Dell EMC Storage with the Avigilon Control Center System

Surveillance

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Sizing Guide

Abstract

This guide helps you understand the benefits of using a Dell EMC storage solution with Avigilon Control Center 6.12. The solution includes both hardware and software elements for video surveillance.

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CHAPTER 1

Introduction

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

Solution overview

The purpose of this guide is to help you understand the benefits of using a Dell EMC storage solution with Avigilon Control Center (ACC). The solution includes both hardware and software elements for video surveillance.

Use this guide to determine the requirements for a successful Avigilon Control Center installation. The storage platforms include VMware ESXi hosts that are running Avigilon Control Center.

Scope

This guide is intended for use by internal Dell EMC sales and pre-sales personnel, and qualified Dell EMC and Avigilon 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™

These guidelines include the following design considerations:

- Architectural overview of Avigilon Control Center
- Dell EMC storage considerations for Avigilon Control Center
- 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 Avigilon Recorders
- Mix of nodes and Avigilon Recorders based on the expected bandwidth in an Isilon implementation
- 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

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 Avigilon Control Center: 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.

- Recommend an Isilon SMB configuration.

- Calculate node maximum bandwidths.

- Recommend disk drive types.

- Confirm the previous test results with lab controlled failures, such as disk rebuilds, node removals, and network path failures.

CHAPTER 2

Solution components

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

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

For our testing, we used 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 the SMB (CIFS) network protocol.

Avigilon Control Center

Avigilon Control Center is an easy to use video management software, and has optimized how security professionals manage and interact with high definition video. As a distributed network platform with enterprise-class reliability, Avigilon can efficiently capture, manage, and store high definition surveillance video while intelligently managing bandwidth and storage.

In the ACC software, servers are organized in clusters called sites. By organizing the system into clusters, you can control user access and system wide events through the site settings. Site settings are stored on the server, or across all servers in a multi-server system

The following table describes the primary ACC services.

Table 1 ACC primary services

Service	Description
Avigilon Control Center Server	The ACC Server records video through the recorder service. The recorder provides dynamic discovery and status polling of units and processes and stores (archives) all video and multimedia streams to storage.
Avigilon Control Center Client	The ACC client provides video playback and review capability.

Releases tested

The following table lists the Avigilon Control Center releases used for our tests.

Table 2 Avigilon Control Center releases

Release	Subrelease
Avigilon Control Center 5	5.10.18.4

Table 2 Avigilon Control Center releases (continued)

Release	Subrelease
Avigilon Control Center 6	6.8.0
	6.10.0.24
	6.12

CHAPTER 3

Configured components

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

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:

Virtualized environment:

- 8 vCPUs

- 16 GB memory

- Network adapter type: VMXNET3 - 10 GbE

- Isolated VLAN for storage (if not FC)

Physical/Baremetal minimum environment:

- 8 Cores

- 32 GB memory

Network environment:

- Network adapter type: 10 GbE

- Camera user VLAN

- Storage VLAN

For all the tests, the virtual CPU (vCPU), memory, and network were configured according to Avigilon best practices. The VMware vSphere configuration was in accordance with the VMware Compatibility Guide (www.vmware.com/resources/compatibility/search.php).

The Dell EMC Surveillance Lab's host hardware met and exceeded the minimum system requirements for an ESXi/ESX installation. The Avigilon Recorder VM was running on an ESXi 6.5 host using Dell EMC PowerEdge servers, such as the Dell EMC FC630s, FC430s, and R730xd. 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.

Isilon clustered storage system

Isilon NAS was designed and developed specifically for 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, and network interfaces. These nodes are integrated with the proprietary Isilon OneFS™ operating system, which is a distributed networked file system that unifies a cluster of nodes into a single shared resource.

Isilon protection with OneFS

New or upgraded clusters, starting with OneFS 7.2, provide a data protection level that meets Dell EMC Isilon guidelines for mean time to data loss (MTTDL) for large capacity nodes. Current releases of OneFS offer a new protection option, +3d:1n1d, which means the cluster can survive three simultaneous disk failures or one entire node failure plus one disk. OneFS also provides an option that continually evaluates the cluster and sends an alert if the cluster falls below the suggested protection level.

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:

Bandwidth sizing guidelines

All solution tests were performed in a lab environment. The storage system, cameras, and VLANs in the lab environment were dedicated to these tests.

Connections to the storage system under test conditions were restricted to ACC Recorder, monitoring, and web management stations. Expect some variance between the lab results and a production environment.

Dell EMC Isilon node and cluster (SMB) single tier

The test results are based on a model in which the constant-bandwidth surveillance video traffic remained unaffected during a single node maintenance cycle, disk rebuild, SP failure, or non-disruptive upgrade.

We used 10 Gigabit Ethernet (GbE) interfaces. We performed all tests with a per-camera bandwidth of 4 Mb/s, so a single Recorder that handles 30 MB/s can support 75such cameras.

We performed all tests with node or drive failures in place in the cluster (for example, with Isilon FlexProtect™ running) to ensure a worst-case scenario for all sizing parameters. Maximum per recorder Bandwidth may vary based on the configuration of the SVR server used.

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

Table 3 Dell EMC Isilon node and cluster (SMB) test results

Cluster	ACC version	OneFS version	Recorders per node	Bandwidth (MB/s)		Drive Size	Maximum Cluster Raw
				Per Recorder	Per node		
X410 [a]	6.10	8.0.1.2	1	30	30	4 TB	20.7 PB
			2	20	40		
			3	20	60		
	6.8	8.0.1.2	1	30	30		
			2	20	40		
			3	20	60		
	5.8	8.0.0.4	1	30	30		
			2	30	60		
			3	20	60		
HD400 [b]	5.8	8.0.0.4	1	30	30	6 TB	50.9 PB
			2	30	60		
			3	20	60		
NL410 [c]	5.8	8.0.0.4	1	30	30	6 TB	30.2 PB
			2	30	60		
			3	20	60		

Table 3 Dell EMC Isilon node and cluster (SMB) test results (continued)

a.   The X410 test was conducted using a 5 node cluster with 130 TB per node raw capacity.
b.   The HD400 test was conducted using a 5 node cluster with 354 TB per node raw capacity.
c.   The NL410 test was conducted using a 5 node cluster with 210 TB per node raw capacity.

This guide provides details on the total load that was tested in the Dell EMC Surveillance Lab. However, the independent software vendor (ISV) should provide the actual server specification. The test results in this guide set a server bandwidth specification that is based on our lab environment, which can be used in the event the ISV does not provide these specifications.

Archive storage (Tiered storage configuration)

To maintain a copy of the video recorded in your system, you can archive the video into Avigilon Backup (AVK) format. AVK files can be opened in the Avigilon Control Center Player and reexported as needed. Video archiving can be configured to occur continuously or on demand.

You can enable the Storage Management Continuous Archive feature to automatically archive video to the archive directory in hourly blocks during the configured time frame.

We recommend that you set up the Storage Management Continuous Archive feature to work with video data aging. By configuring the two features together, you can create a tiered storage configuration to help manage the amount of video retained on the local ACC Server.

We performed tests with the continuous archive feature to archive video to Dell EMC Isilon clusters. Dell EMC PowerEdge servers with high performance drives or Dell EMC SAN storage can be used for storing local video with Dell EMC Isilon storage for archiving. Together, you can create a tiered storage configuration.

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

Table 4 Dell EMC Isilon node and cluster tiered configuration sizing

ACC version	Recorders per node	Live tier		Archive tier				Drive Size	Maximum Cluster Raw
		Write BW per recorder	Disk type [a]	Cluster	OneFS version	Bandwidth (MB/s)			
						Per Recorder	Per Node		
6.12	1	40	Local disks/ SAN	H400	8.1 [b]	42	42	10 TB	17 PB
	2	40				42	84		
	3	40				42	126		

a.   The drive size is not relevant for performance considerations.
b.   See the *Dell EMC Storage with Avigilon Configuration Guide* for additional information regarding OneFS 8.1 installations.

Note

All disk drives are SATA 7200 RPM unless otherwise noted.

CHAPTER 5

Testing and validation

This chapter describes the testing used to validate this solution.

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

Test parameters

All test parameters and scenarios reflect standard production behavior for Avigilon Control Center 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 Avigilon Recorder.

Tests scenarios

We ran tests with the SmartConnect™ configuration in place and the SMB shares were mounted using the SmartConnect zone name. All tests resulted in zero dropped video.

Video playback test

As video is being written to the storage, we recalled or reviewed the video at a rate equal to 30 percent of the write rate.

The review did not affect the write rate or video quality.

Disk failure test

A single disk failure is the most common failure affecting storage systems today. When a disk fails, that disk is removed and replaced. The replacement disk is then reconstructed.

The Isilon cluster was protected using a +2 protection scheme that allows for two simultaneous disk failures. In our test, we failed and recovered two disks. The SmartFail process started and the CPU utilization of the node increased with no observed effect to the write streams.

NIC failure test

A NIC failure test is conducted to evaluate node to node NIC failure/recovery resiliency.

We performed the NIC failure test by removing one NIC cable from the active node that was involved in active recording. When the network fails, the server

must recognize the failure, then it must establish a new connection with a peer node. The TCP socket connections are left open and remain open on the cluster until Isilon's OneFS forces them closed, which allows the server to continue writing.

For more information on reducing the open TCP sockets close duration, see the SMB specific configuration section in the *Dell EMC Storage with Avigilon Control Center Configuration Guide*.

Note

NIC failure impact can be overcome by using NIC aggregation in Active/Passive Failure aggregation mode, which is explained in the next test case. Connectivity to the nodes that are not affected by the network outage continues to be available throughout the test scenario and no impact was observed.

NIC failure test with NIC aggregation in active/passive

The NIC aggregation test are conducted to evaluate the NIC failure/recovery resiliency within a single node.

We did a hard NIC failure test with active/passive aggregation by removing the active NIC port cable. After the network failure, writing to the same node continued and the NIC that was passive was immediately changed to the active NIC. The NIC failure caused no apparent loss.

Note

NIC aggregation in Active/Passive mode remedies only a network disconnection/NIC failure that happens on the Isilon node or the corresponding switch port where it is connected.

Node reboot test

We performed reboot tests to verify that video is not interrupted during maintenance cycles or other reboot activities.

Node poweroff Test

We simulate an unexpected single node hard failure, which causes the servers that were writing to that node to reconnect to a new node. Tests showed that in some cases video loss is possible using the default OneFS lazy queue depth.

For more information on setting the Lazy Queue for a no loss configuration, see the SMB specific configuration section of the *Dell EMC Storage with Avigilon Control Center Configuration Guide*.

⚠ **WARNING**

If running a mixed workload, these changes can adversely affect the other workloads that might be present on the cluster.

Storage bandwidth and configuration test

The storage bandwidth test evaluated video storage and applications with a number of different Dell EMC storage systems. Additional tests evaluated ESXi host hardware in relationship to vCPU settings and the resulting bandwidths.

These tests assumed that the Avigilon Recorder was configured as described by Avigilon best practices and operated within the recommended bandwidth, camera count, and other ACC maximum requirements.

Procedure

1. Configured video storage for a Dell EMC storage system.

2. Set up camera simulators (traffic generators) to produce a traffic load to each Avigilon Recorder at the desired bandwidth.

3. Evaluated the network and video storage to ensure an error-free environment at the induced bandwidth.

4. Introduced storage device errors including:

   - Disk failures and rebuilds on Isilon nodes

   - Initiation of Isilon node failures and recoveries

   - Initiation of Isilon node removals (downsizing a cluster)

   - Initiation of Isilon node additions (scaling up)

   - NIC failures with active/active and active/passive configurations

5. Captured the storage system and host statistics.

6. Based on the test results:

   - If no issues were detected, incremented the bandwidth.

   - If issues were detected, decreased the bandwidth.

   This procedure was repeated until the maximum error-free bandwidth was determined.

CHAPTER 6

Conclusion

This chapter summarizes the testing for this solution:

Summary

The Dell EMC Surveillance Lab performed comprehensive testing with Avigilon Control Center against Dell EMC Isilon clusters. The Avigilon architecture and product suite allows extreme scaling, from a few cameras to up to tens of thousands of cameras, by using Dell EMC storage.

ACC is an easy to use video management software that delivers complete, end-to-end IP video surveillance that captures, records, analyzes, investigates, and visualizes. As a distributed network platform with enterprise-class reliability, ACC can efficiently capture, manage, and store high definition surveillance video while intelligently managing bandwidth and storage.

In the ACC software, servers are organized in clusters that are called sites. By organizing the system into clusters, you can control user access and system wide events through the site settings. Site settings are stored on the server, or across all servers in a multi-server system

The Isilon clusters tested performed well with ACC. Contact the Surveillance Lab team with any questions regarding recommended node types.

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 Avigilon Control Center as a best practice.