Extreme system reliability for casinos with a combined solution of Bosch, Genetec and NetApp

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Extreme system reliability for casinos

High-performance casino solutions from Bosch, Genetec, and NetApp integration

A casino's video system is at the heart of its monitoring center. Operating 24 hours a day, every day of the year, system reliability is critical to profitable and secure operations. In most jurisdictions, when video monitoring or recording fails, casinos are forced to either post live guards or shut down the affected area. In addition to potentially significant lost revenue, fines can be assessed and reputations can be seriously damaged.

While today's video systems offer unprecedented levels of performance and functionality, the resulting complexity results in many potential points of failure. While most of today's systems offer some level of redundancy, one solution is far above the competition. By combining the strengths of Bosch cameras and encoders, Bosch's unique Video Recording Manager (VRM) technology, Bosch/NetApp's high-availability storage systems, and Genetec's powerful video management platform, this high performance casino solution offers exceptional levels of always-on reliability to casino security directors.

Multi-faceted protection

There are so many potential failure points in any modern video system, no single provision can protect against all possibilities. For example, many storage systems use RAID technology, which ensures that no video is lost even if hard drives fail. However, with RAID alone, recording will stop when the network connection between the camera and the storage system fails. To guard against numerous potential failures, our high performance casino solution combines many complementary technologies to deliver multi-faceted protection. In the following sections, we will look at each of these in detail.

It all starts with the camera
In competitors' solutions, video streams from the cameras go to NVR servers, and then to the storage system. Bosch cameras, however, provide the unique ability to stream directly to the storage system. Bosch cameras maintain lists of both primary and failover storage locations, with sufficient information to record independently for days.
If a camera loses connection with the primary storage, it automatically starts streaming to the failover storage location, requiring no external intervention.

All Bosch cameras maintain a buffer memory capable of storing at least 30 seconds of video data. If a camera temporarily loses network connection, recording to this internal RAM memory continues. When the network connection is restored, the video in the buffer is transferred to the primary storage, thereby eliminating recording gaps that would be seen in most competitors' systems.

This buffering technique also comes into play when a storage system fails. As mentioned earlier, Bosch cameras can automatically switch to failover storage if connection to the primary storage is lost. This can take several seconds, but video storage in the memory buffer continues during this time. When the switch to failover storage is complete, the buffered data is also transferred. When primary storage is brought back on-line, a complete, uninterrupted recorded stream is available. Not even one second of data is lost.

“A casino‘s video system is the heart of its monitoring center.”

But what if the network connection to the camera fails, and the failure lasts more than the RAM buffer time span? Bosch cameras can also account for this. Bosch IP cameras accommodate SD cards for extended on-board storage. Depending on data rate and SD card size, the cameras can continue recording for hours or even days, providing plenty of time to repair the problem.
When the network is restored,the video is transferred from the local storage to the primary storage, with no loss of data. Bosch calls this patented technology Automatic Network Replenishment (ANR).

On top of these features, our IP moving cameras and several fixed camera models provide redundant power supply capability. Power over Ethernet (PoE) can be used in addition to an external power supply connection. If one power source fails, the camera remains powered and fully operational from the other source. If the network connection fails due to a PoE failure, the camera continues to record to its local storage. Firmware updates can also cause any camera to go off-line during the update process, typically for several minutes. Bosch cameras have industry-leading firmware update speed to minimize this downtime. Cameras remain on-line during the firmware download, then go off-line for typically only 30 seconds during the transition.

Video recording management

In most of today's video management systems, recording is managed by Network Video Recorders (NVRs). Typical NVRs can handle 64 or more cameras, with some capable of handling several hundred. These NVRs become potential failure points, requiring redundant NVR servers to prevent massive recording loss on failure. As mentioned earlier, Bosch IP cameras completely eliminate the need for NVRs by streaming directly from the camera to storage. But how do the cameras determine where to send their streams?

The Video Recording Manager (VRM) from Bosch orchestrates the recording for all cameras in a system. This groundbreaking software technology manages camera storage without creating bottlenecks. The VRM virtualizes storage by continuously monitoring the capacity and health of all storage devices updating camera recording lists as required. The VRM can be viewed as a kind of traffic cop, directing the traffic from all cameras. Because the data does not flow through VRM servers, these servers can handle very large camera counts – each VRM server handles up to 2000 cameras.
For larger systems, multiple VRM servers can be installed. Failover VRMs can also be installed. A single VRM server can function as a failover for multiple primary VRMs, minimizing the number of servers required.
If a primary server fails, VRM performs automatic hot-failover to a failover VRM server. This occurs with no loss of video data.

Even if there is a VRM failure with no failover, or if both the primary and failover VRMs fail, the cameras keep recording normally. As mentioned above, Bosch IP cameras continue to record according to their on-camera storage lists. As long as the VRM is repaired before the cameras reach the ends of their recording lists – typically several days – no recording will be lost.
When the VRM is brought back on-line, it rebuilds the storage database automatically. The user never has to worry about where the data is stored - this is handled automatically by VRM.

VRM performs another important function that helps ensure that required storage times are met for all cameras. Data rates between cameras can vary significantly. In an NVR system, it is possible for some storage devices to end up with many high-bandwidth streams, while others receive more low-bandwidth streams. This can result in some streams falling short of the desired storage times. VRM overcomes this problem with automatic storage and performance load balancing. VRM continuously monitors device capacity and camera data rates, and automatically distributes the load evenly across all storage devices. This makes optimum use of all storage in your system, and maximizes retention time for all cameras.

Enterprise-class storage

Bosch IP cameras and VRM technologies ensure that data will always be streaming to the storage system. But what about the reliability of the storage system itself? This is another area where our combined Bosch, Genetec, NetApp solution delivers best-in-class performance.

NetApp is known world-wide as a premium supplier of enterprise-class storage. NetApp has worked with Bosch to develop a co-branded version of their E-Series storage system optimized for the unique requirements of video surveillance applications.

Like any system configurable for RAID 5 or RAID 6, the system can withstand the failure of one or two disks, respectively, with no loss of data and no impact on overall system performance. The Bosch/NetApp E-Series additionally provides:

- Redundant, hot-swappable controllers, fans, and power supply units
- Internal dual paths to the disks to eliminate throughput bottlenecks
- Battery-backed cache memory to prevent data loss due to power glitches
- Self-monitoring and healing capabilities (e.g. disk-scrubbing to remove bad blocks from the storage pool)
- Easy Drive Serviceability – NetApp's patented 5 drawer, 4U, 60 drive disk shelf makes replacing drives an easy, safe task with five individual drawers, each accommodating 12 drives and all drives remain on-line when drawer is open.
- Proven reliability – With over 20 years of storage development experience and more than 300,000 systems installed in the past 3 years, the 7th generation E-Series is based on a field-proven design providing the highest reliability and five nines availability.
- The E-Series supports a full set of dynamic features enabling on-the-fly expansion, reconfiguration and maintenance without interrupting storage system I/O.
- The E-Series provides up to 240TB of storage in 4U of space (increasing to 360TB in Q3 2015), in the industry's most serviceable high-density enclosure.
- Advanced service level options available, such as 4-hour on-site service.

Monitor video without interruption

All of the above technologies and features ensure that video is always accurately recorded. To manage your operation, it is equally important for the management system to be on-line and functioning properly. Genetec's Security Center platform provides unsurpassed video management capabilities to ensure that surveillance operators will have access to live and recorded video, and continue to receive notifications of system alarms and events.

All Genetec Security Center management and recording components (e.g. the Directory Server and Archiver Server) provide native failover and redundancy mechanisms, without the need for third-party software. These capabilities ensure that the system will automatically connect to the next designated server in case of hardware or network failure, without affecting the surveillance team's ability to monitor live video, while ensuring that recordings are stored without loss.

User-group specific notifications ensure proper communication of relevant system health events, and Event-to-Action rules can be automated to notify administrators of system alerts. Users can instantly receive notifications of events via the Security Center mobile app or e-mail to rapidly respond to alerts from the system.
The system even remains completely functional during system upgrades. Backward-compatibility allows servers and workstations to be updated incrementally, while remaining fully interoperable. System control can be diverted to the failover servers while the primaries are updated, with downtime-free switches back to the primary servers when complete, allowing organizations to dictate their upgrade schedule.
Intelligent system monitoring provides constant feedback on system operation. Adherence to gaming commission regulations is demonstrated by built in indicators and reporting tools. For example, a report showing reliable 30 fps recording rate is at your fingertips.

What happens when?

The easiest way to illustrate the extreme reliability of the Bosch, Genetec, NetApp solution is to show what happens under various failure scenarios.

Condition	Bosch, Genetec, NetApp Solution	Many Competitor Solutions
The network connection to a camera fails	Automatic Network Replenishment (ANR) enables the camera to continue recording on internal RAM and/or SD card memory. When the network is restored, the video is automatically copied from this local storage to the primary storage, for gap-free recording and normal playback.	Video from the period of network connection failure is lost. In other cases, the video is available, but it is up to the user to find it on camera storage instead of central storage.
The Video Recording Manager (VRM) server fails	The failover VRM server seamlessly takes over without the loss of video data.	VRM is unique to Bosch. Competitor solution: typically a failover NVR takes over when the primary NVR fails. In many cases, video from the transition period is lost.
Both the primary and failover VRM servers fail	The cameras continue to record for up to several days, allowing ample time to repair the servers. Playback of video is not available until one of the VRMs is brought back on-line. When brought back on-line, the VRM rebuilds its database from indexes stored in the storage arrays.	VRM is unique to Bosch. Competitor solution: If primary and failover NVRs fail, recording stops, and video is completely lost until at least one is brought back on-line.
Hard disk drives fail	The system continues to operate normally, with full access to live and recorded video using redundant information from the RAID 5 or RAID 6 configuration. RAID 5 supports a single failure, while RAID 6 supports two concurrent failures. When a faulty disk drive is replaced, data is rebuilt to the new drive, restoring the system to its full fault-tolerant state. Disk replacement is easy, with front-replaceable, hot-swappable drives.	Similar in most cases. While front-replacement is common in lower density arrays, unique to Bosch/NetApp is the easy replacement of disk drives in the high-density shelf. 

Condition	Bosch, Genetec, NetApp Solution	Many Competitor Solutions
A new version of Security Center is being installed.	Backup servers are updated first, and then control is manually switched to these servers. The new software is backwards compatible with the client workstations, so these remain fully functional. The primary server is then updated, and control is subsequently switched back. Client workstations are updated at your leisure, as they remain fully functional with both the old and new versions.	In systems that do not provide backward-compatibility, all workstations remain off-line until they are updated to the new revision. Even worse, some systems go fully off-line during the updating process.
A controller card in a storage array fails.	VRM directs traffic to a backup controller. Operation continues seamlessly.	Some form of controller backup is provided in most high quality systems.
A power supply or cooling fan fails in a storage array.	The redundant unit is fully capable of handling the load. A notification is sent to alert the administrator. The failed unit can be easily changed without disrupting operation.	Similar in most high-quality systems.
An entire disk array fails (highly unlikely due to high level of redundancy).	The cameras detect that primary storage is off-line and direct the streams to the failover storage. Video is buffered in the cameras' local storage, so no data is lost during the transition. When the primary disk array is brought back on-line, all video is available with no recording gaps. It is accessible to the user as usual – no need to worry about where the data is stored, as this is handled automatically.	In many systems, video from the switchover period is lost. Also in many systems, the user must manually select the primary or failover storage to find the desired data.
Camera firmware is updated.	The camera remains on-line while the new firmware is downloaded. When the download is complete, the camera goes off-line, the new firmware is installed, and then returns on-line. Total time off-line is approximately 30 seconds.	Many competitors' cameras will be off-line for many minutes during a firmware update.

A tradition of quality and innovation
For over 125 years, the Bosch name has stood for quality and reliability. Bosch is the global supplier of choice for innovative technology, backed by the highest standards for service and support.

Bosch Security Systems proudly offers a wide range of security, safety, communications and sound solutions that are relied upon every day in applications around the world, from government facilities and public venues to businesses, schools and homes.

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