

Enabling IP video surveillance solutions using Genetec Security Center, IBM Spectrum Scale and IBM Elastic Storage Server

A technical report

Overview

Challenge

How do you configure and size the storage system for highly scalable and larger video surveillance environments?

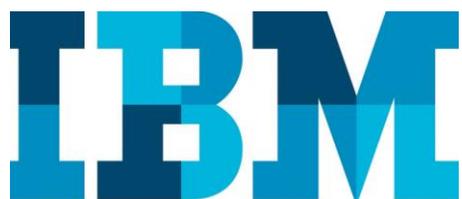
Solution

This paper provides various storage configuration guidelines to gain the best performance from IBM Spectrum Scale and Elastic Storage Server for the larger camera video environments.

The objective of this paper is to discuss the storage considerations to assist users in properly sizing the solutions to operate in a very large digital video surveillance solution. The paper covers the test strategy used and the results of the testing. This paper describes the solution (the highly scalable architecture) for deploying larger Genetec security solutions on IBM® Spectrum Scale™ and IBM Elastic Storage™ Server (ESS). This paper provides recommendations, configuration, and tuning adjustments to help ensure an efficient installation of the joint solution with acceptable performance that meets the needs of the organization.

Genetec Security Center video management software is a powerful surveillance platform that is easy to manage. Security Center is the unified security platform from Genetec that blends IP security systems within a single intuitive interface to simplify your operations. The configuration capabilities of the software design enable you to customize the solution to fit your requirements.

IBM system engineers thoroughly tested the solution using the system parameters outlined in this paper. This technical white paper covers the test results that describe the performance of the Genetec security server running on Spectrum Scale and Elastic Storage Server (ESS). It illustrates the hardware impact (on the processor, storage, and network) when changing the individual parameters of the video surveillance system, and provides recommendations on how to configure the surveillance system for optimal performance.



Assumptions and prerequisites

This solution paper assumes familiarity with the following technology skills:

- Proficiency in installing and configuring the Genetec Security Center
- Familiarity with installing and configuring IBM Spectrum Scale and Elastic Storage Server.
- Proficiency in installing and configuring Microsoft® Windows® and Linux® operating systems.

The configurations documented in this paper are based on the tests that were conducted in the IBM internal lab. These results might differ for individual production implementations in the field.

IBM Spectrum Scale

IBM Spectrum Scale was formerly known as IBM General Parallel File System (IBM GPFS™).

A high-performance enterprise platform for optimizing data and file management, Spectrum Scale is used extensively across industries worldwide. Spectrum Scale simplifies data management with integrated tools designed to help organizations manage petabytes of data and billions of files and also control the cost of managing these ever-growing data volumes.

Part of the IBM Spectrum Storage family, Spectrum Scale introduces revolutionary new features that clearly demonstrate the commitment of IBM to providing groundbreaking storage solutions, including:

- File encryption and secure erase
- Transparent flash cache
- Network performance monitoring
- Active file management (AFM) parallel data transfers
- Network File System (NFS) version 4 support and data migration
- Backup and restore improvements
- File Placement Optimizer (FPO) enhancements

IBM Spectrum Scale allows a group of computers concurrent access to a common set of file data over a direct attached or shared storage area network (SAN) infrastructure, a TCP/IP network, or a combination of connection types. The computers can run a mix of IBM AIX®, Linux, or Microsoft Windows operating systems. Spectrum Scale provides storage management, information lifecycle management tools, centralized administration, and

shared access to file systems from remote Spectrum Storage clusters providing a global namespace.

A Spectrum Scale cluster can be a single node in a tiered storage solution, two nodes providing a high-availability platform supporting a database application, or thousands of nodes used for applications such as weather-pattern modeling. A Spectrum Scale file system is built from a collection of storage devices that contain the file system data and metadata. A file system can be built from a single disk or contain thousands of disks storing petabytes of data. Each file system can be accessible from all nodes within the cluster. There is no practical limit on the size of a file system. The architectural limit for a single file system is more than a yottabyte. Some Spectrum Scale customers use single file systems up to 18 PB in size, while others use file systems containing billions of files. Applications access files through standard Portable Operating System Interface (POSIX) file system interfaces. Because all nodes see all file data, any node in the cluster can concurrently read or update a common set of files, enabling applications to scale out easily. Spectrum Scale maintains the coherency and consistency of the file system using sophisticated byte-range locking, token (distributed lock) management, and journaling. This approach means applications using standard POSIX locking semantics do not need to be modified to run successfully on Spectrum Scale.

Spectrum Scale provides unparalleled I/O performance for unstructured data by:

- Striping data across multiple disks attached to multiple nodes
- Employing high-performance metadata (inode) scans
- Supporting a wide range of file system block sizes to match I/O requirements
- Using advanced algorithms to improve read-ahead and write-behind I/O operations
- Using block-level locking that is based on a sophisticated and scalable token management system to provide data consistency while allowing multiple application nodes to concurrently access files

When creating a Spectrum Scale file system, raw storage devices are assigned to the file system as Network Shared Disks (NSDs). After an NSD is defined, all of the nodes in the Spectrum Scale cluster can access the disk, using a local disk connection or the NSD network protocol for shipping data over a TCP/IP or InfiniBand® connection.

Spectrum Scale token (distributed lock) management coordinates access to NSDs, helping to ensure the consistency of file system data and metadata

when different nodes access the same file. Token management responsibility is dynamically allocated among designated manager nodes in the cluster. Spectrum Scale can assign one or more nodes to act as token managers for a single file system, allowing greater scalability for large numbers of files with high transaction workloads. In the event of a node failure, token management responsibility is transparently moved to another node.

All data stored in a Spectrum Scale file system is striped across all storage devices within a storage pool, irrespective of whether the pool contains 2 or 2,000 storage devices. When storage devices are added to a storage pool, the existing file data can be redistributed across the new storage to improve performance. Data redistribution can be scheduled or can be done organically when there is a high data change rate. When redistributing data, a single node can be assigned to perform the task (to control the impact on a production workload). Alternately, all nodes in the cluster can participate in data movement (in order to complete the operation as quickly as possible).

Along with distributed token management, Spectrum Scale provides scalable metadata management by allowing all nodes of the cluster accessing the file system to perform file metadata operations. This feature distinguishes Spectrum Scale from other cluster file systems, which typically have a centralized metadata server handling fixed regions of the file namespace. A centralized metadata server can often become a performance bottleneck for metadata-intensive operations, limiting scalability and possibly introducing a single point of failure. Spectrum Scale solves this problem by enabling all nodes to manage metadata.

Spectrum Scale supports POSIX and NFS v4 access control lists (ACLs). NFS v4 ACLs can be used to serve files using NFS v4, but can also be used in other deployments—for example, to provide ACL support to nodes running Windows. To provide concurrent access from multiple operating system types, Spectrum Scale allows you to run mixed POSIX and NFS v4 permissions in a single file system and map user and group IDs between Windows and Linux/UNIX environments.

IBM Elastic Storage Server (ESS)

Elastic Storage Server at a glance

- IBM Power System S822L storage servers
 - IBM Spectrum Scale for cluster management.
 - Models
 - GS1, GS2, GS4, GS8
 - GL2, GL4, GL6
 - Maximum of 348 NL-SAS disk drives
 - Maximum usable capacity is 2 PB in 42U rack space.
 - RAID 1, RAID 6 (8+2P or 8+3P) with IBM declustered RAID technology
 - Scale capacity and performance in modular building blocks with automatic load balancing
 - Faster rebuild failed disks with IBM-developed erasure-coding-based declustered RAID technology
 - Single global namespace for the file access
-

IBM Elastic Storage Server is a modern implementation of software-defined storage (SDS), combining IBM Spectrum Scale software with IBM POWER8® processor-based servers and storage enclosures. IBM Spectrum Scale, formerly known as IBM GPFS, is a parallel file system that is at the heart of IBM Elastic Storage Server. IBM Spectrum Scale scales system throughput with each new server while still providing a single namespace to the clients. This ability eliminates data silos and simplifies storage management. By consolidating storage requirements across your organization into IBM Elastic Storage Server, you can reduce inefficiency and acquisition costs while simplifying management and improving data protection.

The key capabilities of IBM Elastic Storage Server include:

Software Redundant Array of Independent Disks (RAID)

IBM Spectrum Scale RAID runs IBM disks in a dual-ported storage enclosure that does not require external RAID storage controllers or other custom hardware RAID acceleration.

Declustering

IBM Spectrum Scale RAID distributes client data, redundancy information, and spare space uniformly across all disks of just a bunch of disks (JBOD). This distribution reduces the rebuild or disk failure recovery process penalties compared to conventional RAID. Critical rebuilds of failed multiterabyte drives full of data can be accomplished in minutes (instead of hours or even days) when using legacy RAID technology.

Data redundancy

IBM Spectrum Scale RAID supports highly reliable 2-fault-tolerant and 3-fault-tolerant Reed-Solomon parity codes (erasure coding) as well as 3-way and 4-way replication.

Large cache

Using a combination of internal and external flash devices along with large memory cache in the IBM Power® server, IBM Elastic Storage Server is better able to mask the inefficiencies and long latency times of nearline serial-attached SCSI (SAS) drives, while still using the high density of the drives themselves.

Superior streaming performance

The system can deliver over 25 GBps of sustained performance.

Scalability

As input/output (I/O) server configurations are added to an installed configuration, both capacity and performance scale while still providing a single namespace to clients. This means installations can start small, and grow as data needs to expand.

Key components

Key lab components

- Genetec Security Center 5.2
 - Windows 2008 R2
 - VMware ESX Hypervisor
 - 10 Gb Ethernet switch
 - IBM Spectrum Scale 4.2.1
 - IBM Elastic Storage Server GL6
 - Mellanox Ethernet adapters and switches
-

This section provides an overview of the components used in the solution.

Genetec video management software

Video management software is the key component of a video surveillance solution that collects video data from the cameras and other data sources.

Genetec Security Center is a leading software designed to provide the security solutions required for large enterprise systems.

The video management software includes the following key components:

- Directory role provides a centralized configuration database for all entities in the Security Center system.
- Omnicast is the IP video management component of Genetec Security Center.
- Omnicast requires an additional server to host the archiver and media router roles.
- Archiver manages the communication with IP camera and storage system. It records up to 300 Mbps of throughput per archive server.

Server platform

Server platform plays a key role in centralized surveillance systems as Omnicast archiver is limited to 300 Mbps. Hypervisors such as VMware can help to host multiple archivers on one physical server depending on the processor and memory resources.

Storage system

Storage system is the critical component in the surveillance system for storing video content. Simplicity, scalability, and affordability are important considerations for storing huge volume of video archives. IBM Spectrum Scale and Elastic Storage Server provides cost effective and highly scalable platform to store and playback the video archives from the thousands of the cameras managed by Genetec Security Center. IBM Spectrum Storage™ family provides a modular architecture, allowing you to scale in capacity and performance bandwidth as per future requirements.

Networking

Networking infrastructure plays an important role in connecting the incoming camera data ingest and storing the archived content to the IBM Spectrum Scale storage systems. 10 Gigabit Ethernet connectivity is recommended for camera network, archiver servers, and IBM Spectrum Scale storage systems.

Lab validation configuration

The following hardware components were used in the lab for validating the functionality and sizing information for the IP video surveillance solution using IBM Storwize® system.

Lab configuration

Genetec directory server

- Two virtual processors, 8 GB memory, one 10 Gb Ethernet and Windows 2008 R2.

Genetec archive server

- Four virtual processors, 32 GB memory, two 10 Gb Ethernet and Windows 2008 R2
- 8+2P RAID storage space from GL6 Elastic Storage Server

Camera network

- Genetec Protocol Unit Simulator for camera ingesting.
- Maximum 100 Mbps per simulator.
- Three workstations for 300 camera simulation.

Elastic Storage Server GL6

- Dual storage servers
- 80 Gbps network - four 10 Gbps bonding on each storage server
- 348 NL-SAS drives; six 4U drive enclosures
- 8+2P data disks and 3-way replication metadata disks

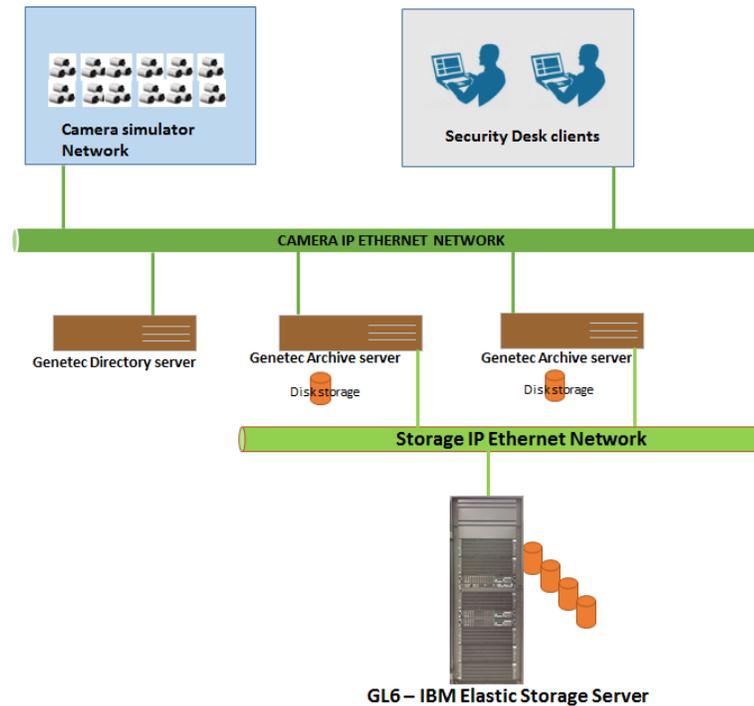


Figure 1: Genetec solution architecture with IBM Elastic Storage Server

No.	Role	Configuration
1	Genetec directory server	Two processor cores, 8 GB memory, Windows 2008 R2, Genetec Security Center 5.2 Security Desk client for playback
2	Genetec archiver server	Four processor cores, 32 GB memory, 10 Gb Ethernet Windows 2008 R2, Genetec Security Center 5.2 archiver role; Cygwin package for 64-bit Windows, Spectrum Scale client for the Windows platform
3	Camera simulator	One processor core, 8 GB memory, 10 Gb Ethernet, Windows 2008 R2, Genetec Protocol Unit Simulator. Three virtual machines, each configured with 100 cameras for simulating 300 cameras
4	Storage unit	IBM Elastic Storage Server GL6, 3-way replicated metadata volumes, RAID 6 (8+2P) data volumes, layer 3+4 Ethernet network bonding

Table 1: Lab configuration details

10 Gb Ethernet network was used for ingesting the video data from camera network to the IBM Elastic Storage Server using Genetec archiver.

Testing and lab validation

Various tests were conducted in the lab with the focus on the storage related factors for the video archiving. The process used for testing the environment controlled and changed camera settings and the quantity of simulated cameras while monitoring key performance metrics for write latency, processor consumption, network utilization, and video frame loss. The Genetec Protocol Unit Simulators utility was used to simulate the cameras. Sustained continuous testing was performed with a given set of parameters for a given period that spans multiple archive periods. Tests were also performed after the system had run for a period of four days with the initial benchmark value and some amount of data had accumulated in the archive database to simulate a production environment. Using the Genetec Protocol Unit simulation utility, the camera count was set at 300 cameras per archive server and run for four days, without loss of frame data.

Test procedure

This section describes the configuration procedure on the IBM Elastic Storage Server, Spectrum Scale client configuration on the Genetec Archiver Server for getting

IBM Elastic Storage Server configuration

Perform the following steps to configure IBM Elastic Storage Server:

1. **Create a cluster:** Run the `gssgencluster` command on the Elastic Management Server node to create the cluster. This command creates a Spectrum Scale cluster using all the nodes. The command assigns server licenses to each I/O server node. It applies the best practice Spectrum Scale configuration parameters for an IBM Spectrum Scale RAID based server. After creating the cluster, the SAS host bus adapter (HBA) firmware, storage enclosure firmware, and drive firmware are upgraded if needed. This command can take a long time to run.
2. **Verify that the cluster is active:** Run the `mmgetstate` command from the I/O node to verify that the cluster is active and operational. Use the `-a` option to include all the nodes of the cluster.

```
[root@heliumems-hs ~]# mmgetstate -a
```

Node number	Node name	GPFS state
1	heliumio1-hs	active
2	heliumio2-hs	active
3	heliumems-hs	active
4	heliumpn1-hs	active
5	heliumpn2-hs	active
6	heliumpn3-hs	active
7	ISV512-Miles1	active

Figure 2: Spectrum Scale cluster status verification

3. **Create the recovery groups:** The `gssgenclusterrgs` command creates the recovery groups and the associated VDisks for `logtip`, `logbackup` and `loghome`.
4. **Verify the recovery configuration:** Log in to one of I/O group node and run the `mmlsrecoverygroup` to check the recovery group configuration.

```
[root@heliumems-hs ~]# mmlsrecoverygroup
```

recovery group	declustered arrays with vdisks	vdisks	servers
rg_heliumio1-hs	3	31	heliumio2-hs.tuc.stglabs.ibm.com,heliumio1-hs.tuc.stglabs.ibm.com
rg_heliumio2-hs	3	31	heliumio1-hs.tuc.stglabs.ibm.com,heliumio2-hs.tuc.stglabs.ibm.com

Figure 3: Recovery group verification

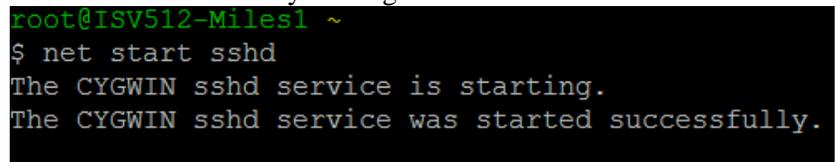
5. Run the command, `gssgenpfsvdisk -v 1 -b <block size for data> -m 1 -n <block size for metadata> -p 5 -l <file name>`
6. Edit the extent sizes in the stanza file created in the previous step as per your requirement.
7. Create the VDisks by running the command, `mmcrvdisk -F <specify the generated file name>`.
8. Make sure that data and metadata VDisks are created in each recovery group using the `mmlsvdisk` command.
9. Create the NSD by running the following command: `mmcrnsd -F <specify the same generated file name>`.
10. Check the NSD using the command, `mmlsnsd`.
11. Create the file system by running the following command:
`mmcrfs <file system name> -F <file name> -B <blocksize> --metadata-block-size <metadata block size> -j scatter -T <mount point>`

12. Create a new rule to make the “data” pool as the default pool for storing the data. For example, open a new file policy.cfg and type
`rule 'default' set pool 'data'`
13. Apply the policy by running the following command:
`mmchpolicy <specify GPFS file system>
policy.cfg`
14. Mount the file system by running the following command:
`mmmount <file system name> -a`
15. Check if the file system is mounted using the `mmlsmount all` command.

Spectrum Scale client configuration on Windows archiver server

This section describes the steps involved in installing and configuring the Spectrum Scale client on the Windows archive server.

1. Cygwin is a POSIX environment available for Windows and can be downloaded from the [Cygwin website](#). Download and install the Cygwin 64-bit Windows binaries on the Windows archiver server. Refer to the IBM Knowledge Center for detailed instructions on installing the Cygwin package.
ibm.com/support/knowledgecenter/STXKQY_4.2.1/com.ibm.spectrum.scale.v4r21.doc/bl1ins_windowscygwin.htm#windowscywin
2. Install and configure the `sshd` service on the Windows Cygwin server using `ssh-host-config` command.
3. Start the `sshd` service by running `net start sshd`.



```
root@ISV512-Miles1 ~  
$ net start sshd  
The CYGWIN sshd service is starting.  
The CYGWIN sshd service was started successfully.
```

Figure 4: Starting an SSH service on the Cygwin server

4. Create a `root` user on the Windows server and add it to the local administrator group.
5. Configure the key-based password-less SSH connection between the Windows server and the Spectrum Scale storage cluster nodes. Make sure that the SSH connection is working without the password between the Windows client and the Spectrum Scale nodes in both directions.
6. Add the Windows archiver client to the Spectrum Scale cluster using the `mmaddnode` command. Run the `mmaddnode -N <windows client hostname>` command in the ESS I/O node.
7. Configure the Spectrum Scale client license on the Windows server using the `mmchlicense` command. Run the command:
`mmchlicense client -accept -N <Windows client hostname>`.

8. Configure the Windows mount point on the Spectrum Scale file system using the `mmchfs` command. Run the command: `mmchfs <file system name> -t <Drive Letter>`.
9. Start the Spectrum Scale service on the Windows node using the `mmstartup -N <node name>` command.
10. Mount the Spectrum Scale storage file system on the Windows node using the `mmmount <file system name> -N <windows node name>` command. This will mount the Spectrum Scale file system as the drive letter on the Windows archiver server.

Genetec archiver configuration

Perform the following steps to configure a Genetec archiver:

1. Configure three servers for simulating the camera data ingestion. Configure each server to simulate up to 100 Mbps camera incoming data.
2. Configure the archive role server with the video storage space from the IBM Spectrum Scale system. Select the drive letter which was mounted from the Elastic Storage Server for storing the video content.

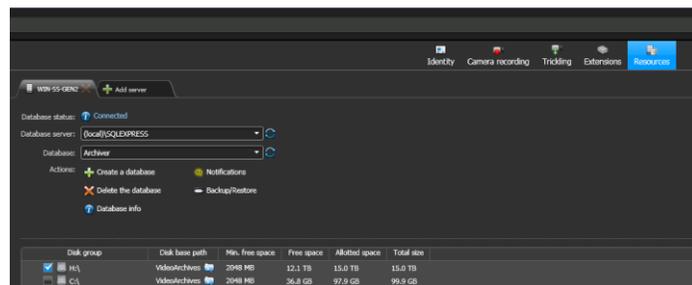


Figure 5: Genetec archiver storage configuration

3. Configure video units to produce the required camera traffic ingestion to the archiver. In this example, up to 300 cameras were added as the video unit to the archiver server for continuous writing to the Elastic Storage space.

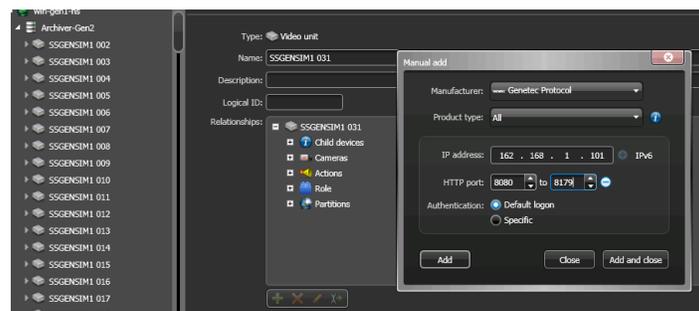


Figure 6: Genetec camera unit configuration

4. Configure motion detection on all the cameras.

Test settings

To validate the storage unit performance to run the archiver, various test cases are simulated in the lab to check the sustained throughput under all archiving conditions. Camera video quality included the following settings:

- Resolution: H.264 1280x1024
- Frames per second: 20
- Recording frames: All

Test case	Storage throughput	Number of simulated cameras	Number of camera simulation servers
1 Mbps per camera continuous recording	300 Mbps	300	3
1 Mbps per camera motion detection	100 Mbps	100	2
5 Mbps per camera continuous recording	300 Mbps	60	3
5 Mbps per camera motion detection	150 Mbps	30	2

Table 2: Genetec camera simulator configuration details

Monitoring and testing with playback workloads

After camera ingesting ran for a period of 24 hours, the test team logged into security desk application to monitor the events, such archiving queue full and pocket loss errors. Security desk was used to request playback streams continuously from the archived storage. Live video caching is disabled for validating the storage video unit performance during the playbacks.

Refer to the following procedure for playback verification.

1. Open a 24-camera view on the security desk application for the playback.
2. Use the timeline selector to select the last four hours of video.
3. Increase the playback speed to forward and backward movement.
4. Click **Play**.

The video playback time must span between data that resides in the archiver and will need to be adjusted during the playback streams. During the five-day test, up to 300 cameras were simulated with h.264, 20 frames per second, continuous recording or motion-detection capabilities. 1 TB of storage unit space has been allocated to the archiver to run different tests. These tests will measure the throughput that IBM storage video unit can sustain when the archiver is deleting the older video files. The following hardware fault injections were simulated at the storage level to measure the sustainability of the IBM storage system.

- Disk failures and rebuild at the IBM Elastic Storage server
- Rebooting of one the ESS storage I/O node
- Network interface controller (NIC) link failures for checking the active/active network bonding on ESS.

No **Archiving Queue Full** or **RTP packet lost** were noticed during these extended testing.

Test results

- Various tests were run, with a simulation of up to 300 cameras, h.264, 20 frames per second, 1 Mbps camera, continuous recording or motion detection on in the environment.
- Archiver server was configured with four virtual processors and 32 GB of memory.
- Archive video storage volume was configured with RAID6 8+2P storage space from the IBM Elastic Storage Server.
- No Archiving Queue Full or RTP packet lost error messages were noticed.

Lab test results show that 300, 1080p cameras produced very minimal workload on the Elastic Storage Server. However, as a result of this proof of concept testing with 300 cameras, IBM Spectrum Scale and Elastic Storage Server is capable of providing the video storage for thousands of cameras. It is recommended to start with three to four archiver servers, each configured with 300 camera count as the base building block configuration and monitor the parameters before adding the additional archive servers and cameras, without the risk of losing data.

Two separate 10 Gb interfaces were configured on the archiver server. One for the incoming camera ingestion and the second one for storing the data on the IBM Elastic Storage Server. During the performance run, the 10 Gb adapter operated at a very low utilization. In a moderate camera count environment, binding multiple 1 Gb adapters might be effective, but this was not tested.

Sizing guidelines

When choosing the hardware for a traditional digital video surveillance solution, the following criteria need to be evaluated.

- Number of cameras per server
- Frame rate and resolution of the cameras
- Retention period
- Physical location of the servers, cameras, and network infrastructure
- Bandwidth capabilities of the network
- Remote cameras or wide area networking for remote locations

The team conducted various tests in the lab to determine the sustainability of IBM storage system with Genetec Security Center.

Archiver server

Refer to the following high-level recommendations for the archiver server:

- A Genetec archiver server supports up to 300 cameras and 300 Mbps throughput.
- Four processor cores and 32 GB memory is recommended.
- Two separate 10 Gb Ethernet interfaces: One for the camera video ingesting and the second one for the IBM Elastic Storage connectivity purpose is recommended.
- A separate VLAN is recommended for the IBM Elastic Storage Server network connectivity to minimize the broadcast traffic.

IBM Elastic Storage Server

IBM Elastic Storage Server provides high performance and extremely scalable solutions suitable for the large video surveillance environments.

Elastic Storage Server model	GL6	GL4	GL2
Connectivity	10 Gb, 40 Gb, and InfiniBand	10 Gb, 40 Gb, and InfiniBand	10 Gb, 40 Gb, and InfiniBand
Maximum storage enclosures	6	4	2
Maximum drives	348	232	116

Table 3: IBM Elastic Storage comparison

The following high-level recommendation are provided for Elastic Storage Server.

- IBM Elastic Storage Server GL family supports 2, 4, 6, and 8 TB NL-SAS drives and provides up to 2 PB of usable storage capacity in each building block.
- Four 10 Gb Ethernet ports are recommended on each IBM storage server I/O node.
- Active/Active Ethernet network bonding is recommended.
- 40 Gigabit and InfiniBand networks are recommended for very large environments.
- Three-way replicated VDisks for metadata and 8+2P RAID6 VDisks for the data is recommended.
- In case of distributed islands of cameras, Storwize V5000 can be configured as the edge video storage system at the remote locations for storing the minimal data. At the core central location, larger scalable solutions based on IBM Spectrum scale and Elastic Storage Server can be configured to store the huge video content
- In the distributed model, network bandwidth becomes a significant factor and data placement and pruning policies might be needed to

transfer the data effectively between various remote edge locations to the central core locations.

IBM Spectrum Scale configuration:

- It is recommended to create the Spectrum Scale GPFS file system with 4 MB or larger block size for the data and 256 KB for meta data purpose.
- Separate VDisks for metadata is recommended.
- Separate file sets are recommended for each archiving server for proper data classification.
- Larger page pool is recommended on the IBM Elastic Storage server I/O nodes.
- Minimum 4 GB of page pool size is recommended on the Windows archiver server.

Summary

IBM has performed an extensive test with Genetec Security Center, IBM Spectrum Scale, and IBM Elastic Storage Server. Depending on your requirements, Genetec and IBM storage system architecture allows a highly scalable and modular solution to hold the video data for thousands of cameras. It also provides larger capacity solutions to hold multiple PB of storage data required for longer archiving purpose.

Software-defined storage: IBM Elastic Storage Server is a modern implementation of software-defined storage, combining IBM Spectrum Scale software with IBM POWER8 processor-based servers and storage enclosures. IBM Spectrum Scale scales system throughput with each new server while still providing a single namespace to the clients.

Designed for highly scalable environments – Genetec Security Center, IBM Spectrum Scale, and IBM Elastic Storage Server provides *best-in-class* and extreme scalable video solutions required for very large enterprises. This solution scales into PB of data with sustained streaming performance required for the larger video surveillance environments.

Resources

The following links provide useful references to supplement the information contained in this paper:

- IBM Systems on PartnerWorld
ibm.com/partnerworld/systems
- IBM Redbooks
ibm.com/redbooks
- IBM Publications Center
ibm.com/e-business/linkweb/publications/servlet/pbi.wss?CTY=US

About the authors

Dave Taylor is an executive consultant and an architect in IBM Systems Group ISV Enablement Organization. He has more than 25 years of experience working with the IBM System Storage and server platforms. You can reach Dave at dltaylor@us.ibm.com.

Sanjay Sudam is a consultant and an architect in IBM Systems Group ISV Enablement Organization. He has more than 15 years of experience working with the IBM System Storage and server platforms. You can reach Sanjay at Sanjay.Sudam@in.ibm.com.



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3039 Cornwallis Road
RTP, NC 27709

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