Dell Technologies IoT Solution | Surveillance with Milestone XProtect Corporate

Surveillance

February 2019

H17627

Sizing Guide

Abstract

The purpose of this guide is to help you understand the benefits of using a Dell Technologies IoT Solution | Surveillance with Milestone XProtect Corporate 2018. Use this guide to determine the requirements for a successful Milestone XProtect Corporate installation.

DELL Technologies

Copyright © 2019 Dell Inc. or its subsidiaries. All rights reserved.

Published February 2019

Dell believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED “AS-IS.“ DELL MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. USE, COPYING, AND DISTRIBUTION OF ANY DELL SOFTWARE DESCRIBED IN THIS PUBLICATION REQUIRES AN APPLICABLE SOFTWARE LICENSE.

Dell, EMC, and other trademarks are trademarks of Dell Inc. or its subsidiaries. Other trademarks may be the property of their respective owners. Published in the USA.

Dell EMC
Hopkinton, Massachusetts 01748-9103
1-508-435-1000 In North America 1-866-464-7381
www.DellEMC.com

CONTENTS

Chapter 1 Introduction 5
Solution overview 6
Scope 6
Key objectives 7

Chapter 2 Solution components 9
Dell EMC storage 10
Storage protocols 10
Milestone XProtect Corporate architecture 10
Releases tested 13
VMware vSphere 13

Chapter 3 Configured components 15
Dell EMC IoT Solution | Surveillance environment 16
Dell EMC ECS Object Storage 17
Dell EMC GeoDrive 17
VMware vSAN 18
VMware vRealize Operations Manager 18

Chapter 4 Sizing the solution 19
Overall bandwidth and capacity guidelines 20
Dell EMC ECS 20
VMware vSAN 21

Chapter 5 Testing and validation 23
Test objectives 24
Test parameters 24
Tests conducted 24
Video playback test 24
Disk group failure test 24
Disk failure test with ECS 24
NIC failure test with ECS 25
Node poweroff test 25
Node poweroff test with ECS 25
Node reboot test with ECS 26
Storage bandwidth and configuration 26

Chapter 6 Conclusion 29
Summary 30
ECS storage 30

CHAPTER 1

Introduction

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

- Solution overview 6
- Scope 6
- Key objectives 7

Solution overview

The purpose of this guide is to help you understand the benefits of using a Dell Technologies IoT Solution | Surveillance with Milestone XProtect Corporate2018. The Surveillance Solution is designed to support the massive storage, compute and networking loads that come with disparate data sources and provides greater flexibility and customization. Security features are not an after thought and have been designed into the solution so you can lead with confidence.

Use this guide to determine the requirements for a successful Milestone XProtect Corporate installation. The storage platforms include VMware ESXi hosts that are running Milestone XProtect Corporate. This solution includes both hardware and software elements for video surveillance and information on VMware virtualization.

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 ECS® Object Storage
- VMware vSAN

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 practices for the following:

- Number of Recorders per vSAN node
- ECS sizing
- GeoDrive configuration

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.
- Calculate maximum bandwidths.
- Describe validated disk drive types.
- Illustrate lab controlled failures, such as disk rebuilds, and network path failures.

CHAPTER 2

Solution components

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

- Dell EMC storage 10
- Storage protocols 10
- Milestone XProtect Corporate architecture 10
- VMware vSphere 13

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:

- ECS Object Storage

Storage protocols

Dell Technologies uses standard file protocols to enable users and applications to access data that is consolidated on a Dell Technologies IoT Solution | Surveillance storage solution.

This guide provides information about the S3 network protocol.

Milestone XProtect Corporate architecture

Milestone XProtect Corporate 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.

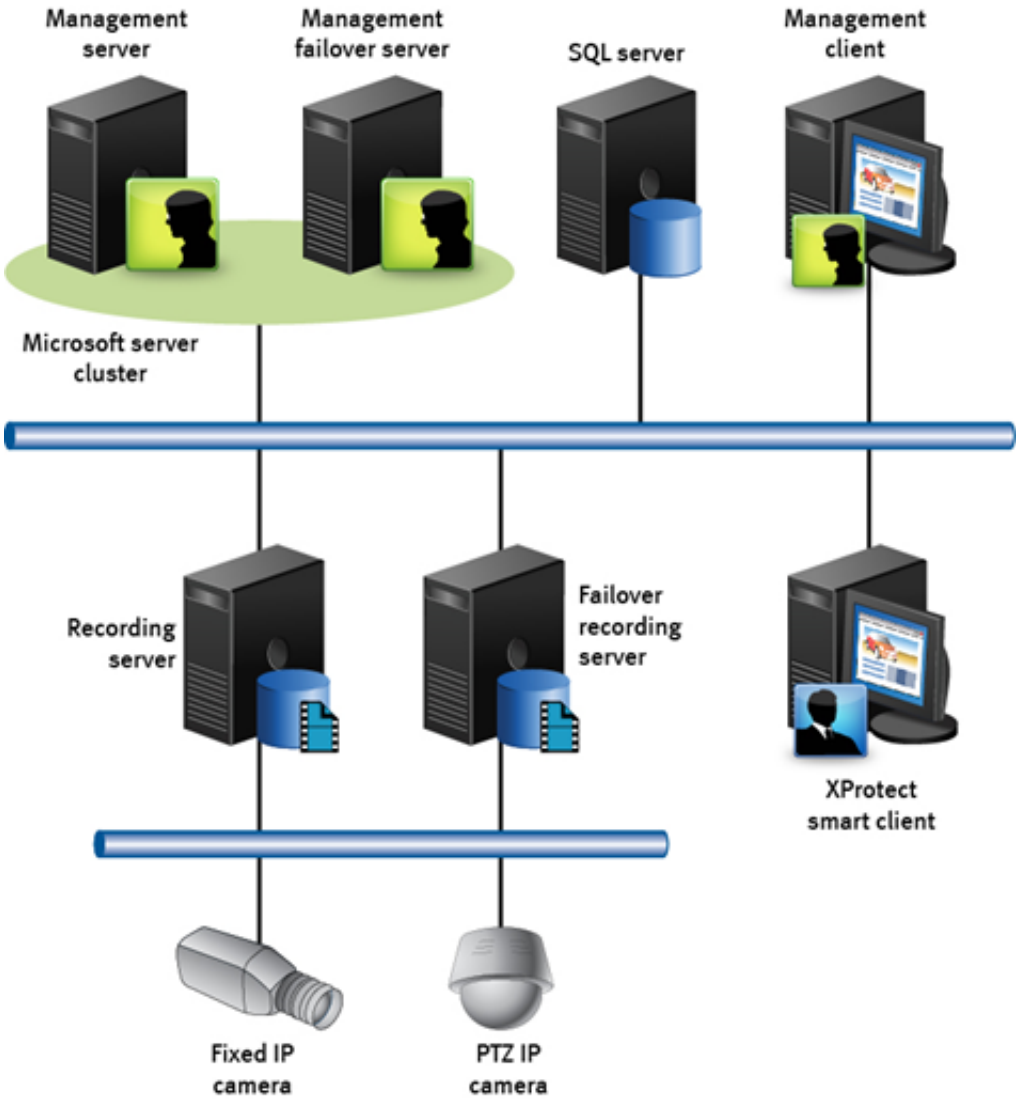
The following table lists XProtect servers, services, and their functions.

XProtect Corporate Server/ Service	Functions
Smart Client	Full-featured remote client, which provides these daily functions: • Live view and playback of multiple views, each with a 100 cameras • Intelligent Pan Tilt Zoom (PTZ) camera control • Advanced search capabilities • Export of evidence material
Matrix	Allows live video streams to be sent to an XProtect Corporate Smart Wall
Recording server	Provides the following functions: • Storage and retrieval of video and audio from MJPEG, MPEG4, MxPEG, H.264, and H.265 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	The Management Application is XProtect's user interface to the management server and provides the following functions: • Managing recording servers, users, and devices

XProtect Corporate Server/ Service	Functions
	• 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



Releases tested

The following table lists the Milestone XProtect Corporate releases used for our tests.

Table 1 Milestone XProtect Corporate releases

VMS	Release
Milestone XProtect Corporate	2017, 2018 R3

VMware vSphere

VMware vSphere is a virtualization platform that is used across thousands of IT environments around the world. VMware vSphere can transform or virtualize computer hardware resources, including CPU, RAM, hard disk, and network controller, to create a fully functional virtual machine (VM) that runs its own operating systems and applications like a physical computer.

The high-availability features of VMware vSphere coupled with VMware vSphere Distributed Resource Scheduler (DRS) and VMware vSphere Storage vMotion enable the seamless migration of virtual desktops from one ESXi server to another with minimal or no impact to the customer's usage.

CHAPTER 3

Configured components

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

- Dell EMC IoT Solution | Surveillance environment 16
- Dell EMC ECS Object Storage 17
- Dell EMC GeoDrive 17
- VMware vSAN 18
- VMware vRealize Operations Manager 18

Dell EMC IoT Solution | Surveillance environment

The Dell EMC Surveillance Lab recommends the following base configuration for a successful implementation:

Virtualized environment

- 8 vCPUs
- 16 GB memory
- Network adapter type: VMXNET3 (GbE and 10 GbE)

R740xd vSAN Ready node (vSAN certified storage)

- Dual Intel Xeon gold 6126 2.6G, 12C/24T
- 192 GB memory
- 10x 3.84 TB SSD SAS Read Intense
- 2x 800 GB SSD SAS Write Intense
- Intel X710 Quad Port 10 Gb DA/SFP+ Ethernet, Network Daughter Card

vSAN cluster

- 4 R740xd vSAN Ready nodes
- 40 total capacity drives
- 8 Disk Groups (1 vSAN cache to 5 capacity SSD_
- 10 GbE NIC connections for:
  - vSAN
  - Administration
  - vMotion
  - vSAN Managment

Switching

- Dual DellS4048s (leaf) vSAN cabinet: vSAN, vMotion, Camera/User
- DualDell Z9100s network core (spine) - optional

External storage

- ECS U4000
- 8 node with 60 drives per node

Supporting Servers

- Review stations: Dell PowerEdge servers - various models
- Work stations: Dell Precision - various models

Refer to the following network and design guides for more information on configuring vSAN for your environment, or contact ProDeploy Plus for vSAN configuration assistance:

- VMware Storage and Availability Technical Documents
- VMware vSAN Design and Sizing Guide
- VMware vSAN Network Design

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).

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 Dell EMC PowerEdge 740xd Ready Nodes.

Dell EMC ECS Object Storage

Dell EMC ECS is a complete software-defined cloud storage platform that supports the storage, manipulation, and analysis of video surveillance and unstructured data on a massive scale on commodity hardware. ECS is specifically designed to support the mobile, cloud, and Big Data workloads that are similar to large-scale workloads.

ECS provides UI, RESTful API, and CLI interfaces for provisioning, managing, and monitoring storage resources. Storage services provided by the unstructured storage engine (USE) ensure that video is available and protected against data corruption, hardware failures, and data center disasters. The USE enables global namespace management and replication across geographically dispersed data centers and enables the following storage services:

Object service

Enables you to store, access, and manipulate video and unstructured data. The object service is compatible with existing Amazon S3, Dell EMC Centera™ content addressable storage (CAS), and Atmos™ APIs.

Hadoop Distributed File System (HDFS)

Helps you use your ECS infrastructure as a Big Data repository against which you can run Hadoop analytic applications.

The provisioning service manages the provisioning of video surveillance storage resources and user access. Specifically, it handles user management, authorization, and authentication for all provisioning requests, resource management, and multitenancy.

You can scale up, scale out, and add users, applications, and services, as well as manage your local and distributed storage resources for your surveillance data through a single view.

Dell EMC GeoDrive

GeoDrive is a lightweight application that allows you to upload and download files to a Dell EMC ECS storage platform. It creates a Windows virtual drive to ECS cloud storage and transfers data from a Windows platform to an ECS using REST S3 API. GeoDrive is designed as an easy access to data in the cloud by allowing Windows applications to interface with an ECS storage server through standard file system APIs.

ECS combined with GeoDrive provides applications and users efficient access to content in the cloud from a Windows platform.

VMware vSAN

VMware vSAN aggregates local or direct-attached data storage devices to create a single storage pool shared across all hosts in the vSAN cluster. vSAN eliminates the need for external shared storage, and simplifies storage configuration and virtual machine provisioning.

vSAN is a distributed layer of software included in the VMware ESXi hypervisor, and it is fully integrated with VMware vSphere. vSAN supports vSphere features that require shared storage, such as High Availability (HA), vMotion, and Distributed Resource Scheduler (DRS). VM storage policies enable you to define VM storage requirements and capabilities.

Each host in a vSAN cluster contributes storage to the cluster. These storage devices combine to create a single vSAN datastore.

VMware vRealize Operations Manager

VMware vRealize Operations Manager delivers intelligent operations management with application-to-storage visibility across physical, virtual, and cloud infrastructures. Using policy-based automation, operations teams automate key processes and improve IT efficiency.

Using data collected from system resources (objects), vRealize Operations Manager identifies issues in any monitored system component, often before the customer notices a problem. vRealize Operations Manager also frequently suggests corrective actions you can take to fix the problem right away. For more challenging problems, vRealize Operations Manager offers rich analytical tools that allow you to review and manipulate object data to reveal hidden issues, investigate complex technical problems, identify trends, or analyze to gauge the health of a single object.

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.

- Overall bandwidth and capacity guidelines 20
- Dell EMC ECS 20
- VMware vSAN 21

Overall bandwidth and capacity guidelines

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, node failures, and failing network paths.

Dell Technologies recommends distributing the archiving time and data upload time in all the recorders to avoid higher IOPS at any time.

During testing, two recorders were used, with the hourly archive offset by 30 minutes. GeoDrive was configured to upload data from the archive folder to ECS after 90 minutes of a file close.

The following table provides bandwidth-sizing guidelines based on the desired number or recorders. The table begins with 8 recorders, as the IOT solution requires a minimum of 4 vSAN nodes.

Table 2 Bandwidth sizing guidelines

Number of recorders	Nodes required		Bandwidth (MB/s)	
	vSAN	ECS	Per recorder	Total
8	4	5 [a]	45	360
10	5	5	45	450
12	6	6	45	540
14	7	7	45	630

a. Five nodes is the minimum number required for an ECS cluster.

The following table provides capacity guidelines based on our test results.

Table 3 Capacity sizing details

Disks per vSAN node	Disk type	Disk size	No. of disks	Storage policy [a] (RAID)	Usable space	
					Per VSAN node	Per recorder [b]
Minimum number	SSD	3.84 TB	10	10	14 TB	7 TB
Maximum number	SSD	3.84 TB	24	10	33 TB	16.5 TB

a. Defines the number of host and device failures that a virtual machine object can tolerate, including using RAID 5 or RAID 6.
b. Four Recorders per node

Dell EMC ECS

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, node failures, 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.

Dell EMC recommends:

- Using SSD, 10k, or 15k rpm SAS drives for the GeoDrive cache disks.

- Calculating drive space requirements for local disk and ECS buckets based on the retention times used.

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

Table 4 Dell EMC ECS Object Storage test results

Cluster	ECS version	Recorders per node	Bandwidth (MB/s)		No. drives/ ECS node	ECS node drives	
			Recorder	Node		Size	Type
ECS U400	3.2.0.0	1	45	45	30	8 TB	NL-SAS
		2	45	90	30	8 TB	NL-SAS
		3	30	90	30	8 TB	NL-SAS
		4	20	80	30	8 TB	NL-SAS

Note

For Milestone recorders, the Archive DB disk must be configured as the cache disk for the GeoDrive tool.

VMware vSAN

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, node failures, and failing network paths.

Dell Technologies recommends:

- Keep some RAM (16GB) for the virtualization OS
- Do not run more than 6 VMs total
- Do not exceed VM designs above 1200 Mbps per server

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

Table 5 Dell EMC ECS Object Storage test results

Server node	VMware version	Recorders per node	Disk groups	Bandwidth (MB/s)		No. capacity drives/ VMware node
				Recorder	Node	
PowerEdge R740xd Ready Node	6.7	1	2-4	45	45	10-24
		2	2-4	45	90	10-24

CHAPTER 5

Testing and validation

This chapter describes the testing used to validate this solution.

- Test objectives 24
- Test parameters 24
- Tests conducted 24
- Storage bandwidth and configuration 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 best video storage performance requirements for use with:
  - ECS Object Storage
- Determine the maximum bandwidth with multiple Recorders.
- Determine all factors with a lab-controlled failure, such as rebuilding disks, 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.

Tests conducted

Video playback test

As video is being written to the storage, video is simultaneously recalled or reviewed at a rate equal to 20 percent of the write rate. The review did not affect the write rate, video quality, or result in dropped video.

Disk group 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.

For the test, disk failure scenarios were induced and the data rebuild to the hot spare disks was observed with effect to write bandwidth. There was no video data loss during recovery.

Disk failure test with ECS

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.

ECS employs a hybrid model of triple mirroring data, metadata, and indexing. Erasure coding is also used for enhanced data protection and reduction of storage overhead. For data integrity, ECS uses checksums.

When the system labels a drive as `FAILED`, the data protection logic rebuilds the data on that drive on other drives in the system. The `FAILED` drive no longer participates in the system in any way. ECS requires a minimum of four nodes to be able to conduct the default erasure coding and six nodes for the cold archive option.

The disk rebuild operation did not affect the write rate, video quality, or result in dropped video.

NIC failure test with ECS

The ECS hard NIC failure test removes one NIC cable from the active node that was involved in active recording to simulate the NIC failure scenario.

The Dell EMC Surveillance Lab uses two 10 GbE, 24-port or 52-port Arista switches that are used to transfer data to and from customer applications as well as internal node-to-node communications. These switches are connected to the ECS nodes in the same rack and employ the Multi-Chassis Link Aggregation (MLAG) feature, which logically links the switches enabling active-active paths between the nodes and customer applications. This configuration results in higher bandwidth while preserving resiliency and redundancy in the data path. Any networking device supporting static LAG or IEEE 802.3ad LACP can connect to this MLAG switch pair. Because the switches are configured as MLAG, these two switches appear and act as one large switch.

The NIC failure tests did not affect the write rate, video quality, or result in dropped video.

Node poweroff test

An unexpected single node hard failure was simulated, which causes the servers that were writing to that node to reconnect to a new node.

Server rebalancing is based on the rules of the HA cluster that the vSAN nodes are a member of. When a vSAN node is failed, the Archivers running on that node are rebooted across the remaining three nodes.

Initially, the four Archivers run across three nodes. Upon recovery of the failed node, VMware vSphere vMotion can then rebalance the cluster.

Node poweroff test with ECS

ECS employs a hybrid model triple mirroring data, metadata, and indexing. Erasure coding is also used for enhanced data protection and reduction of storage overhead.

Erasure coding provides enhanced data protection from a disk or node failure that is storage efficient as compared to conventional protection schemes. The ECS storage engine implements the Reed Solomon 12+4 erasure-coding scheme, in which a chunk is broken into 12 data fragments and 4 coding fragments for parity. These 16 fragments are then dispersed across nodes at the local site. The data and coding fragments for each chunk are equally distributed across nodes in the cluster. For example, with 8 nodes, each node stores 2 of the 16 fragments. The storage engine can then reconstruct a chunk from any 12 fragments of the original 16.

One of the ECS nodes was manually shutdown. The GeoDrive tool load balanced the traffic across all the available nodes and the recorders bypassed the failed node. The node failure did not affect the write rate, video quality, or result in dropped video.

WARNING

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

Node reboot test with ECS

One of the ECS nodes was manually restarted to simulate a node reboot. The GeoDrive tool load balanced the traffic across all the available nodes and the recorders bypassed the failed node. The node reboot did not affect the write rate, video quality, or result in dropped video.

Storage bandwidth and configuration

The purpose of the storage bandwidth test was to evaluate video storage and its application to the various Dell EMC storage arrays and nodes.

Additional tests evaluated ESXi host hardware in relationship to virtual CPU settings and the resulting bandwidths.
During all the tests, we assumed that Milestone XProtect Corporate is correctly configured according to Milestone's best practices and operates within the bandwidth, camera count, and other Milestone parameters.

Procedure

1. Configured video storage for a Dell EMC storage system.
2. Configured Milestone Recorders
3. Set up camera simulators (traffic generators) to produce a traffic load to each Milestone Recorder at the desired bandwidth.
4. Verified that motion detection was in the **On** state for all cameras.
5. Evaluated the network and video storage to ensure an error-free environment at the induced bandwidth.
6. Introduced storage device errors including:
   - NIC failures with active/active and active/passive configurations
   - Disk failures
   - Node failures
7. Captured the storage system and host statistics.
8. 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.

Results

Recorders for the storage protocol to be tested ().

The test results associated with the previous procedure, for each tested Dell EMC storage array or cluster, are presented in *Dell EMC Storage with Milestone XProtect Corporate Configuration Guide*. The test results provide information about the maximum expected bandwidth per array or node, the disk configuration, as well as

recommendations for various configuration parameters derived from extensive testing.

CHAPTER 6

Conclusion

This chapter summarizes the testing for this solution.

- Summary.....30

Summary

The enterprise-grade Dell Technologies IoT Solution | Surveillance provides strong safety and high business value from day one. It is a solution that combines hardware and software optimized for surveillance needs along with management and orchestration capabilities to meet the needs of both OT and IT users.

The Dell EMC Surveillance Lab performed comprehensive testing with Milestone XProtect Corporate against ECS Object Storage and VMware vSAN.

Depending on the implementation needs, you can use Dell EMC storage for Milestone XProtect Corporate.

The Milestone architecture and product suite allows extreme scaling from a few cameras to tens of thousands of cameras using Dell EMC storage.

ECS storage

Dell EMC ECS is a software-defined, cloud-scale, object storage platform that combines the cost advantages of commodity infrastructure with the reliability, availability and serviceability of traditional arrays. With ECS, any organization can deliver scalable and simple public cloud services with the reliability and control of a private-cloud infrastructure.