CONFIGURATION AND SIZING GUIDELINES FOR EMC STORAGE AND MILESTONE XPROTECT
EMC VNX and EMC Isilon

EMC Solutions

Abstract

This white paper explains provides guidelines and recommendations for storage platform positioning and system sizing. The document focuses particularly on the storage design considerations of storage bandwidth and the maximum number of recording servers per storage array or cluster.

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**Executive summary**

**Solution overview** This solution uses EMC® VNX®, EMC Isilon®, and LenovoEMC™ storage platforms with Milestone XProtect Corporate 2013 R2 release video management software (VMS).

This white paper provides guidelines and recommendations for storage platform positioning and system sizing. The document focuses particularly on these storage design considerations:

- Storage bandwidth
- Maximum number of recording servers per storage array or cluster

This white paper is a companion paper to the *Reference Architecture: EMC Storage for Milestone XProtect Corporate—EMC VNX and EMC Isilon*, which describes the solution architecture and discusses the available storage protocols for each storage tier in multi-tier XProtect environments.

**Key results** This white paper addresses these key results from the solution testing:

- Maximum Milestone XProtect 2013 recording server bandwidth with the Live database (Live DB) on VNX storage
- Maximum Milestone XProtect 2013 R2 recording server bandwidth with the Live database (Live DB) and Archive database (Archive DB) implemented on the same VNX5800™ storage array
- Maximum bandwidth per Isilon X400 and NL400 node for the Archive database (Archive DB)
- Isilon X400/NL400 configuration options, including SmartConnect™ and SmartQuotas™
- XProtect recording server configuration recommendations
Introduction

Purpose
This white paper is intended to help EMC field personnel understand the requirements for a successful Milestone Corporate 2013 (or later) installation, Milestone storage tiering options, and storage-specific configuration requirements.

Scope
The scope of this document is to:
- Present an architectural overview of Milestone XProtect Corporate
- Describe EMC storage considerations for Milestone XProtect Corporate
- Summarize the results of the tests carried out by EMC

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

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

Audience
The intended audience for this document is internal EMC and EMC integrators.

Terminology
Block-level storage system
A block-level storage system writes and reads blocks of data using logical block addresses (LBAs), which are translated into disk sector addresses on the drives. Storage-attached network (SAN) environments use block-level storage to provide a higher level of performance compared with the file-level storage. Block-level storage allows the host to control the assigned storage allocations (LUNs or volumes) as if they were independent disks.

Fiber Channel (FC) and iSCSI are the forms of block-level storage used by XProtect for Live DB and Archive DB video storage.

File-level storage system
File-level storage is a storage system residing on a hosting device and acting to proxy storage writes and read functions for one or more hosts. Network-attached storage (NAS) is a form of file-level storage and is accessed using network protocols such as Server Message Block (SMB) or network file system (NFS).

XProtect Corporate recording servers can use NAS SMB storage for the Archive DB video repository.

Live DB and Archive DB
Milestone XProtect Corporate is designed for a tiered storage implementation and best practices are based on a multi-tier environment.
The Live DB is the first tier (Tier-1) for XProtect video recordings and is intended to retain recordings for periods of from 1 hour to 24 hours. The Archive DB is the secondary storage tier (Tier-2) and is intended for long-term storage.

**Live DB only**

On the Xprotect Corporate release tested, implementation using a single NAS Live DB tier may be feasible when the retention time 1 or 2 weeks. As the retention time increases the server startup time increases. Therefore retention times of a month or longer could cause an extended server outage when the server reboots.
Architectural overview of Milestone XProtect Corporate

Overview

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.

XProtect Corporate servers and services

Table 1 lists XProtect Corporate servers, services, and their functions.

Table 1. XProtect Corporate servers and services

<table>
<thead>
<tr>
<th>XProtect server/service</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Client</td>
<td>Full-featured remote client, which provides these daily functions:</td>
</tr>
<tr>
<td></td>
<td>- Simultaneous live view and playback of 100 cameras</td>
</tr>
<tr>
<td></td>
<td>- Intelligent Pan Tilt Zoom (PTZ) camera control</td>
</tr>
<tr>
<td></td>
<td>- Advanced search capabilities</td>
</tr>
<tr>
<td></td>
<td>- Export of evidence material</td>
</tr>
<tr>
<td>Remote Client</td>
<td>Provides live view and playback of up to 16 cameras and performs most daily operations</td>
</tr>
<tr>
<td>Matrix</td>
<td>Allows up to four live video streams to be sent to an XProtect Smart Client PC</td>
</tr>
<tr>
<td>Recording/failover server</td>
<td>Provides the following functions:</td>
</tr>
<tr>
<td></td>
<td>- Storage and retrieval of video and audio from MJPEG, MPEG4, MxPEG, and H264 devices</td>
</tr>
<tr>
<td></td>
<td>- Standby for a single or a group of recording servers, when configured as a failover server</td>
</tr>
<tr>
<td></td>
<td>- Edge Storage capability, which allows cameras to write to an Edge Storage device if the recording server is unreachable</td>
</tr>
<tr>
<td></td>
<td>- Processing events, alerts, and actions</td>
</tr>
<tr>
<td>Management server</td>
<td>The Management Application is XProtect Corporate's user interface to the management server and provides the following functions:</td>
</tr>
<tr>
<td></td>
<td>- Managing recording servers, users, and devices</td>
</tr>
<tr>
<td></td>
<td>- System configuration wizards, automated device discovery, smart bulk configuration, event/alarm configuration, and management of user access privileges</td>
</tr>
<tr>
<td></td>
<td>- Multi-stage storage schemes, which enable video migrations from primary storage (Live DB) to secondary storage (Archive DB)</td>
</tr>
<tr>
<td></td>
<td>- Hosting and controlling access from XProtect clients</td>
</tr>
<tr>
<td></td>
<td>- Logging</td>
</tr>
</tbody>
</table>
Milestone XProtect Corporate architecture

Figure 1 shows a simple Milestone XProtect Corporate architecture. You can achieve scaling by expanding the number of servers in each site in addition to combining many sites into a federated architecture.

Figure 1. Milestone XProtect Corporate architecture
EMC storage considerations for Milestone XProtect Corporate

Overview

To successfully design and implement a Milestone XProtect Corporate system, you need to consider many aspects of the system, including networks, cameras, storage, and more. This section presents storage considerations and recommendations you should take into account when deploying a Milestone XProtect Corporate system on EMC storage platforms.

Video flow

There are many EMC storage platform options for each storage tier. The Live DB can be DAS, FC or iSCSI block storage. The Archive DB can be DAS if the storage requirement is minimal, and FC, iSCSI, or NAS for virtualized server implementations and substantial video storage requirements. Figure 2 illustrates the traffic flow using DAS, SAN, and NAS.

Figure 2. Video flow in a tiered XProtect environment

Video is initiated at the camera and XProtect initially places that video in the Live DB. Milestone recommends a retention period of from 2 hours to 24 hours for video in the Live DB, as outlined in Retention periods.

XProtect moves video files at rest from the Live DB storage tier to the Archive DB storage tier at regular intervals. The Archive DB stores each video file until that file’s full retention time has expired.

Live DB

XProtect’s Live DB write algorithm is optimized for block storage. Therefore, the Live DB works best with the server’s internal DAS or using external FC or iSCSI storage arrays such as the VNX series.

Internal DAS storage is ideal for small implementations with a few servers. As an installation grows, the need to optimize storage for reliability, scalability, manageability, and rack space increases. In larger environments, and in virtualized
server environments, VNX arrays in a SAN (FC or iSCSI) configuration are more practical for the Live DB.

In addition, LenovoEMC storage arrays can be good candidates for the Live DB on small, distributed sites.

### Archive DB

The Archive DB is the long-term storage for XProtect and typically constitutes the majority of the storage capacity requirement. Moving video from the Live DB to the Archive DB involves many activities, including optimizing index files for the larger video repository, as well as moving the files.

In pre-XProtect Corporate 2013 releases, the Archive DB is restricted to DAS or SAN (FC or iSCSI) storage. Changes incorporated into XProtect Corporate 2013 expand the Archive DB storage protocol options to include NAS. Therefore, you can now use both SAN and NAS (SMB2) EMC platforms for the Archive DB.

### Live DB and Archive DB

The Live DB can be a VNX storage array in a SAN configuration. The Archive DB can be an Isilon scale-out cluster in a NAS configuration or a VNX storage array in a SAN configuration.

- With the VNX, both the Live DB and Archive DB can use either FC or iSCSI protocols. For iSCSI, you can use GbE or 10 GB NICs.
- When using smaller VNX arrays with iSCSI, we recommend that the Live DB and Archive DB reside on different arrays.
- When using FC, Live DB and an FC Archive DB can co-exist on the same VNX array.
- Arrays such as the VNX5800 can be used with iSCSI for both the Live DB and Archive DB.
- VNX storage can be used for:
  - LiveDB only
  - LiveDB as the first tier in a tiered implementation
  - Archive DB as the second tier in a tiered implementation
- For Isilon scale-out storage, NAS (SMB2) can be used with Isilon OneFS® 7.0 or later. The OneFS protection scheme should be +2:1 (or greater) for installations up to 10 Nodes, N+2 up to 20 nodes and N+3 for node counts greater than 20. We tested +2:1 on our 5-Node clusters.
- You can use GigE or 10 GB network interface cards (NICs). Test results for this solution are based on both GigE and 10 GB interfaces on the Isilon cluster. XProtect by default moves video from the Live DB to the Archive DB using a single thread. With NAS (SMB2), the Archive DB thread count can be increased to allow parallel video file moves within the archive process.
- We recommend you avoid using Isilon storage for the LiveDB storage tier.

__Storage considerations and recommendations__

**EMC**

**EMC VNX and EMC Isilon**

White Paper
• Although it is possible to use the NFS datastores for the Milestone boot drive in a VMware environment, this configuration with Milestone XProtect has not been tested in the EMC Lab.

**Isilon SmartConnect**

You can configure Isilon SmartConnect to provide load balancing of recording servers across nodes in an Isilon cluster. With SMB2, the load balancing occurs at connection initiation with the Isilon cluster.

- Configure SmartConnect for round robin.
- When designing per node capacity, allow for failover scenarios. If a node fails or is taken offline for maintenance or node removal, SmartConnect must be able to re-attach the recording servers on remaining active nodes, without overloading any node.
- The SMB or SMB2 protocol along with their predictor CIFS, restricts the accuracy of load balancing. For best results use the Isilon management console to monitor session connectivity and load balancing.

SmartConnect Basic can use a round robin connection allocation based on Domain Name Service (DNS) load balancing.

SmartConnect Advanced can include multiple pools per subnet, Dynamic IP (for NFS), and the following load balancing options (Connection policy and Rebalance policy):

- Round robin sequentially directs a connection to the next Isilon IP address in the cycle. This method provides a stable and balanced storage solution for video streaming applications.
- Connection Count provides uniform distribution of XProtect servers to specified nodes in the Isilon cluster. Use a unique IP address pool for video archive read/write access.
- Network Throughput is based on NIC utilization. Use of throughput requires that each recording server is activated, configured, and recording video once it connects to Isilon.
- CPU Usage uses the Node CPU utilization to determine to which Isilon IP address the next connection request will be assigned.

**Isilon SmartQuotas**

When using Isilon cluster, we recommend using SmartQuotas to protect the storage from a run-away application or misconfigured recording server. When configuring SmartQuotas, you must use a Hard Quota.

SmartQuotas allows administrators to limit the storage used for each recording server and presents to the server a view of available storage based on the assigned quota. SmartQuotas allows each recording server to calculate its available disk space and react correctly. Without SmartQuotas, the XProtect administrator must anticipate the total write rate to the cluster and adjust the Min Free Space field on each recording server accordingly. A miscalculation could result in lost video. SmartQuotas resolves the issues caused by manual calculations.
Configure SmartQuotas when more than one recording server is writing to the Isilon cluster and/or the cluster is shared with other users. Enable SmartQuotas and define a quota for each share or directory.

Retention periods

A Live DB retention period longer than 24 hours may result in prolonged recording server restart, as the restart process includes verifying the index files for the retained video recordings. For this reason, Milestone recommends that the Live DB retention period be limited to no more than 24 hours, with a higher frequency preferred. Milestone recommends a minimum retention period of two hours for the Live DB, although one hour is the minimum supported.

The Archive DB retention period depends on business requirements and can range from a few weeks to many months. The archived video index files are not verified upon recording server restart, so server restart is not a consideration for the Archive DB.

Configuring Authentication/Access Control

Our Isilon tests were based on the servers and the Isilon cluster being part of the Microsoft domain through the use of Microsoft Active Directory.

To add an Isilon cluster to the Windows Domain, browse to the Cluster Management section and then to the sub-tab Access Management.

1. Select the Access Zone tab and ensure the access zone “System” has provider status Active Directory, Local, and File marked with a green dot.

2. Using the Active Directory tab, select Join a domain and add the windows domain and appropriate users.

For this solution, we used the VNX7500™ with FC and the VNX5300™ with both FC and iSCSI storage protocols for the Live DB. We used an Isilon scale-out cluster and a VNX-VSS100 with iSCSI for the Archive DB. We tested VNX5800™ with FC/iSCSI on both the Live DB and Archive DB. We also tested the Lenovo EMC px12 storage array for the Live DB for use in small, distributed sites.

Table 2 lists the EMC storage platforms and network protocols determined to be suitable for each XProtect video database storage tier.

Table 2. Storage and protocols for XProtect database tiers

<table>
<thead>
<tr>
<th>Array/cluster</th>
<th>Database</th>
<th>Protocol</th>
<th>Verified</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAS</td>
<td>Live DB</td>
<td>DAS</td>
<td>Yes (by Milestone)</td>
</tr>
<tr>
<td>VNX series</td>
<td>Live DB</td>
<td>FC</td>
<td>Yes (functional test)</td>
</tr>
<tr>
<td>VNX series</td>
<td>Live DB</td>
<td>iSCSI</td>
<td>Yes</td>
</tr>
<tr>
<td>Lenovo EMC px series</td>
<td>Live DB</td>
<td>iSCSI</td>
<td>Yes (functional test)</td>
</tr>
</tbody>
</table>

1 The goal of the testing was functional as regards the Live DB. It focused on testing Milestone XProtect Corporate 2013 beta archive process modules, with the Live DB being a means to provide load for testing Archive DB performance. The Live DB was not tested for performance.
<table>
<thead>
<tr>
<th>Array/cluster</th>
<th>Database</th>
<th>Protocol</th>
<th>Verified</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAS</td>
<td>Archive DB</td>
<td>DAS</td>
<td>Yes (by Milestone)</td>
</tr>
<tr>
<td>Isilon clusters*</td>
<td>Archive DB</td>
<td>SMB2</td>
<td>Yes</td>
</tr>
<tr>
<td>VNX series</td>
<td>Archive DB</td>
<td>FC</td>
<td>Yes (extrapolated)</td>
</tr>
<tr>
<td>VNX series</td>
<td>Archive DB</td>
<td>iSCSI</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Isilon OneFS 7.0 or greater must be used.
Sizing guidelines

Overview

For optimum performance and usability, XProtect and each storage tier must be properly 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 from production environments. Use the performance statistics and configuration information presented here as your 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 XProtect Corporate 2013, the same codebase is used by XProtect Enterprise. Therefore, all sizing data in this document is valid for XProtect Enterprise also. XProtect Enterprise is, however, limited as to the number of recording servers supported.

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.

- Due to the low bandwidth caused by small block writes over SMB2, we do not recommend Isilon for the Live DB. XProtect Corporate 2013 has resolved this issue for the Archive DB process but not for the Live DB. Excessive frame loss at low bandwidth per node resulted in a very low per node scaling factor and does not fully use the Isilon cluster’s performance capabilities.

Note: The write block size is determined by how the LUN or disk was formatted. See Hard disk formatting for information.
Table 3 shows details of Live DB performance on the VNX arrays during lab testing.

### Table 3. Live DB VNX performance

<table>
<thead>
<tr>
<th>Array</th>
<th>Total array BW (MB/s)</th>
<th>Max BW per LUN (MB/s)</th>
<th>LUNs per pool</th>
<th>Pools</th>
<th>Disks per pool</th>
<th>Camera streams</th>
<th>RAID</th>
<th>Disk stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNX7500 FC 4vCPU</td>
<td>320²</td>
<td>40</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>80</td>
<td>5</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td>VNX-VSS100 FC 4vCPU</td>
<td>320³</td>
<td>40</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>80</td>
<td>5</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td>VNX-VSS100 iSCSI 4vCPU</td>
<td>272</td>
<td>34</td>
<td>2</td>
<td>1</td>
<td>15</td>
<td>64</td>
<td>5</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td>VNX-VSS100 iSCSI 8vCPU</td>
<td>354</td>
<td>59</td>
<td>6</td>
<td>1</td>
<td>72</td>
<td>64</td>
<td>5</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td>VNX-5300 iSCSI 8vCPU</td>
<td>354</td>
<td>59</td>
<td>6</td>
<td>1</td>
<td>72</td>
<td>64</td>
<td>5</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td>VNX5800FC and iSCSI 4vCPU</td>
<td>460</td>
<td>25.5</td>
<td>18</td>
<td>1</td>
<td>60</td>
<td>32</td>
<td>5</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
</tbody>
</table>

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. See Hard disk formatting for information.

Table 4 and Table 5 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 4. Archive DB: Isilon sizing³

<table>
<thead>
<tr>
<th>Array</th>
<th>Recorders per node</th>
<th>Avg BW per node (MB/s)</th>
<th>Avg BW per recorder (MB/s)</th>
<th>Cluster size</th>
<th>Disk type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isilon X400 SMB2 4CIF</td>
<td>1:1</td>
<td>34</td>
<td>34</td>
<td>5</td>
<td>NL-SAS, 1 TB⁴, 7,200 rpm, +2:1</td>
</tr>
</tbody>
</table>

² This represents the maximum tested, not the array maximum.
³ The maximum bandwidth per LUN for the Live DB was limited to 34 MB/s (iSCSI) or 40 MB/s (FC)—see Table 3. 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.
⁴ The drive size is not relevant for performance considerations.
<table>
<thead>
<tr>
<th>Array</th>
<th>Recorders per node</th>
<th>Avg BW per node (MB/s)</th>
<th>Avg BW per recorder (MB/s)</th>
<th>Cluster size</th>
<th>Disk type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isilon X400 SMB2 4CIF</td>
<td>2:1</td>
<td>68</td>
<td>34</td>
<td>5</td>
<td>NL-SAS, 1 TB, 7,200 rpm, +2:1</td>
</tr>
<tr>
<td>Isilon X400 SMB2 4CIF</td>
<td>4:1</td>
<td>136</td>
<td>34</td>
<td>5</td>
<td>NL-SAS, 1 TB, 7,200 rpm, +2:1</td>
</tr>
<tr>
<td>Isilon NL400 SMB2 H264</td>
<td>1:1</td>
<td>40</td>
<td>40</td>
<td>5</td>
<td>NL-SAS, 1 TB, 7,200 rpm, +2:1</td>
</tr>
<tr>
<td>Isilon NL400 SMB2 H264</td>
<td>3:1</td>
<td>120</td>
<td>40</td>
<td>5</td>
<td>NL-SAS, 1 TB, 7,200 rpm, +2:1</td>
</tr>
<tr>
<td>Isilon NL400 SMB2 H264</td>
<td>4:1</td>
<td>160</td>
<td>40</td>
<td>5</td>
<td>NL-SAS, 1 TB, 7,200 rpm, +2:1</td>
</tr>
<tr>
<td>Isilon NL400 SMB2 H264</td>
<td>5:1</td>
<td>194</td>
<td>38</td>
<td>5</td>
<td>NL-SAS, 1 TB, 7,200 rpm, +2:1</td>
</tr>
</tbody>
</table>

**Table 5. Archive DB: VNX sizing**

<table>
<thead>
<tr>
<th>Array</th>
<th>Recorders</th>
<th>Array BW (MB/s)</th>
<th>BW per LUN (MB/s)</th>
<th>LUNs per pool</th>
<th>Disks per pool</th>
<th>Disk stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNX-VSS100 iSCSI</td>
<td>3</td>
<td>215</td>
<td>71.67</td>
<td>3</td>
<td>10</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>277</td>
<td>69.25</td>
<td>4</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>384</td>
<td>48</td>
<td>8</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>450</td>
<td>45</td>
<td>10</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>VNX7500 iSCSI</td>
<td>10</td>
<td>450^5</td>
<td>45</td>
<td>10</td>
<td>60</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
<tr>
<td>VNX5800 FC and iSCSI</td>
<td>18</td>
<td>616</td>
<td>34.2</td>
<td>18</td>
<td>60</td>
<td>NL-SAS, 3 TB, 7,200 rpm</td>
</tr>
</tbody>
</table>

^5 Extrapolated based on VNX5300 iSCSI results.
Table 6. Table 6 shows the LUNs or shares per recording server and the bandwidth per LUN or share with the Live DB using VNX FC and the Archive DB using Isilon SMB2. These values are based on two recording servers per node. Live DB on VNX (FC) and Archive DB on Isilon X400 (SMB2)

<table>
<thead>
<tr>
<th>Storage platform</th>
<th>Max. recorders tested</th>
<th>Total recorders</th>
<th>LUN or shares per recorder</th>
<th>BW per LUN or share (MB/s)</th>
<th>Max. BW (MB/s)</th>
<th>Max. VNX or node CPU %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live DB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VNX-VSS100 FC</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>40</td>
<td>n/a</td>
<td>25</td>
</tr>
<tr>
<td>Archive DB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isilon X400</td>
<td>2 per node</td>
<td>8</td>
<td>1</td>
<td>55</td>
<td>110</td>
<td>40</td>
</tr>
</tbody>
</table>

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 seen on the single SP when the archive process is running. Maximum CPU utilization is captured when reviewing video at a rate of 20% 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.

Table 7 shows details of Live DB and Archive DB performance seen on the VNX5800 array.

Table 7. Live DB and Archive DB performance on the VNX5800 array

<table>
<thead>
<tr>
<th>Storage platform</th>
<th>Total Recorders</th>
<th>Number of Cameras</th>
<th>Bandwidth (MB/s)</th>
<th>CPU on VNX SP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Live DB Write</td>
<td>Archive DB Write</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Write</td>
<td>Total Read</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max.</td>
<td>Average</td>
</tr>
<tr>
<td>VNX5800 FC and iSCSI6 H264</td>
<td>18</td>
<td>460</td>
<td>460</td>
<td>616</td>
</tr>
</tbody>
</table>

VMware ESXi 5.1 write performance

In the EMC Physical Security Lab, we have conducted a number of tests comparing various hosts with respect to recording server bandwidth. For this virtualized Milestone XProtect Corporate 2013 solution, we tested using the Dell R910 and Cisco UCS B230.

6 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.
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. Table 8 shows that there can be large differences depending on the host used.

Table 8. **ESXi virtual machine bandwidth variances**

<table>
<thead>
<tr>
<th>Bandwidth</th>
<th>vCPU</th>
<th>Host</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 MB/s (270 Mb/s)</td>
<td>4 @ 1.99 GHz</td>
<td>Dell R910</td>
<td>4 GB per virtual machine</td>
</tr>
<tr>
<td>40 MB/s (270 Mb/s)</td>
<td>6 @ 1.99 GHz</td>
<td>Dell R910</td>
<td>4 GB per virtual machine</td>
</tr>
<tr>
<td>40 MB/s (360 Mb/s)</td>
<td>4 @ 2.26 GHz</td>
<td>Cisco UCS B230</td>
<td>4 GB per virtual machine</td>
</tr>
</tbody>
</table>

Note: The bandwidth variances in Table 8 are informational only. The node or array specifications remain constant, no matter which processor, motherboard architecture, and so on, is used.
XProtect-specific configuration

This section describes best practices for system and XProtect Corporate 2013 configuration.

Note: Internal server storage was not tested. Refer to Milestone recommendations and best practices if using server-based storage.

Active Directory and domain controller

Although local user account authentication is available, we configured Active Directory (AD) user account authentication in the lab to simplify user management.

AD is a distributed directory service included with several Windows Server operating systems; it identifies resources on a network in order for users or applications to access them. If you wish to add users through the AD service, you must have a server with AD installed and acting as the domain controller on your network. Consult your network administrator regarding use of AD with your XProtect deployment.

To configure Milestone recording servers with AD Domain Controller:

1. Ensure that there is a server with AD installed and acting as the domain controller on the network.
2. Add all recording servers, management hosts, and the Isilon cluster to the available domain controller.
3. Log in as the Domain user on the host.
4. In Windows Services, select Milestone XProtect Corporate Recording Server. Click the Log On tab and update the credentials for the Active Directory user.
5. Restart the service.

Multi-tier implementation

When formatting the hard disk for the Live DB in a two tier structure, it is important to change its allocation unit size setting from 4 to 8 KB. The block size of 8 KB significantly improves recording performance. This block size is better suited for the balanced reads and writes rate cause be the archive process.

When formatting the hard disk for the Archive DB, it is important to change its Allocation unit size setting from 4 to 64 KB. The 64 KB block size significantly improves performance of the archive process.

Single tier implementation

When formatting the hard disk for the Live DB only, it is important to change its Allocation unit size setting to 64 KB. The 64 KB block size significantly improves performance of the archive process.

See the Microsoft Support article Default cluster size for NTFS, FAT, and exFAT for more information about single and multi-tier allocation unit sizes.
If motion detection is not working, you must perform the following steps:

1. Disable the **Default Record on Motion Rule** on the management server.
2. Add a new rule named **Record Always** using the following definition:
   
   Perform an action in a time interval 
   always
   start recording **immediately** on **All Cameras**
   
   Perform an action when time interval ends
   stop recording **immediately**

Configuring XProtect to use an Isilon cluster for the Archive DB involves:

- Modifying XProtect to:
  - Increase the number of archive threads
  - Increase the write block size to the Archive DB
- Configuring SmartConnect and Domain Name System (DNS)
- Configuring SmartQuotas

### Modifying the number of archive process threads

When using a NAS (SMB2)-attached Isilon scale-out cluster, each XProtect Corporate recording server must be modified to use a minimum of three and a maximum of four archive processes. By default, XProtect uses a single thread.

**Note:** These minimum and maximum values were derived based on tests conducted on VMware ESXi 5.1 and ESXi 5.5 host in the EMC lab.

To modify the archive process thread count, perform the following steps:

1. Stop the Milestone XProtect Corporate Recording Server Service.
2. **Go to:** `C:\ProgramData\Milestone\XProtect Corporate Recording Server`.
3. Open the RecorderConfig file.
4. Edit the file as follows to change the low priority archive thread pool size from 1 (the default) to 3 and the high priority archive thread pool size from 1 (the default) to 4:

   ```xml
   <thread_pools>
   <delete_thread_pool_size>2</delete_thread_pool_size>
   <low_priority_archive_thread_pool_size>3</low_priority_archive_thread_pool_size>
   <high_priority_archive_thread_pool_size>4</high_priority_archive_thread_pool_size>
   </thread_pools>
   ```
5. Save the file.
6. Start the Milestone XProtect Corporate Recording Server Service.
Note: These steps are based on the beta implementation of XProtect 2013 code.

**Modifying the Archive DB write block size**

This modification is required for NAS.

To modify the Archive DB write block size perform the following steps:

1. Stop your Recording Server Services.
2. Rename the file `%ProgramFiles%\Milestone\XProtect Corporate Recording Server\VideoOS.Platform.Database.dll` to, for example, `VideoOS.Platform.Database.dll, orig`.
3. Open the file `%ProgramData%\Milestone\XProtect Corporate Recording Server\RecorderConfig.xml` in an editor.
4. Update the disk utilization section using one of the following methods:
   a. For version 2013 5.0, add the following xml code highlighted in bold

   ```xml
   <disk_utilization>
   <max_bytes_in_block_files>16777216</max_bytes_in_block_files>
   <max_records_in_block_files>2000</max_records_in_block_files>
   <truncate_block_files>true</truncate_block_files>
   <precreate_block_files>true</precreate_block_files>
   <precreate_sizes>
   <regular>16777216</regular>
   <sequence>65536</sequence>
   <signature>4194304</signature>
   </precreate_sizes>
   <media_block_files use_os_cache="true">
   <read_buffer_size>4096</read_buffer_size>
   <write_buffer_size>4096</write_buffer_size>
   </media_block_files>
   <sequence_block_files use_os_cache="true">
   <read_buffer_size>4096</read_buffer_size>
   <write_buffer_size>4096</write_buffer_size>
   </sequence_block_files>
   <signature_block_files use_os_cache="true">
   <read_buffer_size>4096</read_buffer_size>
   <write_buffer_size>4096</write_buffer_size>
   </signature_block_files>
   <index_files use_os_cache="true">
   <read_buffer_size>4096</read_buffer_size>
   <write_buffer_size>4096</write_buffer_size>
   </index_files>
   <chunk_files use_os_cache="true">
   <read_buffer_size>65536</read_buffer_size>
   <write_buffer_size>65536</write_buffer_size> <!-- default 4096 -->
   </chunk_files>
   </disk_utilization>
   ```
b. For Milestone version 2013 R2 and later, update the `chunk_files use_os_cache` section. Modify the `read_buffer_size` and `write_buffer_size` values to 65536.

```xml
<chunk_files use_os_cache="true">
  <read_buffer_size>65536</read_buffer_size>
  <write_buffer_size>65536</write_buffer_size>
</chunk_files>
```

5. Save the `RecorderConfig.xml` file.
6. Restart your recording server.

**Configuring Isilon SmartConnect and DNS**

SmartConnect provides load balancing of connections to the Isilon cluster as well as failover handling of connections. With SmartConnect all XProtect recorders use a single fully qualified domain name (FQDN) or universal naming convention (UNC) path for video storage access. Using this network name provides load balancing when the connection to the cluster is made and simplifies installations.

SmartConnect Basic uses a round robin connection allocation, based on Domain Name Service (DNS) load balancing.

SmartConnect Advanced (additional license required) provides Dynamic IP (for NFS), and several load balancing options such as connection count, network throughput, round robin, and CPU usage. In all cases, use the default round robin load balancing policy unless directed otherwise by your Isilon account team. SmartConnect Advanced can create multiple pools per subnet, however, and this capability can be useful in many implementations.

The Archiver IP address pool should not be used by other services. Define additional pools for management (such as Isilon InsightIQ or administrative access), evidence repository, post process, or other use.

**Note:** The EMC SmartConnect White paper is a good resource for understanding SmartConnect and its configuration.

To configure SmartConnect, from Cluster Management:

1. Choose the Networking Configuration tab.
2. Under Subnet then Settings, define the SmartConnect service IP (SSIP), the IP address DNS will use for Isilon's authoritative name (See Figure 3).

```
<table>
<thead>
<tr>
<th>Subnet</th>
<th>SSIP: 10.10.1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pool</td>
<td>Zone name: storage subnet# round robin</td>
</tr>
<tr>
<td></td>
<td>SmartConnect service subnet:</td>
</tr>
</tbody>
</table>
```  

**Figure 3. Configure SSIP**

3. Under Pool settings:
a. Define the SmartConnect zone name to which clients will connect.

b. Define the SmartConnect service subnet (the subnet that has the SSIP configured on the DNS server).

c. Set the connection policy to **Round Robin** (the default setting).

d. If using SmartConnect Advanced, verify that the IP allocation method is set to Static.

4. Verify this configuration on the SmartConnect Dashboard.

**Configuring Isilon SmartQuotas**

We recommend Isilon SmartQuotas for all shares on any cluster with an XProtect recording server attached. When correctly configured, SmartQuotas controls and limits storage usage. In an XProtect implementation, SmartQuotas is configured to present a managed segment of thin storage, which creates virtual scale-out storage for the XProtect recording server. In essence, the server is presented with disk utilization and size information as if it was connected to a private LUN or disk.

To configure the SmartQuotas changes perform the following steps:

1. Install the SmartQuotas license

2. From the OneFS GUI select the **File System Management** tab

3. Select the **SmartQuotas** sub-tab

4. From the list of shares, for each share select View details found on the right side of each row

5. Look for the paragraph text “Usage Limits:” and select **Edit usage limits**

6. Define the SmartQuotas limit and set method:
   a. Select **Specify Usage Limits**
   b. Check the box **Set a hard limit**
   c. Fill in the **Hard Limit Value**
   d. Select the size qualifier, typically **TB**.
   e. Select the **Size of hard threshold**

7. Click **Save**

8. Repeat steps 2-7 for the remainder of the shares.

The minimum system requirements for VMware vSphere are as follows:

- VMware ESXi 5.1 or later
- Microsoft Windows Server 2008 R2 (64-bit), Microsoft Windows Server 2008 (32- or 64-bit), or Microsoft Windows Server 2003 (32- or 64-bit)
  To run clustering/failover servers, a Microsoft Windows Server 2003/2008 Enterprise or Data Center edition is needed.
- Four-core 2 GHz processors
• Intel 31xx, 33xx, 52xx, 74xx, or AMD 13xx, 23xx, 84xx series of processors (or later) for VMware Fault Tolerance (FT)—we did not test VMware FT for this solution
• 4 GB of memory for each vSphere guest
• 4 vCPUs defined to the vSphere guests
• VMware VMXNET3 drivers for the virtual NICs
• Microsoft .NET 4.0 Framework
  Microsoft .NET 3.5 Framework SP 1 is required for the SQL Server that contains the XProtect Corporate system configuration
• Internet Information Service (IIS) 5.1 (or later)
• EMC PowerPath/VE (recommended)

Storage adapter requirements
These are some requirements for storage adapters:
• All storage adapters must be VMware certified
• FC/iSCSI adapters must be VMware and EMC certified

Table 9 shows the requirements for each of the storage types.

Table 9. Storage requirements

<table>
<thead>
<tr>
<th>Storage type</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Datastore</td>
<td>• DAS or SAN devices</td>
</tr>
<tr>
<td></td>
<td>• A minimum of 80 GB for each virtual machine</td>
</tr>
<tr>
<td></td>
<td>• NAS-attached VMware NFS datastores</td>
</tr>
<tr>
<td>Video storage</td>
<td>• SAN devices with non-partitioned space (VMware RAW) or NAS devices:</td>
</tr>
<tr>
<td></td>
<td>▪ FC-attached</td>
</tr>
<tr>
<td></td>
<td>▪ iSCSI-attached</td>
</tr>
<tr>
<td></td>
<td>▪ NAS-attached CIFS</td>
</tr>
</tbody>
</table>
Testing and validation overview

Test objectives

The objectives of the solution tests were to:

- Determine the Live DB bandwidth for various EMC storage arrays using FC and iSCSI. The VNX7500 and VNX-VSS100 were used for the Live DB.
- Determine the optimal Archive DB performance requirements for use of Isilon scale-out storage clusters based on various failure scenarios.
- Determine the optimal Archive DB performance requirements for use of a VNX storage array based on various failure scenarios.
- Determine the maximum bandwidth with multiple recording servers.
- Determine the maximum bandwidth and performance on VNX5800 array with both LiveDB and ArchiveDB storage implemented from the same array.

Note: For the test results, see Sizing guidelines.

Test procedure

The test procedure evaluated the Live DB, Archive DB, and XProtect Corporate configuration modifications required to achieve performance thresholds suitable to large-scale customers. Additional tests evaluated ESXi host hardware in relation to vCPU settings and the resulting bandwidths.

The following is a summary of the test procedure:

1. Configure Live DB and Archive DB video storage.
2. Set up the XProtect recording server:
   a. Live DB to VNX storage array
   b. Archive DB to VNX storage array or Isilon cluster
3. Set up camera simulators (traffic generators) to produce a traffic load to each XProtect recording server at the desired bandwidth.
4. Verify that motion detection is in the “on” state (the default) for all cameras.
5. Evaluate the Live DB and Archive DB storage to ensure an error-free environment at the induced bandwidth.
6. Introduce storage device errors, including:
   - Disk failures and rebuilds on VNX and Isilon nodes
   - Using only a single VNX storage processor
   - Isilon node failures and recoveries
   - Isilon node removals (downsizing a cluster)
   
   Note: No two failures were tested simultaneously.
7. Capture the array/cluster and host statistics.
8. Based on the results of step 7:
   - Increment the bandwidth if no issues are detected.
   - Decrement the bandwidth if issues are detected.
   - Re-evaluate by repeating the test procedure.
Conclusion

Summary

EMC performed comprehensive testing with Milestone XProtect Corporate 2013 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 version released in May 2013.

Testing focused on the Archive DB enhancements of XProtect Corporate 2013 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 Corporate 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.

Findings

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.
- NAS-attached EMC Isilon clusters may be used with XProtect 2013 as Archive DB video storage.
- One NFS2 share per XProtect 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.
References

EMC documentation

For additional information, see the documents listed below:

- Reference Architecture: EMC Storage for Milestone XProtect Corporate—EMC VNX and EMC Isilon
- White Paper: Introduction to the EMC VNX Series—A Detailed Review

Other documentation

For additional information on related topics, see the documents listed below:

- XProtect Corporate Administrator’s Getting Started Guide
- XProtect Corporate Administrator’s Manual
- XProtect Smart Client User’s Manual