Milestone Solution Partner IT Infrastructure Components Certification Report

Dell MD3860i Storage Array
Multi-Server 1050 Camera Test Case

April-2016

Revisions

Date	Description
April 2016	Initial release

Table of Contents

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 MD3860 series storage arrays combine next-generation powerful controllers and a dense storage architecture to meet large data repository requirements. The MD3860 series can scale out to over 180 8TB drives improving density and enabling affordable high capacity configurations for data-intensive workloads such as Video Surveillance.

Visit www.dell.com/storage for more.

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 MD3860i storage array. This array was used as the storage location for 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.

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 MD3860i
- Milestone XProtect Corporate 2016
    - 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 A.

MD3860i

Key Findings

The MD3860i performs as primary or 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 1050 camera workload listed below, Seven XProtect Recording Servers were used to manage and record video to a local L: volume and then archived hourly to MD3860i storage via 10 Gbit Ethernet iSCSI connections to the archive video database. A second test was done with all recordings going direct to the MD3860i via iSCSI as the active database.

Test Scenario	Storage Solution	Maximum Number of Cameras	Individual Video Stream Size (Mbps)	Maximum Disk I/O (MBps)
Benchmark	MD3860i	1050	3.65	500

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 is consistent with the Milestone Server and Storage Calculator.

Solution Architecture:

Topology

The test surveillance system was assembled and installed at Nashua Design Center in Nashua, New Hampshire. The system topology included 7 servers running a Microsoft Windows x64 based Server 2012 operating system hosting the Milestone XProtect Corporate Management Server, Management Client, Record Server and Smart Clients. Server allocation:

1 Management Server / Record Server
6 Record Servers
4 View Clients – grid of 25 playback streams

The MD3860i used 10 Gigabit Ethernet interfaces for recording as the storage controller interfaces. MD3860i is a dual controller active-active SAN, and has dual 12 Gigabit SAS connections for expansion. The test topology is shown in Figure 1 below:

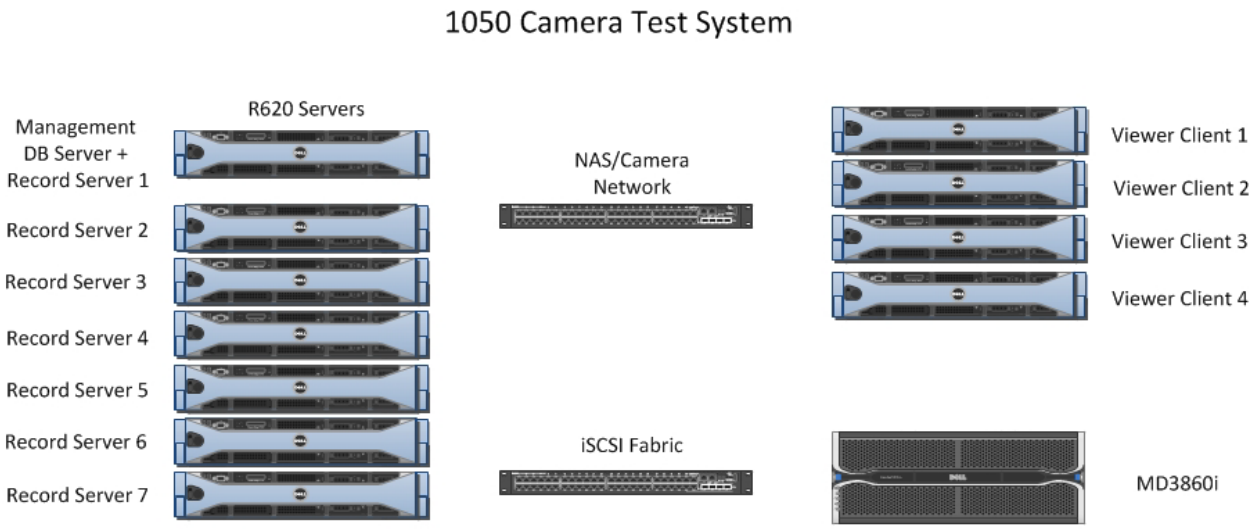


Figure 1

One instance of the video feed simulator and video content files were placed on each Record Server. In this configuration video streams are sent across the IP network to be recorded first locally on each Record server and then archived to MD3860i for longer term storage. Placing the video stream sources within each Record Server removes any potential network bottlenecks between cameras, encoders, or other video sources and the recording servers themselves. The specific configurations detailed in Figure 1 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 Platform

The MD3860i is a 4U high-density storage array configured with 60 x 3.5” 4TB drives for this test. Larger capacity drives can be configured as available. For a sense of capacity and retention time, the MD3860i yields over 164TB of usable DDP or Dynamic Disk Pool capacity or about 30 days retention for 150 cameras at a 30 frame rate. Additional MD3060e expansion enclosures can be added to scale the capacity of the solution, but this system 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 retention times of a typical deployment for 1050 cameras.

The PowerVault Modular Disk Storage Manager tool is used for provisioning and configuration. See figure 2 and 3. Multiple MD platforms can be managed from this interface as system size scales to multiple SANs or SAS expansion systems.

Given the configuration flexibility of the Milestone solution, combinations of the MD series storage systems described above can be used to aggregate even higher camera counts or longer retention times for a single surveillance solution deployment or to increase camera count using pro-rated frame rates or streaming bitrates so that the effective workload is the same.

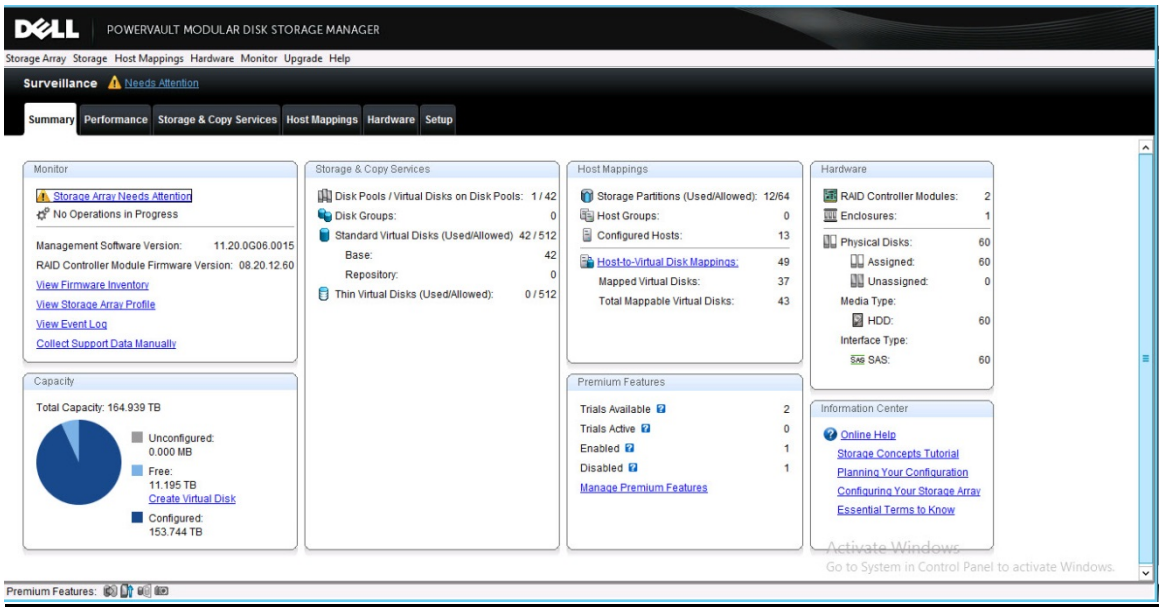


Figure 2

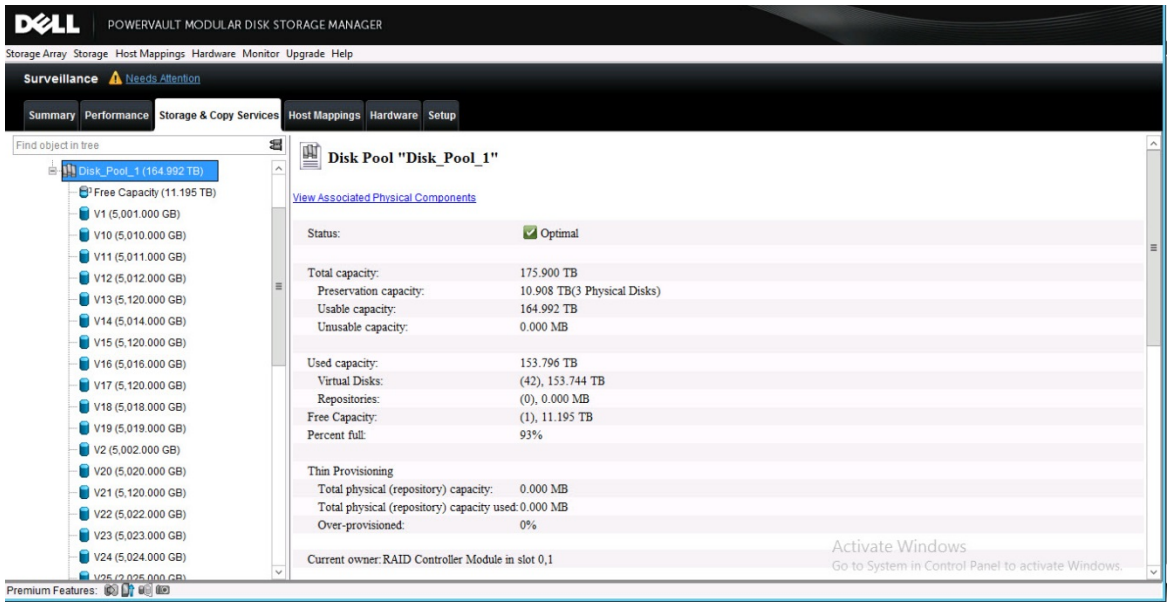


Figure 3

Storage System Configuration

Using storage configuration tools available through PowerVault Modular Disk Storage Manager, a collection of 5TB volumes was created and distributed for use by the recording servers. The storage system is composed of 60 7200 RPM NLSAS drives configured as a Dynamic Disk Pool of storage. The Record Server typically has cameras mapped proportionally to the retention time required for achieving and logical partitioning of video data. Aggregated camera data is moved from the recording server to the MD3860 by iSCSI connection on direct record or interleaved archive schedule every hour. Figures 4 and 5 below illustrate three volumes used for mapping 50 cameras each in our direct to SAN test, and the archive case schedule from Record Server internal volume L: to SAN volume X:.

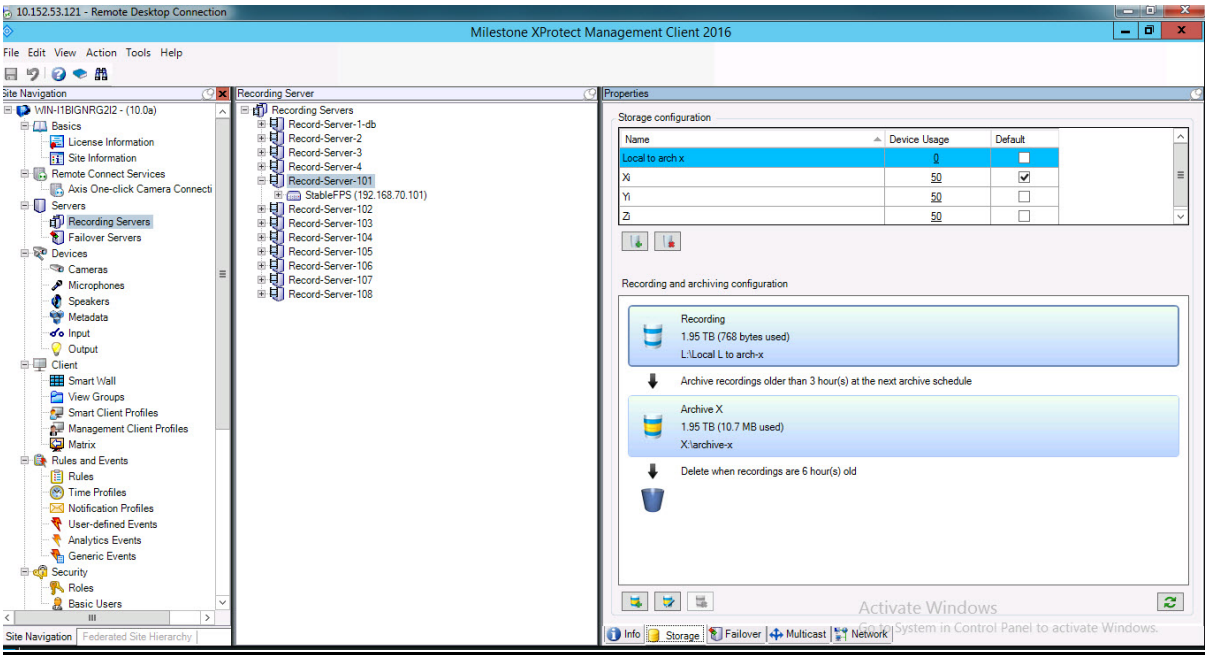


Figure 4

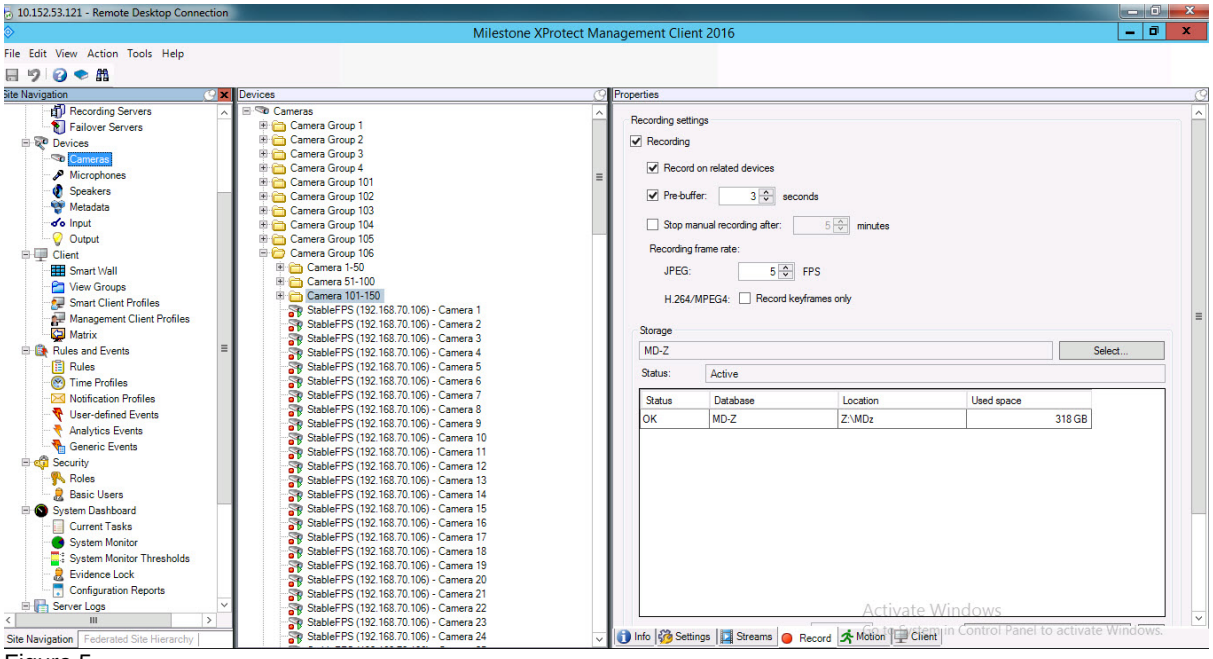


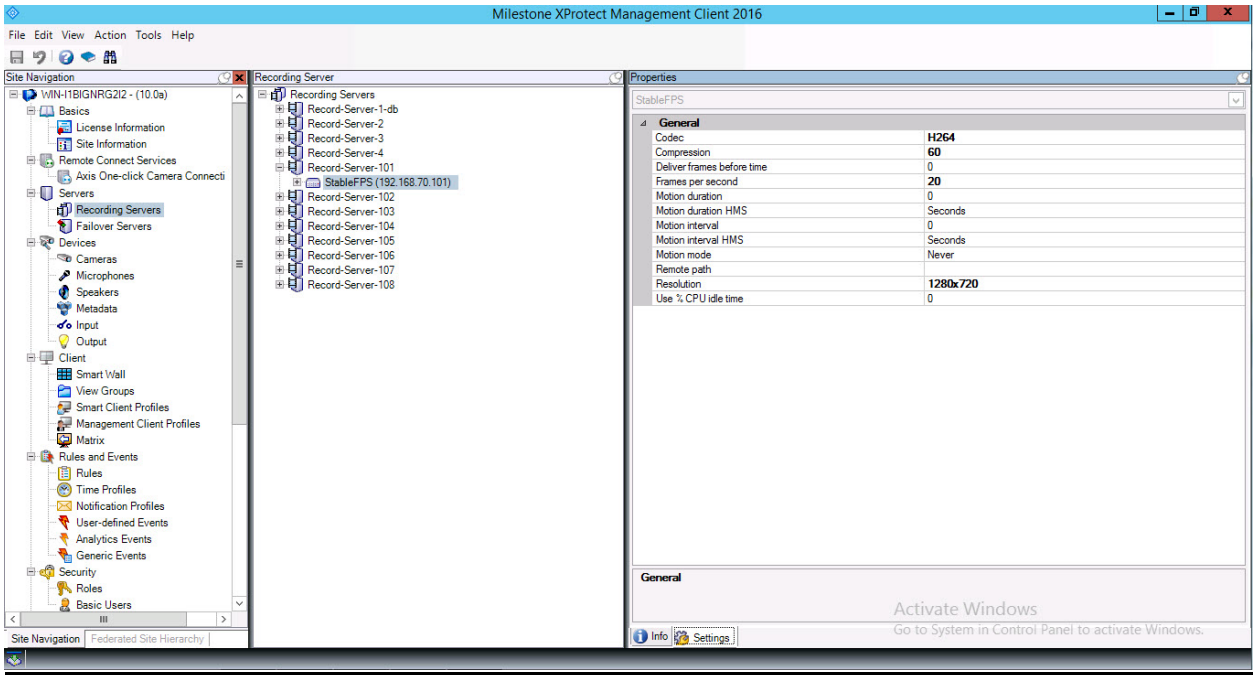
Figure 5

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.

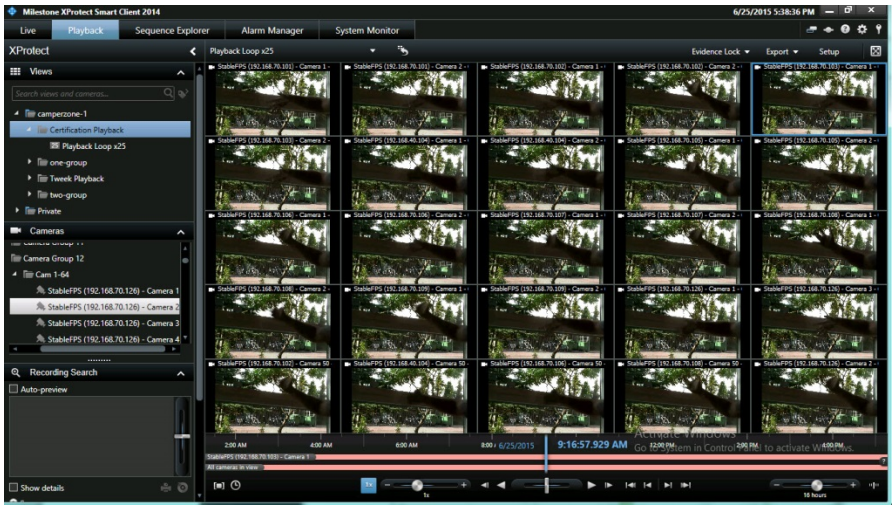
The process of increasing the parameters involved adding additional simulated cameras to each recording server. This process used 1 megapixel resolution streams, with compression of 60% and frame rate of 20 frames per second (FPS). As far as codec options: H.264 was chosen as the only codec with which 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 MD3860i 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 hours)
- Write latency values under 200 ms.

In the test scenarios discussed in this document the XProtect Record Server, which was recording video to the active databases located on each Recording Server, was configured to record 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 XProtect Smart Client application running displaying previously recorded video. To simulate a control center, 100 streams were played back simultaneously, 25 each on 4 separate view client during all testing.



A playback workstation providing 25 playback streams

.

Milestone recommends always configuring a live and an archive database. For the test, each XProtect Record Server was configured to use a live volume database labeled L: and iSCSI block volumes 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 3 hours and 6 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. Direct record to iSCSI volumes X, Y and Z was also tested.

An optimal configuration for performance with the MD3860i solution is to place the live database on each recording server and archive database on the iSCSI attached block volumes. The MD3860i also provided 100 playback streams from 4 dedicated view clients, 25 streams per client. This configuration uses RAID 10 on the local Record Server drives and DDP 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.

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 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:

- 1050 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 using RAID 10
- Archive Database - 60 x 7,200 RPM 4TB NLSAS disks RAID 6

Product Benchmark test results per Recording Server (1 of 7):

Average aggregate Live / Archive Database Write Throughput	500 MBps
Average Live Database Write Throughput per server	72 MBps
Average Individual Camera Stream Size	3.65 Mbps
Average Recording Server CPU Utilization	27%
% Frames Lost	0.0%
Average Live DB IO Latency	<20 ms

Archive migration was scheduled for every 60 minutes. Archives were taking place on a continuous rotation with average aggregate bandwidth of 150 MB/sec.

The maximum stream simulator count of 150 cameras per server at 20 frames per second rate was the boundary condition 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 determining capacity and spindle count for the storage solution. As a result, the aggregate camera count / bandwidth will not typically be a limiting factor in system design for the MD3860 storage array if spread across enough Record Servers.. Separate testing will explore a building block configuration with a single record server and storage array.

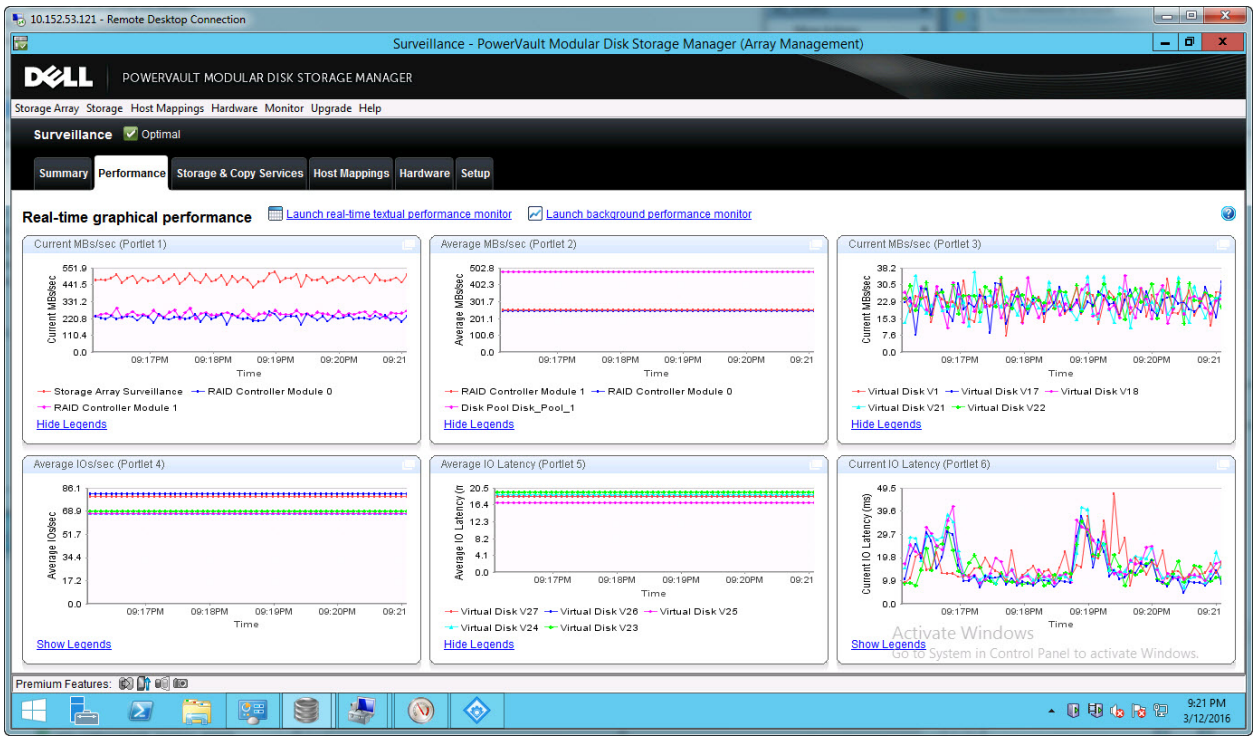


Figure 6

Conclusion:

The Dell MD3860 series is a certified storage platform for use with the Milestone XProtect VMS. With the chosen hard disk configuration used in the test, the MD systems easily supported the benchmark level of performance. The performance testing determined that the MD3860 storage solution can support 1050 cameras at 20 fps with seven record servers with this hardware configuration.

Scaling this solution is possible by aggregating additional MD3860 members into the storage system. 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 can have confidence using the MD-Series storage when building video security and surveillance systems which include the XProtect VMS. The XProtect and MD3860 system is highly scalable with multiple redundancy methods to create reliable high performance surveillance and security solutions for mission critical applications.

Appendix A:

Full Lab Equipment List

- Network

  2x Dell Force-10 S4810 10Gbit Ethernet switch

- Servers

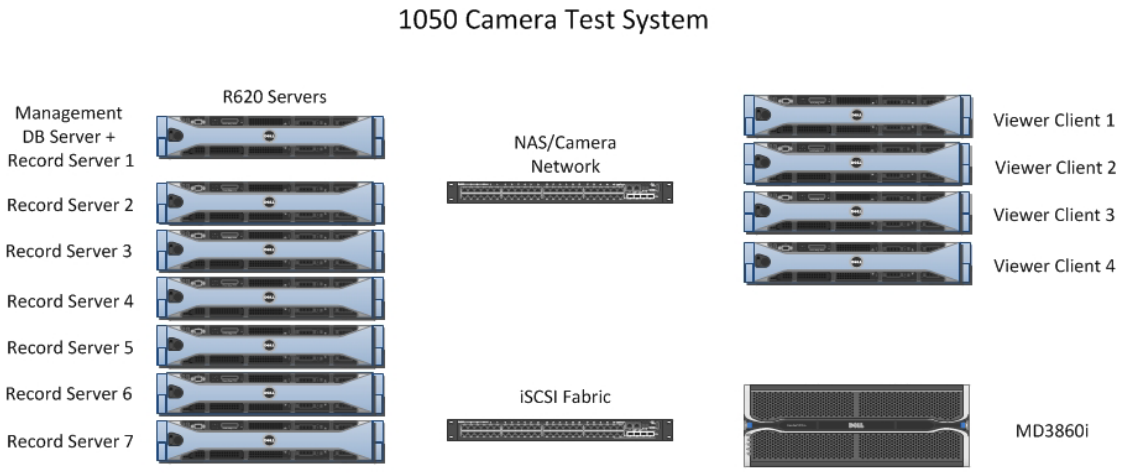
  1x Dell R720 Master DB + Recording Server - Windows 2012-R2, configured with two 2-port, 10 Gbit Ethernet Intel X520 NICs, 32GB RAM, Perc RAID controller with 2x 15Krpm 300GB system drive in R1 and 14x 10K rpm 900GB drives in R10 for (video active database)

  6x Dell R620 Record Server - Windows 2012-R2, configured with two 2-port, 10 Gbit Ethernet Intel X520 NICs, 32GB RAM, Perc RAID controller with 2x 15Krpm 300GB system drive in R1 and 6x 10K rpm 900GB drives in R10 for (video active database)

  4x Dell R620 View Clients - running Windows 2012-R2, configured with two 2-port, 10 Gbit Ethernet Intel X520 NICs, 32GB RAM, Perc RAID controller with 2x 15Krpm 300GB system drive in R1

- Storage

  Dell PowerVault MD3860i 60x4TB NL-SAS drives with dual ten gigabit iSCSI controllers



Appendix B:

Solution Sizing

Approximate Solution Sizing example for HD video at 20 Frames per second camera streams

	Number of MD3860/MD3060-4TB Platforms	1	2	4
	Approximate DDP Capacity TB	150	300	600
Approximate Retention Days using 20 FPS, 3 mbits/sec H.264 1280x720	150 Cameras	30	60	120
	300 cameras	15	30	60
	450 cameras	7.5	15	30

Number of 15-TB Volumes / MD3860/MD3060-4TB	10
Cameras per 15 TB volume at 30 days retention 20 fps 3 mbits/sec using H.264 1280x720	15

Details on Dynamic Disk Pools can be found here:
http://www.dell.com/learn/us/en/04/shared-content~data-sheets~en/documents~dynamic_disk_pooling_technical_report.pdf