Surveillance
Dell EMC Storage with S-1 Video Management Software (SVMS)

Sizing Guide

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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 S-1 Video Management Software (SVMS). The solution includes both hardware and software elements for video surveillance.

Use this guide to determine the requirements for a successful S-1 SVMS installation. The storage platforms include VMware ESXi hosts that are running S-1 SVMS .

Scope

This guide is intended for use by internal Dell EMC sales and pre-sales personnel, and qualified Dell EMC and S-1 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:

- Bandwidth recommendations for S-1 SVMS and one or more Dell EMC systems
- Architectural overview of S-1 SVMS
- Dell EMC storage considerations for S-1 SVMS
- 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 S-1 recorders
- Mix of nodes and S-1 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

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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 S-1 SVMS: 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.

S-1 SVMS

The S-1 SVMS architecture consistc of a single recorder server or multiple recorders that are connected to the Application Manager Server (AMS) structure. You can configure AMS to manage a few cameras or thousands of cameras.

The following table describes the primary S-1 SVMS services.

Table 1 S-1 SVMS primary services

Service	Description
Management server	A server for providing administration and setup of individual servers, DB storage and search.
Streaming server	A server for recording of inputted camera image and transmitting of recorded images. A server for real-time transmission of camera images to clients.
Manager client	Setup of camera for management server, monitoring of server states, administration of other devices and setup for alarm.

Table 2 S-1 SVMS optional services

Service	Description
Intelligent analysis server	A server for real-time image analysis with diversified algorithms.
Transcoder server	A server for conversion and transmission of real-time and VOD images for mobile viewers.
Viewer	• Mosaic viewer : Playback of real-time image and main viewer • 2Dmap viewer : Viewer of event snapshots and event images for 2D map • 3Dmap viewer: Viewer of event snapshots and event images for 3D map : Viewer of real-time event snapshots and event images • GIS map viewer : Viewer of snapshots and events interlocked with Google Earth

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:

- 4 vCPUs (2.1 GHz)
- 12 GB memory
- Network adapter type: VMXNET3 - 10 GbE
- Isolated VLAN for storage (if not FC)
- Local datastore for SVR virtual machine (VM) (SSD/SAS hard disk)

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 S-1 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 S-1 recorder VM was running on an ESXi 6.5 host using Cisco UCS B230 Blade Servers, and various Dell EMC PowerEdge servers. 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.

S-1 recommends using local datastores or SAN-based RAID 1-0 datastores on ESXi hosts to place SVR VMs. Configure NAS and SAN storage for video storage.

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.

Data protection

OneFS does not rely on hardware-based RAID for data protection. The Isilon system uses the Reed-Solomon algorithm for N+M protection with Forward Error Correction (FEC).

Protection is applied at the file level, enabling the cluster to recover data quickly and efficiently. Nodes, directories, and other metadata are protected at the same or a higher level as the data blocks they reference. Since all data, metadata, and FEC blocks are spread across multiple nodes, dedicated parity drives are not required. For more information about Isilon data protection, see *Dell EMC Isilon OneFS: A Technical Overview*.

Although cluster sizes as small as three nodes are possible, for surveillance applications we recommend a minimum of four nodes. Sizing calculations need to include a minimum free space calculation for proper cluster sizing. We recommend a cluster size that enables a node to be removed while retaining a minimum of 10 percent free space in the remaining capacity. This cluster size ensures that node removal and node failures have minimal or no impact on video ingestion.

The Isilon sizing tool provides an accurate calculation. You can find this tool at https://isilon-sizing-tool.herokuapp.com. Other sizing tools from video management software (VMS) and camera vendors may also be used for sizing the necessary bandwidth and storage capacity.

Isilon OneFS is a scale-out, single namespace, clustered file system. To maintain coherency, OneFS implements a distributed lock manager that marshals locks across all nodes in the cluster. When a node is added to or removed from the cluster, all operations must be temporarily suspended until all existing locks are rebalanced across the resulting node set. The system must then recalculate the cluster write plan. The time that is required for this group change to occur depends on the size of the cluster, individual node performance, and the cluster workload.

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.

Cluster size

We recommend a minimum cluster size of four nodes, even if you are not writing to all of them. For example, if you are implementing a four-node recorder solution, implement a four-node cluster. This also meets the recommended best practices for data protection.

To estimate the ideal number of nodes in a cluster, you need to consider cluster bandwidth and capacity.

Sizing by bandwidth

We recommend a cluster size with one or more additional nodes than calculated in bandwidth sizing. This ensures that failover of a node allows for redistribution of NAS connections and avoids any frame loss.

Sizing by aggregate capacity

We recommend a cluster size with enough usable capacity to handle 110 percent of the calculated space requirement, with a minimum added capacity of one full node plus 10 percent. The values are based on camera bit rate.

The Isilon sizing tool can use both the sizing by bandwidth and sizing by aggregate capacity methods when calculating ideal cluster size.

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 S-1 SVMS recorder, monitoring, and web management stations. Expect some variance between the lab results and a production environment.

File storage (NAS)

We conducted validation tests to determine how S-1 works with Dell EMC file storage clusters.

Dell EMC Isilon node and cluster (SMB)

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.

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 32 MB/s can support 64 such 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 recorder server used.

The Dell EMC Surveillance Lab recommends not exceeding 70 percent capacity.

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

Table 3 Dell EMC Isilon node and cluster (SMB) test results for S-1 SVMS

Cluster	OneFS version	SVRs per node	Bandwidth (MB/s)		Drive size	Maximum cluster RAW
			Per SVR	Per node		
NL410	8.0.1.2	1	36	36	6 TB	30.2 PB
	8.0.1.2	2	36	72	6 TB	
	8.0.1.2	3	32	96	6 TB	

Note

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

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.

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 S-1 SVMS 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 S-1 recorder.

Tests conducted

We ran tests with the SmartConnect™ configuration in place and the SMB shares were mounted using the SmartConnect zone name.

Video playback test

As video is being written to the storage and is being viewed live, we recalled or reviewed the video at a rate equal to 20 percent of the write rate. We ran tests with the SmartConnect™ configuration in place and the SMB shares were mounted using the SmartConnect zone name.

The review did not affect the write rate, video quality, or result in dropped video.

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 or video loss.

NIC failure test

We performed the hard NIC failure test by removing one NIC cable from the active node that was involved in active recording. After the NIC failure, writing to the same node failed. When the network fails, the server must recognize the failure, then it must establish a new connection. Also, when the network fails 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.

We can force the open TCP sockets to close for a duration of less than 2 minutes by reducing the `TCP keep idle` and `TCP keep interval` timeout to the optimum values recommended by Isilon Engineering.

To reduce the video loss duration due to the `TCP Socket Open` condition, set the persistent values in the `sysctl.config` file as follows to reduce the impact duration time significantly:

```
 isi_sysctl_cluster
net.inet.tcp.keepidle=61000
 isi_sysctl_cluster
net.inet.tcp.keepintvl=5000
```

Refer to the KB article: 000089232 for further information about how to configure these parameters.

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

We ran 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 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.

In our tests, we could eliminate the global loss of video during high impact cluster interruptions caused by the removal of a node (intentional or failure) or when adding a node to the cluster. The changes also reduced the duration of server reconnections after a node was removed.

In our tests, the servers on the failed node reconnected to a new node, but did not start writing again for an aggregate (reconnect and start writing) duration of up to 52 seconds while waiting for writing to the SMB share to be re-started.

The second issue is that the removal or addition of a node causes an interrupt to the cluster. Therefore, video servers writing to the other nodes might experience a short interruption. The duration of the interruption can be reduced by modifying the OneFS environment variables.

The following code makes the group changes to the cluster that reduce the interruption from 30 seconds to no video loss globally. When video writing to the node failed, the cameras recognized a 50 percent reduction in the recovery duration from 1 minute to 30 seconds. The changes affect the "lazy queue" and other cache related operations on each node.

The following changes are required to modify the remove or add node interruption:

```
declare -i COUNT MDS
BASE=10000
COUNT=$((1.01 * $BASE))
MDS=$(($BASE * 0.75))
isi_sysctl_cluster kern.maxvnodes=$BASE
isi_sysctl_cluster kern.minvnodes=$BASE
isi_sysctl_cluster efs.lin.lock.initiator.lazy_queue_goal=$COUNT
isi_sysctl_cluster efs.ref.initiator.lazy_queue_goal=$COUNT
isi_sysctl_cluster efs.mds.block_lock.initiator.lazy_queue_goal=$MDS
isi_sysctl_cluster efs.bam.datalock.initiator.lazy_queue_goal=$MDS
```

Note

During an abrupt failure of a node, the recorders writing to that node reconnect to any other available node using SmartConnect. During the node fail testing we observed that the reconnected recorder lost about 45 seconds of video.

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 S-1 recorder was configured as described by S-1 best practices and operated within the recommended bandwidth, camera count, and other S-1 SVMS 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 S-1 recorder at the desired bandwidth.
3. Verified that Recording is set to use the H.264 codec and the max resolution is set to 30 FPS (1280x720).
4. Evaluated the network and video storage to ensure an error-free environment at the induced bandwidth.

5. 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 SmartFail
6. Captured the storage system and host statistics.
7. 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

Dell EMC performed comprehensive testing with S-1 SVMS against Dell EMC Isilon clusters. The S-1 architecture and product suite allows extreme scaling, from a few cameras to up to tens of thousands of cameras, by using Dell EMC storage.

S-1 SVMS delivers a complete, end-to-end IP video surveillance VMS, that captures, records, analyzes, investigates and visualizes thousands of IP cameras. With an open platform that supports ONVIF standards, S-1 SVMS integrates with new and existing edge devices, as well as security management and access control systems.

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.

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 S-1 SVMS as a best practice.