Milestone Solution Partner IT Infrastructure Components Certification Report

Dell Storage PS6610, Dell EqualLogic PS6210, Dell EqualLogic FS7610

July 2015

Revisions

Date	Description
July 2015	Initial release

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About Dell Storage

Optimizing storage utilization helps reduce capital and operational expenditures by enabling enterprises to store large amounts of data on less hardware than before. Innovative technologies built into Dell Storage help maximize disk capacity as well as enhance the efficiency of storage and data management.

The Dell Storage PS6610 Series arrays combine next-generation powerful controllers with an updated dense storage architecture to meet large data repository requirements. The PS6610 enables affordable high capacity configurations for data-intensive workloads, such as video surveillance, and can scale out to over 8PB capacity in a group of 16 arrays with improved density.

To learn more, visit Dell.com/Storage.

About Milestone Systems

Milestone Systems is the world's leading provider of open platform IP video surveillance software. Milestone has provided easy-to-use, powerful video management software in more than 100,000 installations worldwide.

Milestone XProtect® products are designed with open architecture and are compatible with more IP cameras, encoders and digital video recorders than any other manufacturer. Because Milestone provides an open platform, you can integrate today's best business solutions and expand what's possible with future innovations.

To learn more, visit www.milestonesys.com.

Executive summary

Abstract

This report highlights the performance results of certification tests performed on Dell Storage PS6610 and Dell EqualLogic PS6210 series storage arrays. These arrays were used as the storage location for the high capacity recording for the live and archive database during this certification test. A full scale test system was created to measure performance, with test results validated by the Milestone Technology Partner program. Additional tests were performed on the PS6610 system with the Dell EqualLogic FS7610 NAS appliance in front of the PS Series SAN to provide an additional SMB-CIFS storage option for system configuration.

Certification of Dell Storage solutions ensure that surveillance systems built using this product in combination with the Milestone XProtect components will be able to record and archive an amount of video consistent with the recommendations of the Milestone Server and Storage Calculator.

Certified products

- Dell Storage PS6610, Dell EqualLogic PS6210, Dell EqualLogic FS7610
- Milestone XProtect Corporate 2014; listed products are certified for use with the entire XProtect product line

Performance of the solution may vary if different XProtect products and/or system components not listed in the tests details are included. For a complete list of all equipment used in the certification, see Appendix A.

Figure 1 PS6610E array

Key findings

The Dell Storage PS6610 Series arrays perform as primary and archive database video storage platform within the Milestone XProtect video management software (VMS) system as an aggregator of Milestone recording servers hosting a live video database. For the 1200 camera workload listed in Table 1, there were 12 XProtect Recording Servers installed in the system. Each server recorded videos to a local L: volume, and then archived videos hourly to the archive video database on a PS6610 storage array through a 10 Gigabit Ethernet iSCSI connection. A second archive target used was an FS7610 NAS appliance in front of the PS6610. A third test was done with all video recordings going directly to the PS6610 via iSCSI. The same tests were repeated and validated on the smaller PS6210 with a 400 camera workload.

Table 1 Certification key findings for test workload

Test scenario	Storage solution	Maximum number of cameras	Individual video stream size (Mbps)	Maximum disk I/O (MBps)
Benchmark	PS6610	1200	5.35	750
Benchmark	PS6210	400	5.35	250

Integrators and end-users designing, installing and operating surveillance systems which incorporate these solution components can have confidence that the system will record and archive video reliably. Customers who wish to gain the maximum value and performance out of their surveillance system can also refer to the best practices and performance limitations outlined in this document to help design a system that exceeds the benchmark limitations for video recording which are followed by the Milestone Server and Storage Calculator.

Storage platform

The PS6610 is a 5U, high-density storage platform configured with 84 x 3.5" 4TB drives for this test. Larger capacity drives can be configured as they become available. For a sense of capacity and retention time, the PS6610 yields over 250TB of usable RAID 6 dual redundant capacity or about 30 days retention for 250 one megapixel cameras at 20 frames per second bit rates. Additional PS6610 arrays can be added to scale the total capacity of the solution. Adding arrays not only increases capacity, but also controller processing and network bandwidth capability of the system inherent in the peer storage architecture. This system, however, was tested with just one array to validate that bandwidth is available even at the smaller capacity and drive counts than would typically be required for the retention times of a typical deployment.

The PS6210 is a 24-drive 4U solution that can be used as a smaller building block for medium sized systems.

The PS Series Group Manager Graphical User Interface (GUI) is used for provisioning and configuration. SAN HQ, the performance monitoring application, manages multiple PS Series SAN groups from a single interface and can scale to manage many systems.

Given the configuration flexibility of the Milestone solution, combinations of the PS Series storage systems described above can be used to aggregate even higher camera counts or longer retention times.

Solution architecture

Topology

The test surveillance system was assembled and installed at the Dell Nashua Design Center in Nashua, New Hampshire. The system topology included 17 servers running a Microsoft® Windows Server® 2012 x64 based operating system hosting the Milestone XProtect Corporate Management Server, Management Client and Smart Clients. Server allocation:

1 – Management Server – 1200 camera configuration

12 – Recording Servers – 100 cameras per server

4 – View Clients – grid of 25 playbacks per server – 100 view streams for PS6610 and 50 for PS6210

The PS6610 used 10 Gigabit Ethernet interfaces for recording as the storage controller interfaces. PS6610 is a dual controller active-standby SAN with mirrored cache. The test topology is shown in Figure 2.

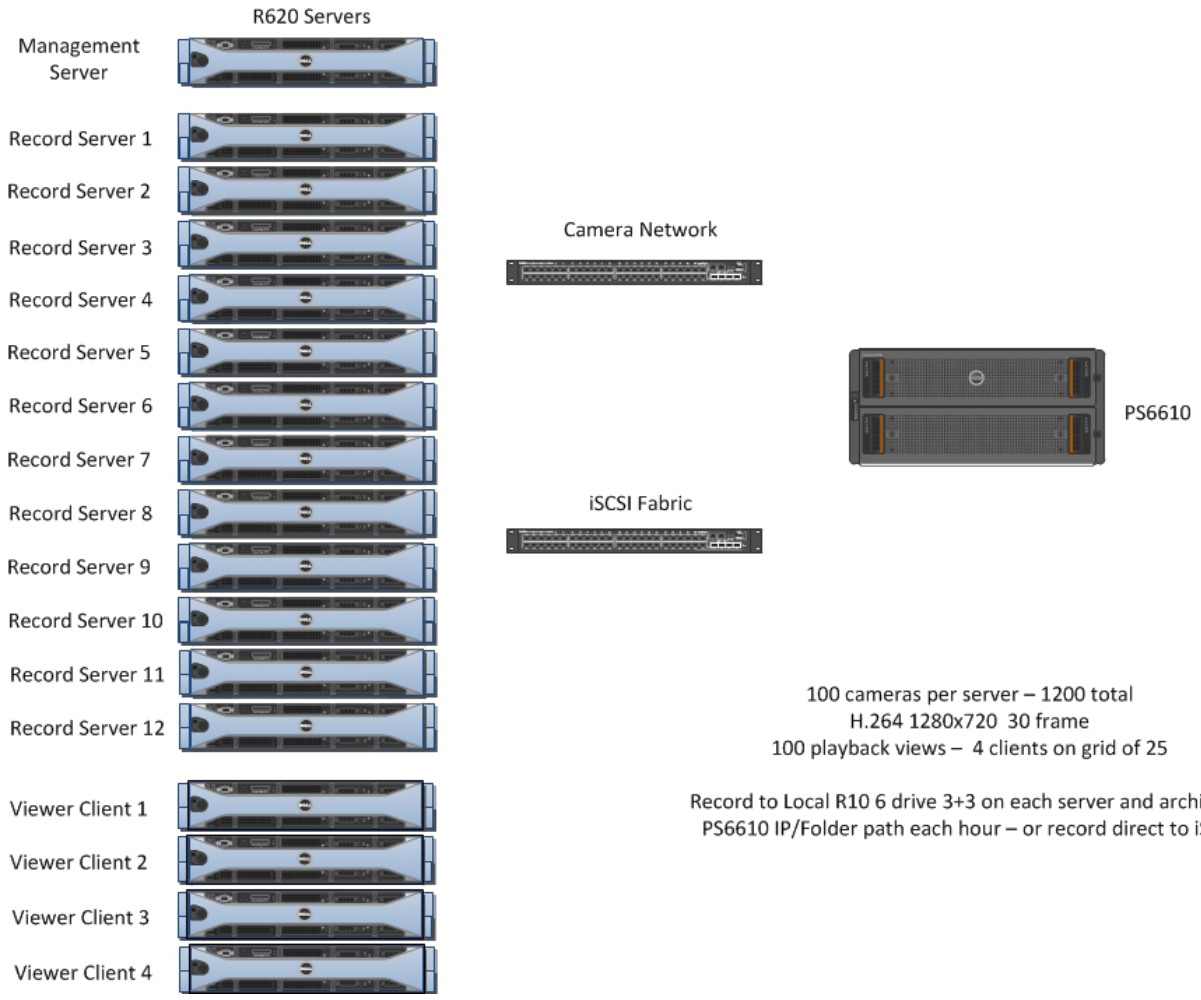


Figure 2 1200 camera test system

One instance of the video feed simulator and video content files were placed on each recording server. In this configuration, video streams were sent across the IP network to be recorded first locally on each recording server and then archived to the PS6610 for long-term storage. Placing the video stream sources within each recording server removes any potential network bottlenecks between cameras, encoders, or other video sources and the recording servers themselves. The specific configurations detailed in Figure 2 were chosen in order to conform to the recommended Milestone storage configuration providing a live database and an archive database for each recording server.

Storage system configuration

Using the built-in storage configuration tools available through the PS Series Group Manager GUI, a collection of volumes was created and distributed for the recording servers to use. The storage system was composed of 84 7.2K RPM NL-SAS drives configured as a RAID 6 pool of storage. Each recording server had cameras mapped proportionally to the retention time required for achieving and logical partitioning of video data. Aggregated camera data is moved from each recording server to the PS6610 by iSCSI connection on direct record or interleaved archive schedule every hour.

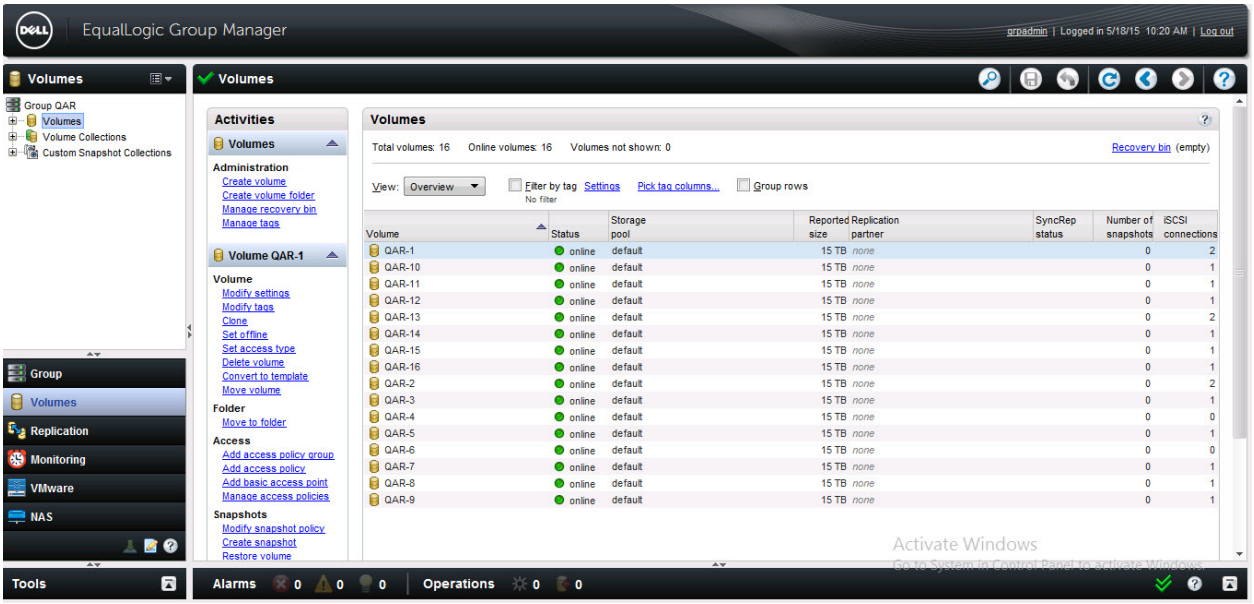


Figure 3 PS Series Group Manager display indicating all active volumes in the RAID 6 logical disk array

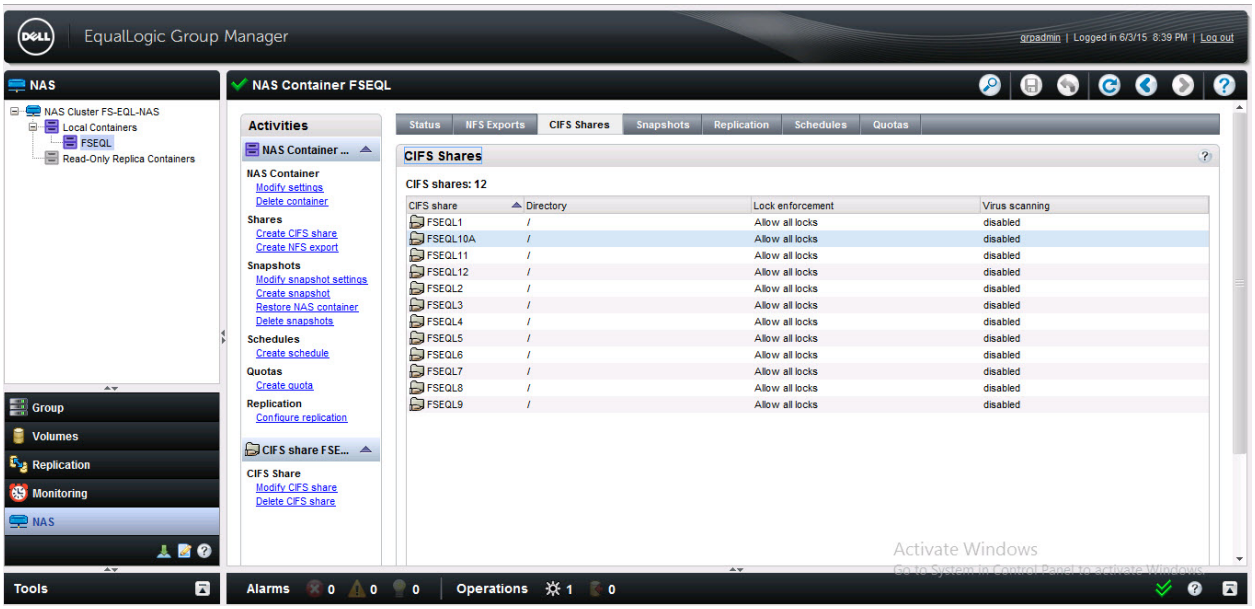


Figure 4 FS7610 folder structure for SMB-CIFS shares

Milestone recommends always configuring a live and an archive database. For the test, each XProtect recording server was configured to use a live volume database labeled L:, and iSCSI block volumes or SMB-CIFS share as the archive database. Video is initially written to the live database, and later moved to the archive database. For the test, retention times for each tier were set at 2 hours and 1 day respectively. Once the archive is full, the oldest data will be deleted and incoming data will be stored. This process causes overhead, and is required to simulate a system in long-term operations.

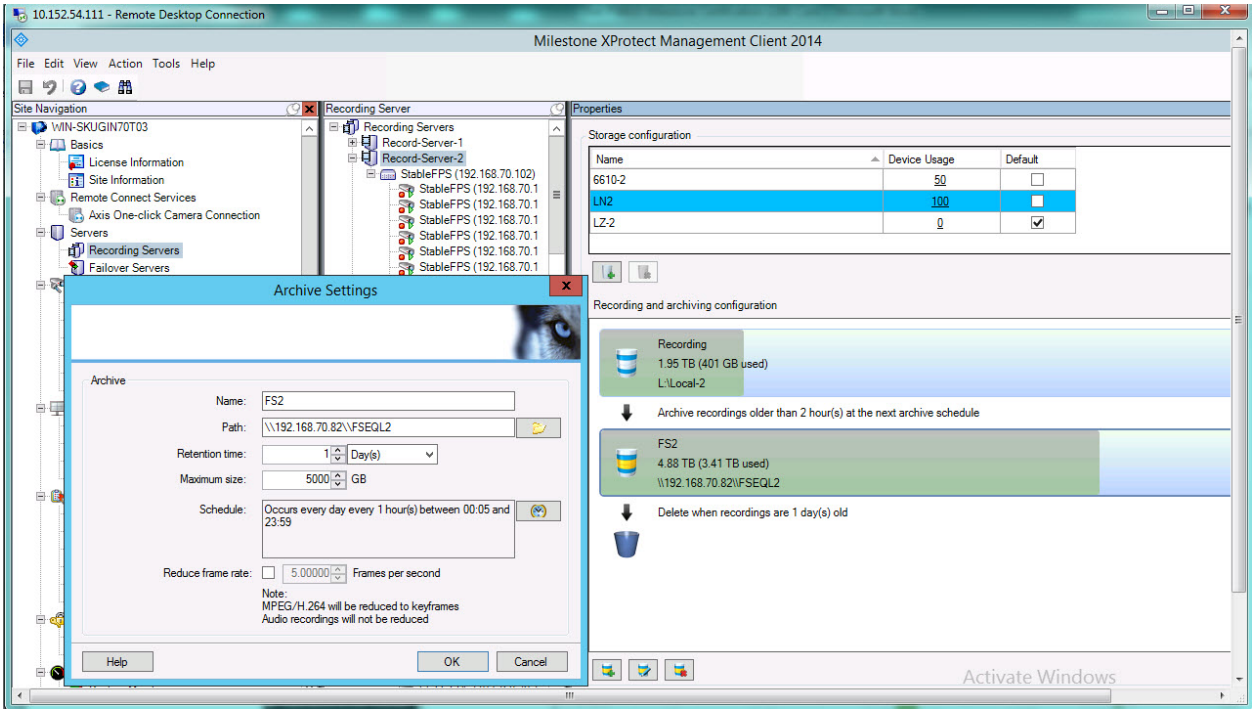


Figure 5 Archive Schedule example

Live and archive video database sizes of 2 and 5 terabytes respectively were used to support an efficient testing process. Increasing these sizes in operational video surveillance deployments will not negatively affect performance results.

An optimal configuration for performance with the PS6610 solution is to place the live database on each recording server and archive database on the iSCSI block volume or SMB-CIFS share. The PS6610 also provided 100 playback streams, 25 each from 4-view clients. This configuration uses RAID 10 on the local recording server drives and RAID 6 on the high capacity drives to provide best practices data protection. The certification has verified that this is an optimal configuration for video recording, storage performance and data protection.

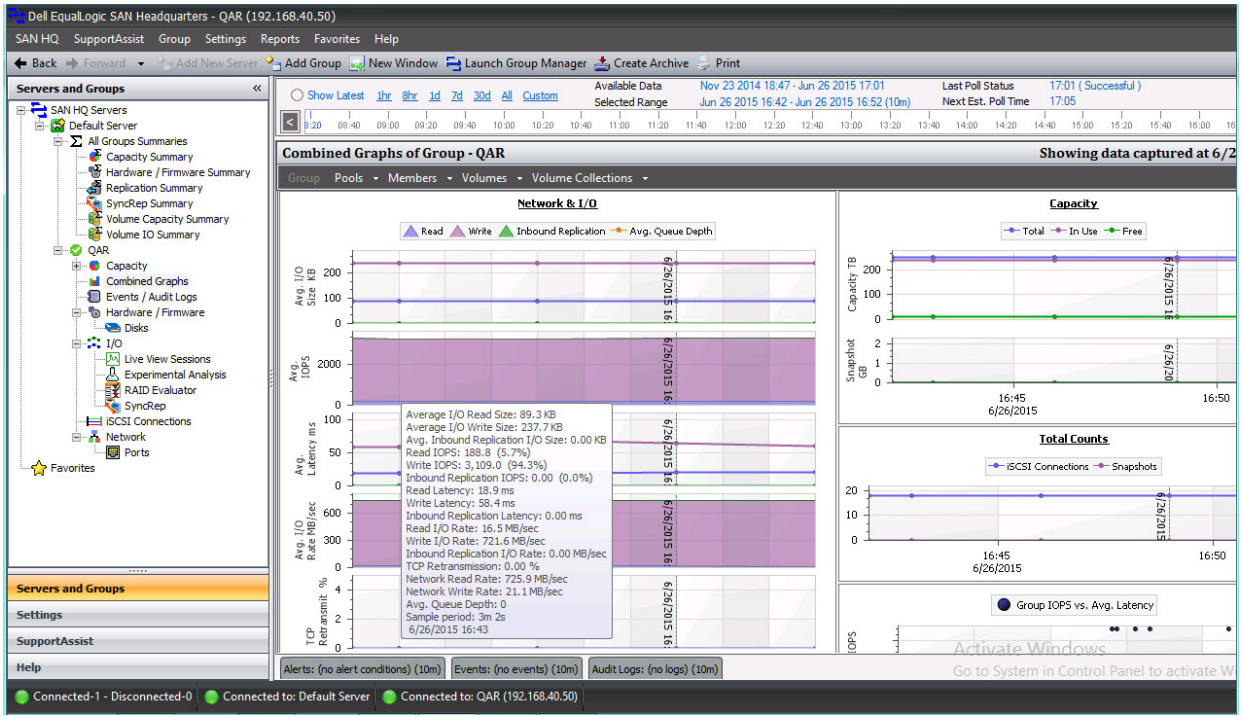


Figure 6 Example of bandwidth and I/O usage during the direct to iSCSI test

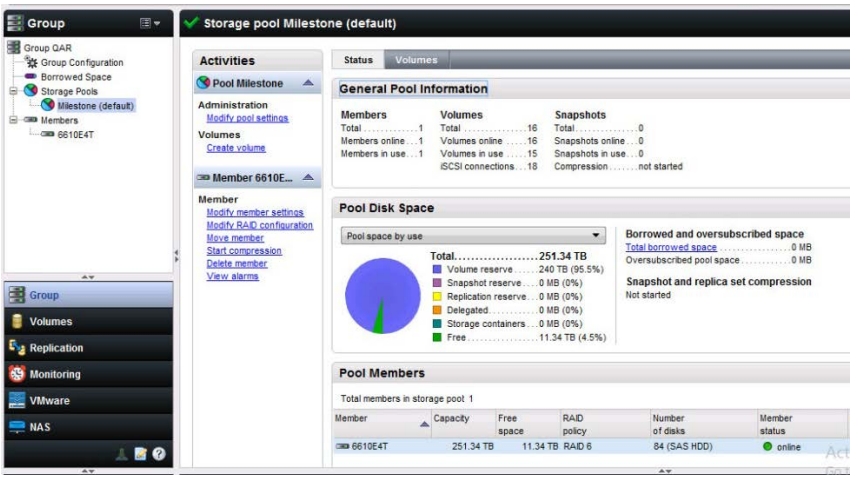


Figure 7 Capacity of over 250 TB usable from one PS6610 array with 4TB NL-SAS drives

Test plan summary

Test process

After installation and configuration of all required system components, the first step in the test was to establish a benchmark performance level against which to measure the performance of the system under more data-intensive levels of video recording. Once the benchmark was established, the system would remain in operation at this level long enough to completely fill the archive video database. At this point the test process calls for increasing the parameters of the video streams to add more data to each stream and each recording server, including the number of cameras, the video codec format, resolution, frames-per-second, and compression levels.

The process of increasing the parameters involved adding additional simulated cameras to each recording server. This process used 1 megapixel resolution streams, with compression of 60% and frame rate of 30 fps. As far as the codec options: H.264 was chosen as the only codec with which all tests would be performed due to the overwhelming utilization of this codec in new IP video surveillance installations.

Per test specifications, the performance of the PS6610 was monitored as the number of cameras increased until we reached one of the following criteria: an unacceptable level of write latency, CPU consumption, archive event duration, or video frame loss. At that point, the data load was reduced and the performance was monitored again. If the system operates at the reduced level of data load within acceptable parameters, then a full data capture takes place and the maximum performance of the storage live and archive process is defined to be at the observed levels of data and video stream parameters. The following statistics defines the acceptable levels of operation:

- Less than 0.1% video frame loss
- CPU values under 70% average
- Archive event duration equal to live database retention (1 hour)
- Write latency values under 200 ms

In the test scenarios discussed in this document, the XProtect recording server, which was recording video to the active databases located on each recording server, was configured to record 100 cameras per server at 30 fps; and these cameras were all configured to record video continuously. In each of the tests we also had multiple XProtect Smart Client applications displaying previously recorded video. The number of streams being played back simultaneously was 25 on 4 separate view clients for a total of 100 playback streams during all testing.

Additionally, the FS7610 is a scale-out NAS solution that can have up to 2 dual node NAS appliance pairs per system, and aggregate bandwidth and capacity from multi-member PS Series SANs. In our configuration example we have a single member PS6610 SAN and single dual controller FS7610 appliance.

Group Manager, the management Graphical User Interface, manages all these elements from a single interface and can scale to manage many systems using SAN HQ to correlate performance monitoring and enable single sign on.

Given the configuration flexibility of the Milestone solution, multiple PS6610 and PS6210 SANs with FS7610 NAS systems described above can be used to aggregate even higher camera counts or longer retention times.

Stop criteria: archiving time, CPU and frame loss

The goal of each performance test was to determine a baseline for the amount of video data that could be recorded to the storage array given the current configuration without creating a negative impact on the long-term health of the surveillance system. Performance levels were determined to be at their maximum based on any one of three factors during each test scenario. If the archiving time for each process increased to over 60 minutes, the CPU utilization of the recording servers measured consistently over 70%. If write latency was observed to be over 200 ms or there was repeated frame loss, then the test was stopped. The Microsoft Performance Monitor was configured to capture two hours of data examining the hard disk I/O and the performance of the physical servers in order to measure the performance of the system at maximum data load levels. The following data was captured on each recording server in each of the tests.

- Recording server video database (bytes/sec)
- Recording server video driver (bytes/sec)
- Total frames per second
- Frames lost per camera
- Memory (bytes)
- CPU %
- Network interface (bytes/sec)
- Live disk volume read latency (sec/read)
- Live disk volume write latency (sec/write)
- Live disk volume read throughput (bytes/sec)
- Live disk volume write throughput (bytes/sec)
- Archive disk volume read latency (sec/read)
- Archive disk volume write latency (sec/write)
- Archive disk volume read throughput (bytes/sec)
- Archive disk volume write throughput (bytes/sec)

Any of this data not represented in this document is outside the scope of our test findings.

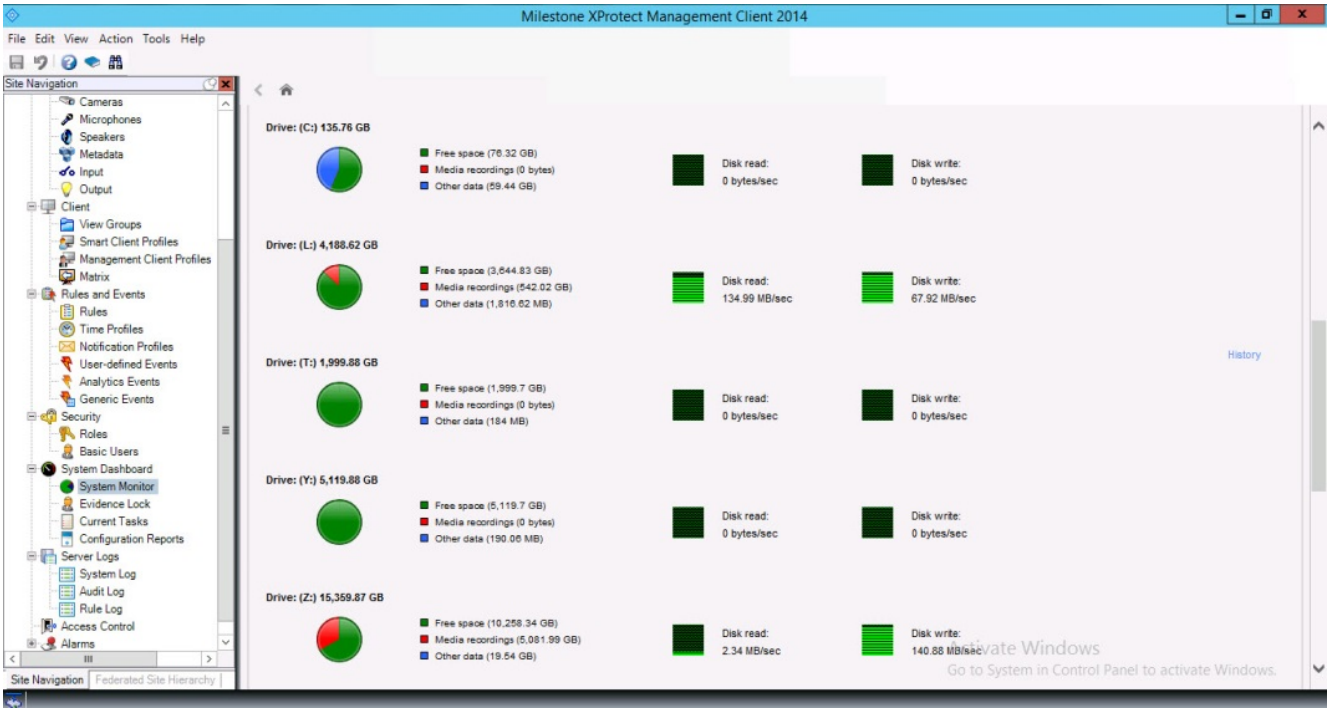


Figure 8 XProtect record server drive load statistics during archive

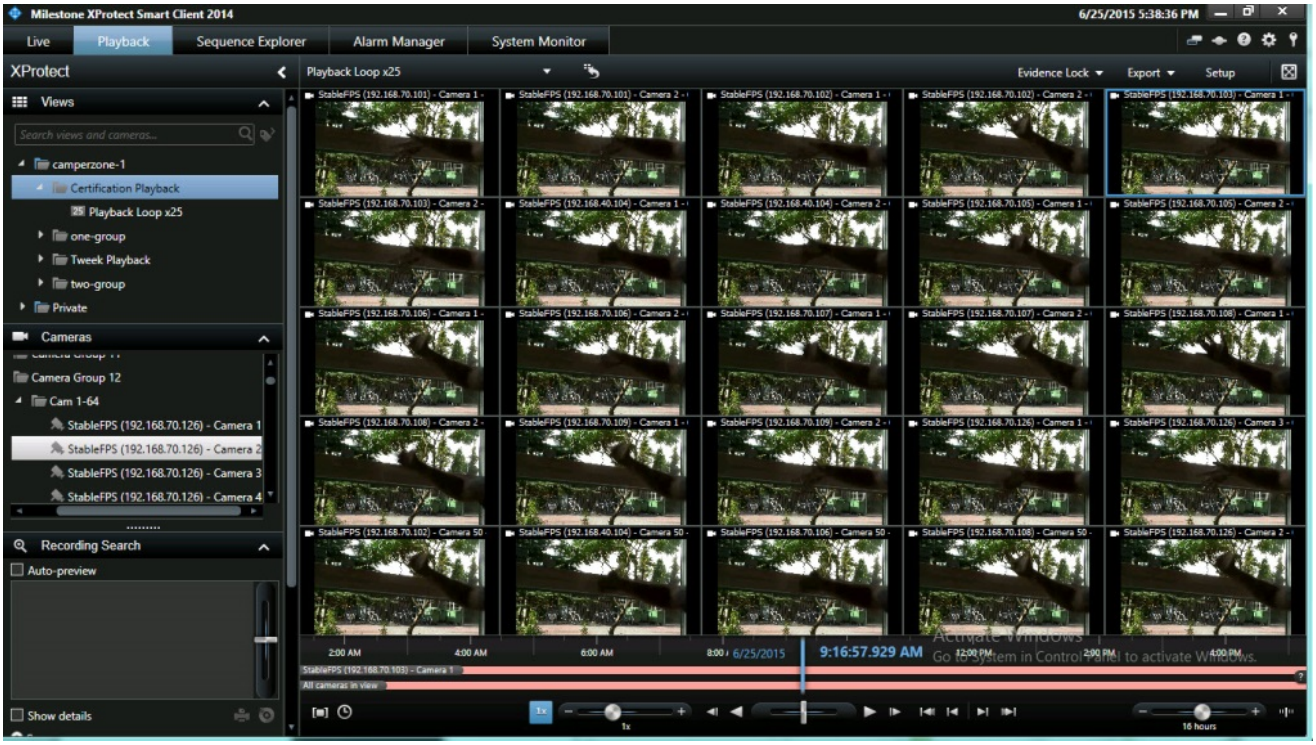


Figure 9 One of 4 workstations providing 25 playback streams each for total of 100 playback streams

Performance results

Performance tests

The data load used in the benchmark test scenario included the following parameters.

Product benchmark test:

- 1200 cameras
- 1 megapixel resolution (1280 x 720)
- H.264 video codec
- 60% compression
- 30 frames per second
- 100% recording
- Live database - 6 x 10K RPM 900GB disks (2000GB database) using RAID 10
- Archive database - 84 x 7.2K RPM 4TB NL-SAS disks (5000GB database per server) using RAID 6

Table 2 Product benchmark test results per recording server (1 of 12)

Benchmark	Results
Average live database write throughput	67 MBps
Average individual camera stream size	5.3 Mbps
Average recording server CPU utilization	27%
% Frames lost	0.0%
Average live database read latency	2.5 ms

Archive migration was scheduled for every 60 minutes with a 5 minute stagger per server. Archives are taking place on a continuous rotation with average aggregate bandwidth of 800 MB/sec.

The synchronous SMB I/O per server at the configured I/O sizes for the NAS archive use case is the boundary condition for archive bandwidth per server and the archive window of 60 minutes was the stop criteria met for the test. There were no problems with frame loss, video latency or CPU utilization caused by the recording server active database or archive process.

The retention time is expected to be the overall guiding metric for capacity and spindle count, and as a result the per array camera count/bandwidth will not typically be a limiting factor in system design for the PS6610 storage array.

Table 3 Approximate solution sizing example for HD video at 20 frames per second (fps) camera streams

	Number of PS6610 4TB platforms	1	2	4
	Approximate R6 capacity in TB	250	500	1,000
Approximate retention days using 20 fps, 3 mbits/sec H.264 1280x720	250 cameras	30	60	120
	500 cameras	15	30	60
	1000 cameras	7.5	15	30

If retention time is 30 days

And single camera capacity consumption is 1TB

Then 15 cameras "fit" into one 15TB volume

Figure 10 Camera mapping example for block volumes

Block based configurations allocate cameras to volumes to fit capacity and retention times. Multiple volumes are typically needed to fulfill the capacity requirements for the cameras on each recording server. File base configurations typically map all the cameras on a record server to the same NAS shared folder, simplifying the mapping aspect of configuration for larger systems.

Conclusion

The Dell Storage PS6610, EqualLogic PS6210 and EqualLogic FS7610 are certified storage platforms for use with the Milestone XProtect VMS. With the chosen hard disk configuration used in the test, the PS Series systems easily supported the benchmark level of performance. The performance testing determined that the PS6610 storage solution can support 1200 cameras at 30 fps with this hardware configuration.

Scaling this solution is possible by aggregating additional PS6610 members into the storage system. Additional SMB-CIFS I/O processing can be added with up to two FS7610 dual node appliances per SAN group. Camera counts can be modified and spread to more servers as needed based on total aggregate live/archive bandwidth per server.

Integrators and end-users should have confidence using the Dell PS Series storage when building video security and surveillance systems including the XProtect VMS and storage solution. These PS series array solutions are certified, and can be used to support XProtect recording servers that record up to 1200 total cameras at megapixel resolution. The XProtect, PS6610, PS6210 and FS7610 integrated system is highly scalable with multiple redundancy methods to create reliable high performance surveillance and security solutions for mission critical applications.

Appendix A. Lab equipment list

Network

2x Dell Force-10 S4810 10Gbit Ethernet switch

Servers

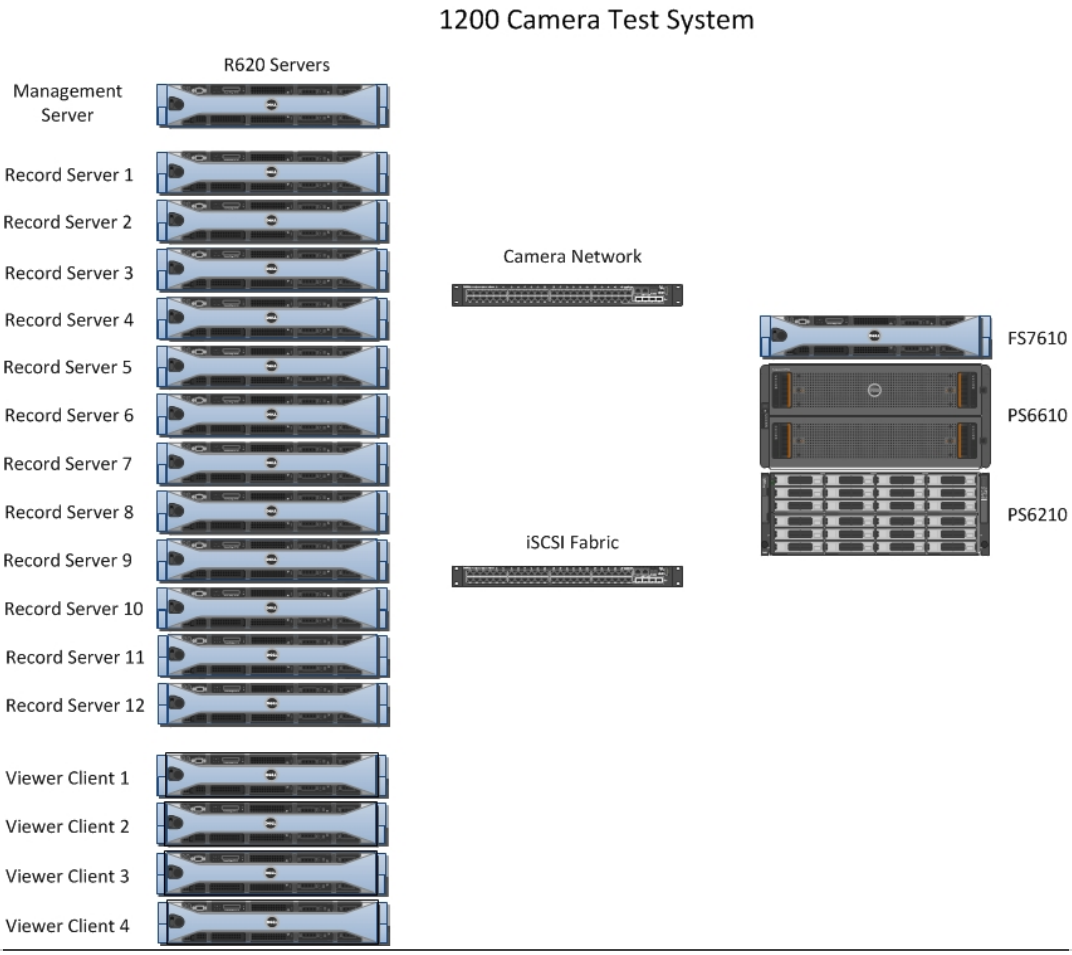
17 Dell PowerEdge R620 servers running Microsoft Windows 2012 R2; each server configured with two 2-port, 10 Gbit Ethernet Intel X520 NICs, 16 GB RAM, PowerEdge RAID controller (PERC) with 2x 15K RPM 300GB system drive in R1 and 6x 10K RPM 900GB drives in R10 for (video active database)

Storage

Dell Storage PS6610 dual controller 10 10GbE iSCSI SAN

Dell EqualLogic PS6210 dual controller 10 10GbE iSCSI SAN

Dell EqualLogic FS7610 dual node 10 10GbE iSCSI NAS appliance



Appendix B. Milestone Record Server tuning

Milestone Recording Server Configuration Tuning

For tuning Archive Bandwidth with FS8600 and Milestone Xprotect Corporate

Active Database record to local server drives (R10) or Block SAS/SAN

#

In each Recording Server – adjust the following:

File found at - ProgramData/Milestone/XProtect Recording Server/RecorderConfig.XML file

Search and find and modify the following tuning adjustments:

Must restart the Milestone Recording Server service after modify/save of file

#

Specifies the maximum number of frames in the queue, both key- and nonkey-frames (H264 and MPEG limit primarily).

Type : System.Int32

Range : 20 - 200
(recommended limits) Default
: 50

<maxframesinqueue>**200**</maxframesinqueue>

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<delete_thread_pool_size>**2**</delete_thread_pool_size>

<low_priority_archive_thread_pool_size>**4**</low_priority_archive_thread_pool_size>

<high_priority_archive_thread_pool_size>4</high_priority_archive_thread_pool_size>

</thread_pools>

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<write_buffer_size>**65536**</write_buffer_size>

</chunk_files>