



Innovative Backup Solutions

The Sun Fire™ X4500 server and Sun™ Enterprise Backup software



Today's IT professionals face tremendous challenges posed by explosive data growth and the need to manage, access, and store data. In addition, the burgeoning costs of storage hardware, datacenter floor space, skilled IT staff, and operational expenses add to rising budgets. Sun offers the Sun StorageTek™ Enterprise Backup solution, a revolutionary data backup and storage solution that integrates massive storage capacity with state-of-the-art server technology to provide enterprise-class compute power, fast data throughput, and high density storage in a compact footprint at a very low cost per gigabyte.

Highlights

- Secure valuable enterprise data with a revolutionary high-performance, low-cost backup solution utilizing Sun Fire™ X4500 servers and Sun Enterprise Backup software
- Cut disk storage costs in half, reduce the amount of datacenter floor space used, and save on power consumption
- Scale and protect data on networked servers and workstations across the enterprise
- Utilize features of the powerful Solaris™ 10 Operating System for additional performance, stability, security, and data integrity
- Take advantage of Solaris ZFS for ease of administration, software RAID, and massive capacity
- Automate and simplify administration tasks with centralized management that helps minimize downtime
- Benefit from best practices devised by Sun engineers for solution deployment

Introducing the Sun StorageTek™ Enterprise Backup solution

The Sun StorageTek Enterprise Backup solution is a high-performance backup solution consisting of the Sun Enterprise™ Backup Software (EBS) running on a Sun Fire™ X4500 server. With the Sun StorageTek Enterprise Backup solution, Sun integrates state-of-the-art server and storage technologies to provide incredibly high data throughput at a low cost per gigabyte. Maximizing efficiencies of space, power, and cost, the solution offers two to five times the density of traditional storage systems at half the cost.

The Sun StorageTek Enterprise Backup solution can enable datacenter managers to cut the cost of disk storage in half, save 50 percent of datacenter floor space, and provide high-speed simultaneous backups for multiple users with the highest level of data integrity. Capable of providing data protection across a wide range of backup platforms, clients, storage systems, file systems, and volume managers, the Sun StorageTek Enterprise Backup software can help protect terabytes of information on thousands of networked servers and workstations. The solution enables IT managers to standardize on one backup application for departmental to enterprise backups.

Solution components

The solution consists of several innovative components, including:

- Enterprise Backup Server — A SPARC®, x64, or x86 host server running the Solaris™ 10 Operating System (OS) 8/07 Update 4, the Sun StorageTek Enterprise Backup Software version 7.4, and the EBS Server module. The server functions as the host to maintain control and scheduling over other EBS hosts in the configuration. The server maintains licensing along with backup schedules and definitions of other EBS clients and Storage Nodes.
- Enterprise Backup Storage Node — A Sun Fire X4500 server running the Solaris 10 OS, the Sun StorageTek Enterprise Backup software and EBS Storage Node modules. The EBS Storage Node controls the resources used in storing data and utilizes Solaris ZFS to provide access to those resources.
- An optional tape library system can be used for cloning, staging, or archiving data.

Clients for the EBS solution consist of any supported platform and operating system running the EBS Client software module and containing the data to be backed up and restored. Client backup schedules are maintained on the EBS Server or manual backups can be performed as needed.



Figure 1. The Sun Fire X4500 server provides massive storage in a small footprint.

Sun Fire™ X4500 servers

Powered by fast, energy efficient, dual-core AMD Opteron® processors, Sun Fire X4500 servers combine the remarkable performance of a four-way x64 server with 24 TB of disk storage that consumes a mere 4U of rack space. Offering the highest storage density available in such a small footprint, the systems deliver optimal data throughput at half the cost of traditional solutions. Sun Fire X4500 servers run virtually any operating system including the Solaris 10 OS, Linux, and Windows environments. Providing enterprise server reliability, availability, and serviceability features, Sun Fire X4500 servers incorporate redundant, hot-swappable components for increased uptime. The servers also offer unprecedented data integrity and dramatically simplified administration with the Solaris 10 OS and Solaris ZFS.

The Solaris™ 10 Operating System

The Solaris 10 OS is the result of significant investments in research and development, with innovative features that deliver performance, stability, and security. Supported on more than 900 x86, x64, and SPARC platforms, the Solaris 10 OS shatters world records and provides industry-leading price/performance. An optimized TCP/IP stack facilitates high-performance networking and supports advanced network computing protocols.

New tools built into the Solaris 10 OS provide observability into systems even when running in production. Solaris Dynamic Tracing makes it possible to troubleshoot problems in real time. Predictive Self Healing technology can help quickly identify and resolve hardware issues for greater stability and increased uptime. With advanced security features such as Process and User Rights Management and a cryptographic framework, IT managers can institute powerful system protections and successfully enforce security policies.

The Solaris ZFS file system

Incorporating advanced data security and protection features, Solaris ZFS offers a dramatic advancement in data management with an innovative approach to data integrity. By protecting data with 64-bit checksums aimed at error detection and correction, Solaris ZFS guards against silent data corruption and eliminates the need for recovery mechanisms such as file system checks. Solaris ZFS redefines file systems as virtualized storage pools (zpool), making it easy to expand or contract file systems simply by adding or removing more disk drives, enabling the easy reallocation of resources and streamlining storage administration. Data management is also simplified by removing the need for a volume manager. As a result, complicated storage management tasks are automated and consolidated, reducing administrative overhead and accomplishing tasks quickly with no system downtime. Utilizing the 128-bit Solaris ZFS file system provides virtually unlimited file system sizes for nearly inexhaustible data capacity and unprecedented scalability.

Sun StorageTek Enterprise Backup Software

Offering an intuitive user interface and policy-based backup engine, the Sun StorageTek Enterprise Backup software helps to automate and simplify the entire backup, recovery, and archiving process.

Capable of centralized data protection across heterogeneous platforms, including the Solaris OS, UNIX®, Windows, Linux, NetWare, Macintosh, and VMWare environments, the Sun Enterprise Backup Software solution provides comprehensive backups of data from small departments to enterprise datacenters. Loaded with features that protect storage assets and minimize downtime, the solution offers centralized management and eases installation and administration.

Best practices in solution deployment

Based on extensive experience, Sun engineers devised a set of best practices to optimize the deployment and operation of the Sun StorageTek Enterprise Backup solution.

Networks

A dedicated network infrastructure for backup traffic is recommended to minimize bandwidth consumption on production LANs. The network interface on Sun Fire X4500 servers provides up to four physical Gigabit Ethernet connections. These connections can be used for backing up four separate subnets, or can be combined for improved throughput to a single subnet. A 10 Gigabit Ethernet network interface card can be installed in the Sun Fire X4500 Peripheral Component Interconnect Extended (PCI-X) expansion slot for use with a 10 Gigabit Ethernet network for even greater bandwidth.

Disks

Software RAID is used to provide data protection in the event of a disk drive failure. Solaris ZFS includes RAID-Z1 and RAID-Z2, offering RAID-0, RAID-1, RAID 0+1, RAID-5, and RAID-6 capabilities. In configuring the RAID sets on the server, a balance of performance, data protection, and disk capacity must be determined based on requirements. For a best practices configuration, Sun recommends configuring Sun Fire X4500 servers with eight RAID-Z1 or RAID-Z2 zpools of five disks each and six hot spares.

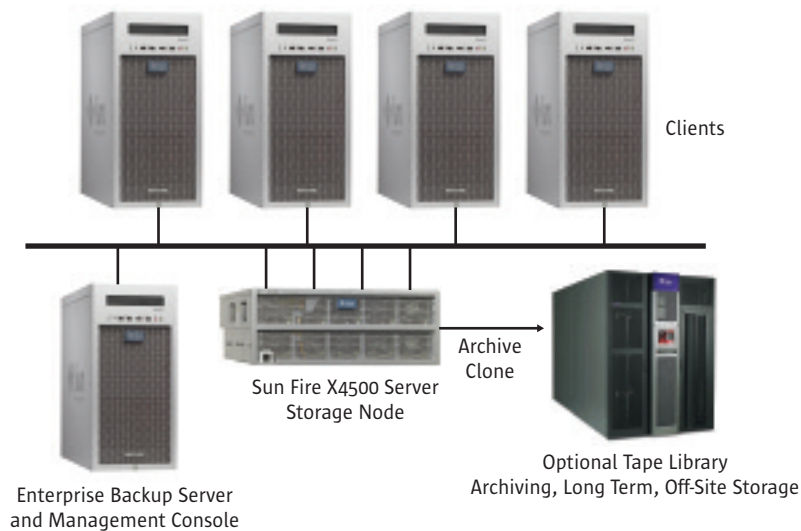


Figure 2. The Sun StorageTek Enterprise Backup System topology diagram.

Spare drives should be used to help ensure nonstop operation and high levels of data protection. The Sun Fire X4500 ships with two mirrored operating system drives and Solaris ZFS preinstalled. To help ensure sufficient capacity on the Sun Fire X4500 server, disk capacity can be monitored, and recycling and staging policies can be created.

Server and software

To configure a Sun Fire X4500 server as an EBS Storage Node, the Sun StorageTek EBS Client and the Sun StorageTek EBS Storage Node modules must be installed. Note that even though the Sun Fire X4500 server might not be utilized as a client, the client package must be installed prior to installing the Storage Node package. Modules such as Storage Node and Disk Backup are separately licensed EBS features. The configuration must also contain sufficient licenses to configure the Sun Fire X4500 server.

Tape Storage

If an optional tape library system is used, Fibre Channel or SCSI connections are used for the connections. The Sun Fire X4500 server can serve as the primary data cache, with a tape library used for longer term storage. Data can be moved to tape after certain file system utilization or time thresholds are reached. The tape library can be attached to a completely separate EBS Storage Node or the EBS server itself.

Sizing and configuration recommendations

While no two businesses, environments, or even workloads are ever the same, it can be helpful to look at performance in a given environment to understand how the Enterprise Backup Software running on a Sun Fire X4500 server might apply.

Application performance testing

Tests employed one Sun Fire X4500 server running the Solaris 10 OS 8/07 with four Gigabit Ethernet interfaces, each connected to a separate subnet. The tests were conducted to determine the scalability of the solution using the four on-board Gigabit Ethernet ports.

Six clients were spread across the four subnets, constituting a sufficient number of clients to saturate a Gigabit Ethernet interface. Each client was configured with two file systems containing four 4 GB files for a total of 16 GB per file system and 32 GB of data per client. The file sizes were large in order to ensure a high rate of data streaming and to saturate the Sun Fire X4500 server ports. By using two file systems per client, the tests were able to run two backup streams reading from each client simultaneously.

Three different zpool configurations were tested:

- RAID-Z1 with zero hot spares, the factory default configuration
- A mirrored configuration utilizing 23 mirrored pairs in a single zpool
- A configuration of eight zpools consisting of five disks each, for a total of 40 disks with six hot spares, the recommended configuration

Each zpool configuration was tested using four Solaris ZFS file systems. The Sun Enterprise Backup software was configured to handle three backup streams per file system. Six clients each ran two streams, resulting in a total of 12 streams over four file systems, with three streams per file system for optimal load balancing. Each zpool configuration was tested four times, the first using just one Gigabit Ethernet port, the second using two ports, until all four Gigabit Ethernet ports were used. In order to increase the number of Gigabit Ethernet ports used in the backup testing, the number of clients used was increased for each testing iteration, forcing the usage of the Gigabit Ethernet ports to grow incrementally to meet demand. During the peak transfer period, testers ran the `zpool iostat` command to obtain ten samples at five-second intervals to determine the rate of data transfer to the disks. Figure 3 illustrates an average of the ten samples.

Gigabit Ethernet test results

Test results show that a Sun Fire X4500 server running the Sun StorageTek Enterprise Backup software and utilizing the Solaris ZFS file system is capable of backing up data at speeds exceeding 300 MB/second over four 1 Gigabit Ethernet ports. One key factor in maximizing performance is the configuration of Solaris ZFS zpools. The most important factors to consider when configuring zpools are maintaining data protection and availability, and the total amount of disk space available.

Because every environment is different, implementation factors such as configuration and size of zpools, the number of Gigabit Ethernet ports, and the RAID level used can affect solution performance. To find out how the Sun StorageTek Enterprise Backup solution can help in a particular environment, contact a Sun sales representative.

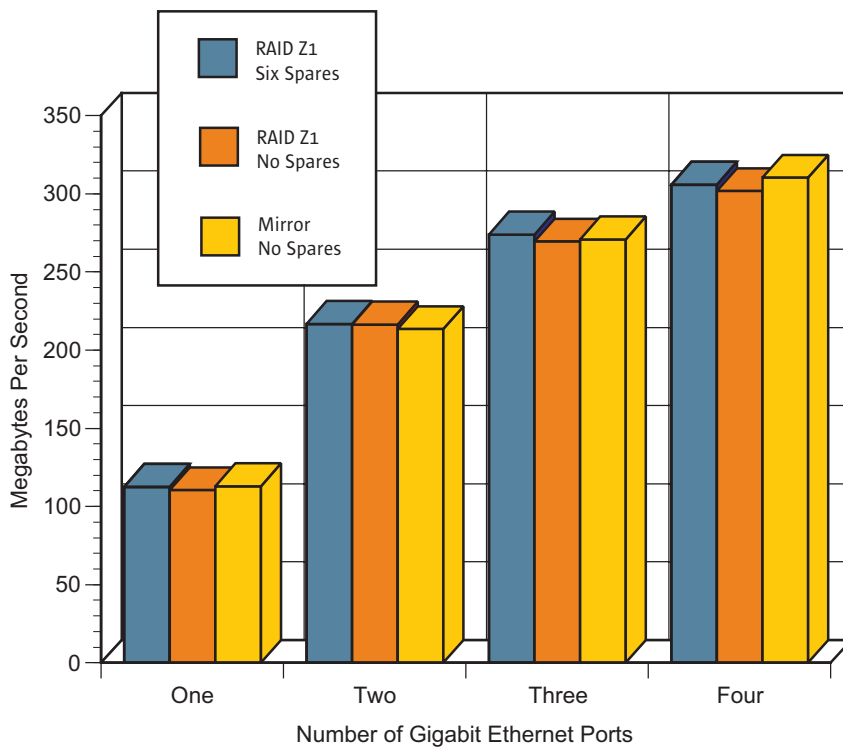


Figure 3. A graph of the data transfer rates to disks.

Learn More

All Sun StorageTek Enterprise Backup solution components, including Sun Enterprise Backup software, are available directly from Sun. To learn more, visit sun.com or contact a Sun representative.

Summary

Sun understands the critical nature of enterprise data and the importance of backing it up, and applies unique approaches to provide state-of-the-art server and storage solutions. The Sun StorageTek Enterprise Backup solution combines fast, powerful AMD Opteron processors in a Sun Fire X4500 server with massive data storage capacity and throughput and adds the innovative Solaris ZFS file system for an integrated system that revolutionizes data storage. The solution combines data storage, management, and access in ways that are far superior to traditional storage in terms of density, data throughput, speed, and cost.

With over two decades of industry experience, Sun demonstrates a proven record of flexible, scalable, innovative, and cost-effective solutions that incorporate the latest technologies and next generation processors. Sun continues to pursue a commitment to provide leading-edge, high-performance solutions that can be used by enterprises to handle explosive data growth and the management challenges that result.