

Surveillance

Dell EMC Storage with Milestone XProtect Corporate

Sizing Guide

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REV 1.3



The Open Platform Company

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CHAPTER 1

Introduction

This chapter provides information on the purpose and scope of this solution:

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Solution overview

Milestone XProtect Corporate is a tiered solution that works well with Dell EMC Unity™ or EMC VNX™ family storage arrays as well as Dell EMC Isilon™ scale-out storage. The first tier of storage, Live DB, can accommodate stored video for the retention period prior to being moved to the second tier, of storage, Archive DB or deleted. The best practice retention time is between 2 and 24 hours. The second storage tier is Archive DB, which can accommodate long video retention cycles prior to being deleted from the second tier of storage.

Live DB requires block storage, such as Dell EMC Unity or EMC VNX family arrays using iSCSI or Fibre Channel (FC), or storage local to the server. In a virtualized environment, the Unity or VNX family arrays can serve a dual purpose by providing storage for the LiveDB and VMware datastores. The Archive DB used as the secondary storage for video and surveillance data can be stored either on an Isilon scale-out storage cluster or on a unique Unity or VNX family array.

While the Milestone XProtect Corporate tiered storage solution can be deployed within a site, depending on the requirements XProtect Corporate can also provide a solution for distributed to central site architectures.

Purpose

This guide provides guidelines for sizing the Dell EMC storage arrays and storage clusters. The sizing recommendations are based on performance and storage protocol conclusions derived from Dell EMC testing.

Use this guide to determine the requirements for a successful Milestone XProtect Corporate 2013, 2014 or 2016 installation, Milestone storage tiering options, and storage-specific configuration requirements.

Scope

This guide is intended for use by internal Dell EMC sales and pre-sales personnel, and qualified Dell EMC and Milestone partners.

The guidelines presented are for storage platform positioning and system sizing. The sizing recommendations are based on performance and storage protocol conclusions derived from Dell EMC testing.

The guidelines for sizing this video storage solution describe the use of the following storage platforms:

- Dell EMC Isilon™
- EMC VNX™
- EMC VNXe™
- EMC VSS™

These guidelines include the following design considerations:

- Architectural overview of Milestone XProtect Corporate
- Dell EMC storage considerations for Milestone XProtect Corporate
- Result summaries for the tests carried out by Dell EMC engineers in a VMware ESXi virtualized infrastructure

Use this guide to determine the best configuration for the following:

- Number of Milestone Recorders
- Mix of nodes and Milestone Recorders based on the expected bandwidth in an Isilon implementation
- Storage using Fibre Channel (FC) and Internet SCSI (iSCSI) on VNX systems
- Storage using Server Message Block (SMB) on Isilon systems
- Load factors related to the use of Dell EMC storage arrays in the customer's solution

Although this document outlines some configuration parameters, it is not intended as a configuration guide. Verify all configurations with the appropriate vendor documentation or representative.

Note

All performance data contained in this report was obtained in a rigorously controlled environment. Network topology and system environment variables can have significant impact on performance and stability. Follow the best practices as outlined in the *Dell EMC Storage with Milestone XProtect Corporate: Configuration Guide* regarding network and storage array configuration. Server and network hardware can also affect performance. Performance varies depending on the specific hardware and software, and might be different from what is outlined here. Performance results will be similar if your environment uses similar hardware and network topology.

Key objectives

The configurations documented in this guide are based on tests conducted in the Dell EMC Surveillance Lab and actual production implementations.

These are the key objectives of this solution:

- Measure the sizing needs for specific system requirements so that an implementation can be correctly sized and the appropriate Dell EMC products can be matched to a customer's requirements.
- Determine the VNX, VNXe, and VSS LUN bandwidth within the storage pool.
- Recommend an Isilon SMB configuration.
- Calculate array or node maximum bandwidths.
- Recommend disk drive types.
- Maximum Milestone XProtect recording server bandwidth with the Live database (Live DB) on VNX, VNXe, and Isilon storage.
- Maximum Milestone XProtect recording server bandwidth with the Live DB and Archive database (Archive DB) implemented on the same VNX5800™ storage array.
- Maximum bandwidth per Isilon node for the Archive DB.
- Confirm the previous test results with lab controlled failures, such as disabled storage processors, disk rebuilds, node removals, and network path failures.

CHAPTER 2

Solution components

This chapter provides information about storage options for video and audio data:

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- [Storage protocols](#)..... 10
- [Milestone XProtect Corporate architecture](#)..... 10

Dell EMC storage

Dell EMC storage arrays are ideal for storing video and audio data.

This guide describes the tests for the following storage arrays:

- Isilon clusters
- VNX arrays
- VNXe arrays
- VSS arrays

For our testing, we used both single and dual storage processors for the full range of VNX, VNXe, and VSS storage arrays and single- and multi-node performance testing on the Isilon storage array.

Storage protocols

Dell EMC uses standard file protocols to enable users and applications to access data that is consolidated on a Dell EMC storage solution.

This guide provides information about these network protocols:

- FC
- iSCSI
- SMB (CIFS)

Milestone XProtect Corporate architecture

Milestone XProtect Corporate 2016 uses a distributed architecture with a management server as the core server. The management server can be centrally located or distributed to multiple sites and connected using the Milestone Federated Architecture. The number of recording servers is unlimited.

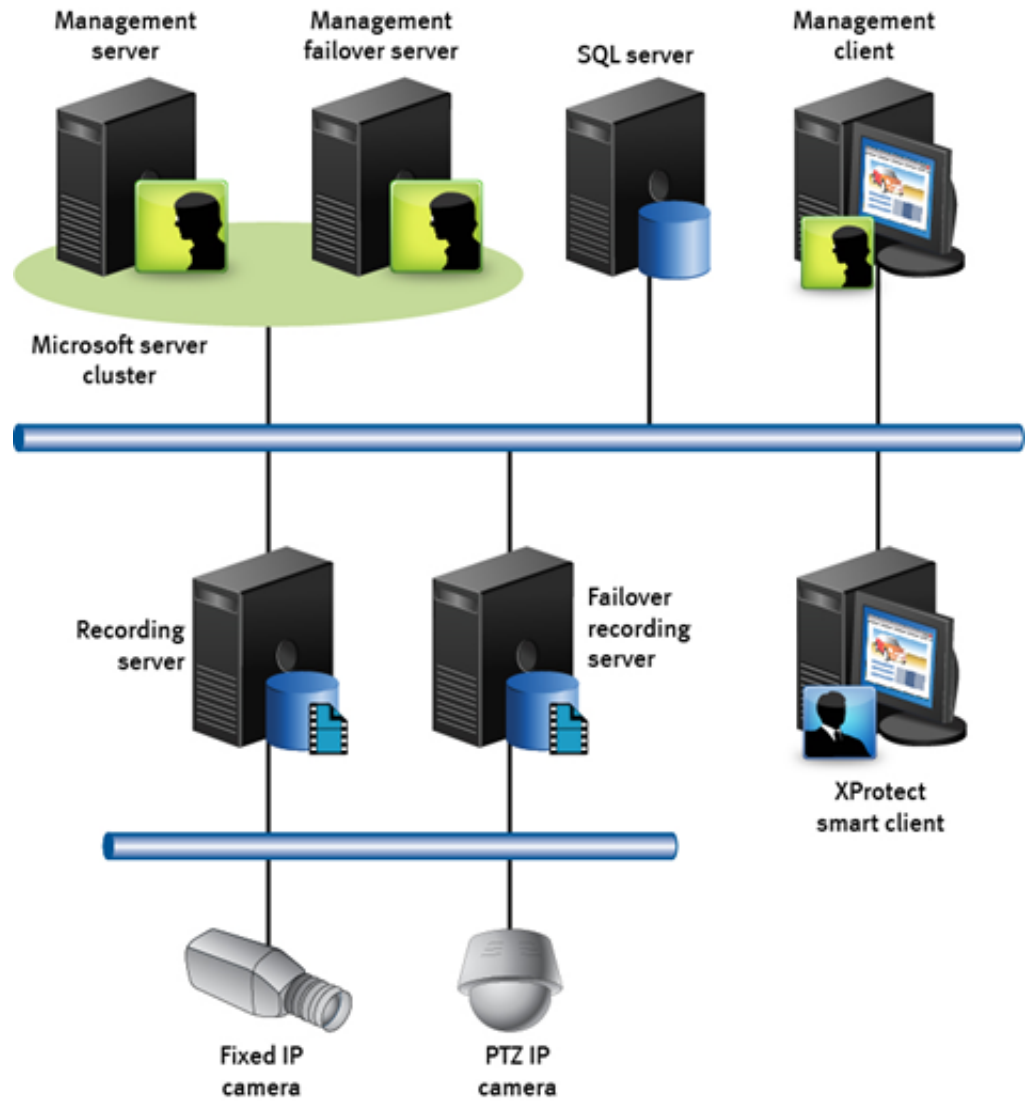
The following table lists XProtect servers, services, and their functions.

XProtect Corporate Server/ Service	Functions
Smart Client	Full-featured remote client, which provides these daily functions: <ul style="list-style-type: none"> • Simultaneous live view and playback of 100 cameras • Intelligent Pan Tilt Zoom (PTZ) camera control • Advanced search capabilities • Export of evidence material
Remote Client	Provides live view and playback of up to 16 cameras and performs most daily operations
Matrix	Allows up to four live video streams to be sent to an XProtect Corporate Smart Client PC
Recording/failover server	Provides the following functions:

XProtect Corporate Server/ Service	Functions
	<ul style="list-style-type: none"> • Storage and retrieval of video and audio from MJPEG, MPEG4, MxPEG, and H264 devices • Standby for a single or a group of recording servers, when configured as a failover server • Edge Storage capability, which allows cameras to write to an Edge Storage device if the recording server is unreachable • Processing events, alerts, and actions
Management server	<p>The Management Application is XProtect's user interface to the management server and provides the following functions:</p> <ul style="list-style-type: none"> • Managing recording servers, users, and devices • System configuration wizards, automated device discovery, smart bulk configuration, event/alarm configuration, and management of user access privileges • Multi-stage storage schemes, which enable video migrations from primary storage (Live DB) to secondary storage (Archive DB) • Hosting and controlling access from XProtect Corporate clients • Logging

The following figure shows a simple Milestone XProtect Corporate architecture. You can scale the system by expanding the number of servers in each site, and you can combine many sites into a federated architecture.

Figure 1 Milestone XProtect Corporate architecture



CHAPTER 3

Configured components

This chapter provides information about the components configured in this solution:

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- [Unity and VNX family array](#)..... 14
- [VNXe family array](#)..... 14
- [Isilon clustered storage system](#)..... 15
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Dell EMC Surveillance Lab test environment

The Dell EMC Surveillance Lab is constantly being upgraded to the most recent software releases.

In order to test this solution, the Dell EMC Surveillance Lab was configured as follows:

- 8 GB memory
- Network adapter type: VMXNET3 (GbE and 10 GbE), E1000, or VMXNET2 (GbE only)
- Isolated VLAN for storage (if not FC)

For all the tests, the virtual CPU (vCPU), memory, and network were configured according to Milestone best practices. The VMware vSphere configuration was in accordance with the VMware Compatibility Guide (www.vmware.com/resources/compatibility/search.php). In addition, Dell EMC PowerPath™ was used for block storage (FC and iSCSI) and is recommended for block storage implementations.

The Dell EMC Surveillance Lab's host hardware met and exceeded the minimum system requirements for an ESXi/ESX installation. The Milestone Recorder VM was running on an ESXi 6.5 host using Cisco UCS B230 Blade Servers with a 20-core ESXi host at 2.2 GHz and 256 GB memory. For more information about VM configuration, see the General recommendations for storage and sizing section of the *Using EMC VNX storage with VMWare vSphere* guide.

VMware ESXi environment

We make sure our test environment host hardware meets the system requirements for an ESXi installation.

The VMware vSphere system requirements are as follows:

- Dell EMC PowerPath for block storage (FC and iSCSI)

For a list of compatible hardware, refer to the [VMware Compatibility Guide](#) and *Milestone XProtect Corporate System Requirements*.

Unity and VNX family array

With the Milestone XProtect solution, a Unity or VNX family array is used for the Live DB, Archive DB, and VMware Datastores.

Unity or VNX can be deployed with GigE or 10 GbE iSCSI NICs. Dell EMC PowerPath™ multipathing is recommended for block storage like VNX and VNXe. PowerPath multipathing automates data path management, failover and recovery, and optimized load balancing to ensure application availability and performance. Native operating system multiple path I/O (MPIO) is recommended for Unity arrays.

VNXe family array

With the Milestone XProtect solution, a VNXe family array is used for the Live DB. An iSCSI-connected VNXe array, implemented with storage pools, provides a cost-effective implementation while maintaining the expected performance. Many mid-sized deployments can use VNXe.

Isilon clustered storage system

The Archive DB can reside on Isilon scale-out network-attached storage (NAS). Isilon storage was designed and developed specifically to address the needs of storing, managing, and accessing digital content and other unstructured data. An Isilon clustered storage system is composed of three or more nodes. Each node is a self-contained, rack-mountable device that contains industry-standard hardware such as disk drives, CPUs, memory chips, and network interfaces. Dell EMC recommends using an Isilon clustered storage system that is composed of five nodes or more.

Dell EMC PowerEdge servers

Dell PowerEdge™ servers are ideal for recording and managing terabytes of video from distributed locations. This section describes best practices for configuring a PowerEdge server system for this solution.

PowerEdge single-unit rack servers are excellent servers when external NAS clusters or block arrays are planned for surveillance storage.

PowerEdge dual-unit rack servers are designed for local video storage where external surveillance storage will not be used.

Configured components

CHAPTER 4

Sizing the solution

This chapter provides information to enable you to quickly determine the correct storage array based on your customer's bandwidth requirements:

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- [Volume limits](#)..... 18
- [Live DB sizing](#)..... 18
- [Archive DB sizing](#)..... 19
- [VNX with Live DB and Archive DB sizing](#).....21
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- [VMware ESXi write performance](#)..... 22

Sizing guidelines

For best performance and usability, XProtect and each storage tier must be correctly configured. This section describes the results of the solution testing as well as configuration settings we found important during our lab tests.

In the same way that the configuration and performance of one production implementation varies from another, lab tests also vary among production environments. Use the performance statistics and configuration information presented here as the base guideline.

For information about the test objectives and the test procedure, see Testing and validation overview.

Note

While all tests for this solution were performed on Milestone XProtect Corporate, the same codebase is used by XProtect Enterprise. Therefore, all sizing data in this document is valid for XProtect Enterprise also. XProtect Enterprise, however, limits the number of recording servers supported.

Dell EMC Surveillance Lab testing shows that Storage Pools provide better performance and are easier to manage for the end customer. Therefore, validation tests are only conducted using Storage Pools. Although all the underlying Storage Pool's RAID Groups configurations perform equally with the surveillance workload, we recommend RAID 6 (6+2) for resilience.

Volume limits

Implementations greater than 8 TB are common when video is stored on high-end storage, such as Isilon scale-out NAS storage and VNX block storage. The clustered file system OneFS uses enables Isilon to handle these large volumes.

Live DB sizing

The Live DB can reside on DAS or block (FC or iSCSI) storage.

For Live DB sizing we recommend the following:

- Set the Live DB retention period from 2 to 24 hours, depending on the implementation's requirements.
- To allow space for video file collection and periodic archiving from the Live DB to the Archive DB, size the available Live DB storage to be at least twice the duration that video is configured to reside on the Live DB. However, the size of the Live DB can be set to a greater value to meet the needs of a particular implementation. The additional space is to accommodate network maintenance, traffic congestion, and other conditions that may temporarily restrict the bandwidth in an IP network and take time to resolve. For a conservative implementation, you may want to include additional space to allow for break-fix conditions.

Isilon Live DB, in a non Archive DB environment, is supported with Milestone XProtect Corporate 2016.

Note

The write block size is determined by how the LUN or disk was formatted. For more information, see the Hard disk formatting section in *Dell EMC Storage with Milestone XProtect: Configuration Guide*.

The following table shows details of Live DB performance on VNX arrays during lab testing.

Table 1 Live DB VNX performance

Array	Milestone Version	Total array BW (MB/s)	Disks per pool	Maximum (RAW)
VNXe1600	2014	300	35	400 TB
VNXe3200	2014	210	120	500 TB
VNX-VSS100	2014	543	90	360 TB
VSS1600	2014	300	35	500 TB
VNX5200	2014	543	90	500 TB
VNX5400	2014	543	120	1 PB
VNX5600	2014	678	120	2 PB
VNX5800	2014	814	120	3 PB
VNX7600	2014	977	120	4 PB
VNX8000	2014	1172	120	6 PB

Note

All disk drives are NL-SAS 7200 RPM unless otherwise noted.

Archive DB sizing

With XProtect Corporate release 2013 (or later), you can use either file or block storage for the Archive DB. If your installation is an earlier version of XProtect, and you want the Archive DB to reside on an Isilon cluster running OneFS 7.0 (or later), check with Milestone to see if they provide a patch for your specific XProtect release.

When the Archive DB resides on EMC VNX block storage, the LUN or disk being formatted determines the write block size. For more information, see the Hard disk formatting section in *Dell EMC Storage with Milestone XProtect: Configuration Guide*.

The following tables provide information to help you understand the sizing components of NAS- and SAN-based implementations. Isilon sizing was based on five recording servers writing to a single Isilon node.

Table 2 Archive DB: VNX

Array	Milestone version	Recorders	Array BW (MB/s)	BW per LUN (MB/s)	LUNs per pool	Disks per pool	Maximum (RAW)
Unity300	2017 11.1A	7	315	45	7	80	6 TB
VNX-VSS100 iSCSI	2014	3	215	72	3	10	3 TB
		4	277	69	4	15	
		8	384	48	8	30	
		10	450	45	10	60	
VNX7500 iSCSI	2014	10	450 ^a	45	10	60	3 TB
VNX5800 FC and iSCSI	2014	18	616	34.2	18	60	3 TB

a. Extrapolated based on VNX5300 iSCSI results.

Note

All disk drives are NL-SAS 7200 RPM unless otherwise noted.

Table 3 Archive DB: Isilon sizing

Array	Milestone version	OneFS	Recorders per node	Avg BW per node (MB/s)	Avg BW per recorder (MB/s)	Cluster size	Disk type
X400 SMB2 4CIF	2014	7.1	1:1	34	34	5	1 TB, +2:1 ^a
			2:1	68	34	5	1 TB, +2:1
			4:1	136	34	5	1 TB, +2:1
NL400 SMB2 H264	2014	7.1	1:1	40	40	5	1 TB, +2:1
			3:1	120	40	5	1 TB, +2:1
			4:1	160	40	5	1 TB, +2:1
			5:1	194	38	5	1 TB, +2:1
		7.2	2:1	102	51	4	4 TB, +2:1
			4:1	164	41	4	4 TB, +2:1
HD400 SMB3 H264	2014	7.2	1:1	37	37	5	6 TB, +2:1

a. The drive size is not relevant for performance considerations.

Note

Add disk drives are SATA 7200 RPB unless otherwise noted.

The maximum bandwidth per LUN for the Live DB was limited to 34 MB/s (iSCSI) or 40 MB/s (FC)-see the previous table, Live DB VNX performance. Therefore, the

maximum bandwidth between the recording servers and Isilon is based on those values. Future tests will validate higher Archive DB bandwidth capabilities for greater numbers of recording servers per node.

VNX with Live DB and Archive DB sizing

The following table shows the LUNs per recording server and the bandwidth per LUN with the Live DB and the Archive DB using VNX iSCSI or FC.

We tested VNX5800 with both Live DB and Archive DB writing to the same VNX5800 array for maximum bandwidth and performance on the single SP. Some recorders are implemented using FC storage and some using iSCSI storage for both the LiveDB and ArchiveDB.

Note

We captured the peak values of write bandwidth and read bandwidth on the single SP when the archive process is running. Maximum CPU utilization is captured when reviewing video at a rate of 20 percent of the current write rate and with a disk rebuild in progress. Bandwidth and CPU usage of the VNX vary with time based on the archive process.

The following table shows details of Live DB and Archive DB performance on the VNX5800 array.

Table 4 Table 1. Live DB and Archive DB performance on the VNX5800 array

Storage platform	Milestone version	Total Recorders	Number of Cameras	Bandwidth (MB/s)				CPU on VNX SP (%)	
				Live DB Write	Archive DB Write	Total Write	Total Read	Max.	Average
VNX5800 FC and iSCSI ^a H264	2014	18	460	460	616	1076	684	90	72

- a. About 9 recorders are implemented using FC SAN storage and remaining 9 recorders using iSCSI SAN storage because of the server and network port limitations.

Dell EMC PowerEdge server storage

The test results are based on a model in which the constant-bandwidth surveillance video traffic remained unaffected during select storage failure scenarios, such as disk rebuild, failing processors, and failing network paths.

We performed all tests with disk drive failures, node failures, storage process failures or NIC failures to ensure a worst-case scenario for all sizing parameters.

Multi-Recorder tests were conducted with a single instance of XProtect running multiple Recorder services.

We used 10 GbE interfaces with up to four Recorder connections at the maximum Milestone-supported values. We performed all tests with a per Recorder bandwidth of 37.5 MB/s with a combination of 1 Mb/s and 5 Mb/s cameras.

With local storage we recommend using RAID 6 to accommodate the disk rebuild duration. For example, in the Dell EMC Surveillance Lab, a disk rebuild in a 16 x 10 TB disk system takes at least 36 hours to complete when 10TB of data and 37.5 MB/s of write are in place.

The following table provides bandwidth-sizing guidelines based on our test results.

Table 5 Dell EMC PowerEdge server test results

Server model	XProtect Version	Drive type	Drive size	RAID	Write BW (MB/s)	CPU (%)	IOPS	Rebuild duration	Data storage	
									Live DB (tier-1)	Archive DB (tier-2)
R730xd	2017	NL-SAS	8 x 4 TB	6	68	8	128	35 hrs	Local	n/a
		NL-SAS	15 x 4TB	6	137	18	117	33 hrs	Local	
		NL-SAS	15 x 10 TB	6	136	10	105	7.2 days	Local	
R630 *	2017	SSD	5 x 1 TB	5	69	10	142	1.5 hrs	Local	Isilon
R530	2017	NL-SAS	6 x 6 TB	6	50	60	65	20 hrs	Local	n/a
R430	2017	SSD	2 x 400 GB	1	87	13	126	n/a	SCV2080	n/a
R430	2017	SSD	2 x 400 GB	1	86	13	126	n/a	Local	Isilon

* These values are extrapolated from Dell EMC Surveillance Lab test results.

Note

- All tests performed on local storage are Milestone certified.
- Stripe size of 128 was used for video storage virtual disks.
- Servers used for external storage must meet Milestone's minimum requirements.

Note

All disk drives are NL-SAS 7200 RPM unless otherwise noted.

VMware ESXi write performance

In the Dell EMC Surveillance Lab, we have conducted a number of tests comparing various hosts with respect to recording server bandwidth. For this virtualized Milestone XProtect Corporate 2014 solution, we tested using the Dell R910 and Cisco UCS B230.

Note

The Dell R910 uses a 1.99 GHz processor for each of its 4 X 8 cores (24 cores). The Cisco UCS B230 uses a 2.26 GHz processor for each of its 2 X 10 cores (20 cores).

The goal of the tests was to determine Milestone XProtect Corporate write performance variances with different CPU clock rates, processor classes, motherboard architectures, and so on—it was not a vendor comparison. The following table shows that there can be large differences depending on the host used.

Table 6 ESXi virtual machine bandwidth variances

Bandwidth per Recorder	vCPU	Host	Memory
34 MB/s (270 Mb/s)	4 @ 1.99 GHz	Dell R910	4 GB per virtual machine
40 MB/s (270 Mb/s)	6 @ 1.99 GHz	Dell R910	4 GB per virtual machine
40 MB/s (360 Mb/s)	4 @ 2.26 GHz	Cisco UCS B230	4 GB per virtual machine
64 MB/s (512 Mb/s)	8 @ 2.26 GHz	Cisco UCS B230	12 GB per virtual machine

Note

The bandwidth variances in the previous table are informational only. The node or array specifications remain constant, no matter which processor, motherboard architecture, and so on, is used.

CHAPTER 5

Testing and validation

This chapter describes the testing used to validate this solution.

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- [Test parameters](#).....26

Test objectives

Many factors must be considered when designing your solution.

The Dell EMC Surveillance Lab tests focus on storage-related factors with the following objectives:

- Determine the bandwidth for various Dell EMC storage arrays using FC and iSCSI.
- Determine the bandwidth for various Dell EMC storage clusters using SMB.
- Determine the best configuration parameters for Isilon and VNX storage options.
- Determine best video storage performance requirements for use with Isilon scale-out storage clusters and VNX storage arrays.
- Determine the maximum bandwidth with multiple Recorders.
- Determine all factors with a lab-controlled failure, such as disabling a storage processor, rebuilding disks, removing a node, or network path failures.

Test parameters

All test parameters and scenarios reflect standard production behavior for Milestone XProtect Corporate under storage-intensive conditions, including typical storage functions and failures. We followed best practices for recovery and break-fix issues for normal situations that might arise in a standard production environment.

We used the following parameters to perform the tests:

- The IP network (Layer 2) is a flat, high-availability network with plenty of capacity, which enabled us to focus on the products we were testing.
- All tests assumed uniform distribution of bandwidth from the Milestone Recorder.

CHAPTER 6

Conclusion

This chapter summarizes the testing for this solution:

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Summary

Dell EMC performed comprehensive testing with Milestone XProtect Corporate 2013 and Milestone XProtect Corporate 2014 beta to benchmark application performance in a Milestone tiered storage environment. Milestone engineering has confirmed that the test results achieved are consistent with the GA versions released.

Testing focused on the Archive DB enhancements of XProtect 2016 that allow the use of Isilon clusters running OneFS 7.0 or later. The archive process, when writing to an Isilon cluster, easily handled all video accumulated between archive process executions. In addition, various forced Isilon failures did not affect the Live DB to Archive DB process.

When using an Isilon cluster for the Archive DB, only two modifications to the XProtect configuration are necessary: increase the number of archive process threads and increase the write block size to the Archive DB.

We also tested an FC- and iSCSI-attached VNX for the both Live DB and Archive DB. The results for this configuration represent the maximum tested, not the array maximum.

For both FC- and iSCSI-attached storage, formatting with 8192 KB blocks for Live DB and 64 KB blocks for Archive DB is required.

Testing and validation of this solution produced these key findings:

- FC- or iSCSI-attached VNX can be used in place of internal server storage for both Live DB and Archive DB video storage.
- When connectivity to an Isilon cluster node fails, the XProtect Corporate Recorders attached to that node can experience some data loss. The Dell EMC Surveillance Lab observed data loss of approximately 15 seconds as the recorder failed to another node.
- Isilon clusters can be used with XProtect Corporate 2016 as Archive DB video storage.
- One SMB share per XProtect Corporate recording server is required.
- Bandwidth to the Isilon clusters and VNX arrays for the Archive DB was not affected during numerous forced failures on the cluster.

EMC VNX arrays

The use of storage pools to create LUNs within the EMC VNX arrays greatly simplifies the configuration and increases the performance when compared to traditional block-level storage. Either iSCSI or FC can be implemented. FC performs better than iSCSI.

EMC VNX-VSS arrays

The VNX Video Surveillance Storage (VSS) is a storage solution that is purpose built to meet the unique demands of the video surveillance environment.

We found that this high availability, low-cost array performs comparably to other arrays in the VNX family.

EMC VNXe arrays

An iSCSI-connected VNXe array, implemented with storage pools, provides a cost-effective implementation while maintaining the expected performance. Many mid-sized deployments can use VNXe.

Low-bandwidth implementations can use a NAS-connected VNXe, but ideally NAS implementations should be based on Dell EMC Isilon scale-out storage.

Dell EMC Isilon scale-out storage

Dell EMC Isilon scale-out storage is ideal for midtier and enterprise customers. An Isilon cluster is based on independent nodes working seamlessly together to present a single file system to all users.

Licensed SmartQuotas options can be configured so that each Recorder view of the storage is based on the assigned quota and not the entire file system. We recommend using SmartQuotas with Milestone XProtect Corporate as a best practice.

Conclusion