Deploying Video Surveillance Solutions with HPE 3PAR StoreServ

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Introduction

- Organizations are placing increased importance on security and safety with video surveillance systems playing a key role.

- Advances in network connected and managed digital surveillance cameras make broader coverage possible.

- Today’s cameras support higher picture resolutions and higher frame rates resulting in each camera sending increasing amounts of live recording data across the network to the video management software system.

- This combination of an increased number of cameras along with increasing amounts of data generated per camera puts a burden on configuring the proper storage system to hold the recorded data. Live data is an asset that needs to be protected and properly managed.

Audience

- This whitepaper is intended for solution architects, project managers, engineers, and support personnel involved in planning, designing, and configuring a video surveillance project.
Video Surveillance using Software

- **Milestone XProtect Corporate** is a fully distributed solution, designed for large multiple site and multiple server installations requiring 24x7 surveillance, with support for devices from different vendors.

- Furthermore, Milestone XProtect Corporate includes fully integrated matrix functionality for distributed viewing of video from any camera on your surveillance system to any computer with a Milestone Smart Client installed.

- The system also offers the possibility of including the standalone XProtect Smart Client-Player when exporting video evidence from the **Smart Client**.

- Finally, Milestone XProtect Corporate handles an unlimited number of cameras, servers, and users—across multiple sites if required.
**Milestone XProtect Corporate** is a powerful Internet protocol (IP) video management software (VMS) designed for large-scale and high-security deployments.

The HPE 3PAR StoreServ array integrates into the Milestone XProtect system at the recording server.

Live video feeds are stored on the HPE 3PAR block volumes on NVMe and SSD storage LUNs.

The recording server supports migrating video from the live recording location to an archive location for long-term retention.
Few Important Highlights

- **Management server**
  The management server stores the configuration of the surveillance system in a relational database either on itself or on a separate Microsoft SQL Server on the network.

- **Recording server**
  The recording server is responsible for recording videos and for communicating with cameras and other devices. The recording server and failover server are typically installed on separate servers rather than on the management server itself.

- **Multistage archive**
  The multistage archiving support in combination with the grooming feature allows recordings to be archived again and again to new storage areas with each archive requiring less and less in terms of storage capacity over time.
How does everything fit?

Live video feeds → Milestone XProtect recording servers → Online access to footage via XProtect Smart Client

Live footage recorded to high performance block volumes

Live footage → Footage playback

Archive/inactive footage → Archive footage retained on capacity optimized file shares
How Milestone stores data on disk

- Milestone writes the data to the recording storage location into multiple directories.
- A directory is created per camera per hour. Data is written into the directory in multiple files each 16 MB in size.
- The number of these files per directory is directly related to the recording rate for the given camera.

This method limits the amount of data that must be repaired in the event of a server failure/restart to only the last hour.

This means there is no restriction on how large of a LUN you may want to use for the recording data.
# Storage and Recording Setting

**Specifying HPE 3PAR StoreServ block volumes**

Milestone recommends using a dedicated block storage device for recording data. In the path field, enter the volume specification of the HPE 3PAR StoreServ block volume, which was configured and presented to this recording server.

The MediaDatabase directory does not have to be predefined on this volume; Milestone XProtect will create this directory.

**Note:** Used SSD LUNs for the block storage LUNs
Capturing live video data - Factors that determine camera rates

- Video resolution
- Frames per second
- Color
- Codec—compression/decompression algorithm,
What is BIT Rate and why do I care:

Bit rate is the product of the frame rate multiplied by the frame size (resolution times color depth).

Not all recording environments necessarily need the highest resolution nor the highest frame rates transmitted 24 hours a day.

- A small office, store, or playground may only need a general view of the scene without detailed motion; therefore, a lower resolution, lower frame rate may suffice for this type of environment.

- A warehouse or a production facility may need to capture more details in background elements and perhaps some general movement in the scene so may only need medium resolution and frame rates.

- Monitoring people and their movement in public transportation areas, stadiums, or arenas will require different frame rates depending on your purpose.
## Camera Simulator Options

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codec</td>
<td>JPEG, MPEG-4, H.264</td>
<td>Video coding/decoding algorithm</td>
</tr>
<tr>
<td>Compression</td>
<td>30, 60</td>
<td>Percentage of data compression</td>
</tr>
<tr>
<td>Frame rate</td>
<td>Variable from 2 to 30</td>
<td>Frames per second (FPS)</td>
</tr>
<tr>
<td>Resolution</td>
<td>640 x 480, 1280 x 720, 2048 x 1537</td>
<td>Frame resolution (number of pixels)</td>
</tr>
<tr>
<td>Motion detection</td>
<td>Never, always, custom</td>
<td>Variable interval and duration</td>
</tr>
</tbody>
</table>
Experiment 1: Comparing H.264 vs JPEG

Observations:

1. For the same resolution and compression, the throughput for JPEG was 1.6 times higher than H.264.

2. Consider the following example. Assume 50 cameras at 1280 x 720 resolution, with a compression factor of 60, and recording for five hours, JPEG would require 945 GB of storage, while H.264 would require only 324 GB of storage—a 65 percent reduction.
Experiment 2: Comparing 15/24/30 FPS

Observations
1. The test for 2048 x 1536 at 30 FPS used only 47 cameras as 50 cameras hit an overflow condition. This affected the total throughput value for the test but did not affect the throughput per camera.
2. The throughput per camera increased approximately 50 percent from 15 FPS to 24 FPS.
3. The throughput per camera increased approximately 20 percent from 24 FPS to 30 FPS.

<table>
<thead>
<tr>
<th>Codec</th>
<th>Resolution</th>
<th>Compression factor</th>
<th>Number of cameras</th>
<th>Frames per second (FPS)</th>
<th>Total throughput (Mbps)</th>
<th>Throughput per camera (Kbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.264</td>
<td>1280 x 720</td>
<td>60</td>
<td>50</td>
<td>15</td>
<td>18</td>
<td>357</td>
</tr>
<tr>
<td>H.264</td>
<td>1280 x 720</td>
<td>60</td>
<td>50</td>
<td>24</td>
<td>28</td>
<td>566</td>
</tr>
<tr>
<td>H.264</td>
<td>1280 x 720</td>
<td>60</td>
<td>50</td>
<td>30</td>
<td>34</td>
<td>685</td>
</tr>
<tr>
<td>H.264</td>
<td>2048 x 1536</td>
<td>60</td>
<td>50</td>
<td>15</td>
<td>53</td>
<td>1,048</td>
</tr>
<tr>
<td>H.264</td>
<td>2048 x 1536</td>
<td>60</td>
<td>50</td>
<td>24</td>
<td>80</td>
<td>1,600</td>
</tr>
<tr>
<td>H.264</td>
<td>2048 x 1536</td>
<td>60</td>
<td>47</td>
<td>30</td>
<td>91</td>
<td>1,956</td>
</tr>
</tbody>
</table>
Video Archiving
Video Retention and archiving

- The live video data will remain in the recording location till one of two actions is taken—the specified retention time is expired or unless an archive location has been configured.
Configuring the Archiving Storage: Things to Note

- Maximum Size
- Retention Time
- Archive Schedule
Video Playback competing with Recording and archiving:

- Playback (red line) of archived video from the first level archive while data is also being written to the archive (blue line) from the recording location. The recording video stream is shown for comparison (green line).
Test Data
Six Test Workloads

- Using the Milestone-provided camera simulation software tool, Milestone provided, we configured six recording servers with the workloads described.

<table>
<thead>
<tr>
<th>Workload reference</th>
<th>Resolution</th>
<th>Frames per second</th>
<th>Recording rate per camera</th>
<th>Number of cameras configured</th>
<th>Resulting aggregate recording rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>640 x 80</td>
<td>8 FPS</td>
<td>37.8 KB/s</td>
<td>150</td>
<td>5.8 MB/s</td>
</tr>
<tr>
<td>2</td>
<td>1280 x 720</td>
<td>15 FPS</td>
<td>360 KB/s</td>
<td>35</td>
<td>12.6 MB/s</td>
</tr>
<tr>
<td>3</td>
<td>1280 x 720</td>
<td>24 FPS</td>
<td>556 KB/s</td>
<td>24</td>
<td>13.3 MB/s</td>
</tr>
<tr>
<td>4</td>
<td>1280 x 720</td>
<td>30 FPS</td>
<td>685 KB/s</td>
<td>18</td>
<td>12.3 MB/s</td>
</tr>
<tr>
<td>5</td>
<td>2048 x 1536</td>
<td>15 FPS</td>
<td>1048 KB/s</td>
<td>30</td>
<td>28.8 MB/s</td>
</tr>
<tr>
<td>6</td>
<td>2048 x 1536</td>
<td>30 FPS</td>
<td>1955 KB/s</td>
<td>15</td>
<td>29.3 MB/s</td>
</tr>
</tbody>
</table>

The purpose of this exercise was to determine the maximize number of cameras each workload would support while maintaining a balance between the incoming live data rate and the archive data rate under the restriction of a maximum size of 1,000 GB for the recording storage.
General observations

- Achieving the balance between the recording and archiving rate required careful monitoring.
- We observed that it took one or two archive schedules to determine if archiving was keeping pace.
- The first scheduled archive has the potential to move a larger amount of data than subsequent archives, depending upon the retention times and the archiving schedule.
- This workload may be too much for one scheduled archive and may require several additional archive operations to even out.
- If you alter the number of cameras configured per recording server, whether the goal is to reduce or increase capacity utilization, it will also take one or two archive schedules to be able to evaluate the overall effect of the change.
- When making either of these changes, it is necessary to re-evaluate the retention times on the recording data and the first level arc
Write Performance – Workload 1
Conclusion

- When planning the storage subsystem layout, it is important to keep in mind that data is constantly moving into and out of the recording and archive storage locations.

- Flash Optimized Block Volumes had a better performance in recording statistics compared to regular disks.

- Combining Archiving with recording allows greater flexibility in the backend storage utilizations.
Thank You