# Milestone Solution Partner IT Infrastructure Components Certification Report

**Dell FS8600 NAS Storage**

**1-5-2015**

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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.

Scalable file systems also play a key role in maximizing capacity. Dell Fluid File System (FluidFS) was engineered to avoid the scalability limitations of traditional network attached storage (NAS) and file servers. FluidFS v3 can address up to 2 PB within a single NAS pool, allowing organizations to gain exceptional control over the explosive growth of unstructured data. Visit www.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. Visit www.milestonesys.com for more.

# Executive Summary:

## Abstract

This report highlights the performance results of certification tests performed on Dell FS8600 with SC8000 and SC280 series storage controllers and expansion chassis.  This system was used as the storage location for high capacity 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.

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 FS8600 with SC8000 and SC280
- 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 check Appendix B.*

Dell Storage SAN
with FS8600 NAS

FS8600-FC

SC8000

SC280-4T

SC280-4T
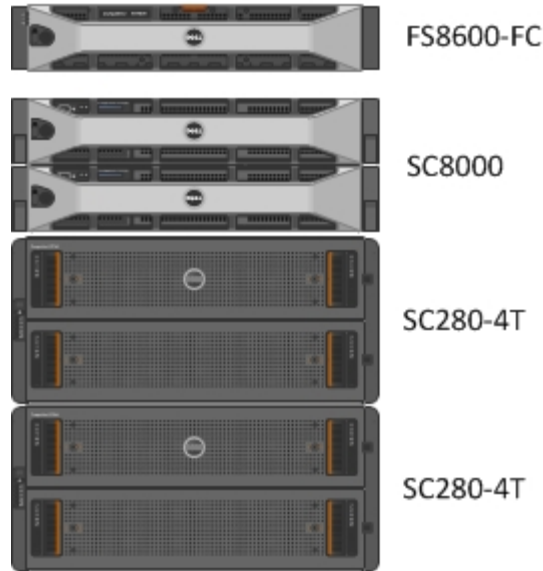
## Key Findings

The FS8600 performs as an archive database video storage platform within the Milestone XProtect VMS system as an aggregator of Milestone Recording Servers hosting a live video database.  For the 1500 camera workload listed below, there were ten XProtect Recording Servers installed in the system each which recorded video to a local L: volume and then archived hourly to FS86000 storage via 10 Gbit Ethernet synchronous SMB connection to the archive video database.

| Test Scenario | Storage Solution | Maximum Number of Cameras | Individual Video Stream Size (Mbps) | Maximum Disk I/O (MBps) |
|---|---|---|---|---|
| Benchmark | FS8600 | 1500 | 3.6 | 750 |

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.

## Solution Architecture:

<u>Topology</u>

The test surveillance system was assembled and installed at Nashua Design Center in Nashua New Hampshire. The system topology included 15 servers running a Microsoft Windows x64 based Server 2012 operating system hosting the Milestone XProtect Corporate Management Server, Management Client and Smart Clients.  Server allocation:

  1 – Management Server –1500 camera configuration
10 – Recording Servers – up to 150 cameras per server
  4 – View Clients – grid of 25 playback per server – 100 view streams

The FS8600 used 10 Gigabit Ethernet interfaces for recording servers and 16 Gbit Fibre Channel as the storage controller interfaces.  FS8600 is a dual node NAS appliance connected to the dual controller active-active SC8000 storage controller.  The test topology is shown in Figure 1 below:
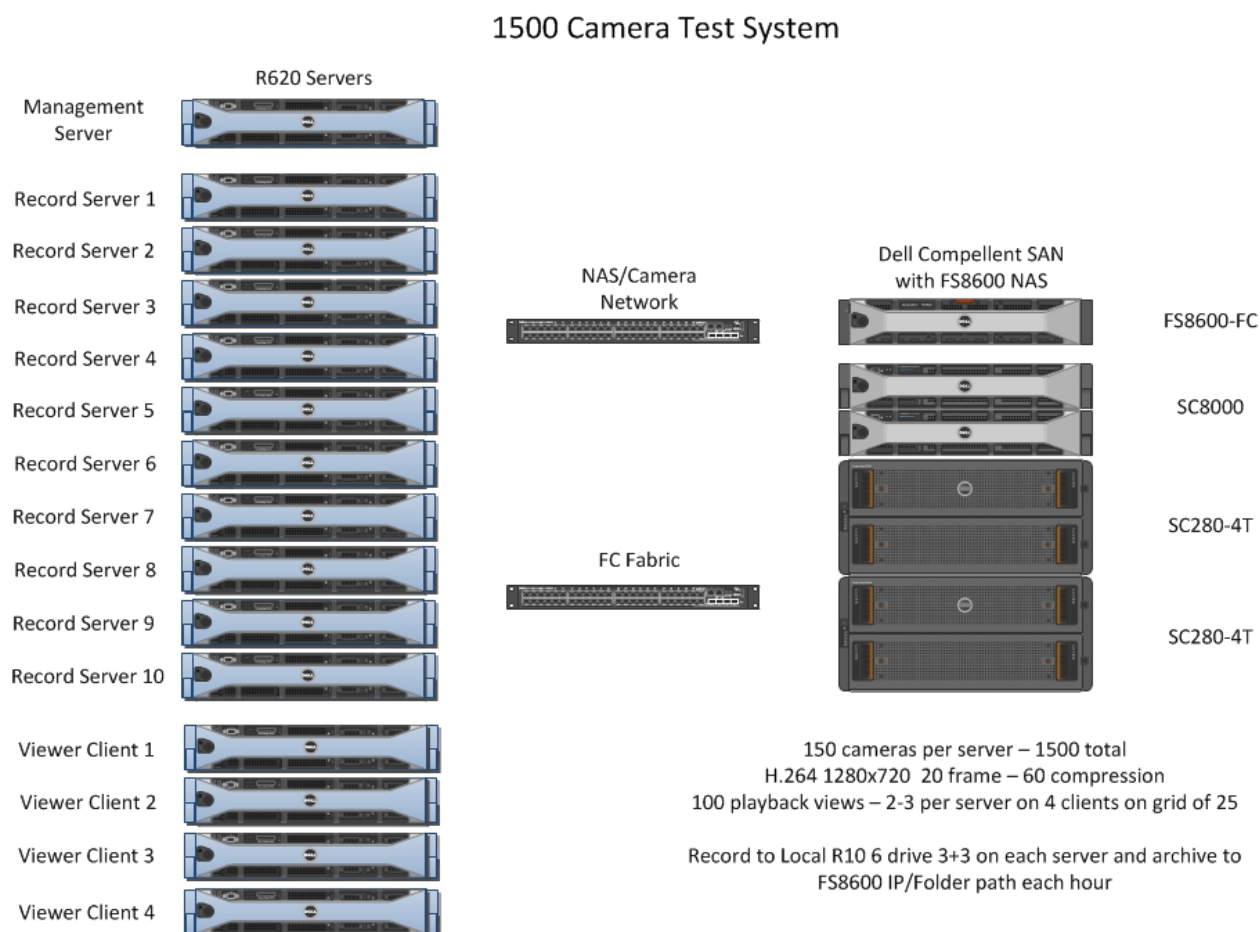


One instance of the video feed simulator and video content files were placed on each Recording Server. In this configuration video streams are sent across the IP network to be recorded first locally on each Recording Server and then archived to FS8600 for longer term storage.  Placing the video stream 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 above were chosen in order to conform to the recommended Milestone storage configuration; providing a live database and an archive database for each recording server.

The SC280 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 two SC280s yields over 600TB of usable RAID-6 dual redundant capacity or about 30 days retention for 500 cameras at the configured bitrates.  Additional SC280s can be added to scale the capacity of the solution, but this system was tested with just two arrays to validate that bandwidth is available even at the smaller capacity and drive counts.

Additionally, the FS8600 is a scale out NAS solution that can have up to 4 dual node NAS appliance pairs per system, and aggregate bandwidth and capacity from two SC8000 dual controller SANs.  In our configuration example we have a single SC8000 controller pair and single dual node FS8600 appliance.

Enterprise Manager, the management Graphical User Interface, manages all these elements from a single interface and can scale to manage many systems.

Given the configuration flexibility of the Milestone solution, multiple archive FS8600 systems described above can be used to aggregate even higher camera counts or longer retention times.

### Approximate Solution Sizing example for 3.6 Mbit H.264 IP camera streams

| | Number of SC280-4TB Platforms | 2 | 4 | 6 | 8 |
|---|---|---|---|---|---|
| | Approximate R6 Capacity in TB | 604 | 1,208 | 1,812 | 2,416 |
| Approximate Retention Days using 20 FPS H.264 1280x720 | 500 Cameras | 30 | 60 | 90 | 120 |
| | 1000 cameras | 15 | 30 | 45 | 60 |
| | 1500 cameras | 10 | 20 | 30 | 40 |

## Storage System Configuration

Using the built in storage configuration tools available through the FS8600 Enterprise Manager graphical user interface, a single NAS storage pool was created from 186 4TB 7200 RPM NLSAS drives. This RAID 6 NAS target had individual folders created to locate each recording server archive database for logical partitioning of video data.  Data is moved from each recording server to the FS8600 by synchronous SMB connection on an interleaved archive schedule every hour.
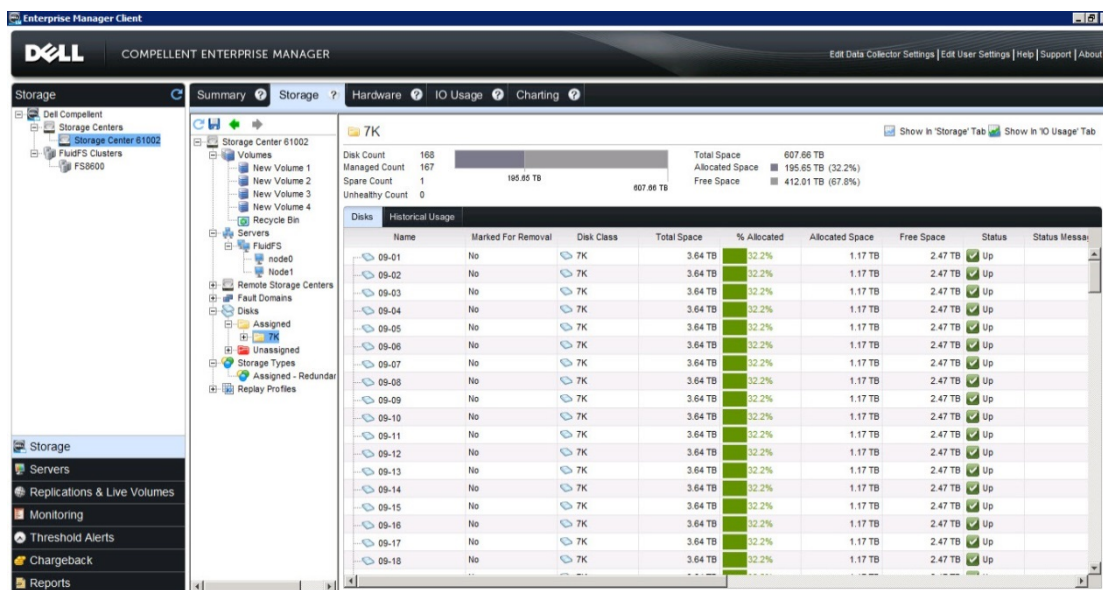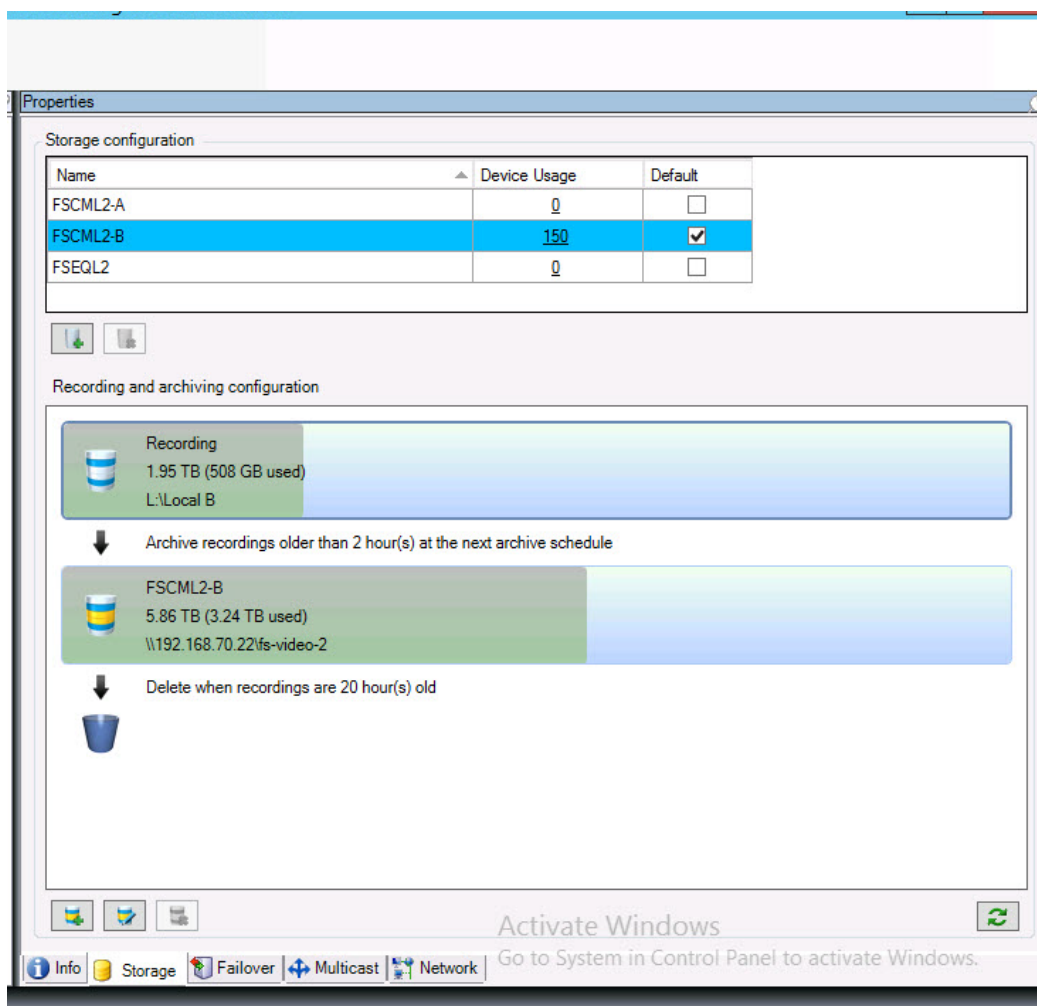


*Enterprise Manager display indicating all active physical disks in the RAID 6 logical disk array.*
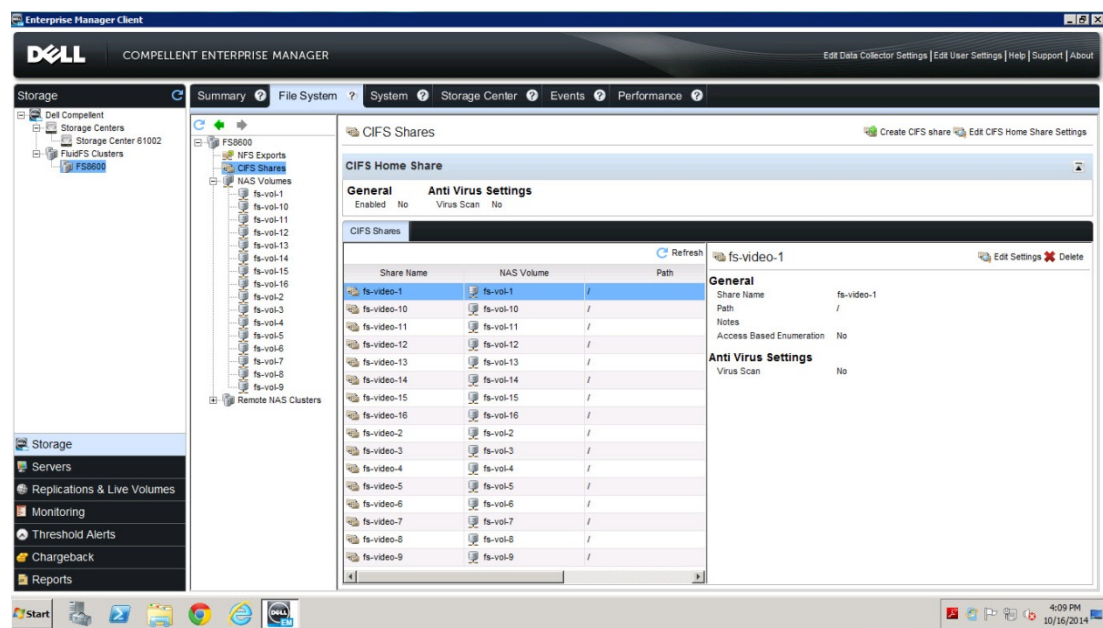


*FS8600 folder structure for SMB shares*

Milestone recommends always configuring a live and an archive database. For the test, each XProtect Recording Server was configured to use 2 Terabytes local as a live volume database, and 6 Terabytes via SMB share as the archive database.  Video is initially written to the live database, and later moved to the archive database. Retention times for each tier were set at 2 and 20 hours 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.

Properties

Storage configuration

| Name | Device Usage | Default |
| --- | --- | --- |
| FSCML2-A | 0 | ☐ |
| FSCML2-B | 150 | ☑ |
| FSEQL2 | 0 | ☐ |

Recording and archiving configuration

Recording
1.95 TB (508 GB used)
L:\Local B

Archive recordings older than 2 hour(s) at the next archive schedule

FSCML2-B
5.86 TB (3.24 TB used)
\\192.168.70.22\fs-video-2

Delete when recordings are 20 hour(s) old

Activate Windows
Go to System in Control Panel to activate Windows.

Info | Storage | Failover | Multicast | Network

*Live and archive video database sizes of 2 and 6 terabytes respectively, were used to support an efficient testing process. Increasing these sizes in operational video surveillance deployments will not negatively affect performance results.*

The optimal configuration for performance with the FS8600 solution is to place the live database on each recording server and archive database on the CIFS share. The FS8600 also provided 100 playback streams, 25 each from 4 view clients.  This configuration uses direct write to RAID 6 to provide the highest rate read/write performance with no additional data migration overhead. The certification has verified that this is the optimal configuration for video recording and storage performance.

# 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 20 frames per second (FPS). As far as 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 FS8600 was monitored as the number of cameras was 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. Acceptable levels of operation are defined according to the following statistics:

- 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 up to 150 cameras per server at 20 fps; and these cameras were all configured to record video continuously.  In each of the tests we also had multiple XProtect Smart Client applications running 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.

## Stop Criteria:  Archiving Time, CPU, and Frame-loss

The goal of each performance test was to determine the maximum amount of video data which 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 was 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 which is not represented in this document is outside the scope of our test findings.*

# Performance Results:

## Performance Tests:

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

Product Benchmark Test:

- 1500 cameras
- 1 megapixel resolution (1280x720)
- H.264 video codec
- 60% compression
- 20 frames per second
- 100% recording
- Live Database - 6 x 10,000 RPM 900GB disks (2000 GB database) using RAID 10
- Archive Database - 168 x 7,200 RPM 4TB disks (6000 GB database per server) RAID 6

Product Benchmark test results per Recording Server:

| | |
|---|---|
| Average Live Database Write Throughput | 72 MBps |
| Average Individual Camera Stream Size | 3.6 Mbps |
| Average Recording Server CPU Utilization | 12% |
| % Frames Lost | 0.0% |
| Average Live DB Read Latency | 2.5 ms |

Archive migration was scheduled for every 60 minutes with a 5 minute stagger per server and rest period (which could be used for future server archive time slots)  The periodicity of this schedule can be clearly seen in the graphs below of the total disk read and write throughput charted over the course of multiple hours. Archives are taking place on a continuous rotation with max aggregate bandwidth of 750 MB/sec. From the FS8600 perspective in Enterprise Manager, to the archive storage, IO size and latency is a mixture of 64K CIFS aggregated video writes into large 1MB blocks and smaller 4K database activity and do not represent the actual IO sizes, just the effective average.  Further smoothing of the IO bandwidth could have been achieved with even proportional archive time stagger vs. the 5 minutes offset per server that resulted in periods of less intense archive activity represented below.

The synchronous SMB IO per server at the configured IO sizes 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.
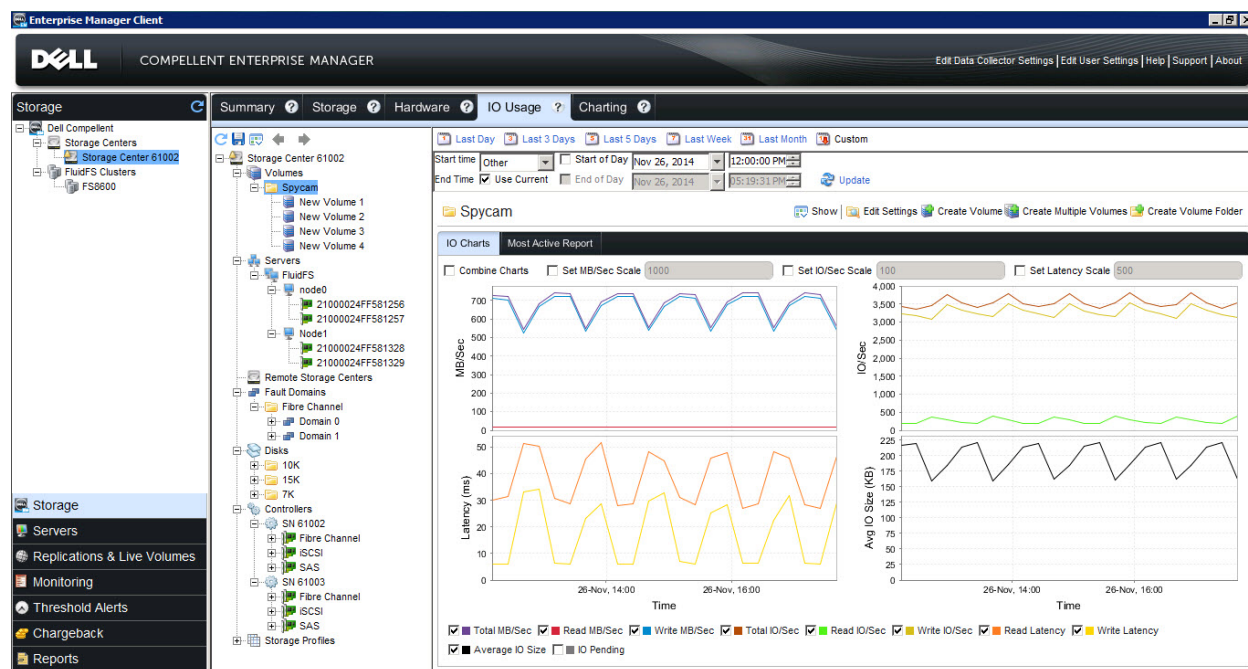


## Conclusion:

The FS8600 is a certified storage platform for use with the Milestone XProtect VMS.  With the chosen hard disk configuration used in the test, the FS8600 easily supported the benchmark level of performance.  The performance testing determined that the FS8600 storage solution can support 1500 cameras at 20 fps with this hardware configuration.

Scaling this solution is possible by aggregating an additional SC8000 and storage subsystem into additional FS8600 nodes.  Additional storage capacity can be added with incremental SC280 storage arrays.  Camera counts can be modified and spread to more servers as needed based on total aggregate archive bandwidth per server.

Integrators and end users should have confidence when building video security and surveillance systems which include the XProtect VMS and the FS8600 storage solution. These solutions are certified, and can be used to support XProtect Recording Servers which are recording between 1 and 150 cameras at megapixel resolution up to 1500 total cameras.  The XProtect and FS8600/SC8000/SC280 integrated system is highly scalable with multiple redundancy methods to create reliable high performance surveillance and security solutions for mission critical applications.

# Appendix A:

<u>Full Lab Equipment List</u>

- Network

  2x Dell Force-10 S4810 10Gbit Ethernet switch
  2x Brocade 6505 16Gbit Fibre Channel switch

- Servers

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

- Storage

  Dell FS8600 NAS dual node appliance
  SC8000 dual active-active controllers
  2x SC280 storage arrays – 84 4TB drives each