drives per tray (minimum configurations). Maximum 6 CSM200 Expansion Trays per 6180 Controller Tray with 8 host ports and 3 CSM200 Expansion Trays with 6180 Controller Tray with 4 Host Ports. Need to order appropriate Rack Rail Kit. Quantity 1 per tray. See Rack Ready – Additional Options section for part numbers.	
XTCCSM2R01A0L3750Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 3750GB, 5 * 750GB 7.2Krpm SATA-II Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables.
XTCCSM2R01A0N5000Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 5TB, 5 * 1TB 7.2Krpm SATA-II Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables.
XTCCSM2R01A0P2250	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 2250GB, 5 * 450GB 15Krpm 4Gb FC-AL Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 2 * shortwave SFPs with LC-LC FC cables.
X-Option CSM200 Expansion Trays — Rack-Ready with 16 drives per tray (minimum configurations). Maximum 6 CSM200 Expansion Trays per 6180 Controller Tray with 8 host ports and 3 CSM200 Expansion Trays with 6180 Controller Tray with 4 Host Ports. Need to order appropriate Rack Rail Kit. Quantity 1 per tray. See Rack Ready – Additional Options section for part numbers.	
XTCCSM2R01A0C2336Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 2336GB, 16 * 146GB 15Krpm 4Gb FC-AL Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables. (Standard Configuration)
XTCCSM2R01A0A8000Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 8000GB, 16 * 500GB 7.2Krpm SATA-II Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables. (Standard Configuration)
XTCCSM2R01A0J4800Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 4800GB, 16 * 300GB 15Krpm 4Gb FC-AL Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables. (Standard Configuration)
XTCCSM2R01A0L12TBZ	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 12TB,16 * 750GB 7.2Krpm SATA-II Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables. (Standard Configuration)
XTCCSM2R01A0N16TBZ	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 16TB,16 * 1TB 7.2Krpm SATA-II Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables. (Standard Configuration)
XTCCSM2R01A0P7200	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray, 16TB,16 * 450 GB 15Krpm 4Gb FC-AL Drives, 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables. (Standard Configuration)

Expansion trays with custom number of drives can be built using the following parts. Drives will be integrated into the expansion tray at the factory but the expansion tray will have to racked and cabled in the field. Minimum of 5 drives is required. Mixing drive types in a tray is not factory configurable but can accomplished in the field.

Rack Ready Diskless CSM200 Trays with customizable Drive Options

Marketing Part Number	Description
CSM200 Diskless Expansion Trays, 0 x 1 — Rack-Ready expansion trays with custom number of drives can built using the below part numbers. Need to order appropriate Rack Rail Kit. Quantity 1 per tray. See Rack Ready – Additional Options section for part numbers.	
TCCSM2M01A0-0Z	RoHS-5, Sun Storage (tm) CSM200, Rack-Ready Expansion Tray - Diskless Chassis, 0GB, 0 drives; must order minimum 6 drives. Includes: 2 * I/O Modules, 2 * redundant AC power supplies and cooling fans, 2 * FC ports for expansions, 4 * shortwave SFPs with 2* 2M LC-LC FC cables.
Drives for diskless chassis — rack ready. Drives will be integrated into the expansion tray at the factory but the expansion try will have to be racked and cabled in the field. Minimum of 6 drives are required with every CSM 200 Diskless Expansion Tray. Mixing drive types in a tray is not factory configurable but can be accomplished in the field.	
TC-FC1CF-146G15KZ	RoHS-6, Sun Storage (tm) 6140 array /CSM200, 146GB 10Krpm FC-AL drive (For factory integration only)
TC-ST1CF-500G7KZ	RoHS-6, Sun StorageTek (tm) 6140 array / CSM200, 500GB 7.2Krpm SATA drive (For factory integration only)
TC-FC1CF-300G15KZ	RoHS-6, Sun Storage (tm) 6140 array / CSM200, 300GB 15Krpm FC-AL drive (For factory integration only)
TC-ST1CF-750G7KZ	RoHS-6, Sun Storage (tm) 6140 array / CSM200, 750GB 7.2Krpm SATA drive (For factory integration only)
TC-ST1CF-1TB7KZ	RoHS-6, Sun Storage (tm) 6140 array / CSM200, 1TB 7Krpm SATA drive (For factory integration only)
TC-FC1CF-450G15K	RoHS-6, Sun Storage (tm) 6140 array / CSM200, 450GB 15Krpm FC-AL drive (For factory integration only)

Step 3: Premium Feature Software

Marketing Part Number	Description
Sun Storage 6180 array — Premium Feature Software	
XTCTIER1-BASE8	Recommended base quantity 8 Domain right-to-use (RTU)license key
XTCTIER1-UG128	128 Domain right-to-use (RTU) upgrade license key. Base quantity must be purchase in conjunction or prior to the purchase of the upgrade license.
XTCTIER1-CPY	Local copy services (snapshot & volume copy). The key enables 8 snapshots per volume (512 total), and 1023 total volume copies.
XTCTIER1-REPL	Sun Storage Data Replicator software right-to-use (RTU) license key. Key enables 64 replication pairs.

Step 4: Rack Rail Kits (as needed)

Marketing Part Number	Description
Sun Storage Rack Rail Kits – Order 1 Rack Rail Kit per controller tray and/or expansion tray. Rack Rail Kit based on tray type and rack the tray will be mounted in	
XTA6x80CTRL-RK2-RL	Sun Modular Storage Rail Rack Kit. For use with Storage 6180 Controller in Sun Rack II (1242 or 1042). 1 * rack rail kit needed per controller tray. Each rail kit includes 2 rack rails, 4*screws and installation guide.
XTA6000-RK2-RL	Sun Modular Storage Rail Rack Kit. For use with CSM200 Expansion Tray in Sun Rack II (1242 or 1042). 1 * rack rail kit needed per controller tray. Each rail kit includes 2 rack rails, 4*screws and installation guide.
XTCCSM2-RK-19UZ	Sun Modular Storage Rail Rack Kit – For use with Storage 6180 Controller Tray or CSM200 expansion trays in Sun Rack 900/1000, F40 Racks or non-Sun Racks

Step 5: Additional Options (as needed)

Marketing Part Number	Description	Category
Sun Storage Rak		
SG-XPCIE1FC-QF8	Sun StorageTek 8 Gb FC PCIe Host Bus Adapter, Single Port Includes Standard and Low Profile Brackets, Low Profile Form Factor, QLogic, RoHS-6 Compliant	Networking I/O Connectivity
SG-XPCIE1FC-EM8	Sun StorageTek 8 Gb FC PCIe Host Bus Adapter, Single Port Includes Standard and Low Profile Brackets, Low Profile Form Factor, Emulex, RoHS-6 Compliant	
SG-XPCIE2FC-QF8	Sun StorageTek 8 Gb FC PCIe Host Bus Adapter, Dual Port Includes Standard and Low Profile Brackets, Low Profile Form Factor, QLogic, RoHS-6 Compliant	
SG-XPCIE2FC-EM8	Sun StorageTek 8 Gb FC PCIe Host Bus Adapter, Dual Port Includes Standard and Low Profile Brackets, Low Profile Form Factor, Emulex, RoHS-6 Compliant	
XTB6180-2G2PCTL-FC	Sun Storage 6180 system, Fibre Channel RAID Controller with 2GB cache & 4*8Gb/s Host Ports. Please purchase qty 2.	Sun Storage 6180 Array Upgrade Controller Kits
XTA6180-2G4PCTL-FC	Sun Storage 6180 system, Fibre Channel RAID Controller with 2GB cache & 2*8Gb/s Host Ports. Please purchase qty. 2. Customer can only upgrade to a 6180-4 port-4GB array from a 6140-4 port-2GB array using this part. For a 6140-8port-4GB array, please use XTA6180-2G4PCTL-FC for upgrading to 6180	

Optional — Sun Services

The Sun Storage 6180 arrays are available with optional, but highly recommended, enhanced services packages, which allow organizations to rapidly implement complex data storage environments. These extended service packages help ensure the use of sound storage installation and configuration practices, thereby allowing Sun to implement the support infrastructure that is required to maintain the most demanding enterprise and data center environments.

Recommended services available for the Sun Storage 6180 arrays are shown in the table below.

Installation Service	Marketing Part Number
Sun Storage Array Installation, base charge for the Sun Storage 6180 array/CSM200, 3U Tel	EIS-ARRAY
Sun Storage Tray Installation, per tray charge for Sun Storage 6180 array	EIS-ARRAY-TRAY
Sun Storage Array Installation, after hours base charge for the Sun Storage 6180 array	EIS-ARRAY-AH
Sun Storage Tray Installation, after hours per tray charge for the Sun Storage 6180 array	EIS-ARRAY-TRAY-AH
Various storage services are offered by Sun Professional Services (SunPS℠)	Available now, please refer to the following URL for more details: *http://sunps.central/services/storage/index.html*

SunSpectrumSM Instant Upgrades (Warranty Upgrades)

The SunSpectrumSM program is a service offering that allows customers to choose the level of service best suited to their needs. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris Operating System, and telephone support for Sun software packages. Customers should check with their local Sun Services representative for program and feature availability in their areas.

For information specific to the Sun Storage 6180 aray, refer to:

http://www.sun.com/service/support/products/storage/

The four levels of SunSpectrum support contracts range from SunSpectrum BronzeSM level to SunSpectrum PlatinumSM level. Contact a Sun Services representative for further details. The following part numbers can be used to upgrade system warranty to the given level of SunSpectrum service for each specified product:

Part Numbers	Service
IWU-61804G4P-1G	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 1 year of Gold support.
IWU-61804G4P-2G	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 2 year of Gold support.
IWU-61804G4P-3G	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 3 year of Gold support.
IWU-61804G4P-1P	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 1 year of Platinum support.
IWU-61804G4P-2P	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 2 years of Platinum support.
IWU-61804G4P-3P	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 3 years of Platinum support.
IWU-61804G4P-1S	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 1 year of Silver support.
IWU-61804G4P-2S	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 2 year of Silver support.
IWU-61804G4P-3S	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 3 year of Silver support.
IWU-61804G4P-24-1G	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 1 year of Gold 7x24 support.

Part Numbers	Service
IWU-61804G4P-24-2G	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 2 years of Gold 7x24 support.
IWU-61804G4P-24-3G	Sun Storage 6180 array 4 GB cache, 4 host port dual controller tray upgrade to 3 years of Gold 7x24 support.
IWU-61804G8P-1G	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 1 year of Gold support.
IWU-61804G8P-2G	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 2 year of Gold support.
IWU-61804G8P-3G	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 3 year of Gold support.
IWU-61804G8P-1P	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 1 year of Platinum support.
IWU-61804G8P-2P	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 2 years of Platinum support.
IWU-61804G8P-3P	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 3 years of Platinum support.
IWU-61804G8P-1S	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 1 year of Silver support.
IWU-61804G8P-2S	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 2 year of Silver support.
IWU-61804G8P-3S	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 3 year of Silver support.
IWU-61804G8P-24-1G	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 1 year of Gold 7x24 support.
IWU-61804G8P-24-2G	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 2 years of Gold 7x24 support.
IWU-61804G8P-24-3G	Sun Storage 6180 array 4 GB cache, 8 host port dual controller tray upgrade to 3 years of Gold 7x24 support.

Upgrades

Customer Loyalty Investment Protection Program

The Sun Storage Modular Disk family, with its modular architecture, improves the overall reliability of the customer's installation through a reduced component count and minimal footprint without sacrificing scalability. This "pay-as-you-grow" modularity allows for just-in-time purchases that track market prices providing an affordable entry point and unparalleled investment protection through the migration or re-deployment of existing Sun Modular Disk family equipment.

With tight budgets and limited resources, the ability to provide increased performance, better optimization and improved manageability offered by newer systems, while easily re-utilizing existing legacy equipment currently on the floor, is a major cost savings for our customers. Furthermore, Licenses for Premium Features (Snapshot, Volume Copy, Replications and Storage Domains) can be moved forward for a minimal fee during a system upgrade.

Customers can protect their investment in Sun Storage storage by trading up to a Sun Storage 6180 array. Customers can trade-in Sun Storage 6140 arrays and/or other legacy Sun Storage Arrays on a one for one basis or Non Sun storage systems can also be traded-in.

Trade-ins to the Sun Storage 6180 array are available as controller tray or full system swaps through the Sun Upgrade Advantage Program. Please note, currently only CSM200 expansion trays can migrate to a Sun Storage 6180 array.   Sun handles the disposition of older assets for the customer at no charge. Please order one RMA Kit (part number UG-RMA) for one for one trade-ins. When consolidating, order one RMA Kit (part number CU-CONSOL-RMA) when multiple systems are to be traded-in. RMA kits provide customers instructions on where to return the used residual equipment.

The array to be traded-in must be owned by, used by, and in the possession of the customer at least (90) days prior to trading-in. To qualify for the trade-in allowance, the customer must return within 90 days, a fully functional system with all drives. If trade-in is not returned within 90 days, Sun can bill back and customer agrees to pay promptly the full amount of the trade-in allowance. No credit or return of trade-in equipment is allowed after expiration of 90 days. For customers who want to use the online returns Web tool or are requesting pickup of traded equipment must do so before their return date. More information on Sun returns can be found at: *www.sun.com/ibb/upgrades/sunreturns.html.*

For additional help on upgrades, IBB representatives are trained and ready to assist:

http://ibb.eng/org/ or send an email to ibbrvalues@sun.com.

Resources:

- Internal IBB Upgrades Home Page: ibb.eng/upgrades
- To find your local IBB sales representative:http://ibb.eng/org/
- External IBB Upgrades Home Page: www.sun.com/ibb/upgrades
  - Storage Consolidation Calculator: http://ibb.eng/
    This tool helps calculate what is to be traded-in and what is to be purchased and provides a trade-in allowance code.
  - Sun Returns: www.sun.com/ibb/upgrades/sunreturns.html.

6180 Upgrade Controller Kits

Customers can also upgrade from a Sun Storage 6140 to a Sun Storage 6180 by swapping out the FC Controllers using a 6180 Upgrade Controller Kit. There are two caveats to note with these upgrades:

1) Customers using this method will not receive a new 3 year warranty. The warranty purchased with their 6140 will stay intact. For example, a customer has 1 year left on the 3 year warranty provided with their 6140 controller tray and upgrades their FC RAID controllers. Although they have now upgraded to a 6180, the customer still only has 1 year left on their warranty.

2) A customer may not upgrade from a 6140 4GB Cache/8 Host Port configuration to a 6180 4GB Cache/4 Host Port configuration. See chart below for relevant part numbers for each upgrade. For each part number a quantity of 2 will be needed for upgrade.

	6180 4 GB - Host Ports	6180 4GB – 8 Host Ports
6140 2GB – 4 Host Ports	XTB6180-2G2PCTL-FC	XTA6180-2G4PCTL-FC
6140 4GB – 8 Host Ports	N/A	XTA6180-2G4PCTL-FC

Service and Support

SunSpectrum

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris Operating System, and telephone support for Sun software packages. Customers should check with their local Sun Services representatives for program and feature availability in their areas.

SunSpectrum program support contracts are available both during and after the warranty program. Customers can choose to uplift the service and support agreement to meet their business needs by purchasing a SunSpectrum contract. For more information on the SunSpectrum program offerings refer to the following URL: *http://service.central/TS/ESP/SunSpectrum/Feature_Matrix/index.html*.

The four levels of SunSpectrum support contracts are outlined below.

Program	Description
Mission-Critical SunSpectrum Platinum℠ Support	Designed for mission-critical storage systems, the Platinum Service Plan provides complete 24x7 coverage, our highest priority response, interoperability assistance, and additional specialized services to help customers proactively maintain high availability.
Business-Critical SunSpectrum Gold℠ Support	Key storage systems need to be available. With SunSpectrum Gold, customers receive business-critical support that includes extended hardware service coverage hours and interoperability assistance. Telephone support is provided 24x7. On-site support is provided from 8 a.m. To 8 p.m. Mon. through Fri. with 4 hour response.
System Coverage SunSpectrum Silver℠ Support	For basic support at a great value, SunSpectrum Silver is the answer. Customers get all of the essentials, including hardware service coverage during normal business hours.
Self-Directed SunSpectrum Bronze℠ Support	Provided for customers who rely primarily upon their own in-house service capabilities. Allows customers to deliver high quality service by giving them access to UNIX® expertise, Sun certified replacement parts, software releases and technical tools. Support is provided 8 a.m. to 5 p.m. Mon. through Fri.

For information specific to the Sun Storage 6000 array models, refer to:

http://www.sun.com/service/storageplans/

Sun Data Protection Services, Data Erasure

The volumes of data collected in any business contain bits and pieces of valuable knowledge. When those bits and pieces are put in context, they are transformed into highly productive information. This becomes the professional wisdom that can be used to create strategic competitive advantages. Obviously, it is critical to have a retention policy in place to safeguard the information that keeps you competitive. Government regulations also mandate the retention of certain data. Yet, the retention of data beyond its useful purpose or required time frames can increase exposure to security breaches, posing serious financial and punitive implications. Cases of both personal and company liability have garnered public attention. Therefore, it's also critical to marry any data retention policy with a data destruction policy. In fact, some governments now mandate data destruction and are beginning to implement audit cycles to verify compliance. Holding on to data that is not critical to your competitiveness is no longer an option.

The longer you keep data after it has outlived its purpose, the more exposure you have to data loss and unforeseen compromise. And data that has passed its mandated retention period could put you and your company at risk—it's important that it is efficiently destroyed.

Data security guidelines are also driving corporations worldwide to protect customer data when equipment is being removed from active use or redeployed. Regulators want to make sure that when assets are retired, the data doesn't get into the wrong hands if it somehow still lingers on the disk device. The Sun Data Protection Services, Data Erasure offering gives you the opportunity to demonstrate proactive planning when replacing old technology, repairing current assets, or redeploying equipment for use by other datacenters or applications. Erasing data protects you from security breaches during a move, cleans and prepares assets for re-use, and contributes to an eco-minded solution for meeting the challenges of a changing or expanding datacenter.

A service that keeps you in control at all times fits well within most internal data destruction policies. Sun Data Protection Services, Data Erasure is software-enabled data eradication, delivered at your site by Sun-badged system engineers. Our tested solution erases to standards as stringent as the U.S. Department of Defense's Directive 5220—22M, overwriting data three times directly to the hard disk platter surface, including remapped sectors. Upon completion, Sun provides you with detailed audit reports that demonstrate compliance with both your internal data security processes and external regulatory guidelines.

Plus, our erasure process has been tested and standardized globally. In fact, Sun uses this process as part of its own data destruction policy. Sun's Chief Data Strategy and Privacy Officer believes that adding an audit-ready data erasure solution to an organization's strategic plan is essential in today's competitive landscape. That means you can employ the same trusted company and process at sites worldwide, allowing you to build, document, and demonstrate a strong, uniform destruction policy. And you can validate full chain of control of your data assets because Sun's service is performed at your site— meaning you have tighter control over your assets containing sensitive corporate or customer data.

Sun offers systems, software, and solutions for managing complex data environments and complying with numerous government and corporate regulations. Sun's integrated, tiered storage solutions are designed to respond to the emerging regulatory environment and customer data requirements for information retention, identity management, and security, while at the same time helping reduce IT cost and complexity. From the desktop application to the back-end archive, Sun customers benefit from total systems leadership and the experience that comes with more than 25 years as a systems vendor. Sun delivers an effective and economical infrastructure to enable you to manage data from creation to deletion.

To learn more about Sun Data Protection Services, Data Erasure, contact your Sun sales representative or authorized reseller or visit sun.com/service/sdps/dataerasure.

Warranty

The following table indicates warranty details for the Sun Storage 6180 array:

Repair Support Duration	Software Support Duration	Phone Coverage		Hardware Coverage		
		Hours of Coverage	Call-Back Response Time	Hours of Coverage	Response Time[1]	Delivery Method
3 years	90 days	8 a.m – 8 p.m.	Customer-defined priority (4 hr, 8 hr, NBD)	Local business hours, M-F, 8 a.m. - 5 p.m.	• Next Business Day • 8 Business Hours	On-site

For the latest warranty information for the Sun Storage 6180 array, refer to:

http://www.sun.com/service/warranty/network.html

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[1] Average response times may vary by country.

Education

For further information on courses visit Sun Ed Web at `http://www.sun.com/service/suned`, or to order, call: 1-800-422-8020.

Sun Enterprise Services

Sun Enterprise Services provides first call support and escalates to Sun Storage DMG Global Services. Services offered through Sun Enterprise Services are:

- Sun Installation Services — provides installation and limited implementation of Sun Storage 6180 array
  - Site audit
  - Installation planning
  - System installation specification
  - Statement of installation
  - Installation and customization of Sun hardware and software
  - Installation verification
  - System turnover
- Sun Integration Services
  - Project management
  - Requirements validation
  - Solution design validation
  - Build specification report creation
  - Test plan development and execution
  - Documentation
  - Knowledge transfer
- Sun Storage Consolidation Services
  - TCO review services
  - SAN assessment, architecture, and implementation
  - Hardware and software installation
  - Storage migration services
  - Education services
  - Support service

Professional Services

Sun Client Solutions is updating existing Storage Migration, Backup and Recovery, SAN, and Point-in-Time Copy Services to include support for Sun Storage 6180 array. A fixed price Sun Storage 6180 Array Implementation service is not being released for this product.

Point-In-Time Copy Services

This service delivers a customized unassisted backup and recovery solution for the Oracle RDBMS Instances installed on a specific set of servers. This service includes assessment of a customer's business and Service Level Agreements (SLA) requirements; current architecture study of existing storage, backup strategies, and system availability to determine an appropriate archival solution utilizing existing hardware whenever possible; and design and implementation of a Automated Point In Time BackUp Logistics and Logic solution.

SAN Architecture and Implementation

This service complements the Sun Storage Array Architecture and Implementation Service that addresses directly attached storage configurations.

The objective of the service is to facilitate the use of Sun Storage products in a SAN environment. While some solutions may include non-Sun branded products, one Sun server and one Sun Storage array must be included in the proposed solution.

Storage Migration Service

This service can help customers safely transfer data from one storage system to another storage system, without pulling their internal resources from other critical business tasks. This service also assists the customer to take advantage of the unique heterogeneous support provided by this new generation Sun Storage 6180 array. For most current pricing check the current Sun Pricebook or contact your local Sun Service Sales representative.

Backup and Restore Services

Assessment — The Backup and Restore Assessment service delivers an assessment of an existing Sun StorageTek Enterprise NetBackup or Solstice Backup environment. The assessment is to help ensure that the existing configuration and operational environment meets customer requirements. It reveals weaknesses or shortcomings in the areas of server/client configurations. Additionally, it reviews the historical operations of the backup and restore environment to help ensure problems are not reoccurring. The service reviews the system management processes and personnel to help ensure operational continuity of the environment.

Architecture — Sun's Backup and Restore Architecture service develops an open architecture for backup and restore that meets the customer's needs and fits their computing environment. This architecture service becomes a foundation for implementing a comprehensive backup and restore solution.

Consulting Services

Sun Client Services offers multiple levels of consulting services to ensure a smooth data migration from other storage products to the Sun Storage 6180 array. Sun Client Services offers a wide range of data management and migration services to accommodate most customer environments and circumstances. Contact local Sun Client Services for further details and quotation for the specific customer environment.

Sun also offers a wide variety of consultative services that can help the customer architect their Sun Storage 6180 array into existing storage infrastructures. These services are generally custom-priced engagements that can assist with the design and implementation of larger storage architectures. These services can also assist with analysis of total cost of ownership (TCO), storage migration, comprehensive review of backup and recovery procedures, data replication design and implementation, and security issues.

Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token #
Product Literature				
– *Sun Storage 6180 array, Just the Facts*	Reference Guide (this document)	Training, Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570145
– *Sun Storage 6180 array, Customer Presentation*	6180 Customer Sales Presentation	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570366
– *Sun Storage 6180 array, Technical Presentation*	6180 Technical Sales Presentation	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570284
– *Sun Storage 6000 Family Customer Presentation*	Customer Presentation	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #477405
References				
– *Sun Intro*	E-mail Introduction	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570645
– *Sun Storage 6180 Array Data Sheet*	Data Sheet	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570144 Sun Lit #CRDS150 48.A4-0
– *Sun Midrange Modular Storage Sales Reference Sheet*	Reference Sheet	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #551648
– *Sun Storage 6180 Premium Software Sales Reference Sheet*	Reference Sheet	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #551649

Collateral	Description	Purpose	Distribution	Token #
− *Sun Storage 6180 Array Competitive Profile vs. EMC*	Beat Sheet	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570367
− *Sun Storage 6180 Array Competitive Profile vs. HP*	Beat Sheet	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570369
− *Sun Storage 6180 Array Competitive Profile vs. HDS*	Beat Sheet	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570368
− *Sun Storage 6180 Array Quick Start Ordering Guide*	Internal Ordering Guide	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #570702
− *Sun Storage 2500 & 6000 disk products in a VMware, ESX server & VCenter solutions*	White Paper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #555317
− *Sun Storage 2500 & 6000 disk products in a Microsoft Exchange solution*	White Pager	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #555316
− *Sun Storage 2500 & 6000 disk products for Oracle Database Solutions*	White Paper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #555315
− *VMware Storage VMotion Best Practices for Sun Storage 6000 series and 2500 series arrays*	White Paper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #559704
− *Choosing and Sizing Sun Modular Arrays to Complement Sun Volume Servers*	White Paper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #559382
− *VMware Implementations Disaster Recovery*	White Paper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #563905

Collateral	Description	Purpose	Distribution	Token #
– *VMware Storage Concepts*	White Paper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #563902
– *VMware Storage VMotion*	Whitepaper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #563908
– *Designing Storage Infrastructure for Virtualized Data Centers*	Whitepaper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #563894
– *Sizing Oracle OLTP Databases for Modular Storage*	Whitepaper	Sales Tool	SunWIN, Partner Portal, One Stop, MySales, KnowYourStorage	SunWIN #563405
External Web Sites				
– *Sun Web Site*	`http://www.sun.com`			
– *Sun Network Storage Main Page*	`http://www.sun.com/storage/`			
– *Sun Storage 6180 Array Main Page*	`http://www.sun.com/6180`			
– *Sun SAN Main Page*	`http://www.sun.com/storage/san/multiplatform_support.html`			
– *Sun Customer Ready Systems (CRS) Program*	`http://www.sun.com/servers/cr/index.jsp`			
– *Sun Upgrade Advantage Program*	`http://ibb.eng.sun.com/`			
Internal Web Sites				
– *Sun Storage 6180 Array Main Page*	`https://sunspace.sfbay.sun.com/display/Onestop/Sun%20Storage Tek%206180%20Array` `http://mysales.central.sun.com/public/storage/6180.html` `http://www.knowyourstorage.com`			
– *Sun Customer Ready Systems (CRS) Program*	`http://mysales.sun.com/web/public/systems/customerready`			
– *Sun Upgrade Advantage Program*	`http://ibb.eng.sun.com/`			

Glossary

Array	Storage system consisting of trays and controller units. Storage system consisting of a minimum of one controller unit. Also includes one or more slots to house disks drives.
Array hot-spare	Disk that serves as a hot-spare within an array. A reserve disk that can be made available to all virtual disks within an array.
Bandwidth	A measure of the capacity of a communication channel, usually specified in MB/second.
Block or block size	Amount of data sent or received by the host per I/O operation. Atomic read/write operation to/from a disk. Size of data unit that is striped across disks.
Cache	Staging area used to provide higher performance to applications for reads and writes. During reads, the controller unit tries to keep the latest and most often accessed data in cache and also tries to pre-stage cache with future data during sequential accesses. For writes, cache is used to provide delayed writes to the disks. This delays the parity calculations and disk writes during RAID 5 operations. More optimization and advanced staging algorithms thus provide better performance.
Cache hit	Read or write request for data that is already in cache. Therefore, a request can be serviced without needing to go to disk.
CLI	Command Line Interface.
Controller tray	A tray with one or more installed controller units.
Controller unit	The intelligence card that manages RAID functions and failover characteristics for an array or tray, or group of trays.
Copy-On-Write (COW)	The process that Sun StorageTek Data Snapshot software uses to preserve point-in-time data when new data is written to disk. With each write, the system preserves the old data in snapshot reserve space, so that it can re-create the volume as it existed at the time of the snapshot.
DAS	Direct attach storage. Storage directly attached to servers or hosts (as opposed to SAN storage where storage is attached to a network of storage devices).
Data path	The path traveled by data packet — between the host processor and the disk.
Disk	Physical entity that stores data (as compared to a virtual disk, which is a logical grouping of disks or storage extents).
Disk Slot	Slots on trays that house physical disks.
DMP	VERITAS dynamic multipathing.
Drive depopulation	Drive depopulation allows additional spindles to be added to drive trays that are not fully populated with 14 drives.

ECC	Error correction code. Extra bits added to words, or double words, that correct all single-bit errors, and detect all double-bit errors. A superior technology to parity, which detects, but does not correct, single-bit errors, and cannot detect double-bit errors.
Fabric	A group of interconnections between ports that includes a fabric element. A collection of switches and the connections between them.
FC-AL	Fibre Channel arbitrated loop, a loop topology used with Fibre Channel.
Fiber	A wire or optical strand. Spelled *fibre* in the context of Fibre Channel.
Fibre Channel	A set of standards for a serial I/O bus capable of transferring data between two ports up to 100 MB per second. Fibre Channel supports point-to-point, arbitrated loop, and switched topologies. Fibre Channel can be implemented with either optical fiber (note spelling) or copper.
Fiber-optic cable	Jacketed cable made from thin strands of glass, through which pulses of light transmit data. Used for high-speed transmission over medium to long distances.
F_Port	On a Fibre Channel switch, a port that supports an N_port.
HBA	Host bus adapter. A card that connects a peripheral device to the computer system's I/O bus.
Host	Represents a data host and is comprised of 0 or more initiators. A host has a name that is unique to the storage array on which it lives (the uniqueness is enforced by the storage array firmware).
Host group	Is a collection of host objects on a particular storage array. Host groups have names that are unique to the storage array on which they live (the uniqueness is enforced by the storage array firmware).
Host ports	DSP ports attached to hosts or host-facing SAN ports. Any DSP port is capable of being either a host port or a storage port.
Hot-spare	Disk used by a controller unit to replace a failed disk.
Hot-swappable	A hot-swappable component can be installed or removed by simply pulling the component out and putting the new one in. The system either automatically recognizes the component change and configures itself as necessary or requires user interaction to configure the system. However, in neither case is a reboot required. All hot-swappable components are hot-pluggable, but not all hot-pluggable components are hot-swappable.
In-band	Using the data path between a host(s) and a storage device to transport system management traffic.
Initiator	Is a port on a fiber channel card of a data host. The initiator has a world-wide name (WWN) that is globally unique and a name. Note that because the array allows the use of duplicate names for initiators, the management software can allow duplicate names to be used on the same storage array.
I/O	Input/output.
I/O rate	A measure of a device's capacity to transfer data to and from another device within a given time period, typically as I/O operations per second.
IOPS	Input/output operations per second. A measure of I/O performance, this is commonly used to quote random I/O performance.

IP	Internet protocol. A set of protocols developed by the United States Department of Defense to communicate between dissimilar computers across networks.
LED	Light emitting diode.
LUN	Logical Unit as defined by SNIA. Defines a volume as it is mapped to particular host(s) or initiator(s). Distinguished from a volume in a sense that the same volume can represent a different LUN to different host(s) or initiator(s).
LUN mapping	Assigning volume permissions (read-only, read/write, or none) to a host or initiator.
LUN masking	A technique that prevents all but certain initiators from gaining access to a volume.
Management path	The out-of-band path that connects components of the system to the storage service processor.
Mapping	An association between a storage volume and either a host or a host group that has a Logical Unit Number (LUN). All mappings are implicitly read/write mappings between the volume and all initiators contained inside the host or host group.
Mirrored cache	Redundant copies of data residing in cache — the (write) data residing in cache that has not yet been written to the hard disks is duplicated for failover operation.
Mirroring (RAID)	Redundant storage of data, achieved by duplicating files (so there is always a primary file and a copy of the primary file) onto separate disks.
MTBF	Mean time between failures. A measure of reliability, this is the average expected time between failures of equipment, usually measured in operating hours.
MTBDL	Mean time between data loss. In a RAID system, this is the average expected time between two rapid disk failures that would cause irreparable data loss.
MTTR	Mean time to repair. A measure of availability, this is the average time the system is out of commission to complete a repair process.
Multipathing	Providing two or more physical paths to a given target or device.
Non-disruptive	Does not prevent system or data access at any time during operation. Data path access is not sacrificed, and the host does not see any I/O failure (unless dual points of failure). Availability of management services not included.
N_Port	A Fibre Channel port in a point-to-point or fabric topology.
NL_Port	A port attached to a node for use in all three topologies (point-to-point, arbitrated loop, or fabric).
NVRAM cache	A non-volatile (battery-backed) random access memory area used as an intermediate store for data between a host computer system and disk drives to achieve faster writes and, in some cases, faster reads.
OLTP	On-line transaction processing.
Optical fiber	Any filament of fiber, made of dielectric material, that guides light.

Out-of-band	Using a path other than the data path to transport system management information. Connecting to a management port using an IP network, for example.
Parity	Additional information stored along with the data that allows the controller to reconstruct lost data on RAID 3 or 5 LUNs if a single drive fails.
Partitions	See Storage Domains.
Path failure	The loss of a data or management path.
Path failover and recovery	The process of automatically moving traffic to a different path when a path either fails, or is re-instated.
Point-in-time copy	A frozen copy of a volume's data, as created when taking a snapshot.
Port	An access point on a device for attaching a link.
Primary volume	Used in the context of snapshots, the primary volume is the live data set from which the snapshot copy is made.
Profile	A set of attributes applied to a set of storage in a Common Array designed to help optimize that pool for a particular access pattern and/or level of data protection. Profiles are associated with Common Arrays to define the attributes of the pool.
Protocol	A convention for data transmission that defines timing, control, format, and data representation.
RAID	Redundant array of independent disks. A set of disk drives that appear to be a single logical disk drive to an application such as a database or file system. Different RAID levels provide different capacity, performance, availability, and cost characteristics.
RAS	Reliability, availability, and serviceability. Reliability is a measure of the likelihood that problems will occur. A highly reliable system has few problems. Once a problem occurs, availability is the measure of how the system protects the user from being adversely affected by the problem. Serviceability is a measure of how easy it is to repair the problem.
Read-ahead	Sequential data read from disk into cache without having actually been requested by the application host, in anticipation that it will be requested by the host. When the request occurs, it can be serviced as a low latency cache hit, thus improving host application performance.
Reconstruction	The process of rebuilding lost data on a replacement disk after a disk failure.
Redundancy	Duplication for the purpose of achieving fault tolerance. Refers to duplication or addition of components, data, and functions within the array.
Repository volume	A special volume created as a resource for a snapshot volume.
SAN	Storage area network. SAN architecture uses high-performance, high-capacity Fibre Channel switches to connect storage islands to servers. This approach provides physical connectivity, facilitating information sharing, or simplifying management across servers.

Snapshot volumes	aApoint-in-time image of a standard volume. Only possible if the premium feature for snapshots is enabled.
SNMP	Simple network management protocol. A simple protocol designed to allow networked entities (for example, hosts, routers) to exchange monitoring information.
Source volume	A source volume used in a volume copy operation. Can be a standard volume or a snapshot volume. It is a logical entity that has an associated storage profile, and has a collection of storage volumes that all adhere to the storage profile. A common array is always scoped by a storage array and has a unique name relative to that storage array.
Storage Domain	A logical domain with its own storage, and its own management environment. It is one or more mappings between a host or host group, and volumes. A Storage Domain may contain up to 256 volumes, each volume having a unique LUN ID with a value between 0 and 255. Storage Domain is synonymous to the term *partitioning*.
Storage pool	A collection of disks, virtual disks or storage extents, generally with common configuration, availability, and performance characteristics, that can be carved into volumes.
Storage Profile	A collection of attributes that identifies the storage properties of a storage volume. The attributes contain values that are applicable at the level of storage array, Vdisk, and volume.
Storage volume	Volume on a particular Vdisk on a particular storage array
Striping	Laying data out over a series of disks or virtual disks, allows multiple disk controllers to simultaneously access data, thus improving performance. Spreading or interleaving logical contiguous blocks of data across multiple independent disk spindles. Striping allows multiple disk controllers to simultaneously access data, improving performance.
Stripe size	Total amount of data in a disk stripe, that is, the block size multiplied by number of data disks in the stripe.
Stripe width	Total number of disks in a disk stripe.
Sun StorageTek Data Snapshot software	Dependent style point-in-time copies, using copy on write technology.
Sun StorageTek Common Array Manager software	Uses virtualization capabilities of the Sun Storage 6180 array to simplify storage management, using common arrays and application-oriented storage profiles.
Switch	The name of an implementation of the fabric topology. A fabric element that implements a fabric. The fabric element that allows each port of a switch to be connected to any other port on that switch. A collection of switches implement a fabric and provide the network through which any device can communicate with any other device.
Syslog	The internal log file maintained by Sun Storage 6180 arrays to track events and alerts as well as informational and notice messages. This log file can be sent periodically to a host server for evaluation using the `syslogd(1M)` function.

Target volume	A standard volume to which the data on the source volume is copied during a volume copy operation. Note all data on the target volume is destroyed during the copy operation and when the copy operation is complete the target volume is read-only.
Telemetry stream	Stream of data generated by monitoring agents.
Throughput	A measure of sequential I/O performance, quoted as megabytes per second (MB/sec.). See *IOPS and I/O rate.*
Topology	The components used to connect two or more ports together. Also, a specific way of connecting those components, as in point-to-point, fabric, or arbitrated loop.
Transfer rate	The rate at which data is transferred, usually measured in megabytes per second (MB/s).
Tray	An enclosure containing disks.
Tray depopulation	Trays delivered without the full compliment of disks installed. Allows additional disks to be added to trays that are not fully populated.
Vdisk	See Virtual disk.
Virtual disk	Any abstraction or collection of disks that appears as a single disk to the device mounting it. Is a volume group (a RAID set) on a particular storage array comprised of similar disk types (either FC or SATA).
Volume	A logical structure created on a Storage Array for data storage. Can be a single physical disk or a virtual disk mapped from one or more underlying extents. These are the typical volumes that users access from data hosts.
Warm boot device	Bootable on all supported HBAs with storage booted before server booting.
XOR	eXclusive OR. A binary mathematical operation performed on data to produce parity information. In RAID levels 3 and 5, parity is generated from the user data, stored, and used to regenerate lost data if a drive failure occurs.
Zone or zoning	Provided by fabric switches, a function that allows segmentation of node by physical port, name, or address.