TECHNICAL BRIEF

Unified Storage Solution for Video Surveillance

July, 2012

TABLE OF CONTENTS

Overview

Video Surveillance is being driven by new requirements such as demand for higher resolution, longer retention times, and the need to implement new technologies, such as video analytics, augmented reality, and cloud storage.

IP Video Surveillance offers superior benefits but single, proprietary storage vendor solutions can inhibit your video surveillance from incorporating new technologies, integrating best of breed solutions, and maintaining investments in your current solution. Today, most organizations can benefit from a flexible, open enterprise storage solution.

The Challenges

The industry is evolving. Presently, you are seeing transitions such as CCTV to IP networks, DVR to NVRs, local storage to combinations of local, shared, or remote storage. The growth of video data brings increased storage administration needs—both effort and cost are expanding. In addition, massive data archiving must accommodate an ever increasing amount of data so storage systems must be able to expand capacity as needed, without a massive hardware / software overhaul.

Another area of concern is your data integrity: the amount of data is increasing exponentially and the retention time is increasing significantly. Issues such as bit rot, phantom writes, misdirected reads/writes, parity errors, driver bugs, and accidental overwrites are just a few additional hurdles.

Hard drive failures are the number one cause of equipment failure with security video. A drive failure can put all recorded data, from any number of cameras, at risk.

Inflexible allocation of bandwidth is another issue because it is difficult to automate many standard functions, such as:

- Archiving at night when bandwidth is available
- Recording at higher resolution when data is critical and at lower resolution for all other data

Also remember that with 99% write traffic, if a NVR / DVR / camera cannot store video, then video frames can be lost.

So, with storage accounting for 30% or more of the total cost of a video surveillance solution, you must consider how you maintain your current investment and scale for future requirements for video standards such as:

- MPEG 4, great for live viewing, but may benefit from additional storage capacity and compression
- H.264, same as MPEG 4 but less robust, so need additional bandwidth to ensure frames are not dropped, and JPEG2000, provides multiple resolutions from a single frame, so may warrant event-specific service levels and use more storage capacity on demand.

Other areas of focus include:

- How can you guarantee data reliability and data consistency so that when critical events are archived, they are not lost or their accuracy challenged?
- How can you control cost, provide performance, and simplify administration given the growing collaborative environment of event handling and the complexity of case creation associated with video surveillance?
- How can you future proof your video surveillance solution for the use of SSD technologies or applications, such as video search, augmented reality, and cloud storage without being locked in to a single vendor and their roadmap.

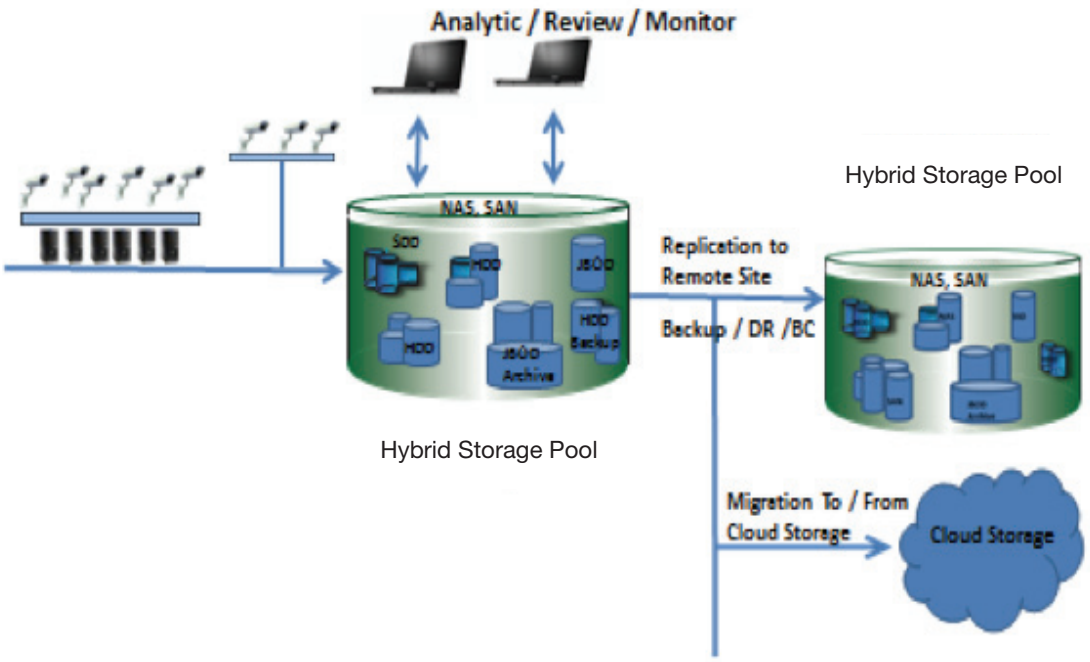

Figure 1: SGI NAS Storage Solution Diagram

Solution Overview

Proprietary hardware RAID systems are built from similar components. The big difference is the proprietary RAID software.

Software is the Key

- SGI NAS combines data management functionalities, storage and disk management, and volume and file system management into one system. This allows you to administer storage, with far fewer steps, from a single console.
- Provides interface communications support for: FC, NFS, iSCSI, CIFS, SAS, AoE, and InfiniBand.
- SGI NAS abstracts the software from the physical storage, providing hardware vendor independence.
- Provides RAID data protection, unlimited snapshots and clones, and deduplication and compression.
- Provides local and remote replication, integrates into existing networks.
- Aligns storage resources with the level of speed, capacity, and safety that you choose for your applications.
- Software and hardware are separate, allowing for use of industry standard hardware with physical storage.

Data Integrity Always is Maintained

Your data is protected from all forms of corruptions. You are guaranteed end-end data integrity from when data is first written to when it is accessed, no matter how long it is stored.

Flexible Streaming Formats

SGI NAS enables you to get the most from your video surveillance, whether you are using H.264, MPEG4, JPEG, MJPEG, JPEG2000, or combinations of these streaming standards.

The Hybrid Storage Pool provides the bandwidth requirements for multiple H.264, MPEG 4, and JPEG streams or to take advantage of the multi-resolution features of JPEG2000 frames.

The HSP effectively creates class of services to help implement automatic event handling using a combination of multiple bandwidths with multiple storage targets to guarantee data integrity for stored data and metadata. This is required for effectively supporting augmented reality, video search and video analytics applications.

Optimal Workflow for Video Surveillance Storage

SGI NAS Storage provides the features needed to optimize the activities associated with your workflow so that you obtain the full benefits from your video surveillance solution. Below, you can see the basic workflow of a video surveillance solution, from ingesting the data to the final steps of backup, archiving, and disaster recovery.

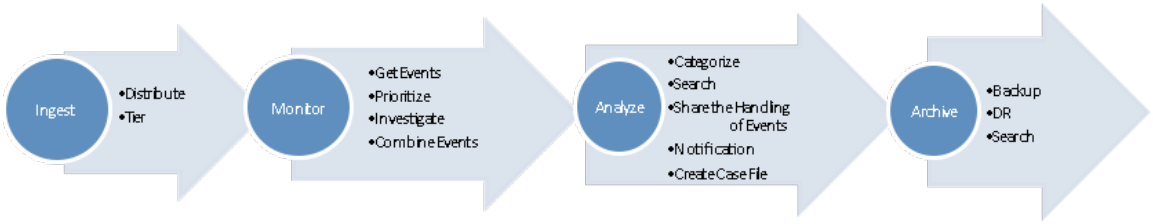

Figure 2: Typical Workflow for Video Surveillance

In the following table below, we can see the features and the benefits that an enterprise class video surveillance solution presents (see Table 1).

Activity	Feature	Benefit
Ingest	Protected Writes Clustering Dynamic Scalability Striping	Accelerated Write Performance High Availability—Protects Against Service Loss, Provides Load Balancing Scalability: The Pool can be grown or expanded while online by adding drives or replacing smaller drives with larger drives. Data is striped across all drives in the pool, thereby providing load balancing as well as increased performance.
Monitor	VDEV & ZPOOL	Class of Service (COS): Creates multiple virtual storage pools from any combination of storage (JBOD, SSD, HDD) based on your speed / capacity / safety, needed for the storage pool.
Analyze	Unlimited Snapshots, Auto-Sync, Auto-Tier, Auto CDP, Ditto Blocks, Integrated Indexing	Schedule Multiple Copies, Multiple Locations Integrated Search: Data is indexed so you can perform Boolean searches within the file system
Archive	Copy On Write 256-Bit Checksum Single, Double, Triple Parity Auto Scrub	End-to-end Data Integrity: SGI NAS creates a new block for each operation instead of overwriting the original data block. Self-healing: Checksum for metadata, user data, and additional copies of the data blocks are created. Data and Metadata Integrity Checks: Periodically force the checking of checksums. 256 Bit Checksum (Self-healing)

Table 1: Key Benefits and Features of a Unified Storage Solution for Video Surveillance

Performance

Hybrid Storage Pools: Optimizing Performance

The Hybrid Storage Pools (HSP) is a key provision to SGI NAS system optimization. A storage pool is a logical representation of RAID protected storage. The HSP provides the ability to use specialized devices, such as SSDs, to accelerate read and write performance. The components of the HSP are:

- **Main pool:** Contains the persistent copy of the data for the pool. Where data is kept and protected by RAID.
- **ZFS intent log (ZIL):** An optional cache for fast, synchronous write semantics. This log is used to optimize latency of write workloads. For write-intensive workloads, a separate, faster log device is added. A rule of thumb is that the device should be 10x lower write latency than the main pool devices. It is common to see SSDs used for logs along with HDDs in the main pool.
- **Level-2 Adaptive Replacement Cache (L2ARC):** An optional read cache, cost effectively extending cache performance. For read intensive workloads, this cache allows excellent read system performance to be achieved.

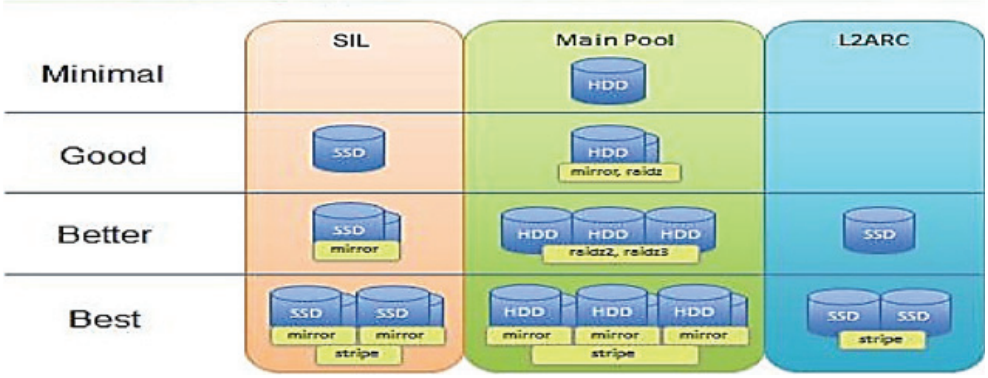

Figure 3: Hybrid Storage Pools—Cache Accelerates File Server Performance

The combined I/O bandwidth of all devices in the pool is available to all file systems at all times.

SGI NAS's read / write cache technology ensures access to your active data is accelerated significantly by leveraging SSDs without creating another storage tier. This allows the end user to control workloads by dynamically adding read / write caches. Compared to traditional spinning disks, data access is faster by a factor of 10 or better.

Protected Write

Write operations can be accelerated when data is written to the physical devices independently of releasing the application on the server for continued processing. Using solid state technology as the initial target for writes, and decoupling the application performance from the device for updating and data protection calculations, increases performance. When better write performance is desired, a separate log device can be added.

Striping

Data is stripped across all drives in the pool, thereby providing load balancing as well as increased performance. If bigger or more drives are added to the pool, capacity and striping is adjusted automatically.

VDEV / Zpool

Class of service can be implemented by grouping virtual devices within the HSP. Scalability is automatic just by adding virtual devices of the same size or larger. You use the VDEV and Zpool to manage the level of speed / capacity / safety that you desire from the storage pools.

Data Integrity

Copy-on-Write (COW)

SGI NAS has a copy on- write (COW) file system, creating a new block for each operation instead of overwriting the original data block like traditional file systems. This provides end-end data integrity.

256 Bit Checksum (Self-healing)

SGI NAS has a transactional, object-based, 128-bit file system supporting unlimited storage capacity. As a unique feature, it calculates the checksums of metadata, user data, and additional copies of data-blocks (i.e., ditto-blocks) per data set. Utilizing this information, the system is capable of identifying data corruption and correcting the errors.

Ditto Blocks

Ditto blocks create multiple copies of data and metadata. This does not replace mirroring but can be in addition to mirroring.

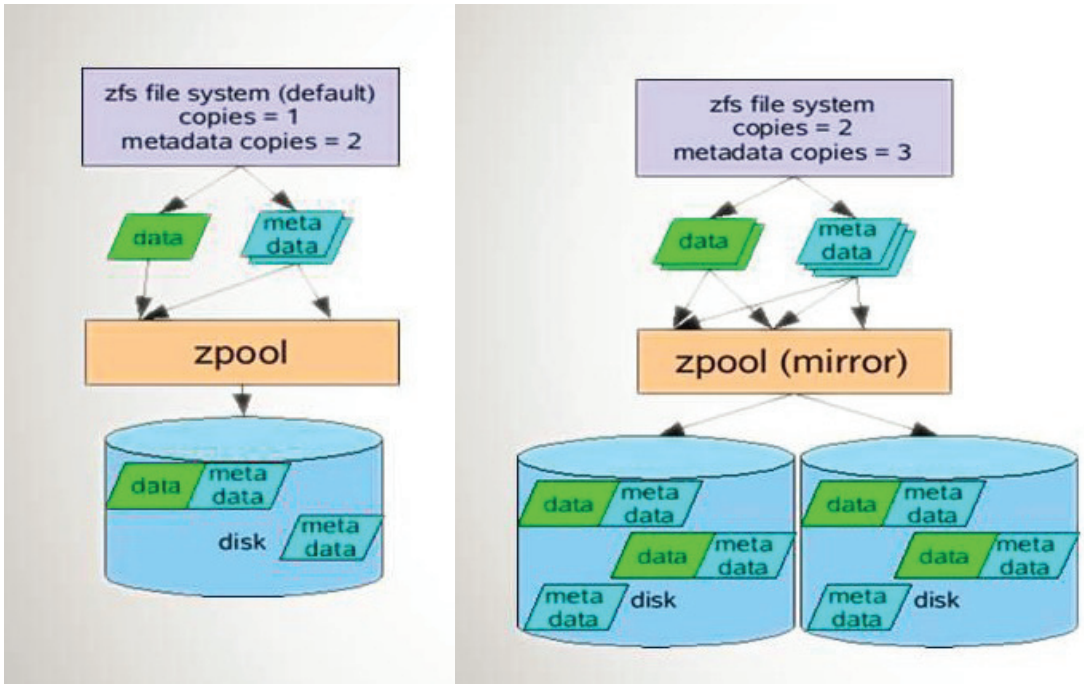

Figure 4: Multiple Copies With and Without Mirroring

Single, Double, or Triple Parity

SGI NAS supports software-RAID mirror (RAID-1), RAIDZ (similar to RAID-5), RAIDZ-2 (similar to RAID-6), and RAID-Z3). This provides up to a three-way protection of your data.

RAID Controller Not Needed

SGI NAS does not rely on disk reporting read errors and does not trust either side of the mirror data on read—checksums validate the data.

The use of a RAID controller and battery-backed NVRAM becomes redundant, so potential data loss caused by possible failure of those components is avoided, which adds reliability to the solution.

Auto-Scrub

Periodically reads data to force check sum verification (i.e., read bad datathen fetch good data—repair bad data).

Data Reliability

Auto-CDP (Automated Continuous Data Protection)

Schedule synchronous, real time, remote, block-level replication over an IP network (i.e., remote Mirroring). Volumes can be mirrored seamlessly between geographically distant appliances providing security against site failures.

Auto-Sync

Schedule asynchronous replication between two different SGI NAS appliances and provide deduplication. This includes data and metadata. After the initial replication, only the accumulated differences are transferred.

Auto-Tier

Schedule replication of a source to a destination: The destination can have different policies, such as retention or expiration polices. After the initial replication, only the accumulated differences are transferred.

Auto-Snap

Schedule automatic, periodic creation of snapshots: Due to copy on- write (creating a new block for each operation instead of overwriting the original data block like traditional file systems), snapshots are inherent and created immediately without any impact on the system.

The recovery point objective (**RPO**) value for data backup with snapshots is almost zero. In addition, users can access snapshots, as well as single files, to restore data, thereby bringing the recovery time objective (**RTO**) value to almost zero.

HA Clustering

Clustering provides high-availability of services, applications, and business processes. In addition, clustering provides load balancing and horizontal scalability of services.

MetroCluster

Supports cluster configurations where the cluster nodes are two independent, geographically distant, nodes. This protects against service loss in case all systems at one site fail (for example, a power outage).

Management

Dynamic Scalability

The HSP can be grown or expanded while online by adding drives or replacing smaller drives with larger drives.

Figure 5: Scalability with Options

Powerful Management

SGI NAS combines data management functionalities, storage and disk management, volume management, and file system management into one system. You accomplish administration with fewer instructions than a Traditional Proprietary storage system. The result is that Administration is faster, easier and cheaper. Administration can use command line or GUI.

Future Proofing Your Investment

Future proof your video surveillance solution for the implementation of new technologies, such as SSDs, or applications, such as video search, augmented reality, and cloud storage, without single vendor lock-in.

128 Bit File System

Provides unlimited capacity- you can add devices and types of devices for capacity without concerns for number of attributes or number of files. You can address pools of 256 billion terabytes in size.

Device Abstraction

The HSP can utilize a wide variety of storage technologies including combinations of JBODs, HHDs, SSDs and new technologies are easily added to existing systems, thereby protecting your technology investment.

Vendor Independence

SGI NAS is built on Open Source technology and supports industry standard protocols. Because the software is separate from the physical storage, software can accommodate new storage devices or new protocols.

APIs and Plug-ins

SGI NAS provides Open APIs and a SDK that can be used in Perl, Python, Ruby, C and Rest style development. Additionally, SGI NAS uses the API to deliver free and open source plugins to extend the functionality of SGI NAS.

Why Choose SGI NAS?

SGI NAS, built upon ZFS technology, runs on industry standard x86 servers, and provides NAS and SAN capabilities, including support for CIFS, NFS, iSCSI, and Fibre Channel storage access. In addition, SGI NAS enables you to protect data through a range of backup and replication capabilities, including unlimited snapshots and clones. It also allows synchronization to multiple destinations, thereby allowing site-to-site replications across disparate destinations.

SGI NAS provides hardware-independent, open, unified storage management at a fraction of the cost of legacy systems, allowing for high-efficiency scalability while eliminating costly vendor lock-in.

Features	Benefits
Support for NAS(NFS, CIFS, WebDav, FTP) and support for SAN (iSCI & FC)	Flexibility to manage resources based on your performance requirements. Ability to retain its older storage systems
Simplified Disk Management	Manage disks and JBODs using either command line or SGI NAS Management Viewer (NMV).
Data Deduplication and Native Compression	Inline data DE duplication and compression reduce the use of primary storage
Integrated Snapshot Search	Perform indexing and Boolean searches from the file system to search for files within snapshots.
Total Product Safety	Proactive, automated alert mechanisms send alerts when configuration deviates from “Golden Image” (best configuration).
Virtualization	VMware, XEN, Hyper-V
Reserve Space for Future Growth	Reserve pool space; ensure to never run out of space accidentally; allow for work continuation without disruption (ZFS).
REST Style API	Integration with third-party application.
Encryption	Available for additional security.

Table 2: Additional SGI NAS Features

SGI NAS Overview

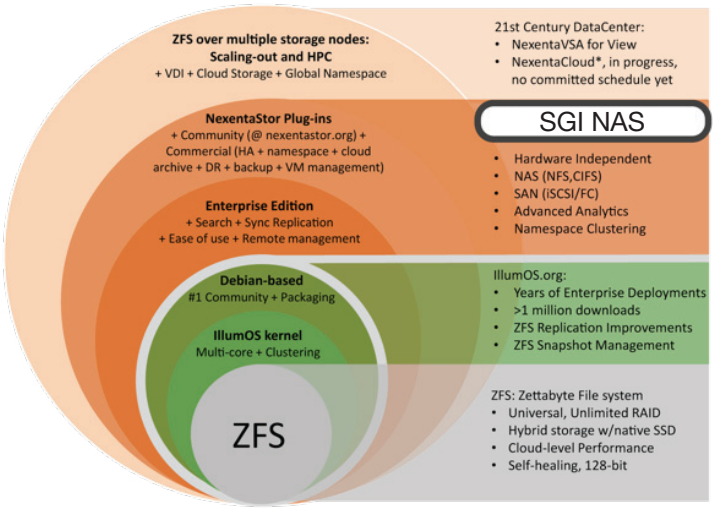

Figure 6: SGI NAS Overview

SGI NAS licensing is based on total storage, not the number or speed of processors or the amount of RAM. New or faster network interfaces can be added to improve client performance without incurring additional storage licensing costs. This allows a company to start small and grow as capacity requirements increase.

SGI NAS has more than 4000 customers worldwide using SGI NAS to manage of storage in JBOD, NAS, SAN, and SSD configurations. Together with our partners, SGI NAS can provide ultimate flexibility, support, and performance requirements for your data storage needs. If you are looking into storage solutions, or if your present storage configurations are outdated, pricey, hard to use, or just plain unreliable, call us. We can help.

For more information on SGI NAS, or any SGI NAS products, please visit us at: sgi.com.

Global Sales and Support: sgi.com/global