Digital video surveillance systems are rapidly becoming ubiquitous, empowering a broad variety of security solutions throughout the public and private sectors. Whether deployed in somber financial institutions or flashy Las Vegas casinos, Fortune 100 corporate headquarters or corner convenience stores, digital surveillance systems share one fundamental trait—they rely on hard drive storage to house their copious amounts of video data.

Not surprisingly, the specific characteristics of that video data will vary depending on the environment a surveillance digital video recorder (SDVR) system must monitor. Understanding a security environment’s unique surveillance needs and challenges is key to configuring an SDVR system’s hard drive storage for maximum performance and cost-effectiveness.

In general, many video surveillance deployments can be broken down into five basic environments: banking/finance, casinos/gaming, retail/commercial, corporate and government (homeland security, law enforcement). Benefiting all of these environments, the enormous capacity and enhanced reliability of surveillance-optimized hard drives enable SDVR systems to deliver a comprehensive range of features and capabilities, including:

- Higher image quality
- More active cameras
- Longer video archiving
- Megapixel camera recording
- Intelligent video surveillance

This paper examines the individual characteristics of each video surveillance environment and how those characteristics impact SDVR storage capacity requirements. A storage profile table then suggests optimal capacity and hard drive configurations for each environment. Each table assumes that the latest video encoding techniques—either MPEG-4 or H.264—are being utilized.
Video Surveillance Storage: How Much Is Enough?

Banking/Finance

While video footage of bank tellers robbed at gunpoint is most familiar to the public, surveillance experts know that SDVR systems perform a much broader array of security functions in financial institutions. Beyond the obvious need for camera surveillance at teller windows, bank vaults and safety deposit boxes must also be monitored to record the movements of both external parties and bank employees in these sensitive, restricted areas.

Bank exteriors are vulnerable as well, thus comprehensive security solutions must incorporate additional cameras to capture suspicious persons, vehicles and activity in the immediate vicinity of the building. ATMs are particularly at risk, given their unmanned operation and typically isolated, external locations. Without proper surveillance measures in place, ATMs will tend to be avoided by customers and thus diminish bank revenues.

As can be seen, a bank’s greatest vulnerabilities are in a relatively few static locations, thus surveillance via a moderate number of video streams from fixed-position cameras may be sufficient, typically capturing either low- or medium-resolution images depending on the specific camera locations.

Because evidence of theft or fraud might not be immediately apparent, financial institutions may archive their video data for longer periods than some other businesses; this practice can significantly raise SDVR storage capacity requirements.

Casinos/Gaming

Consider the security challenges of typical casinos: often open 24 hours a day; accommodating thousands of people at a time in venues that can be larger than a football field, all with easy entrance and exit to and from the facility.

Such an environment invites criminal behavior, whether it be theft or pickpocketing, physical assault or cheating in the various games of chance.

And these threats do not come solely from the casino’s guests. Employees cost casinos millions of dollars every year. According to the Nevada Gaming Commission, between 1999-2000 the casinos’ own employees accounted for over one third of those arrested for theft or cheating. Additionally, 67% of the monies or case value from 2009 Nevada casino arrests were the result of an employee alone or collusion with an outside party.1

In response, many casinos take a two-tiered approach to video surveillance. The first tier employs conventional techniques (moderate image resolutions, multiple cameras for widespread coverage) with special emphasis on cash-handling areas. The second tier is more sophisticated, utilizing high-resolution streams and intelligent video surveillance software in the gaming areas to identify and track a small number of high-risk individuals (for example, professional card cheats) in very crowded settings.

Given the sheer number of people involved and the multitude of locations where potential criminal activity could take place, it should come as no surprise that casinos rely on an enormous quantity of cameras to ensure comprehensive security coverage. Moderate resolution video streams are effective for general surveillance, but the large number of cameras/streams involved places enormous demands on storage capacity. In addition, the high-resolution streams used to closely monitor gaming area activity further boost capacity requirements.

Retail/Commercial

Shoplifting has long been the bane of retail businesses, and the problem shows no signs of letting up. The 2011 National Retail Security Survey found that crime-related losses in the retail industry exceeded US$37 billion. Approximately US$30 billion of these losses came from shoplifting and employee theft.

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1 Assumes continuous recording 24x7
2 Assumes H.264 encoding

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### Video Surveillance Storage Profile: Banking/Finance

<table>
<thead>
<tr>
<th>Image Resolution</th>
<th>Frames per Second (fps)</th>
<th>Number of Cameras</th>
<th># Days Recording</th>
<th>Approximate Storage Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIF 352x288</td>
<td>10</td>
<td>8/16</td>
<td>90</td>
<td>2TB/4TB</td>
</tr>
<tr>
<td>4CIF 704x576</td>
<td>10</td>
<td>4/8</td>
<td>90</td>
<td>3TB/6TB</td>
</tr>
<tr>
<td>1 Megapixel 1280x1024</td>
<td>10</td>
<td>4/8</td>
<td>90</td>
<td>9TB/18TB</td>
</tr>
<tr>
<td>2 Megapixel 1600x1200</td>
<td>10</td>
<td>4/8</td>
<td>90</td>
<td>13TB/26TB</td>
</tr>
</tbody>
</table>

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### Video Surveillance Storage Profile: Casino/Gaming

<table>
<thead>
<tr>
<th>Image Resolution</th>
<th>Frames per Second (fps)</th>
<th>Number of Cameras</th>
<th># Days Recording</th>
<th>Approximate Storage Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>4CIF 704x576</td>
<td>30</td>
<td>16/32</td>
<td>90</td>
<td>32TB/64TB</td>
</tr>
<tr>
<td>1 Megapixel 1280x1024</td>
<td>30</td>
<td>16/32</td>
<td>90</td>
<td>104TB/208TB</td>
</tr>
<tr>
<td>2 Megapixel 1600x1200</td>
<td>30</td>
<td>16/32</td>
<td>90</td>
<td>154TB/308TB</td>
</tr>
<tr>
<td>3 Megapixel 2048x1536</td>
<td>30</td>
<td>16/32</td>
<td>90</td>
<td>252TB/504TB</td>
</tr>
</tbody>
</table>

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1 Assumes continuous recording 24x7
2 Assumes H.264 encoding

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*“What Is the Real Cost of Employee Theft?”*  
Video Surveillance Storage: How Much Is Enough?

While thefts of these types can take place throughout a store, the typically open floor plans of most retail environments enable a moderate number of cameras to achieve extensive surveillance coverage. Comprehensive surveillance networks are particularly important in addressing employee theft, which accounts for about US$16 billion of the losses noted above. Because they are intimately familiar with the physical layout of the retail environment in which they work, employees are more adept at avoiding detection by marginal video surveillance systems.

While installing a reasonable number of strategically-placed cameras relaying medium-resolution images to SDVR systems is the widely-accepted approach to retail video surveillance, some companies are investing in more sophisticated techniques. For example, by leveraging intelligent software’s ability to analyze high-resolution images, surveillance systems can identify customer or employee behaviors (specific to that retail environment) and quickly notify security personnel for investigation.

Deploying a moderate number of cameras, with some feeding high-resolution streams to intelligent surveillance applications, can require a substantial amount of SDVR storage capacity, but the modest cost this entails pales in light of the enormous crime-related losses retailers suffer.

Corporate

Similar concerns regarding employee theft are found in the corporate world, only to a greater degree. Sensitive customer information, competitive market data, proprietary trade secrets and other intellectual property are all at risk, and their value can be many orders of magnitude higher than that of physical merchandise stolen from retail environments.

Video Surveillance Storage: Corporate

<table>
<thead>
<tr>
<th>Image Resolution</th>
<th>Frames per Second (fps)</th>
<th>Number of Cameras</th>
<th># Days Recording</th>
<th>Approximate Storage Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>QCIF 176x144</td>
<td>5</td>
<td>8/16</td>
<td>30</td>
<td>86.5GB/173GB</td>
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<tr>
<td>CIF 352x288</td>
<td>5</td>
<td>8/16</td>
<td>30</td>
<td>225GB/450GB</td>
</tr>
<tr>
<td>4CIF 704x576</td>
<td>5</td>
<td>8/16</td>
<td>30</td>
<td>700GB/1.4TB</td>
</tr>
<tr>
<td>1 Megapixel 1280x1024</td>
<td>5</td>
<td>8/16</td>
<td>30</td>
<td>2.25TB/4.5TB</td>
</tr>
</tbody>
</table>

1 Assumes recording 50% of the time
2 Assumes MPEG-4 encoding

Compounding this security challenge is the growing risk of terrorist activity, which potentially threatens every type of corporate environment, from office buildings to manufacturing plants. Major financial and business enterprises may be particularly attractive targets to attackers, hence many such firms are turning to surveillance solutions with facial recognition capabilities that can analyze video footage and flag the presence of specific suspect individuals.

Similar to retail environments, corporate venues are vulnerable to both employee-based criminal activity from within and significant threats from external parties. As a result, corporate video surveillance solutions often resemble those found in retail, though often utilizing higher camera counts to ensure extensive coverage in large office or plant areas, coupled with powerful intelligent video surveillance to secure high-risk areas from external threats.

The additional storage capacity such security measures demand represents a negligible expense in light of the potential benefit.

Government
(Homeland Security, Law Enforcement)

Faced with unprecedented risk of mass disruption from terrorist attacks, federal, state and local governmental agencies are increasingly turning to digital video surveillance solutions to proactively defend the homeland. Airports and seaports are high-profile targets, as well as other sites through which terrorists could enter the country. Reservoirs, nuclear power plants and other public utilities are also highly vulnerable to terrorist strikes.

Of course, communities throughout the country continue to wage an ongoing war against domestic crimes upon persons and property. While such criminal activity is more commonplace and thus less traumatic to the public than a terrorist attack, it remains a top priority for law enforcement officials throughout the country.

With so much at stake, it’s no wonder that homeland security officials are rapidly turning to digital surveillance systems utilizing high-resolution image acquisition and behavior pattern analysis software to detect and flag
suspicious individuals, as well as facial recognition programs to identify known terrorist suspects. Abundant storage capacity makes these advanced capabilities feasible, as well as the extended archival periods required by many government facilities.

The SV35 Series drive is the industry’s leading hard drive designed and optimized for surveillance digital video recorders (SDVR). The drive enables security professionals to improve SDVR reliability and performance by recording multiple video streams simultaneously while consuming less power and generating less heat. Now security professionals can design for lower cost, reduce heat (extending the life of their system) and use a surveillance-optimized hard drive series that will grow and evolve with their solutions.

<table>
<thead>
<tr>
<th>Video Surveillance Storage Profile: Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Resolution</td>
</tr>
<tr>
<td>QCIF 176x144</td>
</tr>
<tr>
<td>CIF 352x288</td>
</tr>
<tr>
<td>4CIF 704x576</td>
</tr>
<tr>
<td>1 Megapixel 1280x1024</td>
</tr>
</tbody>
</table>

1 Assumes recording on motion with 50% of the time with motion
2 Assumes MPEG-4 encoding

Seagate® SV35 Series™ Drive

The SV35 Series drive is the industry’s leading hard drive designed and optimized for surveillance digital video recorders (SDVR). The drive enables security professionals to improve SDVR reliability and performance by recording multiple video streams simultaneously while consuming less power and generating less heat. Now security professionals can design for lower cost, reduce heat (extending the life of their system) and use a surveillance-optimized hard drive series that will grow and evolve with their solutions.

Key Features and Benefits

- 1, 2 and 3TB capacities using perpendicular recording and AcuTrac™ technology
- Designed for 24x7 operation with high-write duty cycles
- Low power consumption and reduced heat generation
- Higher temperature tolerance than standard desktop drives
- ATA-7 streaming commands allow data reads/writes to be tailored for increased video streaming performance
- Massive capacity—up to 3TB—stores up to 42 days in high-resolution video (1280x1024, 30fps, H.264)

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Seagate Constellation® ES Series

The Constellation ES drive is a true workhorse, designed to deliver ultra-high storage capacity in demanding 24x7 enterprise IP- or RAID-based surveillance environments.

Key Features and Benefits

- High rotational vibration tolerance for closely packed, multi-drive system designs
- MTBF up to 1 million hours, industry’s highest-reliability 7200-RPM drive
- Multi-drive firmware for maximum system performance
- High capacity—up to 3TB with perpendicular recording and AcuTrac technology
- Up to 2x performance in RAID and JBOD systems
- Ease of integration, using common platform for all capacities
- Future-proofed SATA and SAS interface support
- Advanced power management for reduced power use

Conclusion

Digital video surveillance systems are bringing unprecedented security to a wide range of public and private institutions, and hard drive capacity, performance and reliability are critical to enabling digital video surveillance. Adding more cameras to broaden security coverage, employing higher capture rates and frame resolution to improve image quality, and extending archival periods all boost storage capacity, performance and reliability requirements. A new breed of surveillance hard drives is specifically designed to meet these expanding storage needs, both today and well into the future.