

# Application Note



## How does EonStor IP SAN Serve as Ideal Storage for Video Surveillance?

### Abstract

This document describes the trend of video surveillance from analog to digital; and how EonStor IP SAN is qualified as ideal storage match for surveillance by offering low cost-per-capacity, high availability, robust data protection, ample performance and ease-of-use.

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When surveillance technology transforms from analog to digital, the requirements for video storage are becoming more demanding. To consolidate robust analog/digital hybrid environment or IP-surveillance, a storage solution offering low cost-per-capacity, high availability, robust data protection, ample performance and ease-of-use is indispensable. Concerning these characteristics, Infortrend's EonStor IP SAN is readily qualified as the ideal storage for video surveillance.

### **Evolving Surveillance Scenario: from Analog to Digital**

Since the initial deployment of CCTV (closed circuit television) video systems in the 1960s and 1970s, analog technology had dominated monitoring and surveillance market until digital technology revolutionized the scenario. According to Frost & Sullivan, the demand for digital surveillance systems will surpass that for analog systems in 2012. To understand the reason of the trend, we should probe into how the advent of digital technology addresses the problems of analog CCTV surveillance

High installation costs over large area, lack of remote accessibility, intensive maintenance, time-consuming recording retrieval and poor video quality – these are the main shortcomings of traditional analog surveillance. In a typical CCTV installation, the transmission of video signals relies on coaxial cables. Since coaxial cables can only extend over limited distance (or the signals will seriously degrade), expanding CCTV systems means procuring new hardware to replicate switching infrastructure in multiple locations. The required high expenses contradict with the common belief that CCTV is a cost-effective surveillance solution. Since the distributed installations are not built on the same infrastructure, monitoring real-time images is only possible in the control room local to an installation. Besides deployment and access limitation, using VHS tapes as the storage medium also results in many problems. Maintaining banks of Video Cassette Recorders (VCRs) and massive tape library is very labor-intensive. When users want to retrieve information from a tape, they have to go through the time-consuming process of loading the tape and then fast forwarding to the part they need. What's worse, the recordings can be of poor quality because of cameras' limited resolution and the use of worn-out tapes. In the 1990s, the DVR (Digital Video Recorder) technology arose to address some of the CCTV problems.

DVR is a kind of device transforming analog inputs into digital format and then storing the videos in its internal hard disk. The replacement of tape with hard disk as storage medium leads to many immediate benefits. Maintaining hard drives is much easier than maintaining dozens of VHS cassettes. Users no longer need to worry that image quality would degrade along with tape's wearing out over time. When videos are recorded as computer files, they can be compressed for more efficient capacity utilization. Recording retrieval also becomes more flexible. Only by selecting camera ID, time and date, users can easily get to the section they want to check via non-linear access. They can even make multiple exact copies in a short time when necessary. When connected to the IP network through network ports, DVR also allows remote control and monitoring of wide-spread installations in a central office. Leveraging and improving legacy system, DVR receives wide adoption (approximately 70%) in today's surveillance market. However, this technology still has some inherent disadvantages.

The most disturbing disadvantages of DVR are location-dependent deployment, unsatisfactory image quality, restricted capacity, unreliability and distributed storage. IP-surveillance solution satisfactorily solves the first two problems. The two key components of IP surveillance are IP camera and NVR (Network Video Recorder). A common NVR is a standard computer with NVR software installed. The main difference between DVR and NVR is the source of their video inputs. DVR receives analog streams from analog cameras, while NVR receives digital streams from IP cameras. In CCTV + DVR configuration, DVRs have to be located near to the camera clusters because the connection between CCTVs and DVRs relies on coaxial cables. Even if DVRs can be accessed remotely, physical maintenance of the scattered DVR islands still requires many efforts. In IP surveillance configuration, NVRs and IP cameras are independent in their physical locations because the signal transmission depends on extended Ethernet infrastructure. Location-independence brings users great deployment flexibility. NVRs can be strategically placed to enable maintenance effectiveness and optimal bandwidth utilization. When users need to expand surveillance coverage, adding new devices is as simple as plug-and-play.

Regarding image quality, resolution and frame rate are two determining factors. By using DVR, video clarity won't be influenced by tape quality but its resolution and frame rate are still limited. Since DVR has to be responsible for

digitalizing the analog signals coming from all connected cameras, its burdened processing power is not capable of rendering high resolution and high frame rate video. Unsatisfactory quality can seriously diminish the usefulness of the recordings, especially when they serve as the reference of official investigations. However, in IP surveillance, the task of digitalizing signals is offloaded from the recorder to camera. NVR's processing power is therefore enough to support full frame rate (30 fps) and multi-megapixel images coming from IP cameras. The combination of full frame rate and high resolution gives birth to videos which expose minute image details and capture real-time, high speed motions.

IP surveillance consisting of NVR and IP camera addresses some DVR + CCTV problems, but there are still other problems, including restricted capacity, unreliability, and distributed storage, that can be solved only when suitable storage is integrated to meet rigorous demands of video storage. Short of scalability, DVR/NVR's limited internal storage often impels users to compromise on the resolution, frame rates and retention time of recordings. Low resolution and poor frame rate reduces the usefulness of videos, while inadequate retention time may lead to compliance issues. Surveillance application's writing activities basically follows the cycle: simultaneous writing from multiple channels, removal of data when retention cycle ends, cleaned space for new writings. The complex interleaving of data writing and recurring space re-allocation make DVR/NVR storage prone to failure. Without comprehensive data protection features, drive failure will immediately cause data loss and surveillance downtime; the consequences are unaffordable to users. Internal storage also leads to the problem of storage islands. Not only are storage resources poorly utilized but the distributed environment increases maintenance overheads. To solve these storage-related problems, users need a robust, external storage solution. Infortrend's EonStor IP SAN solution is the satisfactory answer.

## **EonStor IP SAN: the Ideal Storage for Video**

### **Surveillance**

There are five criteria users should consider when choosing storage for their surveillance deployments:

1. Low cost-per-capacity

2. High Availability
3. Data Protection
4. Ample Performance
5. Easy to Use, Easy to Manage

Below we will illustrate how Infortrend's IP SAN solution meets the five criteria.

### **Low Cost-per-Capacity**

Surveillance application's capacity demands are much greater than normal business applications, such as database transactions and email, because continuous recording operations lead to rapidly culminating video footage. For example, recording real-time (30 frames per second) D1 MPEG-4 video from one channel (camera input) can consume 20GB of space with 24/7 operation for a day. If there are 16 cameras feeding into the NVR server and the data have to be kept for a month, the total storage space required is  $20 \times 16 \times 30 = 9600$  GB. Infortrend's budget-friendly iSCSI arrays, such as A16E and A12E, deliver competitive cost-per-capacity to meet the demands of the large amount of data. Adopting high capacity, cost-effective SATA drives to expand system capacity in the most economic way, users no longer need to compromise on resolution, frame rate and retention time for cost concerns. For applications whose capacity demand is more rigorous, Infortrend also offers highly-scalable models, such as S16E and S12E, for choice. They can not only be scaled up to 80TB (S16E, single controller model, connected with 4 JBODs) allows the mixture of SAS and SATA drives for tiered storage.

### **High Availability**

24/7 uptime is necessary in most surveillance scenarios since users can never predict when a critical event will happen. In traditional DVR/NVR configuration, drive failure means data corruption and downtime of the whole banks of cameras. Fault-tolerant design and RAID capabilities of EonStor IP SAN mitigate the threat of single point of failure. When any hardware component fails, system will immediately issue alerts to users, reminding them to do replacement. If it is a drive that fails, RAID functionality (including RAID 0, 1, 5, 6, 10, 30, 50, 60) can protect against data loss and ensure no recording interruption. If it is a hardware module in redundant pair that fails, whether it is a controller, a PSU, a cooling module or a BBU, the fault-tolerant design would enable continuous operation and users could hot-swap the failed module. Moreover, EonStor IP SAN supports link aggregation (trunking) feature to

enhance path availability between EonStor array and DVR/NVR host. When a data path is broken because of array component, connection cable, switch, or HBA/NIC failure, video recording can still continue through the alternative data path. With EonStor IP SAN, users can rest assured of data integrity and operation continuity even in the cases of hardware failures or broken wired connections.

### **Data Protection**

There are times when data corruption and system downtime result from OS/application malfunctions, human errors, virus attacks or natural disasters. Knowing that fault-tolerant design and RAID capabilities are insufficient to deal with these challenges, Infortrend enhances its EonStor IP SAN with robust array-based data protection features. For the highly valuable video data which can not suffer from any loss, users can apply the highest-level of protection by making a copy at remote site through sync/async remote replication capability. Even when the local storage site is destroyed by disasters, the remotely-preserved data are still retrievable. In the past when FC was the only protocol for SAN, disaster recovery was an unimaginable plan for surveillance application because it requires high cost and complex maintenance. Now with cost-effective, easy-to-maintain, feature-rich EonStor IP SAN, critical video recordings can be soundly protected as they deserve.

### **Ample Performance**

I/O activities in surveillance scenario are quite different from those in normal business environment. Normal business data are read 80 percent of the time and written only 20 percent of the time, while video data are written 100 percent of the time and read occasionally only when incidents occur. Moreover, instead of written randomly in short bursts as in normal business case, video data are written sequentially in large size. Video storage's performance should be powerful enough not only to effectively deal with the continuous sequential writing operations but to smoothly serve video streams for viewing. EonStor's iSCSI arrays offer two or four host channels on each controller. The ample bandwidth eliminates the possibility that storage becomes performance bottleneck when large-sized video data are transferred. EonStor IP SAN's support for trunking feature further improves system throughput by doing intelligent load balancing among multiple data paths. According to our internal tests on the A16E-G2130, the data transfer rate delivered through two host channels is as the following:

(RAID5 End-to-End / Sequential IO)

I/O Parameters		WB (MBPS)	
Host Channels	I/O Size	Read	Write
Dual Channel	512 Bytes	219.04	205.17
	1M Bytes	218.00	204.95
	4M Bytes	211.88	203.66

If higher performance is desired, users can choose the arrays coming with four host channels on each controller. According to our internal tests on the S16E-R1130, the data transfer rate delivered through four host channels can achieve the following:

I/O Parameters		WB (MBPS)	
Host Channels	I/O Size	Read	Write
Dual Channel	512 Bytes	422.36	306.36
	1M Bytes	416.07	308.27

The ample performance not only allows simultaneous recordings from multiple cameras but ensures no-delay access when clients request to view recorded or live video.

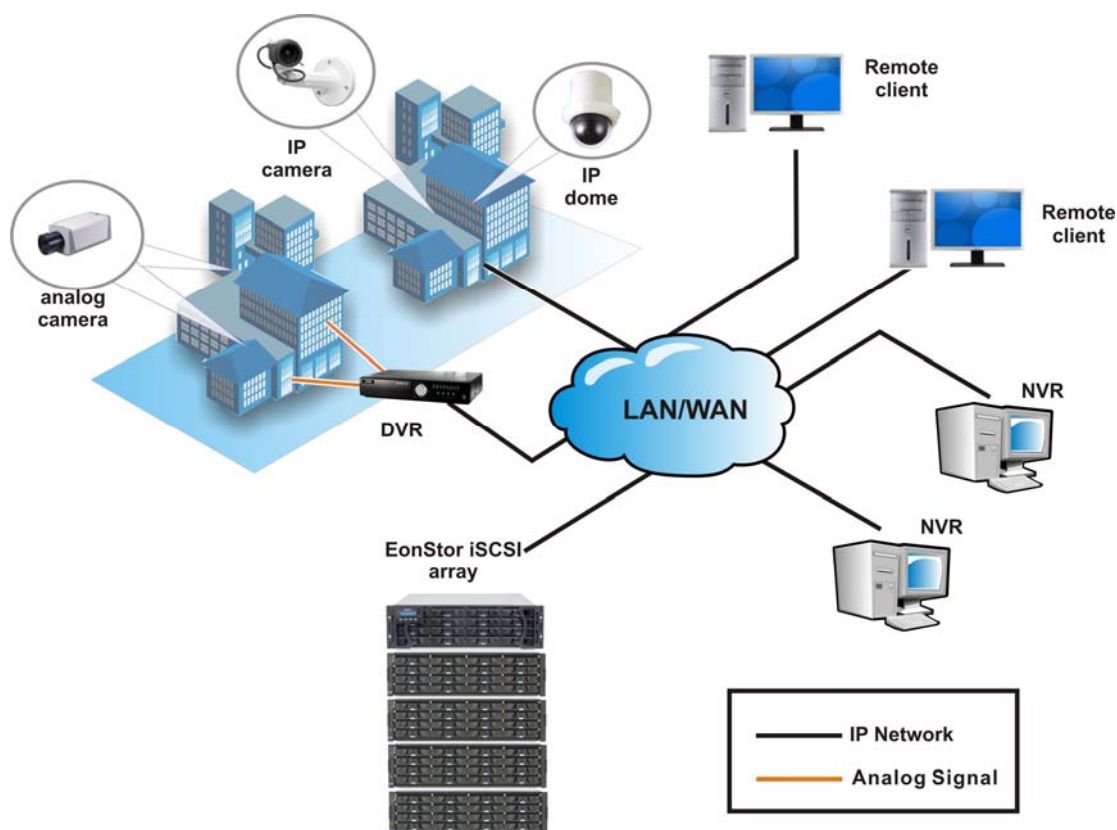
### Easy to Use, Easy to Manage

Security personnel are often equipped with limited technical knowledge, so it is important that storage systems are easy to install, expand, configure, manage and monitor. NVR's physical connection with EonStor IP SAN can be easily made through Network Interface Cards (NICs) most NVR hosts natively provide. Even when additional NICs are required, the simple installation can be done in minutes. If security personnel find it necessary to expand capacity, they can easily achieve it through easy cabling. After the hardware components are set up, Infortrend's proprietary management software suite, SANWatch, allows users to discover, configure, administer, and monitor EonStor arrays through user-friendly GUI, whether they are remote or local, one or many. When any events which may intimidate system health happen, users can be notified through various ways, such as email, SNMP traps, or

SMS. This helps them ensure system's non-stop operation even when they are away from it. Besides facilitating centralized management, consolidated video storage also improves recourse utilization. Based on application needs, users can flexibly allocate the capacity among NVR/DVR hosts, thus enabling the most effective utilization of the storage pool.

## IP-Surveillance Application Example

To upgrade traditional analog-based surveillance into IP-surveillance, users have to procure IP cameras, NVRs and IP storage. As to the old analog cameras, they can be incorporated through DVRs. Below is an application example.



In this configuration, the video streams coming from analog cameras are digitalized through DVR and then stored in its internal storage or EonStor iSCSI arrays. As to the streams already digitalized in IP cameras, they will go through NVR and be stored in NVR's internal storage or also EonStor iSCSI arrays. Users can easily access these videos through remote clients since they are all network-connected. Remote clients and NVR/DVR hosts are both allowed to manage EonStor storage systems. When any hardware

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components fail, RAID features and fault-tolerant hardware designs ensure data integrity and system uptime. To those especially valuable video data, users can use further protect them with SANWatch's advanced data protection features. Expanding the IP-based infrastructure is quite simple. When a new IP camera is added, NVR can automatically scan and assign a valid IP address to it, thus enabling quick plug-and-play integration. When a new EonStor storage system is installed, the capacity can be shared among all DVR/NVR hosts only after a few configuration steps through SANWatch GUI.

### **Conclusion**

In recent years, the infrastructure of video surveillance has been gradually upgraded from analog to digital. The upgrading task requires the match of a robust IP storage in terms of cost/capacity ratio, availability, data protection, performance and management easiness. Infortrend's EonStor IP SAN solution proves to be an ideal storage companion for the surveillance enabling better deployment flexibility, remote accessibility and expansion capability.