

Storage Systems Towards Securing Information End-to-End

Video surveillance is an industry that changes and advances along with technology. Similar to any other industry, the high demands of the market for products and solutions are what drive the changes and evolution to meet them. Over the course of three decades, the demands on video surveillance systems have resulted in larger capacity of storage medium, and integration with other systems. A growing range of storage choices means a flexible and specific solution can be created for every security user.

● BY KARISHMA SEN

In the world of security and surveillance, captured video and audio data plays a key role in forensics and aftermath of any instance. The safety, security and accuracy of this vital data are ensured by the storage systems. Also with emerging new technology in video surveillance, advanced and high speed storage solutions are required to meet the demands of the time and ensure data privacy. A healthy storage system shall have zero downtime, high data retrieval rate, redundancy, high data storage handling, good lifecycle, high data availability, energy efficient and expandable.

“As digital surveillance systems increase in popularity, data storage becomes an important issue especially when monitoring large installations. One of the primary objectives of surveillance system is to provide required video evidence for an incident to the authorities to aid their investigation. This objective can be met only if the video footage is stored in the reliable media and is available when required”, said Chandran Krishnan, Chief Technology Officer & Executive Director, Autocop-Facility Security Division.

Various storage options have appeared on the market, from local storage devices such as D/ NVRs and hybrid video recorders (HVRs) to extended storage spaces found in NAS, SAN and cloud storage, which allows security users to pick and choose according to individual needs. To use every piece of equipment to its full potential, it is important to consider the application capabilities of both existing and new technologies.

EVOLUTION OF STORAGE SYSTEMS

Storage systems are built by taking the basic capability of a storage device, such as the hard disk drive, and add-

ing layers of hardware and software to obtain a highly reliable, high-performance, and easily managed system. We explain in this paper how storage systems have evolved over five decades to meet changing customer needs.

Recognizing the inferiority of VHS tape as a recording and storage medium, many users of analog video surveillance systems made the switch to digital video recorders (DVRs) when they became available. It records video and stores them in digital format. The recording medium for DVRs are usually hard discs, flash drives, or SD memory cards which allow hours of recording limited only by the capacity of the recording medium. NVR is a fully digital network video setup as no analog component touches the image. NVRs can be a standard network server that is equipped with either an internal or attached storage or both with possibly video analysis software. The use of an NVR configuration permits true IP cameras to act as video servers where the images will be directly inputted to the NVR where it will be directly managed by the NVR video software. HVR is an open platform technology that is based on generic PCs having the right video software. They are equipped with a proprietary hardware with embedded video management software that allows you to manage video from both network cameras and encoders. True NVRs only takes network video inputs, while hybrid DVRs can work with both analog input and network video input. The main benefit in using either NVR or Hybrid DVR, aside from ease of installation, is that all recording and video management are handled all on a single box.

Sanchit Agrawal, Product Manager, EverFocus Electronics India said, “A DVR takes analog data from traditional analog cameras as an input, converts and



Chandran Krishnan, Chief Technology Officer & Executive Director, Autocop-Facility Security Division.



Khwaja Saifuddin, Sr. Director (Sales) - Middle East, Africa & South Asia, Western Digital



Sanchit Agrawal, Product Manager, EverFocus Electronics India

compresses it and stores the data in digital format on a local storage (DAS). An NVR takes digital data from the IP Cameras over Ethernet as an input, processes it and stores the data on the storage systems (DAS, NAS, SANs). An HVR incorporates the functions of both DVR and NVR. It takes both analog and digital inputs from traditional CCTV cameras and IP cameras respectively. It supports Direct Attached Storage (DAS), Network Attached Storage (NAS) and Storage Area Network (SAN) unlike DVRs. A DVR is optimized to store data locally on DAS, whereas, an NVR or an HVR is optimized to store data either on the network storage or local storage. Hence one has to decide a right product as per the system architecture”.

STORAGE SYSTEMS COME OF AGE: FUTURE OUTLOOK

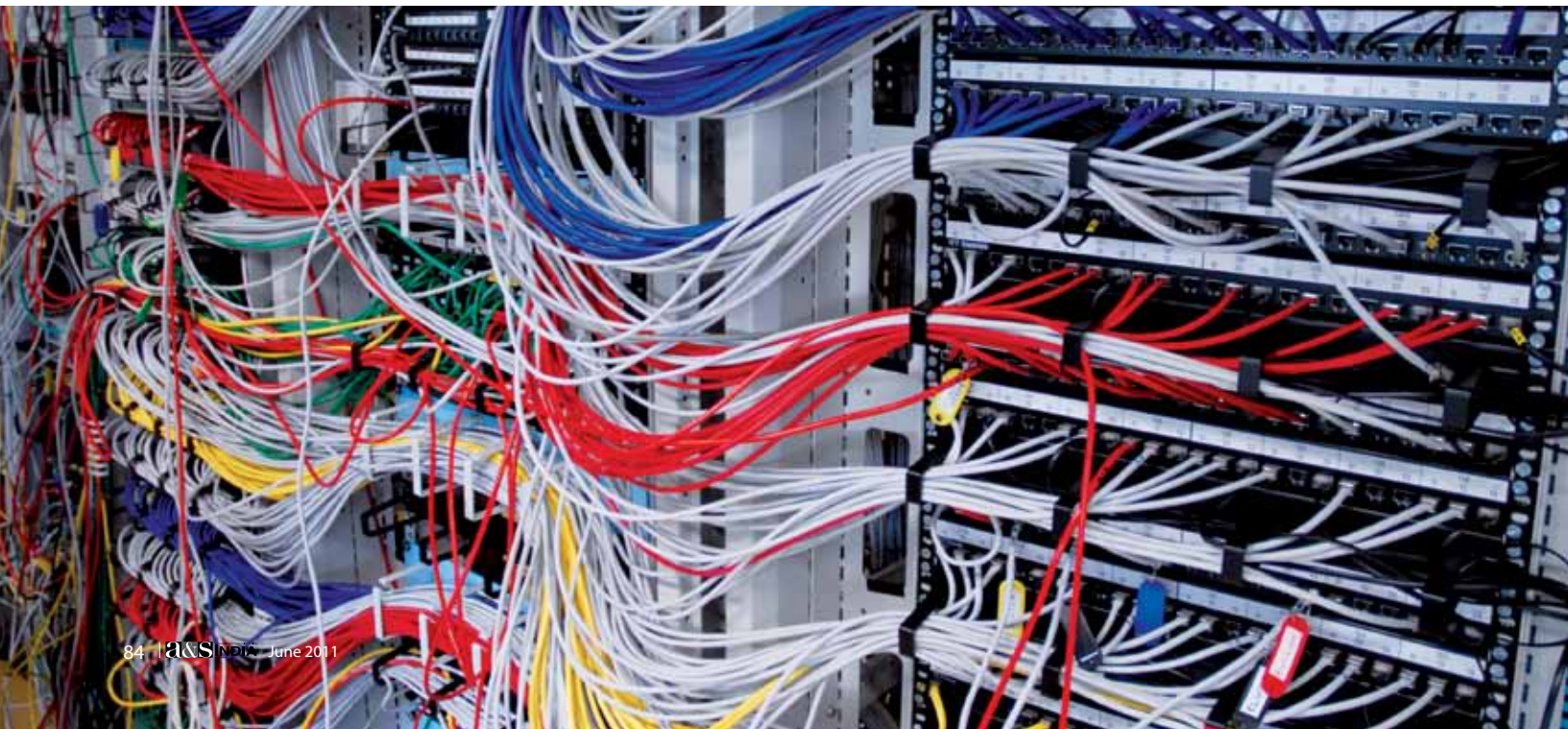
“One of the most common and popular way of storing the surveillance data is on the Hard Disk Drive (HDD) in the DVR, which is classified as Directly Attached Storage (DAS). While it is the most cost effective option, one of the major challenges of this option is its limited scalability. Industry has moved into NAS (Network Attached Storage) and SAN (Storage Area network). Both SAN and NAS eliminate the issues with the DAS and provided flexible options to improve the storage capacity, availability”, said Chandran Krishnan, Chief Technology Officer & Executive Director, Autocop-Facility Security Division. “Storage is becoming a more matured topic and many leading brands are spending millions of dollars to bring

out technology. Among the data storage trends for 2011 are primary storage deduplication, automated tiering and storage resource analysis software for better business analytics”, He added.

Sanchit Agrawal, Product Manager, EverFocus Electronics said, “CacheCade technology and Remote Data Replication are two latest innovative yields in storage systems. CacheCade Technology enhances the I/O performance of hard drive-based system storage by caching frequently accessed, or “hot spot,” data to solid-state drives (SSDs). This enables SSDs to act as a secondary tier of high-performance controller cache in front of hard drives, accelerating application and workload performance by 70 percent. By allowing for very large data sets to be present in cache, the technology helps to maximize performance for transactional applications such as file and web servers, data mining, OLTP and database servers”. “Remote Data Replication technology featuring hybrid host connectivity of SAS and iSCSI has greatly improved data protection. Remote replication, a key element of a comprehensive disaster recovery plan, has traditionally been unavailable as DAS (Direct Attached Storage) solutions do not have the capability to transmit data to remote locations. With the iSCSI ports on new hybrid models, users can now directly connect their systems to IP networks to send data to a remote replication for secure storage”, he added.

“The current broad trend in video surveillance from an Indian perspective is the gradual transition to network

▼ The technology helps to maximize performance for transactional applications such as file and web servers, data mining, OLTP and database servers.



or IP surveillance. In a way, this trend also implies a drastic improvement in image quality and frame rates, and hence a heightened need for video storage capacity. Gradually, business managers will also begin saving video recordings for longer to comply with legislation. Ultimately the pressure falls on the hard disk. To combat these pressures, HDD vendors are trying to provide greater capacities on surveillance drives”, said Khwaja Saifuddin, Sr. Director (Sales) - Middle East, Africa & South Asia, Western Digital.

RUN FOR YOUR MONEY

Storage solutions are becoming bigger in size and lower in cost posing new challenges for product development. “Advances in storage technology have reduced cost and improved performance and capacity; however, disk drive reliability has only improved slowly. In a typical environment for large storage systems, such as supercomputing systems, data loss is intolerable: losing just the data from a single drive, while it might hold less than 0.1% of the total storage, can result in the loss of a large file spread over thousands of drives”, Sanchit believed. “A failure in a single device might be rare, but a system with thousands of devices will experience failures and even groups of almost simultaneous failures much more frequently. As an example, consider the Internet Archive, a digital library that contains over 100 terabytes of compressed data and suffers about thirty disk failures per month. To make matters worse, the time to rebuild a single disk is becoming longer as increases in disk capacity outpace increases in bandwidth. These phenomena make it challenging to ensure high reliability for large-scale storage systems”, he added.

Lowering prices on hardware does not pose a threat to manufacturers who intend to offer solutions. “Data loss due to use of low-cost, high-capacity disk drives, can be more catastrophic. But the technology advancements and storage architectures that are available today, addresses these concerns fully. For example, good selection and deployment of RAID system alone will bring down the issue drastically and if it is coupled with HA (High Available) architecture, the benefits are more. Improper selection of storage system

may simply beat the cost of surveillance infrastructure; therefore, proper selection of technology & storage architecture based on the risk profiling will help to build highly reliable storage solution within the given budget”, Chandran explained.

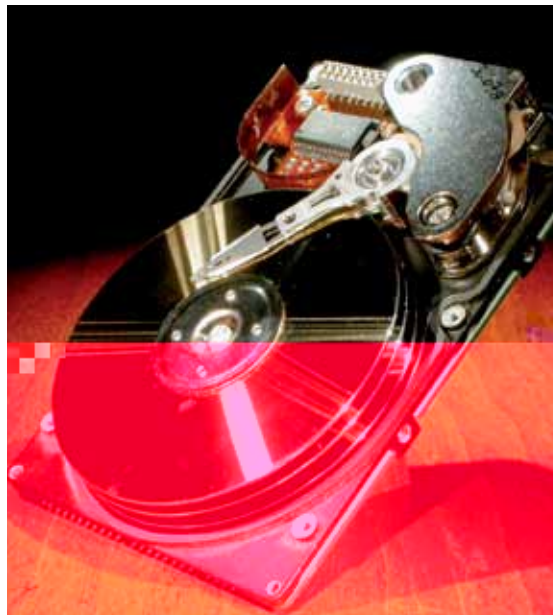
“3TB drive designed for surveillance enables surveillance systems with two or more cameras to record high levels of clarity (30 frames per second) at a broad range of resolution settings and still store 30 days or more of video footage. Using high-capacity surveillance drives will be-

come even more important as HD becomes increasingly pervasive. High resolution video provides far greater detail when compared to standard low resolution video. They are more reliable because with the increase of the capacity we also introduce new designs that boost the reliability. For instance the stablestac, better temp control, Advance Formatting drives, gives us the opportunity to increase the error correction bit”, said Khwaja Saifuddin, Sr. Director (Sales) - Middle East, Africa & South Asia, Western Digital

SYSTEM INTEGRATORS

The role of a System Integrator (SI) is mainly technical, procedural and organizational. “The key concern for a system integrator is an organized, robust and a highly efficient system design but with budgetary constraints. The only factor that influences the effectiveness is the right choice of products, right system architecture and technical compliance and compatibility of the chosen system modules. Getting different components from different vendors may create technical incompatibility and thereby increase the system vulnerability. This may lead to inefficient and ineffective system which may fail to solve the purpose or even a dead system. Hence it is required for an SI to select the system components after a detailed research. Once pre-sale activities complete in succession, another major concern is the post-sale support which includes maintenance and expansion. Overlooking these points often leads to a deadlock situation for an SI”, said Sanchit Agrawal, Product Manager, EverFocus Electronics India.

“Lack of knowledge regarding the difference between



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the desktop/PC drives and AV HDD which we recommend for the surveillance environments is the most basic problem. Life in a personal computer (desktop) doesn't compare to the extreme environment in today's always-on, capacity-consuming digital video surveillance systems. What's needed is a drive that has been engineered to manage up to 10 simultaneous audio-video streams and welcomes the challenge of an environment that's running 24x7 while offering exceptional dollars-per-gigabyte value", explained Saifuddin.

"Storage is the most neglected component while arriving at the budgetary estimation for a CCTV surveillance system by the customer. Naturally, it will be difficult for the System Integrator to fit 'storage solution' also into the customer's budget. So, lot of compromise is done on selecting the right sized storage. The other issue is not having a proper storage policy that defines what must be stored (eg. only incident or entire live stream), how long and what must be done when the storage is full, what backup system to be used, etc. With the lack of storage policy, it is difficult to achieve the overall objective of managing or safeguarding the surveillance data" explained Chandran Krishnan, Chief Technology Officer & Executive Director, Autocop-Facility Security Division.

ADVANCING TO THE CLOUD

With the rise of cloud storage, the options are increasing. But the cloud storage marketplace has been a fast-moving one, with more than its fair share of hype. The backup space is probably the most mature and well-utilized cloud storage offering. The customer retains primary data at its location and backs up to the cloud using a variety of methods, including file- and Web-based protocols. "Cloud storage is a model of networked online storage where data is stored on multiple virtual servers, generally hosted by third parties, rather than being hosted on dedicated servers. Hosting companies operate large data centers; and people who require their data to be hosted buy or lease storage capacity from them and use it for their storage needs. The data centre operators, in the background, virtualize the resources according to the requirements of the customer and expose them as storage pools, which the customers can themselves use to store files or data objects. Physically, the resource may span across multiple servers", said Sanchit, "Cloud storage services may be accessed through a web service application programming interface (API) or through a Web-based user interface", he added.



Cloud Storage



ADVANTAGES

- Companies need only pay for the storage they actually use.
- Companies do not need to install physical storage devices in their own datacenter or offices, which reduces IT and hosting costs.
- Storage maintenance tasks, such as backup, data replication, and purchasing additional storage devices are offloaded to the responsibility of a service provider, allowing organizations to focus on their core business

CHALLENGES

- Security of stored data and data in transit may be a concern when storing sensitive data at a cloud storage provider.
- Performance may be lower than local storage.
- Reliability and availability depends on wide area network availability and on the level of precautions taken by the service provider.
- Users with specific records-keeping requirements, such as public agencies that must retain electronic records according to statute, may encounter complications with using cloud computing and storage.