Surveillance
Dell EMC Storage with Bosch Video Recording Manager

Sizing and Configuration Guide

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Dell EMC
Surveillance Lab
Tested

BOSCH

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CHAPTER 1

Introduction

This chapter provides an introduction to this solution.

Solution overview

This solution uses EMC VNX™ and EMC VNXe™ storage systems with VMware ESXi hosts running Bosch Video Management System (BVMS), Bosch Video Recording Manager (VRM), and Microsoft iSCSI Gateway Servers.

Purpose

You can use this document to determine the requirements for a successful BVMS installation.

This document also provides guidelines for sizing the Dell EMC storage arrays. The sizing recommendations are based on performance and storage protocols derived from Dell EMC testing.

Scope

This document focuses on guidelines for storage array positioning and sizing for a customer's specific system design requirements.

The scope of this document includes:

- Bandwidth recommendations for Bosch VRM release 3.0 or later and one or more Dell EMC systems. Bosch VRM version 3.0.0073 was tested for these guidelines

- Several Dell EMC storage system configurations that are ideal for physical security solutions with BVMS

- Results summary of the Dell EMC performance tests described in this document

By using this document. you can determine the best configuration, including:

- Number of Bosch VRMs and number of Windows 2012 Gateway Servers required for a customer's solution

- Storage access protocol configurations for the iSCSI protocol

- Load factors for building Dell EMC storage arrays for a customer's solution

All performance data contained in this report was obtained in a rigorously controlled environment. Performance varies depending on the specific hardware and software and may be different from what is outlined here.

Audience

The intended audience for this document includes internal Dell EMC sales and presales personnel.

Key recommendations

You can use the guidelines in this white paper to do the following through the Microsoft iSCSI gateway:

- Determine the recorder services' maximum bandwidth for the Dell EMC storage arrays.

- Measure sizing needs for Dell EMC storage options to correctly size the implementation with Dell EMC products that match the customer's requirements.

- Determine the VNX or VNXe bandwidth for each LUN.

- Determine the disk pool and LUN configurations.

- Recommend the applicable disk drive types

Introduction

CHAPTER 2

Solution components

This chapter describes the components for this solution.

Dell EMC arrays and clusters

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

This document describes tests for each of the following systems:

* This document describes tests for each of the following systems: EMC VNX

* EMC VNXe

All collection scenario tests were performed with at least one failed or recovered component. We[1] performed our testing with both single and dual storage processors on a VNX storage system with disk recovery processes for all systems.

Storage protocols

This document provides information about the following network protocols:

* iSCSI

Bosch Video Recording Manager

A BVMS installation can consist of a single server and is a management superset of VRM.

The VRM provides base level system-wide recording, monitoring, and management of Bosch iSCSI storage, video servers, and cameras for a BVMS. You can configure VRM to manage a few cameras or thousands of cameras.

The iSCSI disk arrays are not attached directly to a VRM, but instead can be attached anywhere on a standard IP network through a 1 GbE uplink. The following table describes four primary Video Management System services.

Table 1 BVMS primary services

Service	Description
Video Recording Manager(VRM) Server	VRM Server manages the recordings of the devices, configuration details, and system settings, and acts as a centralized service for communicating with individual modules. Cameras can record and store the video to the iSCSI virtual disks. The virtual disks are created on an iSCSI LUN that is mounted as a drive on a Windows 2012R2 server.
VRM Monitor	The VRM Monitor module monitors the VRM system. This module is where information about the connected Bosch Video over IP (BVIP) devices, storage systems, and recordings is displayed. The module also monitors online and offline storage, the system health status for cameras, and any problems with the system.
Configuration Manager	Use Configuration Manager to configure the VRM system. The program can be installed on one or more Windows PCs that provide network access to the computer on which VRM Server has been started. This program enables you to specify

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1. In this document, "we" refers to the Dell EMC Surveillance Lab team that tested and validated this solution.

Table 1 BVMS primary services (continued)

Service	Description
	the IP cameras and encoders for each recording, as well as which iSCSI storage systems are used to store the recordings.
Bosch Video Client	Bosch Video Client is a Windows PC application for live viewing and playback of network-connected cameras, and the search and export of recorded video.

Note

The VRM comprises Bosch Video Streaming Gateway software. The solution validated in the Dell EMC Surveillance Lab is based on cameras writing through a Microsoft iSCSI gateway. The Bosch video streaming gateway was not tested.

The Microsoft iSCSI gateway is a term that Bosch uses to describe Microsoft's iSCSI target, which allows Windows Server to present itself as an iSCSI disk array. Although the iSCSI target was available for Windows Server 2008, it was not incorporated into Windows Server until the 2012 release.

CHAPTER 3

Configuring the solution

This chapter describes how to configure the solution.

BVMS architecture

There are many design options for a BVMS implementation, and Bosch offers many training courses related to design and implementation. These design details are beyond the scope of this paper.

The Bosch VRM *User Manual Video Re-Operation Guide* provides the necessary information to plan a BVMS. The data sheet on the Bosch Video Client provides a detailed explanation of how to use the video client application. The *Bosch Video Management System 3rd Party Storage* document provides a detailed explanation of how to create iSCSI virtual disks on iSCSI targets on a Microsoft Windows 2012R2 server.

Note

The size of a single LUN assigned on the Bosch VRM under iSCSI System cannot exceed 2000 GB (or 2 TB); otherwise problems will occur when the LUN is formatted with Configuration Manager.

These documents are available from a Bosch partner or through the Bosch Partner network. They are intended for systems integrators, architects, network IT planners, and system administrators. They assume readers know what BVMS software does, how it works, and how to deploy and configure Windows IP networks. This white paper is not intended to replace or supersede any Bosch document.

The following figure represents the basic configuration that we tested for this solution.

Figure 1 Solution configuration
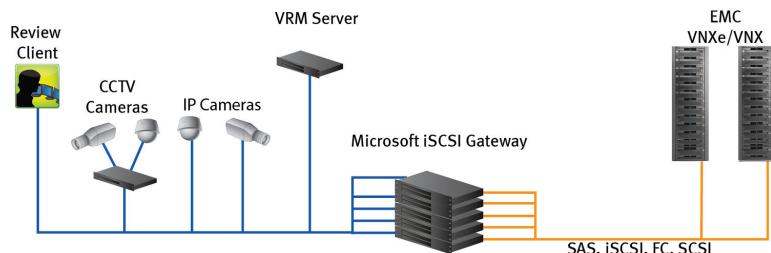
EMC VNX and EMC VNXe

This section describes best practices for configuring a VNX or VNXe environment for the solution. For further details about best practices on VNX and VNXe, refer to the *Performance Best Practices Guide* of the appropriate storage system.

Flash drives (not recommended)
Due to the high percentage of sequential large block writes, we do not recommend the use of flash drives for video storage within a surveillance application.

Disk drives
Although any supported drive will work, video surveillance systems typically rely on the density of the storage system. We recommend Near Line (NL)-SAS drives of the highest available density in this solution. In general, we used terabyte (TB) or multiple TB NL-SAS drives when performing tests.

Storage pools (recommended)
The tests we conducted with BVMS confirm that storage pools, defined with the maximum allowable number of disks per pool, perform as well as, or better than, traditional RAID groups, and we therefore recommend that you use storage pools. Storage pools also reduce the required storage-system management tasks.

Building a storage pool is a straightforward process. You can configure either RAID 5 or RAID 6, depending on the VNX family member restrictions and the risk factors that the customer is willing to accept. When configuring storage pools, use large storage pools with large-sized LUNs and configure the LUNs as "thick" instead of "thin."

Background zeroing (recommended)
Background zeroing erases any data previously written to the drive. All drives for newly bound LUNs and new Virtual Provisioning pools are zeroed. New drives come from the factory pre-zeroed.

Cameras that start writing to the Bosch storage while background zeroing is in progress will have performance issues. We recommend not starting any recording from the Bosch VRM until the zeroing process is complete. The zeroing rate varies between 20 MB/s and 50 MB/s, depending on the drive type, and the zeroing process can adversely affect storage performance, particularly when many LUNs or maximum-size storage pools are created simultaneously.

If the drives have been used previously, the zeroing process can be accelerated by manually pre-zeroing drives before binding or pool creation.

VNXe RAID configurations
We recommend the following RAID configurations:

- RAID 5 or RAID 10 with SAS drives

- RAID 6 with NL-SAS drives (recommended)

Note

Do not use flash drives. See the Flash drives (not recommended) section for details.

Bosch iSCSI initiators
Bosch VRM works based on the Bosch-defined iSCSI initiator addresses for the IP cameras, Bosch VRM server, and the iSCSI storage pools. To configure working iSCSI storage, you need to add an iSCSI system and assign the LUNs.

Microsoft iSCSI gateway
We used Microsoft Windows Server 2012 64-bit iSCSI target and iSCSI software initiators in this solution, which act as a gateway server between VNX or VNXe storage, the cameras, and Bosch VRM.

- iSCSI software initiators are 64-bit initiators.

- Microsoft Windows Server 2012 R2 or later supports the creation of iSCSI target and iSCSI virtual disks which can be assigned as LUNs on the Bosch VRM for the cameras to write to.

Note

At the time of publication, we had not tested the Cisco UCS unified adapter iSCSI capabilities. This solution does not support Microsoft software initiators on Microsoft Windows Server prior to Windows Server 2012R2.

Tested architectures

In the Dell EMC Surveillance Lab, writes to the VNX or VNXe storage systems are tested using the following two methods:

- Cameras writing directly to the VNX or VNXe raw iSCSI LUNs assigned using Bosch-defined IQN addresses. Based on test results, this configuration is not recommended.

- Cameras writing to the virtual iSCSI disks created on an iSCSI or Fibre Channel (FC) disk drive mounted on the 'Microsoft Windows iSCSI Gateway Server'

Cameras writing to the virtual iSCSI disks created on the Windows Server 2012 iSCSI gateway

Due to the limitation with the direct iSCSI LUN architecture and errors with cameras writing to the VNX iSCSI LUNs, Bosch and Dell EMC found a way to improve camera write performance to the VNX or VNXe storage systems when using Bosch Video Management Systems.

This architecture uses Windows 2012R2 64-bit Server as Microsoft Gateway Server between VNX or VNXe using iSCSI or FC, the cameras and the VRM. In this architecture, iSCSI or FC LUN size can be any size supported by VNX or VNXe storage systems and can be mapped on the Gateway Server using Microsoft iSCSI Initiator addresses. Once the LUN is formatted as a disk drive on the Gateway Server, we can create an iSCSI target and as many virtual iSCSI disks as we need on the disk drive.

Note

Each virtual iSCSI disk size should not exceed 2000 GB as the Bosch VRM does not support LUNs greater than 2000 GB The maximum LUN size that can be created on a VNX5300, VSS-100, or VNXe3200 is 16 TB.

The advantages in using this architecture are:

- The iSCSI connection between VNX or VNXe and the Gateway Server is the Microsoft Software iSCSI, which has been validated and shown to work well with the Dell EMC storage systems. If FC is used, raw LUNs can be mapped as disk drives.

  Note

  In the Dell EMC Surveillance Lab, tests were conducted using the iSCSI protocol. The FC protocol has been tested for compatibility with the Bosch VRM and worked as good or better than the iSCSI protocol.

- The cameras and VRM do not need an iSCSI connection to the VNX or VNXe storage systems, thus reducing the number of I/O events happening concurrently through the separate connections. This had a significant impact on the write performance, and iSCSI write errors and iSCSI connection errors were reduced significantly.

With this configuration, we are able to test the VNX VSS-100 storage system at the bandwidth of 322 MB/s on single SP, using 512 CIF cameras with each camera of 5 Mbps bandwidth.

Configuring the solution

To configure the solution:

Procedure

1. Before creating a storage pool, run disk pre-zeroing for all VNX systems that will store data.

```
naviseccli zerodisk -messner <disk-id> <disk-id> <disk-id>
start
naviseccli zerodisk -messner <disk-id> <disk-id> <disk-id>
status
```

2. Assign the IP addresses to the active and passive ports on the iSCSI NICs of VNX or VNXe that will be used for I/O with Microsoft iSCSI Gateway Server.

3. Create a storage pool with a maximum number of disks and create LUNs of the required size for Microsoft iSCSI Gateway Server.

   For example, in the Dell EMC Surveillance Lab, we created 16 TB LUNs, the maximum size supported on the VNX5300 and VSS-100.

4. Register the Microsoft iSCSI initiator address for the Gateway Server on which the LUN needs to be mounted as a disk drive.

5. Create a storage group on the VNX and connect LUNs and hosts to the storage group.

6. Format the raw LUN on the Gateway Server and create target and virtual iSCSI disks (vdisks). Each vdisk needs to be less than 2000 GB. Wait until the vdisk creation process is complete. For detailed steps, refer to the *Bosch Video Management System 3rd Party Storage* document, which explains how to create an iSCSI target and virtual iSCSI disks on the Microsoft iSCSI Gateway Server.

   For example, in the Dell EMC Surveillance Lab, we created a target on the same server and eight vdisks, each with a size of 1950 GB.

7. Allocate the cameras to the VRM using Device Allocator, which is managed and recorded to the VNX iSCSI storage.

8. Add the Gateway Server address on the Bosch VRM as the iSCSI System.

9. Assign the vdisks available to the VRM using LUN Assignment so that cameras can write to the vdisks.

10. Change the Max. Number of iSCSI sessions and Max. Bit rate [Mbps] from the default based on the customer requirements and the supported values for Bosch VRM.

11. Set the Recording Preferences for the cameras by selecting the required iSCSI system as Primary Target and Secondary Target under **Camera > Recording > Recording Profiles**.

12. Set the Maximum Retention Time and Minimum Retention Time under **Camera > Recording > Recording Profiles**.

13. Start and stop the camera recording by using the button under **Devices > Recording > Recording Scheduler**.

14. Use the VRM monitor to monitor the camera recording, status of the cameras, number of LUNs, number of cameras, remaining space, bandwidth of camera recording, and so on.

VNX and VNXe family sizing and configuration

The following table presents the various measurements we took while testing Video Management System across selected VNX or VNXe family storage arrays.

When implementing the solution in the Dell EMC Surveillance Lab, the following sizing guide was derived using a 16 TB per Microsoft iSCSI Gateway Server, each eight 2 TB vdisks were created per LUN. The storage was configured with a single storage pool.

Table 2 VNX or VNXe sizing guide

Storage array	Disks	Array bandwidth
VNXe1600*	35	256
VNXe3200	120	210
VNX-VSS100	90	381
VNX5200*	55	360
VNX5400*	120	476
VNX5600*	120	500
	240	800
VNX5800*	500	800
	120	530
	240	847
	360	1271
VNX7600*	750	1271
	120	547
	240	876
	360	1314
	480	1752
VNX8000*	1000	1752
	120	655
	240	1047
	360	1571
	480	2094
	600	2618
	1000	2618

* The disks used in the Dell EMC Surveillance Labs are NL-SAS, 7200 rpm unless otherwise stated.

Firmware at time of tests

The following table lists the firmware builds used in these tests. Expect equal or better results if you use more recent firmware or newer models of VNX or VNXe storage.

Table 3 Firmware builds

Model	Firmware
VNX5300	VNX OE 5.32.000.5.206
VNX-VSS100	VNX OE 5.32.000.5.215
VNXe3200	VNXe OE 3.1.1.5395470

Minimum requirements and recommendations

Refer to the installation guide for your VMS version to find the minimum and recommended hardware specifications.

Video Management System

Different VMS server types have different hardware specifications that include the processor speed and type, memory specifications based on the processor, storage concerns, and Ethernet NICs. Refer to the VMS installation guide for the VMS version you are implementing for software and operating system requirements.

VMware ESX and ESXi

VMware vSphere minimum system requirements are as follows:

- VMware ESX and ESXi 4.0 or later

- Four-core 1.99 GHz processors or greater

- 6 GB of memory for each vSphere guest running a VMS server

- Dell EMC PowerPath™ for block storage

For a list of compatible hardware, refer to the *VMware Compatibility Guide*.

Tested vCPU, memory, and network

Our test environment had the following configuration:

- VMware ESXi 5.1 Update 1 and ESXi 5.5

- 20-core ESXi host at 2.2 GHz or greater

- 128 GB or greater memory per ESXi 5.1 host

Each virtualized Bosch host featured:

- Eight (8) virtual CPUs (vCPU)

- 8 GB memory

- Network adapter type: VMXNET3

- Private VLAN for storage

- Dedicated vNIC for storage

Storage adapter requirements

The following are the storage adapter requirements:

- All storage adapters must be VMware certified.

- If used, FC and iSCSI adapters must be VMware and Dell EMC certified.

The following table shows the requirements for each of the storage types.

Table 4 Storage requirements

Storage type	Requirements
Datastore	DAS or SAN devices and a minimum of 80 GB for each virtual machine
Video storage	SAN devices with unpartitioned space (VMware raw) and iSCSI-attached

CHAPTER 4

Testing and validation

This chapter presents the findings from our testing.

Test objectives

Many factors should be taken into account when you are designing your solution using the Microsoft iSCSI gateway solution.

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

- Determine the bandwidth for various Dell EMC storage systems with iSCSI.

- Determine the configuration parameters for VNX or VNXe storage.

- Determine optimal performance requirements for use with VNX or VNXe storage arrays based on various failure scenarios.

- Determine the maximum bandwidth with multiple Windows iSCSI gateway servers.

Test parameters

The following test parameters were used for performing tests of Bosch VMS:

- Tests were conducted by loading each Microsoft iSCSI gateway server at a bandwidth of 80 MB/s with 128 CIF cameras.

  Note

  80 MB/s (640 Mb/s) is the maximum recommended bandwidth.

- All test measurements were based on active failure scenarios. Failure scenarios include drive failures and recovery and storage processor failures. Testing with these realistic scenarios helps ensure a successful implementation that can withstand various types of failures.

- The IP network is a flat (Layer 2), high availability network with plenty of capacity, which allowed us to focus on the products we were testing.

- All tests assumed uniform distribution of bandwidth from the Video Management System Recorders.

Testing storage bandwidth and configuration

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

Before you begin

These tests assumed that the Bosch Video Management System was configured as described in Bosch's best practices and operated within the recommended bandwidth, camera count, and other Bosch maximum requirements.

Procedure

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

2. Configured Bosch VRM for the iSCSI storage protocol to be tested.

3. Set up camera simulators (traffic generators) to produce a traffic load to each Microsoft iSCSI gateway server at the recommended bandwidth.

4. Verified that motion detection was set to On 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:

   • Disk failures and rebuilds on VNX and VNXe

   • The use of only one VNX or VNXe storage processor

7. Captured the storage system and host statistics.

8. Based on the test results:

   • If no issues were detected, we incremented the bandwidth. If issues were detected, we decremented the bandwidth.

   • Repeated previous step until the maximum, error-free, bandwidth was reached.

CHAPTER 5

Conclusion

This section presents a summary of our findings.

Summary

VNX arrays

As compared to traditional block-level storage, the use of storage pools to create LUNs within the VNX storage systems greatly simplifies the configuration and increases performance. iSCSI can be implemented for this solution.

VNX-VSS arrays

The VNX-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.

VNXe arrays

The iSCSI-connected VNXe, implemented with storage pools, provides a cost-effective implementation while maintaining expected performance levels. VNXe may be used in many midsized deployments.