Milestone Solution Partner Certification

Reference Architecture

Rasilient Systems

AS85 + PS5000 Video Class (NFD Systems)

11-11-2016

rasilient
built for surveillance

milestone
The Open Platform Company

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About Rasilient Systems:

Rasilient Systems is the world's leading provider of IP video surveillance and storage systems purposely architected for IP video data. Its systems have been installed worldwide since 2001 in places that demand ultimate video surveillance quality and reliability. They include museums, city and federal government offices, aerospace contractors, financial institutions, education establishments and coliseums.

Rasilient's patented NFD technology focuses on delivering superior video data recording performance and reliability to eliminate recording gaps to reduce costly liabilities from image losses. Its high speed servers are VMS agnostic. Its RAID controllers are optimized for video surveillance traffic offering extraordinary reliability, efficiency, and scalability in storage. For more information, please go to www.rasilient.com.

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.

Introduction:

This reference architecture was created because of the Milestone Technology Partner certification tests performed on Rasilient NFD systems (formerly known as XCS) with AS85 and PS5000 Video Class. During the test process engineers from Milestone and Rasilient Systems designed special scenarios to test the performance of XProtect software when used in typical surveillance environments. The Milestone Technology Partner (MTP) Certification program seeks to confirm that server, storage and network solutions provided by qualified MTP vendors meet the performance benchmarks required to support the Milestone XProtect VMS applications, and to measure the maximum performance available to Milestone customers if they choose to build a solution using certified MTP products.

Certified Products

- NFD Systems (AS85 + PS5000 Video Class)

- Milestone XProtect Corporate 2016 R3 (10.2a)

Performance of the solution may vary if different XProtect products and/or system components not listed in the tests details are included.

Test Process:

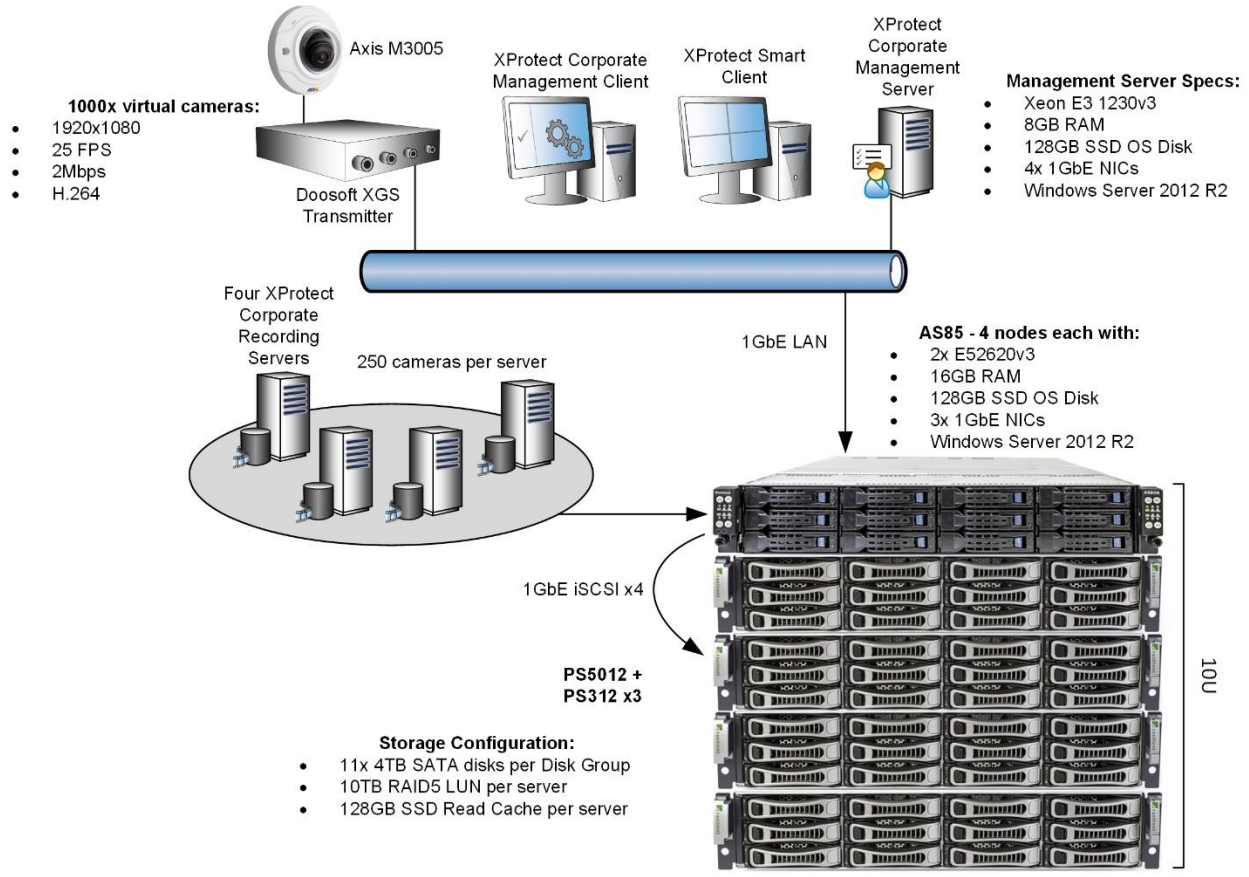
This test system was specifically designed to verify that Rasilient NFD systems would support 1000 total cameras on an XProtect Corporate system. Four blade servers in the AS85 each supported an XProtect Recording Server recording 250 camera streams each, with all cameras streaming at 2Mbps.

Test System Video Stream Profile:	Test System Video Recording Architecture:
• 1000 total cameras • 4 total Recording Servers • 250 cameras per server • 1920x1080 image resolution • 25 frames per second • 2 Mbps stream size • Recording Continuously – No Video Motion Detection (VMD) • Each server recorded only to the Live Database - no archiving	• AS85R STD – Contains 4x Server Blades • Each blade contains: Dual Xeon E5 2620v3, 16GB RAM, 3x GbE NICs, 128 GB SSD OS drive, WS2012 R2 • PS5000 Video Class SAN storage array • 44x 4TB SATA 5.9K RPM • 4x 11 drive RAID5 – Live Database • 128GB SSD read cache per disk group • iSCSI storage interface

Topology

The test scenarios used to test the NFD systems were designed to ensure that this system could easily support 1000 HD cameras on 4 XProtect Recording Servers all running within the single AS85 unit, and record video on the PS5000 array without dropping any frames. The topology was the same in both scenarios, however in the second scenario, the RAID array was in the process of rebuilding due to a simulated drive failure.

Scenario 1:



Custom XProtect Recording Server Configurations:

Each of the four XProtect Corporate Recording Servers was specifically customized by a Milestone engineer to operate optimally under a large data load. This includes making changes within the XProtect Management Client and customizing the Recording Server .xml config files.

- Applying all recommended hotfixes to the XProtect Corporate 2016 R3 Recording Servers
- Disabling all Video Motion Detection and default recording rules
- Creating a custom rule to continuously record all cameras
- Increasing the maximum frames allowed in the recording queue from the default of 50 to 500
- Increasing the duration of each camera directory from 1 hour to 8 hours

After installation and configuration of all required XProtect VMS components, the first step in the test was to gather a 24-hour benchmark of performance data. This data will prove that this solution will support the full 1000 cameras without dropping a single frame while operating at full health. Also, it is against this level of performance that we will compare the performance of the system when it is operating in a degraded state due to the RAID rebuild. For the NFD systems to pass this test it needed to operate within the following limits.

Performance Criteria:

- <70% CPU utilization on all Recording Servers
- <200 ms Read Latency on all Recording Servers
- Zero dropped frames across the entire NFD systems

Test Results:

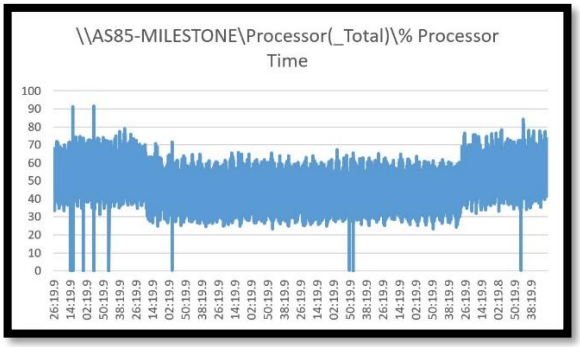
The performance of the array was monitored during both the benchmark and degraded state tests to ensure that we never reached an unacceptable level of write latency, CPU consumption, or video frame loss. If the system has less than 200 miliseconds of Read Latency, has an average CPU consumption of less than 70%, and records 99.9% of the frames that is what Milestone considers acceptable parameters for performance. Rasilient Systems wanted to achieve 100% of recorded frames and this level of performance was adopted as the new limit. If the system was operating within these parameters, then a full 24-hour data capture would take place.

Scenario 1 Performance Data & Analysis:

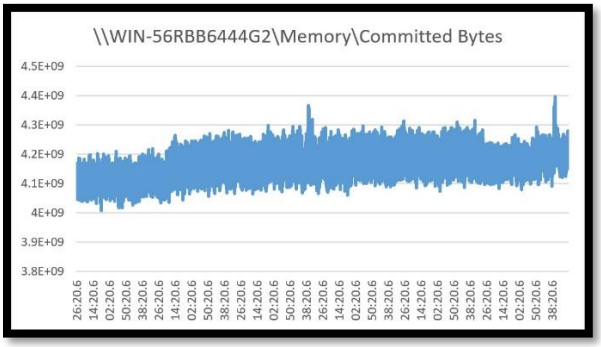
Scenario 1 is a benchmark test with the recording bandwidth on each recording server measured at 59MB/sec for a total of 1.90GB/sec. All 1000 cameras were set to recording continuously at 25 FPS. The data points in the table below each represent an average taken over a 24-hour period, except the maximum I/O per second data, which represents the maximum I/O that each Recording Server was measured to be processing during any one second during the entire 24-hour period. The data for each of these statistics was sampled every second across every server throughout the entire 24-hour period.

Server	Frame Loss %	CPU %	Read Latency (ms)	Disk Throughput (MBps)	Max IO/sec
1	0	46.82	11.5	59.91	31,965
2	0	48.36	11.05	59.92	27,514
3	0	42.23	10.33	59.90	31,646
4	0	49.38	10.23	59.73	27,021

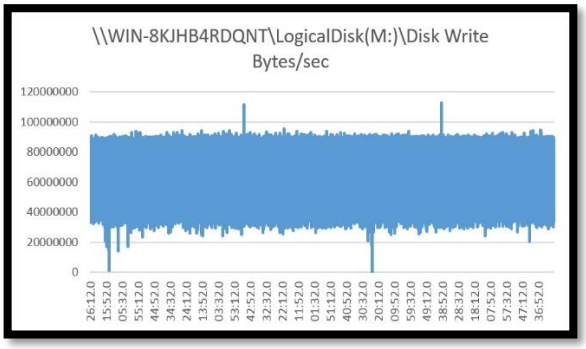
CPU Utilization on Server 1



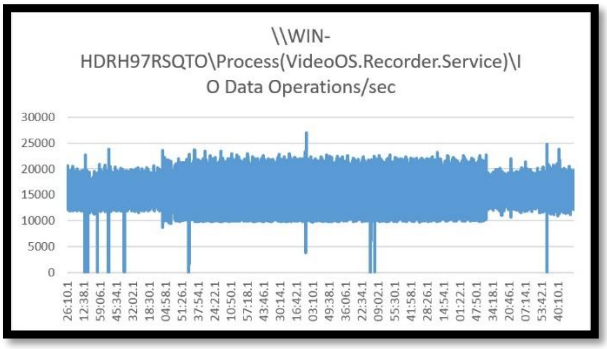
Memory Consumption on Server 2



Disk Throughput (Bps) on Server 3



Recording Server IO/sec on Server 4



All the performance data that was analyzed: CPU, Memory, Disk Throughput…etc., from each of the four servers was extremely predictable, stable, and similar across all four servers. This represents a very healthy operational environment, and there were exactly zero frames lost across all four servers. In fact, we repeated this 24-hour test 3 times, for a total of 72-hours across a period of more than 3 weeks, and in none of our data samples could we find an instance of lost frames.

Once the (Scenario 1) benchmark data was analyzed and it was determined that the system was operating in a healthy state, the test process called for initiating a RAID rebuild to determine if the system would still support the same amount of video while in a degraded state. We chose to initiate a RAID array rebuild by removing a disk at random from each disk group while the system was running to artificially create a degraded state for the recording architecture.

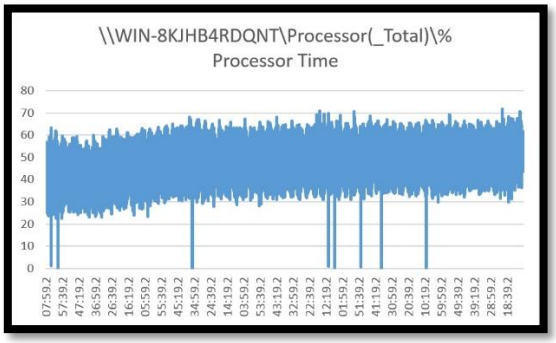
Scenario 2 Performance Data & Analysis:

Scenario 2 is like the first scenario, except for two things:

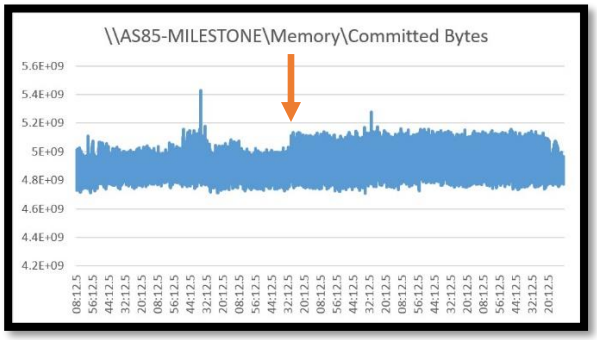
1. Recording bandwidth on each server was measured at 65MB/sec for a total of 2.09GB/sec.
2. RAID rebuild is triggered by a simulated drive failure (a spinning drive was physically removed), and test results were collected during the rebuild and for a short period after the rebuild completed.

Server	Frame Loss %	CPU %	Read Latency (ms)	Disk Throughput (MBps)	Max IO/sec
1	0	59.42	14.7	65.83	36,378
2	0	57.89	14.66	65.84	33,140
3	0	47.56	12.09	68.83	30,956
4	0	45.8	10.59	65.8	37,601

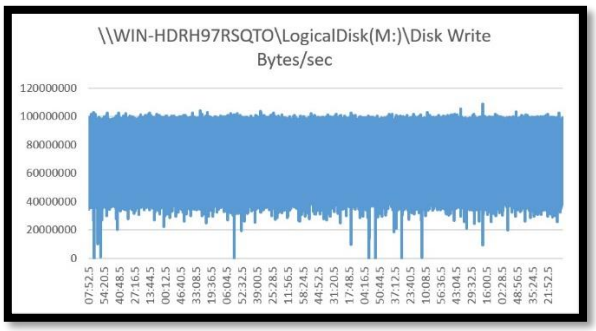
CPU Utilization on Server 3



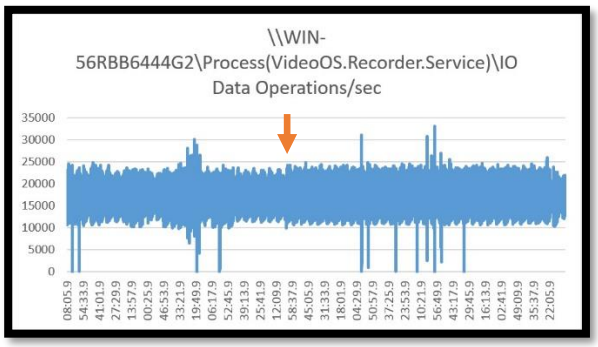
Memory Consumption on Server 1



Disk Throughput (Bps) on Server 4



Recording Server IO/sec on Server 2



There were a couple of changes to the video stream profile between scenario 1 and scenario 2. The stream size of each individual camera was increased from 1.90 to 2.09 Mbps. This affected the total disk throughput by increasing the amount of data being recorded from 59 to 65 MBps on each server. With increased data, we also saw an increase in CPU consumption and an increase in IOps.

The RAID rebuild affected all of the servers in a similar manner, but the health of the servers was not negatively impacted. The only observable impact was a slight increase in memory consumption after the rebuild completed, and a more consistent IO profile after the rebuild completed as well. The RAID rebuild took about 36 hours to complete, and our data sample was started when there were 10-12 hours remaining in the rebuild. You can see the rebuild complete at the points indicated with the orange arrows

in the graphs above from the Memory, and the IOps. Most importantly, during the entire rebuild process and during our entire 24-hour data sample there were zero dropped frames.

Conclusion:

Performance of the AS85 and PS5000 NFD systems solutions from Rasilient Systems Inc. integrated with the Milestone XProtect VMS was highly impressive. The solution supported a total of 260MBps of disk throughput, and over 2Gbps of network bandwidth from the 1000 cameras in the test system.

The NFD systems also exceeded expectations by not dropping a single frame of video during the entire test period, while supporting 1000 high definition video surveillance cameras and being subject to a intentionally triggered disk failure that caused a RAID rebuild. This is an extremely impressive level of performance. The NFD system is certified as a server and storage platform for use with the Milestone XProtect VMS.

Integrators and end users designing, installing and operating surveillance systems which incorporate the NFD systems can be confident that the system will record video reliably in healthy conditions and degraded conditions. Scenarios where this solution would be particularly effective include education, government, casinos, large shopping centers, airports, and any facility where there are 250 to 1000 or more surveillance cameras with a dense distribution. Even more valuable is the fact that the NFD systems and XProtect have been proven to record every frame of video, which is often mandated by regulatory standards.