Technical Report

E2800 and E5700 with Milestone XProtect VMS

Milestone Certification Effort Results

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In partnership with

Abstract

This report provides detailed certification test results performed on NetApp® E2800 and E5700 hybrid storage arrays. These arrays served as the video storage system for the Milestone XProtect video management software (VMS) surveillance system. This effort followed the Milestone certification process and sought to confirm that server, storage, and network solutions provided by qualified solution partners met the minimum performance benchmarks to support Milestone XProtect VMS applications. This report outlines the configuration and performance results of the certification efforts.

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1 E2800 Test Setup

NetApp tested the E2812 and E2860 storage arrays in multiple scenarios and configurations with Milestone XProtect Corporate video management software. The test systems were configured and installed at a NetApp test laboratory. (For more information on the NetApp® E2800 storage system, see TR-4725: Introduction to NetApp E-Series E2800 Arrays.)

1.1 Products Tested

- NetApp E-Series storage:
  - E2860 storage array with E-Series SANtricity® OS controller software 11.50.1
  - E2812 storage array with E-Series SANtricity OS controller software 11.50.1
- Milestone XProtect 2019 R1 Corporate

Note: Performance of the solution might vary if different XProtect products and/or system components not listed in the tests details are used.

1.2 Test Components

- Storage arrays:
  - NetApp E2860, dual 10Gb controllers, 16GB RAM, 60 x 7200 RPM near-line SAS (NL-SAS) HDD, two 30-drive disk pools
  - NetApp E2812, dual 10Gb controllers, 16GB RAM, 12 x 7200 RPM NL-SAS HDD, in two 4+2 RAID 6 configurations
- VMS:
  - XProtect Corp 2019 R1 Recording Server—Intel Xeon CPU E5-2670 v3 @ 2.30GHz, 128GB RAM, Windows Server 2019 Datacenter 64-bit
  - XProtect Corp 2019 R1 Management Server—Intel Xeon CPU ES-2699 v3 @ 2.3GHz, 131072MB RAM, Windows Server 2016 Datacenter 64-bit
  - XProtect Corp 2019 R1 Smart Client—Intel Xeon CPU ES-2630 v3 @ 2.4GHz, 65536MB RAM, Windows Server 2016 Datacenter 64-bit
- Camera simulator:
  - Simulated camera named the feed server (stable FPS)—Intel Xeon CPU ES-2630 v3 @ 2.4GHz, 65536MB RAM, Windows Server 2016 Datacenter 64-bit
- Network (camera and storage):
  - 2 x 10Gb Ethernet (10GbE) switches used for client and feed networks
  - 1 x 10GbE switch used for iSCSI storage network

Scenario 1: 800 simulated video streams were used in this test. The E2860 array was the tier 1 (primary) storage. Two 30-drive disk pools were created on the storage, each with a single volume mapped to the recording server (RS).

Scenario 2: 800 simulated video streams were used in this test. The E2812 array was the tier 1 storage. Two 4+2 RAID 6 volume groups were created on the storage, each with a single volume mapped to the RS.

Scenario 3: 400 simulated video cameras were used in this test. The RS wrote to the tier 1 storage volumes that were provided by the E2812 array. The video was then archived to the E2860 array.

In all test scenarios, the simulated video streams used the following configuration:

- 30 frames per second (FPS)
- H.264 video codec
- Image resolution of 1920x1080 (2.1 megapixel/1080p/6 megabits per second [Mbps])

Figure 1, Figure 2, and Figure 3 show the testing topology for each scenario and Figure 4 shows the RS settings for camera groups.

Figure 1) Scenario 1: E2800 as tier 1 storage.

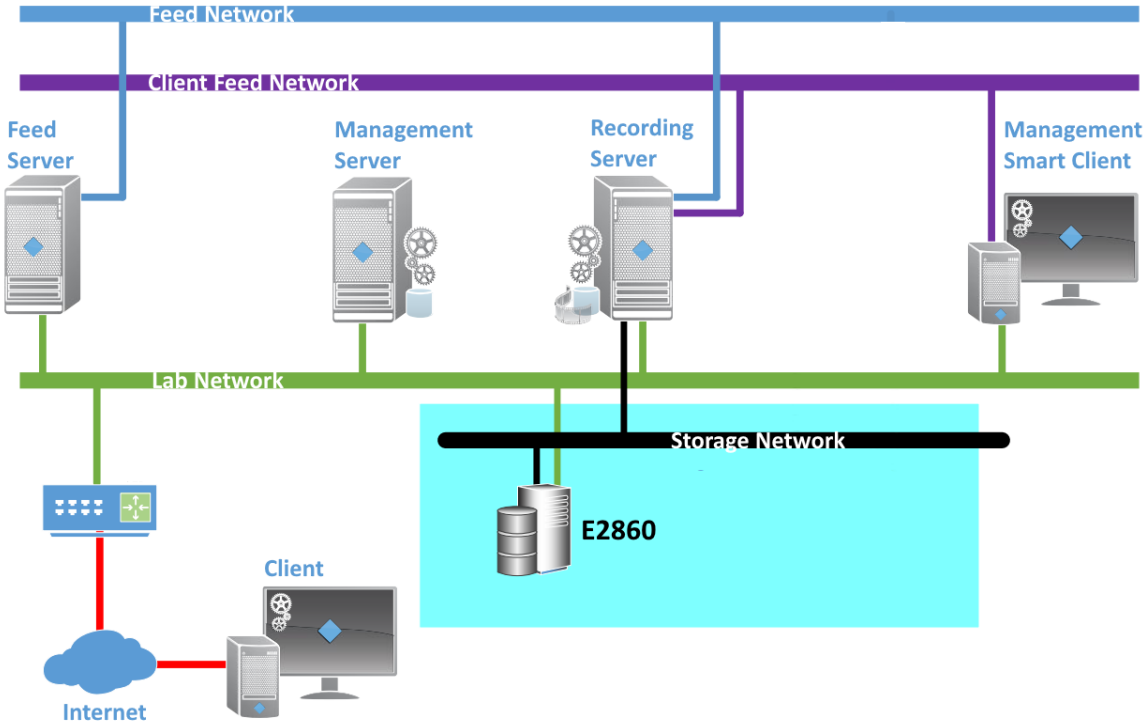


Figure 2) Scenario 2: E2812 as tier 1 storage.

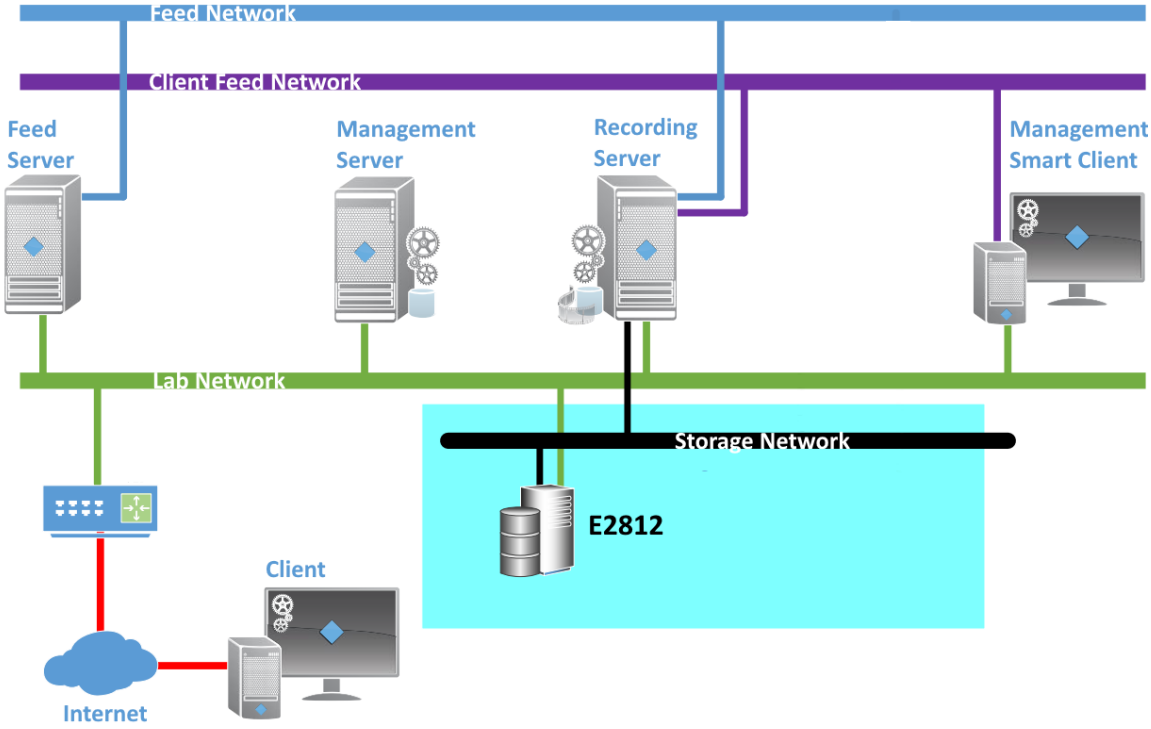


Figure 3) Scenario 3: E2812 as tier 1, E2860 as tier 2.

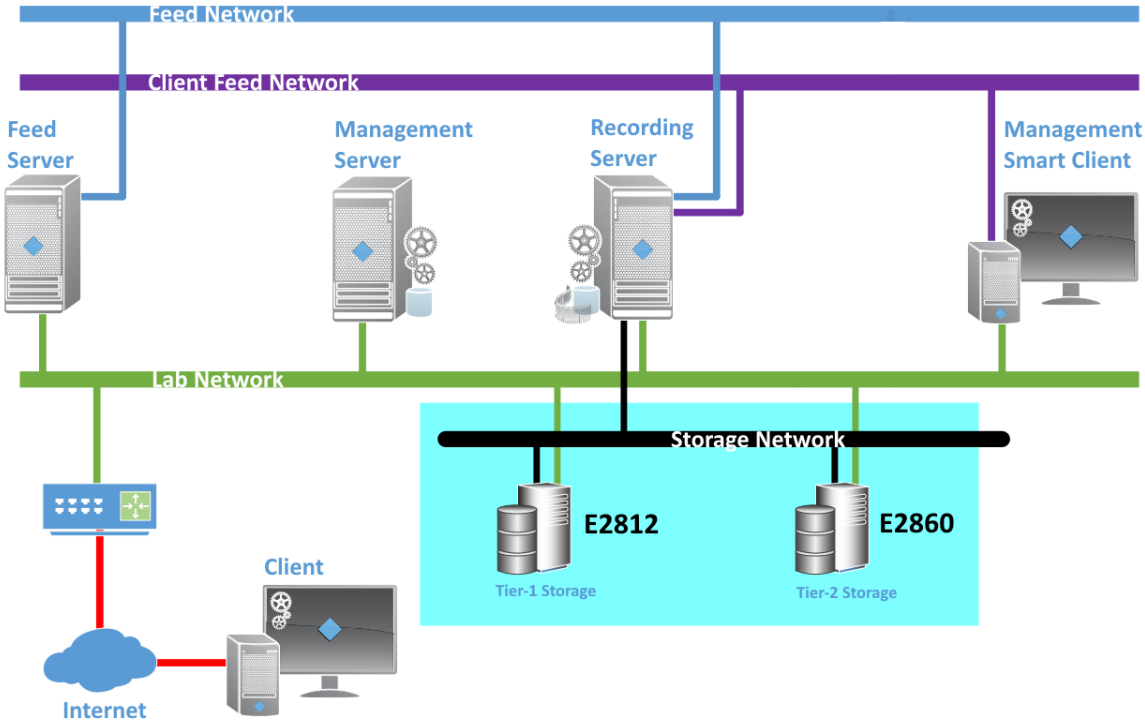
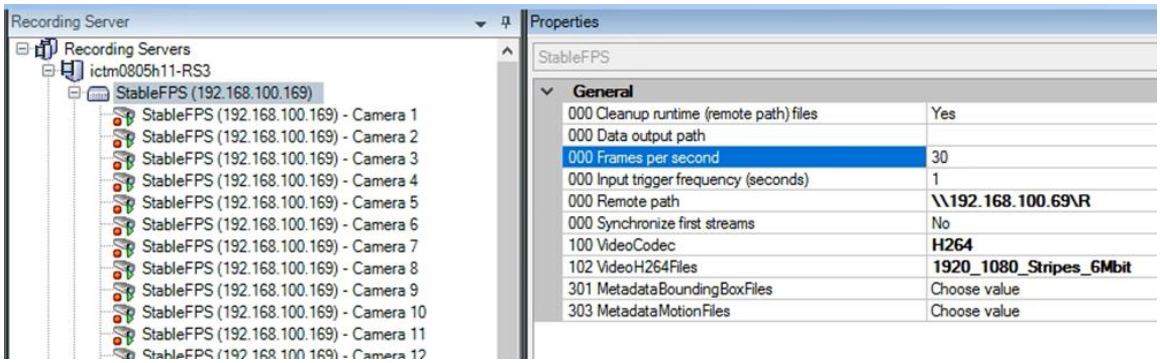


Figure 4) RS settings: camera groups.



2 E2800 Performance Results and Description of Tested Features

The first and second test case scenarios provided performance results with 800 cameras recording to two volumes (400 cameras per volume) on a single NetApp E2800 storage system in two configurations. The third scenario tested both E2800 storage system configurations with the E2812 array configured as tier 1 storage and the E2860 array as the archive storage.

Each array had two volumes presented to the recording host. In all scenarios, the E2860 had two 30-drive disk pools, each with a single volume mapped to the recording host. The E2812 had two 4+2 RAID 6 volume groups, each with a single volume mapped to the recording host. There were four RS instances running from the single recording host, and each instance was run for a 12-hour period.

The resulting data was collected by using the Windows performance monitor on the RS for each test run, and all tests completed successfully with no dropped frames or other issues. The figures and tables that

follow show the throughput for one storage volume, the write latency to that volume, and the combined recorded metrics averaged over the 12-hour period for each scenario.

Figure 5) Scenario 1: E2860, 800-camera throughput.

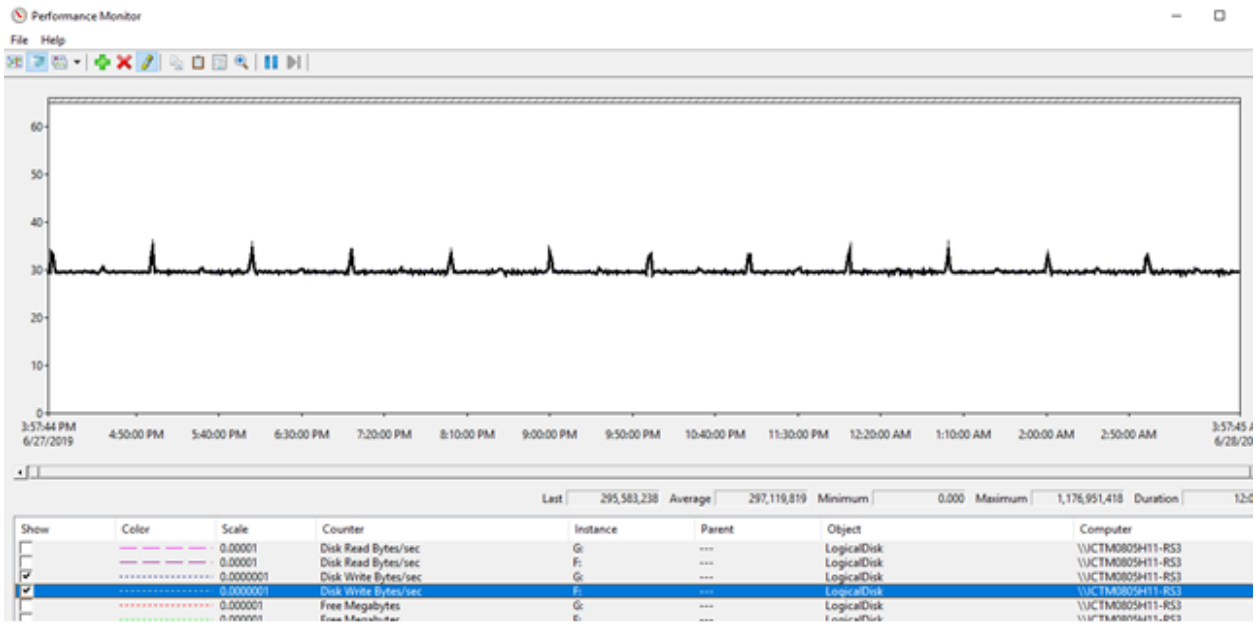


Figure 6) Scenario 1: E2860, 800-camera write latency, average disk seconds per write.

Table 1) Scenario 1 performance results: E2860.

Metric	
RSs	Single x86_64 server running Windows 2019
RS %processor avg.	24%

Metric	
Cameras	800
FPS	30
Codec	H264
Video file	1920_1080_Stripes_6Mbit
Live storage	E2860
Feed servers	1
Byte/sec (feed net)	615,820,072
Media/sec (total FPS)	23,998.51
Live disks	2x 10TB Windows volumes—F, G
F: write bytes/sec	297,119,819.09
F: sec/write (latency)	0.004
G: write bytes/sec	297,122,851.84
G: sec/write (latency)	0.004
Live disks write total (bytes/sec)	594,242,670.93

Figure 7) Scenario 2: E2812, 800-camera throughput.

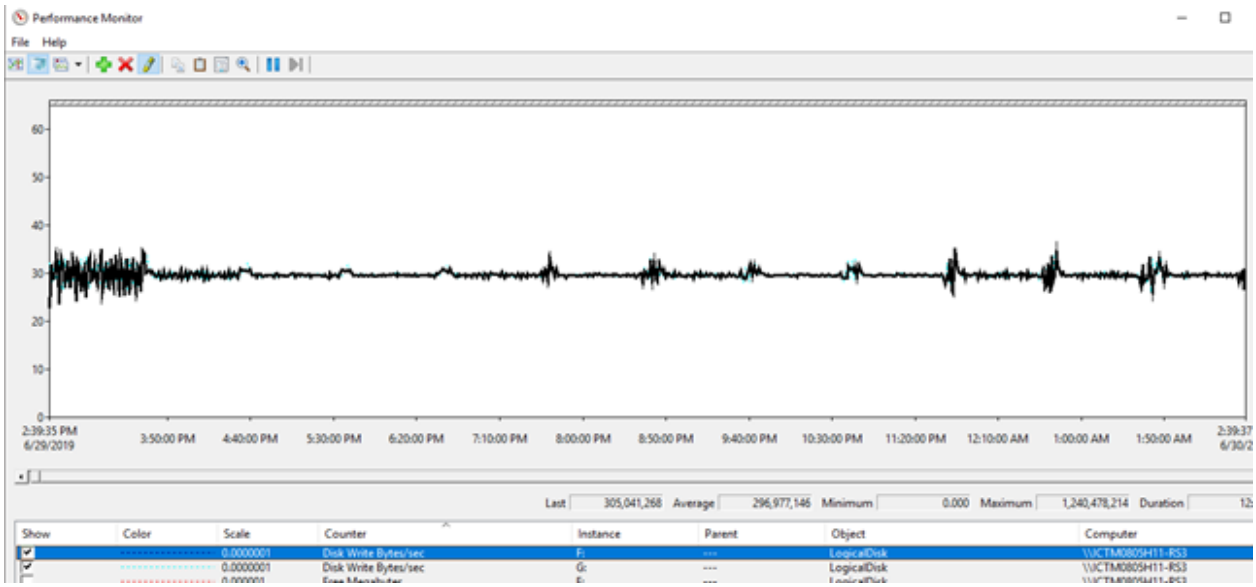


Figure 8) Scenario 2: E2812, 800-cameras write latency, average disk seconds per write.

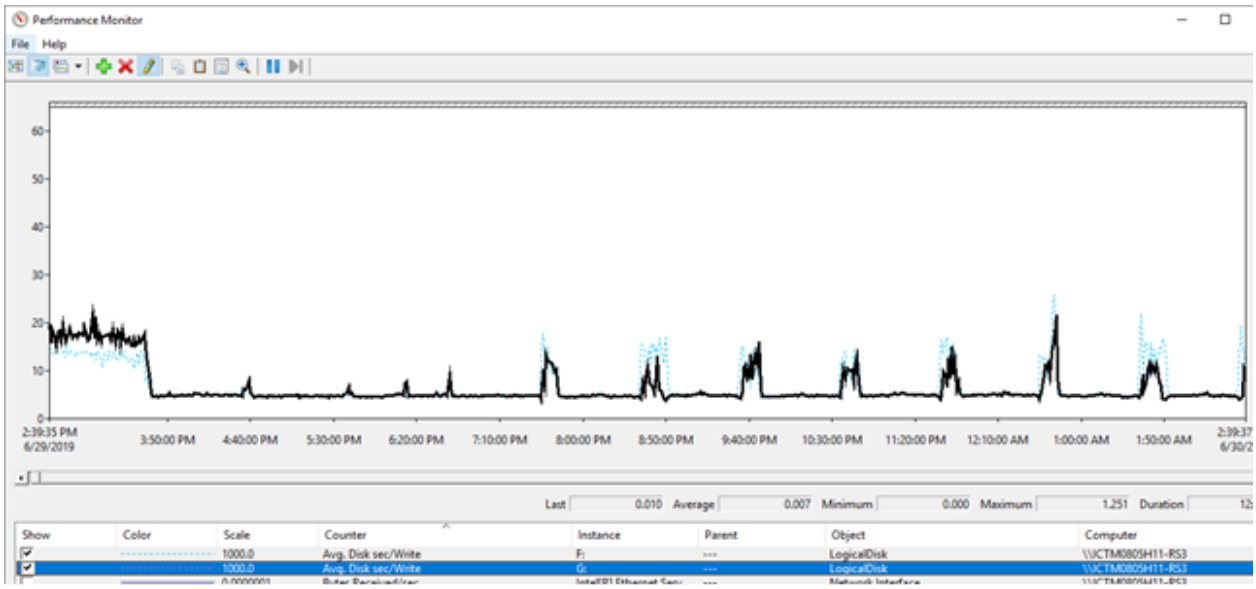


Table 2) Performance results, scenario 2: E2812.

Metric	
RSs	Single x86_64 server running Windows 2019
RS %processor avg.	28%
Cameras	800
FPS	30
Codec	H264
Video file	1920_1080_Stripes_6Mbit
Live storage	E2812
Feed servers	1
Byte/sec (feed net)	615,885,739
Media/sec (total FPS)	23,978.36
Live disks	2x 10TB Windows volumes—F, G
F: write bytes/sec	296,977,146.23
F: sec/write (latency)	0.007
G: write bytes/sec	296,887,948.38
G: sec/write (latency)	0.007
Live disks write total (bytes/sec)	593,865,094.60

Note: The total write throughput and latency were very similar for both the 60-drive configuration and the 12-drive configuration. Because latency with NL-SAS drives can easily exceed 20ms, the results showed that in both cases the systems were not operating at their maximum capable

throughput. This fact became more important as the workload changed to a combination of writes and reads associated with the archiving test case in scenario 3.

Figure 9) Scenario 3: E2812 tier 1, E2860 tier 2, 400-camera throughput with archiving.

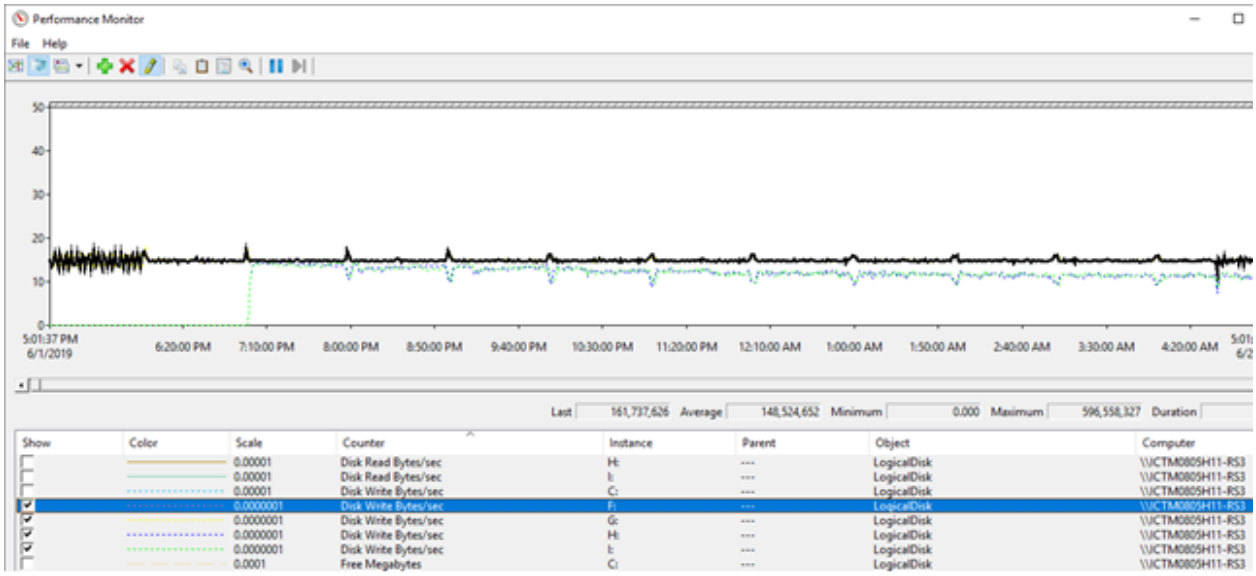


Figure 10) Scenario 3: E2812 tier 1, E2860 tier 2, 400-camera write latency, average disk seconds per write.

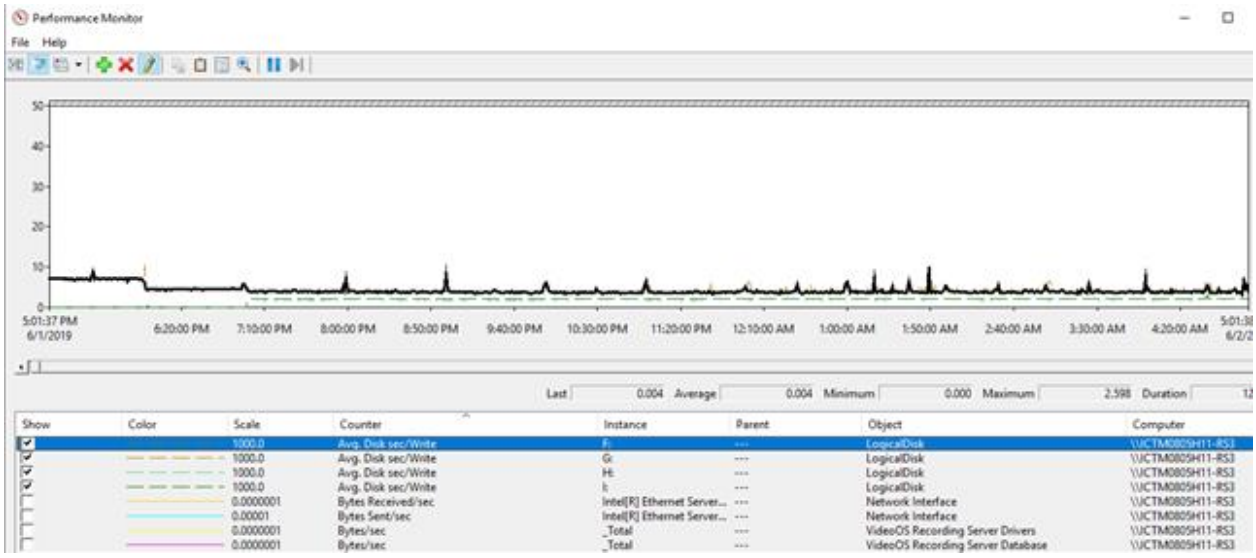


Table 3 provides a consolidated view of the test results for the recording and archiving test case in scenario 3.

Table 3) Performance results, scenario 3: E2812 live, E2860 archive.

Metric	
RSs	Single x86_64 server running Windows 2019
RS %processor avg.	6.39%
Cameras	400

Metric	
FPS	30
Codec	H264
Video file	1920_1080_Stripes_6Mbit
Live storage	E2812
Archive storage	E2860
Feed servers	1
Byte/sec (feed net)	307,958,306
Media/sec (total FPS)	11,993.81
Live disks	2x 10TB Windows volumes—F, G
Archive disks	2x 25TB Windows volumes—H, I
F: write bytes/sec	148,524,652
F: sec/write (latency)	0.004
G: write bytes/sec	148,540,000
G: sec/write (latency)	0.004
Live disks write total (bytes/sec)	297,064,652
F: read bytes/sec	142,523,393
F: sec/read (latency)	0.046
G: read bytes/sec	142,723,424
G: sec/read (latency)	0.045
Live disks read total (bytes/sec)	285,246,817
H: write bytes/sec	101,390,030
H: sec/write (latency)	0.002
I: write bytes/sec	101,523,657
I: sec/write (latency)	0.002
Archive disks write total (bytes/sec)	202,913,687

3 E2800 with Milestone Husky X8 Setup

NetApp tested the E2824 array with Milestone's Husky X8 network video recorder (NVR) with XProtect. In this scenario, the NetApp storage array was set up with a single controller in simplex mode with a single iSCSI connection to the Milestone Husky X8. The test system was configured and installed at a NetApp test laboratory.

The Husky X8 comes pre-loaded with Windows 10, which does not support full duplex controllers and multipathing to a Storage Area Network. A Windows version that supports multipathing (for example, Windows Server 2019) is required for a more highly available storage solution.

3.1 Products Tested

- NetApp E-Series storage: E2824 storage array with E-Series SANtricity OS Controller Software 11.50.1
- Milestone Husky X8 NVR
- Milestone XProtect 2019 R3 Corporate

3.2 Test Components

- Storage array:
  - NetApp E2824, single 10Gb iSCSI controller, 16GB RAM, 24 x 10520 RPM SAS HDD, two 12-drive DDP
- VMS:
  - XProtect Corp 2019 R3 running on the Milestone Husky X8 NVR; Windows 10
- Camera simulator:
  - Simulated camera named the feed server (stable FPS)—Intel Xeon CPU ES-2630 v3 @ 2.4GHz, 65536MB RAM, Windows Server 2016 Datacenter 64-bit
- Network (camera and storage):
  - 2x 10GbE switches used for client and feed networks
  - 1x 10GbE switch used for iSCSI storage network

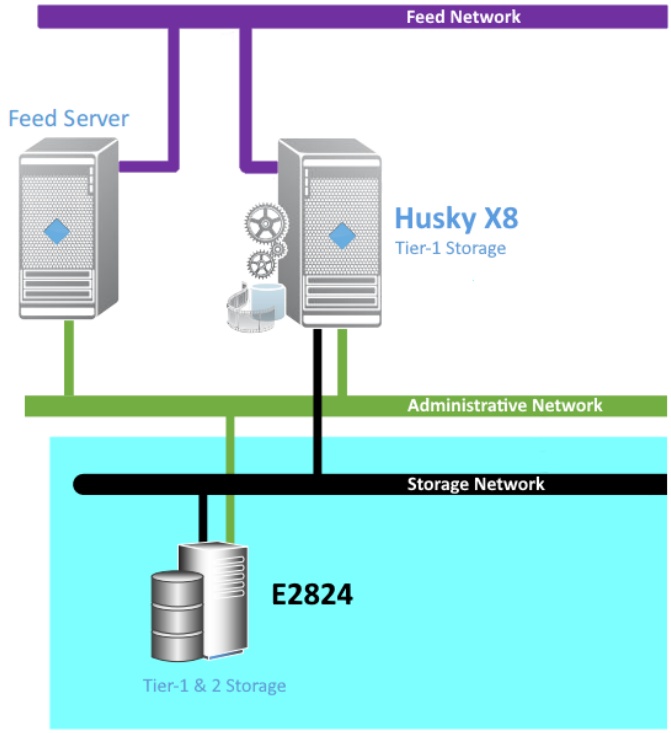
Scenario 1: 300 simulated video streams were used in this test. The E2824 array was configured with two 12-drive disk pools, and the Husky X8 was configured with a single RAID 5 volume on its internal storage drives. The Husky X8 had Windows 10 installed and was connected by 10G iSCSI to the simplex array. There were four RS instances running on the Husky X8. Two recorded 150 video streams to the RAID 5 volume, which were then archived to one of the disk pools. The remaining 150 video streams were recorded directly to the other disk pool.

In this test scenario, the simulated video streams used the following configuration:

- 20 FPS
- H.264 video codec
- Image resolution of 1920x1080 (2.1 megapixel/1080p/4Mbps)

The testing topology is shown in Figure 11.

Figure 11) E2824 storage connected to a Husky X8.



4 E2800 with Husky X8: Performance Results and Description of Tested Features

This test scenario provided performance results with 300 total simulated cameras recording to volumes on each disk pool (150 cameras per volume) on a single NetApp E2824 array. The first 150 cameras were recorded to the Husky X8 internal storage on a RAID 5 volume and then archived to the disk pool as tier 2 storage. The second 150 cameras were recorded directly to the other disk pool volume as tier 1 storage. Table 4 shows the Windows disk letter layout. The Husky's internal RAID 5 volume was mapped to D. The disk pool volumes were mapped to letters E (tier 1) and F (tier 2).

The resulting data was collected by using the Windows performance monitor on the Husky X8 NVR. The figures and tables that follow show the throughput for the storage volumes, the write latency, and the combined recorded metrics averaged over a 12-hour period.

Figure 12) E2824 tier 1: 150-camera write latency, average disk seconds per write.

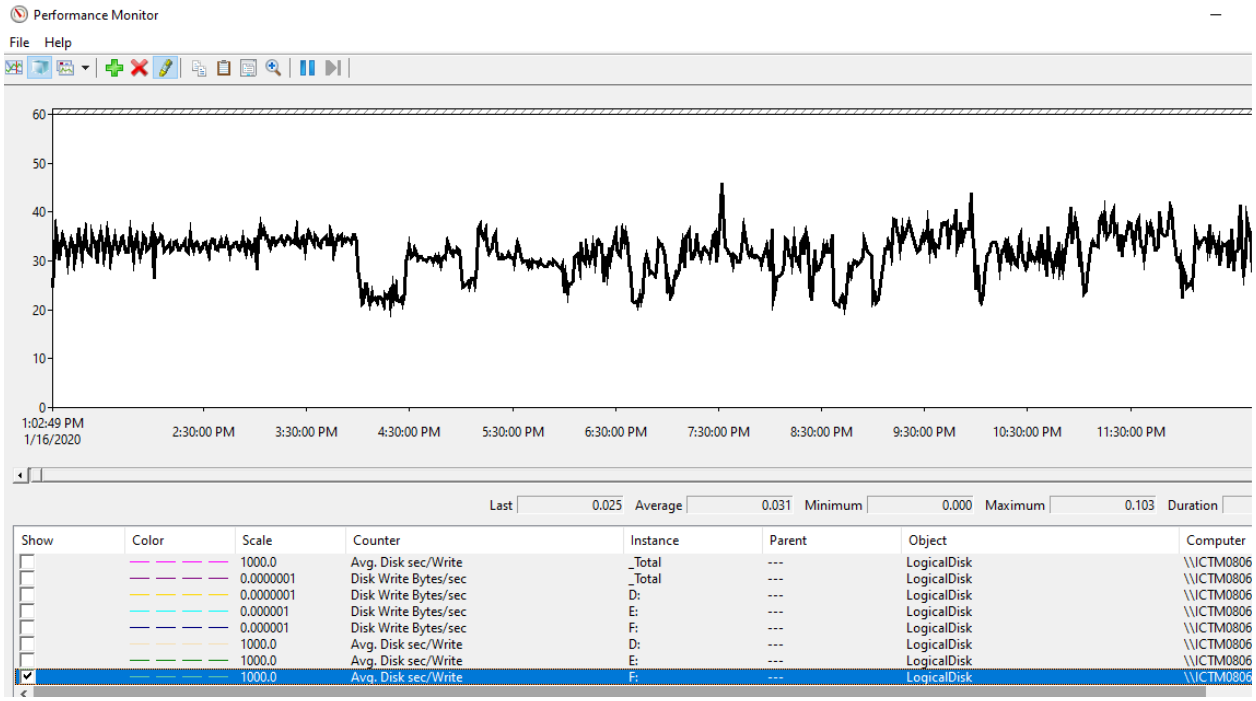


Figure 13) E2824 tier 1: 150-cameras, write bytes per second.

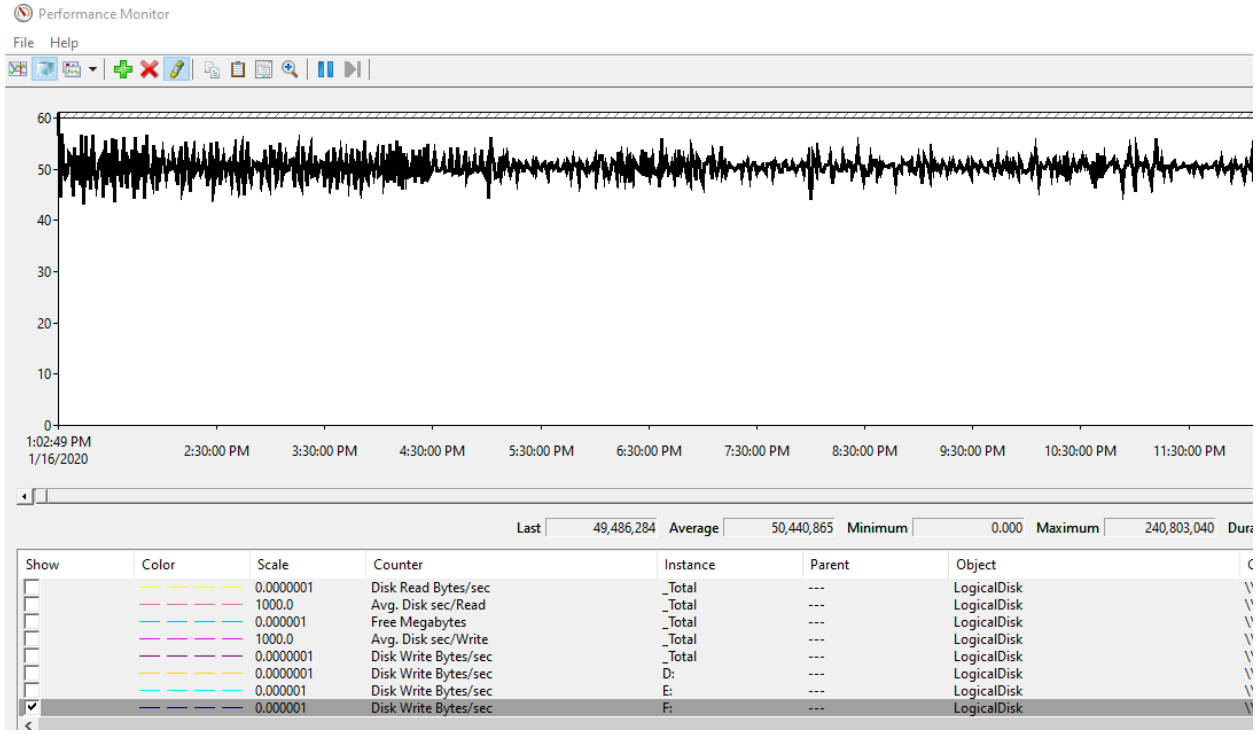


Table 4) Performance results: E2824 live and archive.

Metric	
RSs	Husky X8, Windows 10
Cameras	300
FPS	20
Codec	H264
Video file	1920_1080_Stripes_4Mbit
Live storage	Husky R5, E2824
Archive storage	E2824
%processor avg.	17%
Feed servers	1
Byte/sec (feed net)	104,731,848.72
Media/sec (total FPS)	5,999.89
Live disks	D, F
Archive disks	E
D: write bytes/sec	50,447,440.90
F: write bytes/sec	50,440,864.54
Total E-Series throughput live	50,440,864.54
E: write bytes/sec	38,301,072.78
Total throughput archive	38,301,072.78
D: sec/write	0.001
E: sec/write	0.032
F: sec/write	0.031
D: sec/read	0.021
E: sec/read	0.003
F: sec/read	0.006

5 E5700 Test Setup

NetApp tested the E5700 storage array under multiple scenarios and configurations with Milestone XProtect Corporate video management software. The test systems were configured and installed at a NetApp test laboratory. (For more information about the E5700 storage system, see TR-4724: Introduction to NetApp E-Series E5700 Arrays.

5.1 Products Tested

- NetApp E-Series storage:
  - E5760 storage array with NetApp E-Series SANtricity® OS controller software 11.50.1
  - E2812 storage array (used during tier 2 archive testing) with E-Series SANtricity OS controller software 11.50.1
- Milestone XProtect 2019 R3 Corporate

  Note: Performance of the solution might vary if different XProtect products and/or system components not listed in the test details are used.

5.2 Test Components

- Storage arrays:
  - NetApp E5760 array, dual 10Gb controllers, 64GB RAM, 60 x 7200 RPM NL-SAS (NL-SAS) HDD, two 30-drive DDP
  - NetApp E2812 array, dual 10Gb controllers, 16GB RAM, 12 x 7200 RPM NL-SAS HDD, in two 4+2 RAID 6 configurations
- VMS:
  - XProtect Corp 2019 R3 Recording Server—Intel Xeon CPU E5-2670 v3 @ 2.30GHz, 128GB RAM, Windows Server 2019 Datacenter 64-bit
  - XProtect Corp 2019 R3 Management Server—Intel Xeon CPU ES-2699 v3 @ 2.3GHz, 131072MB RAM, Windows Server 2016 Datacenter 64-bit
  - XProtect Corp 2019 R3 Smart Client—Intel Xeon CPU ES-2630 v3 @ 2.4GHz, 65536MB RAM, Windows Server 2016 Datacenter 64-bit
- Camera simulator:
  - Simulated camera named the feed server (stable FPS)—Intel Xeon CPU ES-2630 v3 @ 2.4GHz, 65536MB RAM, Windows Server 2016 Datacenter 64-bit
- Network (camera and storage):
  - 2x 10GbE switches used for client and feed networks
  - 1x 10GbE switch used for iSCSI storage network

Scenario 1: 800 simulated video streams were used in this test. The E5760 array was the tier 1 (primary) storage. Two 30-drive disk pools were created on the storage, each with a single volume mapped to the RS.

Scenario 2: 400 simulated video cameras were used in this test. The RS wrote to the tier 1 storage volumes that were provided by the E2812 array. The video was then archived to the E5760 array.

In both test scenarios, the simulated video streams used the following configuration:

- 30 FPS
- H.264 video codec
- Image resolution of 1920x1080 (2.1 megapixel/1080p/6Mbps)

The following figures show the testing topology for each scenario:

Figure 14) Scenario 1: E5760 array as tier 1 storage.

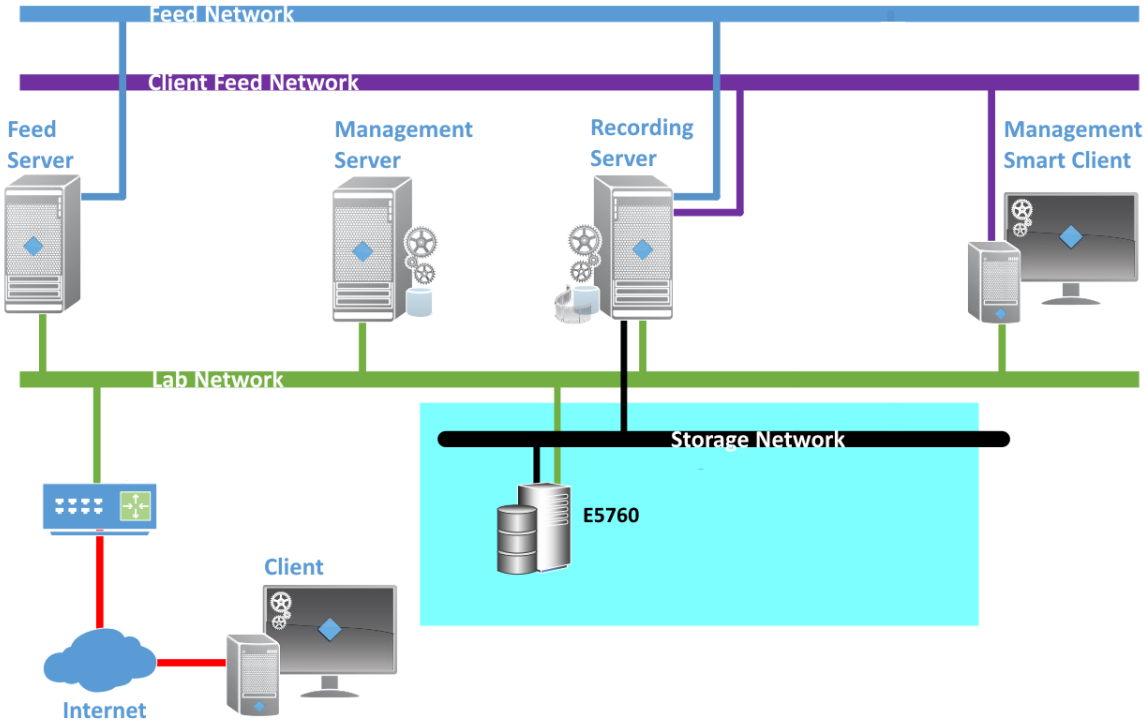


Figure 15) Scenario 2: E2812 as tier 1, E5760 as tier 2.

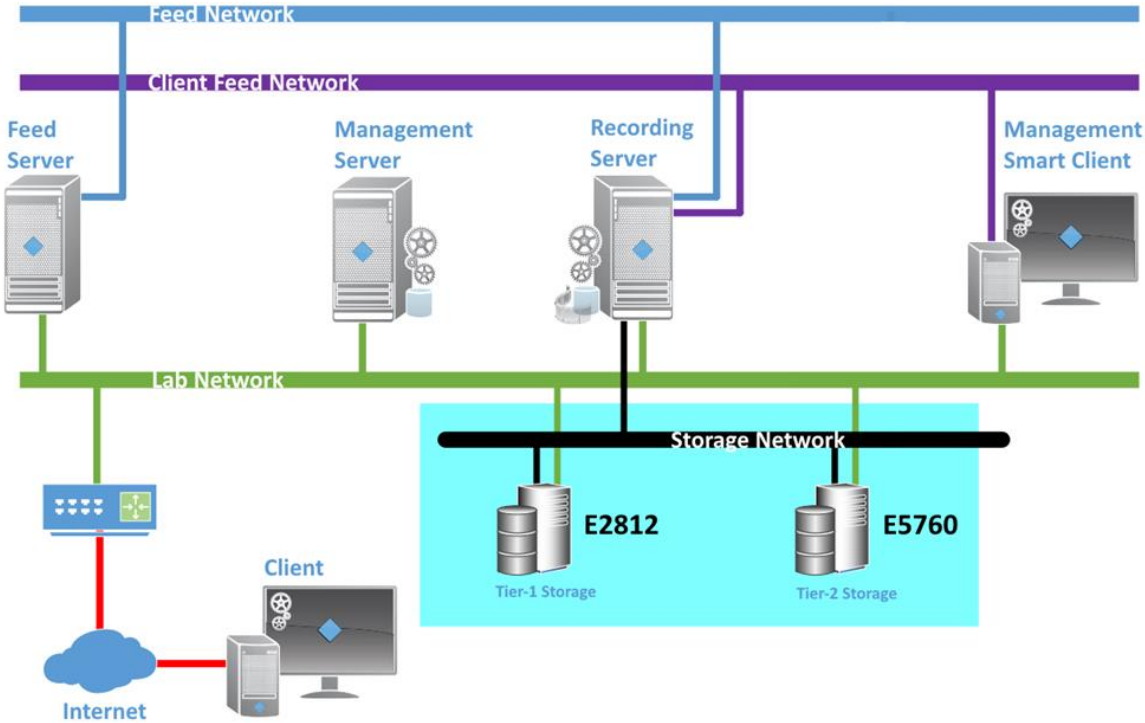
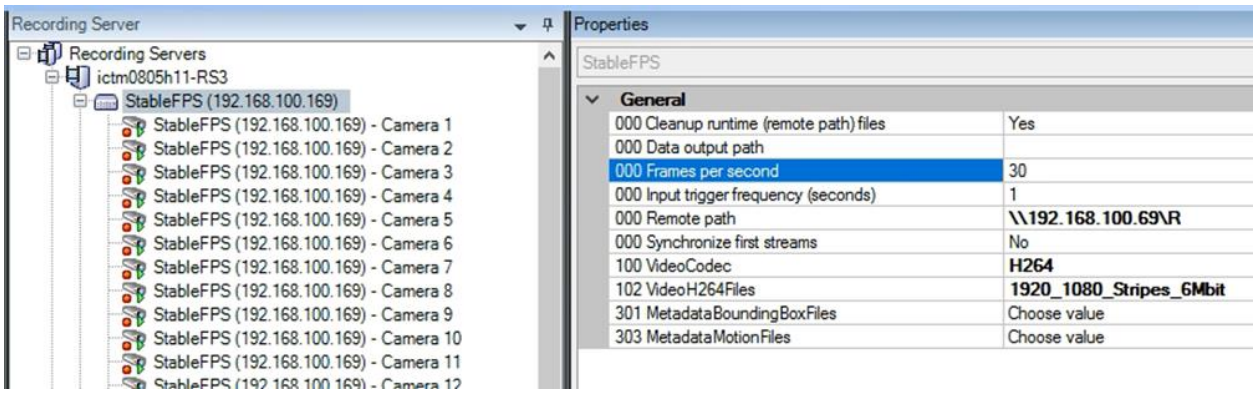


Figure 16) RS settings: camera groups.



6 E5700 Performance Results and Description of Tested Features

The first test case scenario provided performance results with 800 cameras recording to two volumes (400 cameras per volume) on a single NetApp E5760 storage system. The second scenario tested the E5700 storage system as the tier 2 storage in a configuration with the E2812 array serving as tier 1 storage.

Each array had two volumes presented to the recording host. In all scenarios, the E5760 had two 30-drive disk pools, each with a single volume mapped to the recording host. The E2812 had two 4+2 RAID 6 volume groups, each with a single volume mapped to the recording host. There were four RS instances running from the single (physical) recording host, and each instance was run for a 12-hour period.

The resulting data was collected by using the Windows performance monitor on the RS for each test run, and all tests completed successfully with no dropped frames or other issues. The figures and tables that follow show the throughput for one storage volume, the write latency to that volume, and the combined recorded metrics averaged over the 12-hour period for each scenario.

Figure 17) Scenario 1: E5760, 800-camera throughput.

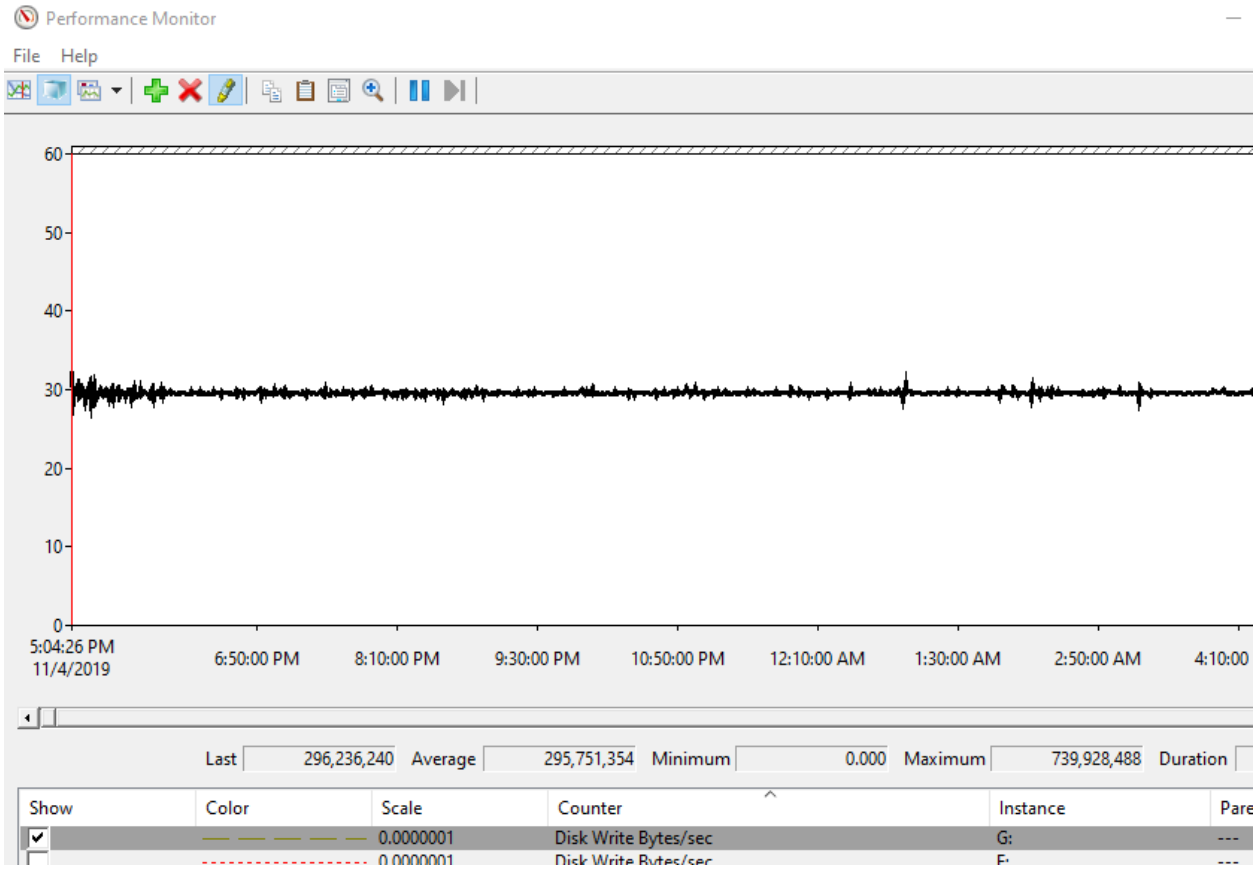


Figure 18) Scenario 1: E5760, 800-camera write latency, average disk seconds per write.

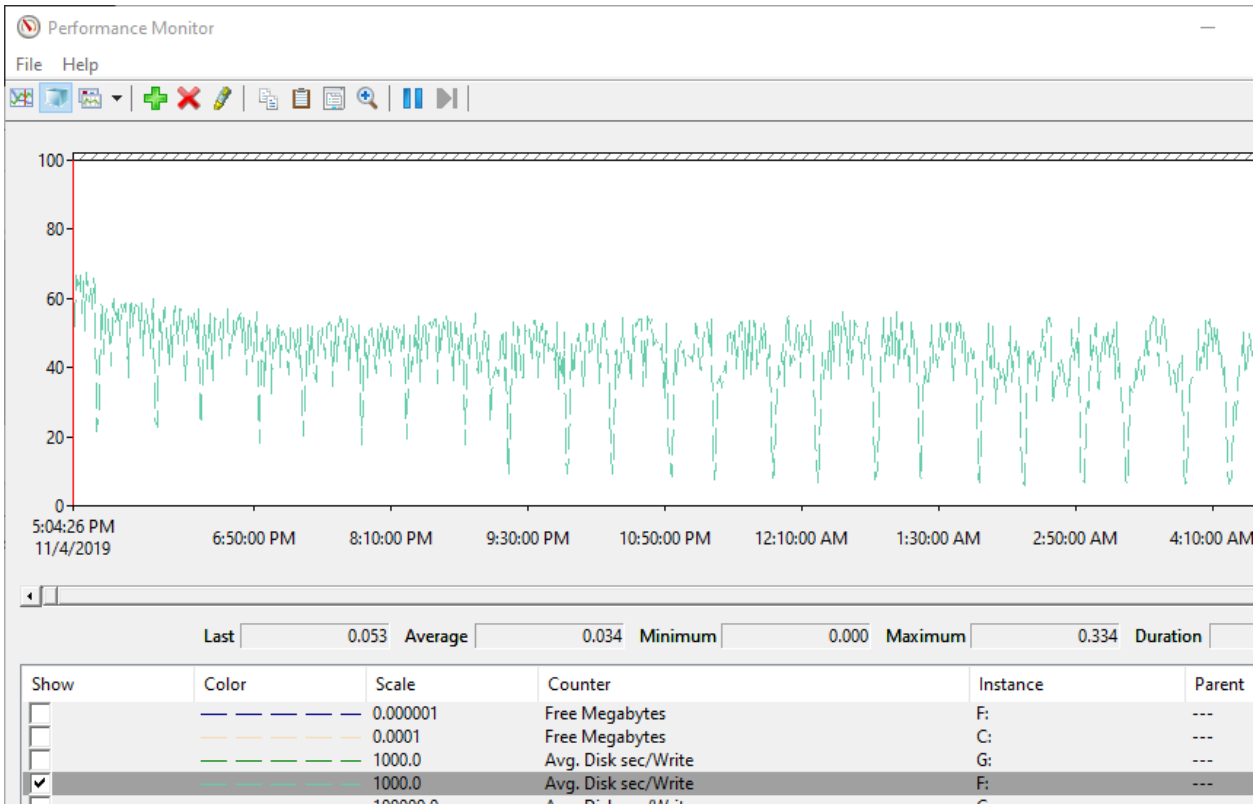


Table 5) Scenario 1 performance results: E5760.

Metric	
RSs	1x x86_64 Server Windows 2019
RS %processor avg.	30%
Cameras	800
FPS	30
Codec	H264
Video file	1920_1080_Stripes_6Mbit
Live storage	E5760
Feed servers	1
Byte/sec (feed net)	404,399,644
Media/sec (total FPS)	23999.502
Live disks	2x 10TB Windows volumes - F, G
F: write bytes/sec	295,723,781
F: sec/write (latency)	0.036
G: write bytes/sec	295,738,801

Metric	
G: sec/write (latency)	0.039
Live disks write total (bytes/sec)	591,462,582

Figure 19) Scenario 2: E2812 tier 1, E5760 tier 2 400-camera throughput during archiving.

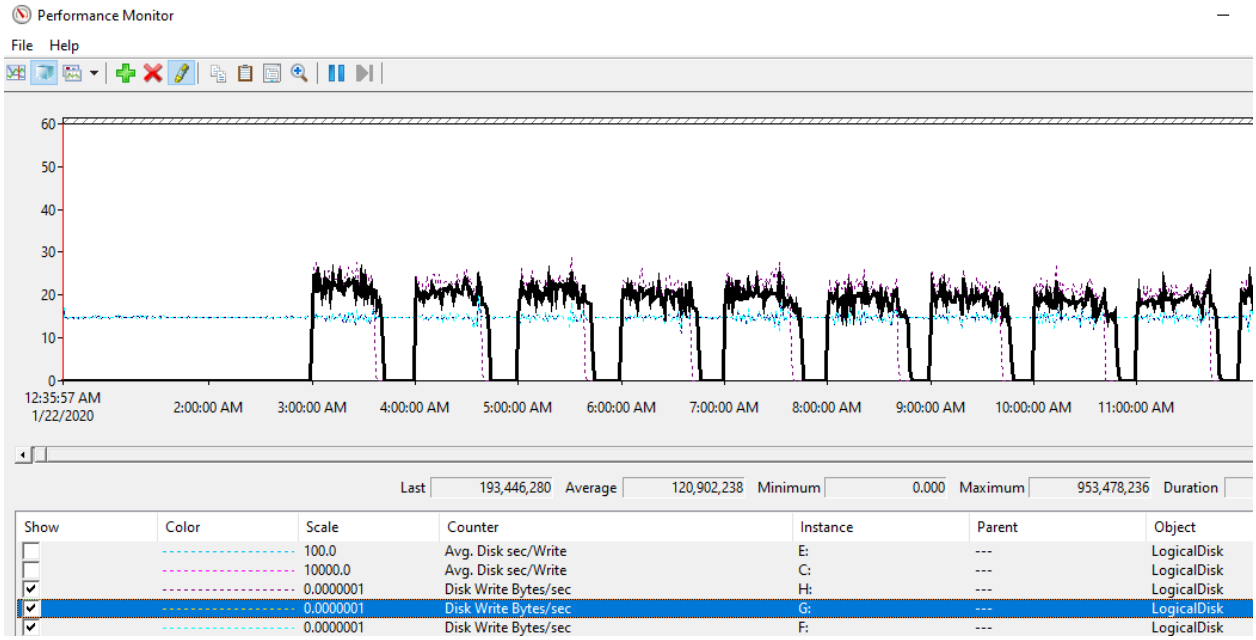


Figure 20) Scenario 2: E2812 tier 1, E5760 tier 2, 400-camera write latency, average disk seconds per write during archiving.

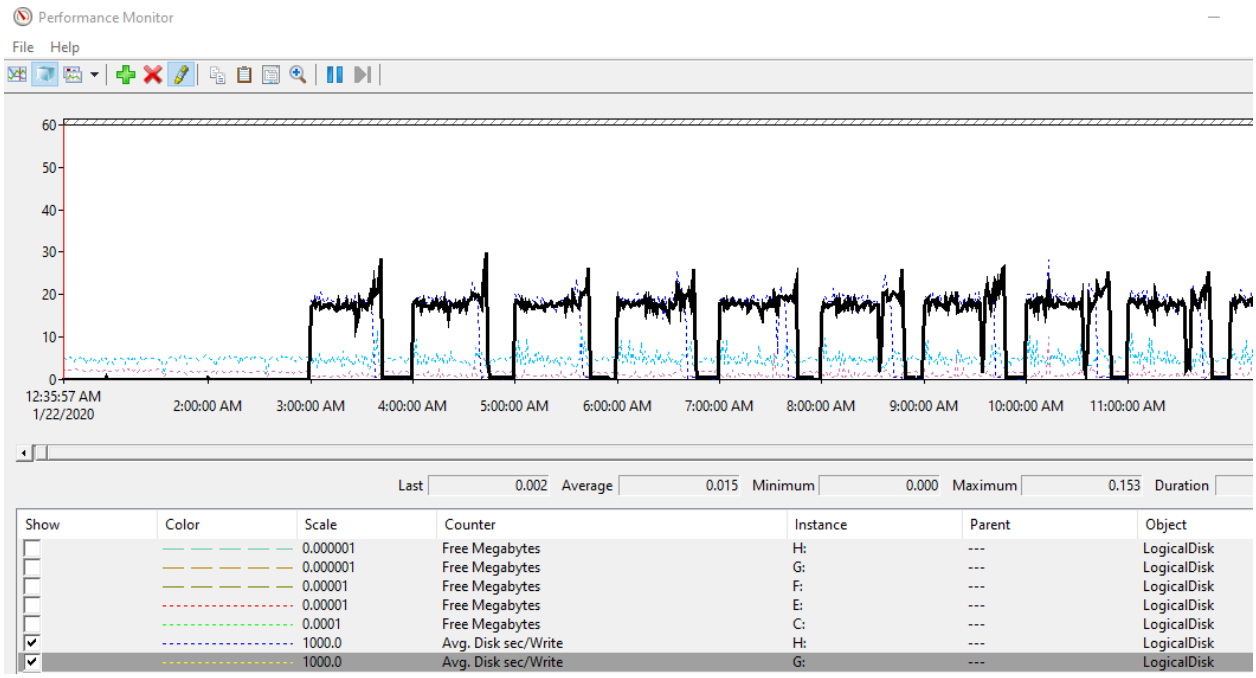


Table 6 provides a consolidated view of the test results during the archiving period for the 12-hour recording and archiving test case.

Table 6) Performance results, scenario 2: E2812 tier 1 (live), E5760 tier 2 (archive).

Metric	
RSs	Single x86_64 server running Windows 2019
RS %processor avg	13.00%
Cameras	400
FPS	30
Codec	H264
Video file	1920_1080_Stripes_6Mbit
Live storage	E2812
Archive storage	E5760
Feed servers	1
Byte/sec (feed net)	307,958,306
Media/sec (total FPS)	11,999.72
Live disks	2x 8TB volumes - E, F
Archive disks	2x 45TB volumes - G, H
F: write bytes/sec	147,904,923.48
F: sec/write (latency)	0.037
G: write bytes/sec	147,900,422.52
G: sec/write (latency)	0.020
Live disks write total (bytes/sec)	295,805,346.00
F: read bytes/sec	162,821,604.73
F: sec/read (latency)	0.055
G: read bytes/sec	162,397,928.56
G: sec/read (latency)	0.046
Live disks read total (bytes/sec)	325,219,533.29
H: write bytes/sec	150,956,649.65
H: sec/write (latency)	0.016
I: write bytes/sec	152,279,103.86
I: sec/write (latency)	0.016
Archive disks write total (bytes/sec)	303,235,753.51

7 Conclusion

The NetApp E2800 and E5700 storage arrays are excellent choices as the storage and archive targets for Milestone XProtect video management software. The test results confirmed that these storage systems lend themselves to flexible and scalable storage solutions that provide consistent, high throughput and low latency.

In all cases, the systems were configured with the minimum high-availability (HA) host interface connectivity and iSCSI sessions, and NetApp used 7,200 RPM NL-SAS drives for both live recording streams and archiving streams to a secondary storage system. In multiple test scenarios, the storage systems consistently outperformed certification requirements, achieving high levels of data throughput with consistently low latency.

This testing, performed over extended periods, confirmed that disk speed was not a significant bottleneck, even for the E2800 12-drive system. Both NetApp E-Series arrays had remaining performance headroom when more drives were added or when more host links and associated iSCSI sessions were added. As a result, integrators and end users designing, installing, and operating Milestone surveillance systems integrated with E-Series storage systems can have confidence that the systems will be easy to deploy and will reliably record and archive surveillance video; no special settings are required.

Where to Find Additional Information

To learn more about the information that is described in this document, review the following documents:

- Solution Brief—Milestone and NetApp Deliver Superior Enterprise Surveillance Solutions
  http://www.netapp.com/us/media/ds-3373.pdf
- White paper—NetApp E-Series Storage for Video Surveillance: The advantages of simple, Reliable Block Storage in Video Surveillance Environments
  http://www.netapp.com/us/media/wp-7240.pdf
- TR-4652: SANtricity OS Dynamic Disk Pools
  https://www.netapp.com/us/media/tr-4652.pdf
- NetApp E-Series for Video Surveillance Best Practices Guide
  https://www.netapp.com/us/media/tr-4825.pdf

Version History

Version	Date	Document Version History
Version 1.0	May 2020	Initial release.

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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