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Recording at the Edge

Solution Brief



What is “Recording at the Edge”?

Recording at the Edge is the concept of taking audio/video from a camera and storing it at the “edge” of the Ethernet network – instead of transporting it across the network to a centralized recording facility (such as a network video recorder).

Recording at the Edge is a distributed (or de-centralized) approach to storage: the video is spread across a number of edge storage devices, as opposed to being centralized on one.

Network Bandwidth-Friendly

It does not use any bandwidth to record video – the network is only used to play back audio/video from the edge at a review station. When the network includes a WAN (or worse, the Internet), Recording at the Edge becomes the only way to ensure high-quality recordings. Since nobody has unlimited bandwidth on their networks, this simple concept is particularly appealing to IT, which has to carefully manage this critical resource.

Reliability

Recording is independent of the network’s health and degree of congestion. Even if the network grinds to a halt, recording continues unaffected.

Simplicity

Recording at the Edge can be achieved by deploying PC-based DVRs at the edge – but with vulnerable operating systems, these are more challenging to maintain than a simple, purpose-built embedded appliance. Embedded DVRs are better suited to this role, since conventional DVRs focus on recording, searching, and playback rather than scalable live streaming over the network (a primary function of an IP-based CCTV architecture).

Fault Tolerance

If one edge recorder fails, only those cameras connected to that unit stop recording. In a centralized approach, all cameras cease to be recorded.

Pre-Alarm Recording

To enhance security, centralized storage is frequently used to record alarm video for easy alarm verification and long-term secure storage. Pre-alarm recording is offered by introducing a buffer in the encoder so that the seconds or minutes of video before and after an alarm can be automatically transmitted to the centralized storage. Because of the huge edge storage capacities of Bosch VideoJet encoders (from 256 MB to 800 GB), you can continuously record video at high frame rates and high resolutions, and still take advantage of pre-alarm recording.



Bosch’s VideoJet 8008 with 800 GB internal storage for 8 cameras supports Recording at the Edge

Worked Example

For instance, if you continuously transmit a 1 Mbps stream (30 FPS at 4CIF) to a central recorder in anticipation of an alarm event, you consume 1 Mbps of network bandwidth, or send about 11 GB of video data per day. However, when you use Recording at the Edge with pre-alarm recording configured to five seconds pre- and 10 seconds post-alarm, then assuming 20 alarms per day, you transmit only about 40 MB of video. The same 11 GB will still be recorded locally, but only 40 MB (or 0.4 % of it) will touch the network. And in those instances where the pre-alarm video is not long enough, it is comforting to know that the original complete video is always available, recorded at the edge.

Network Fault Tolerance

One of the concerns about IP-based CCTV is its dependence on the network. With Recording at the Edge, this is not an issue because network outages only impact live video. Conversely, in a centralized storage model, both live video and the ability to record is lost. Bosch's patent-pending Automatic Network Replenishment (ANR) combines the buffering qualities of Recording at the Edge with an intelligent central network video recorder that tracks any "gaps" in its recordings due to network interruptions, and automatically fills, or replenishes the gaps.

Dual Streaming

In situations where network bandwidth is severely limited, Recording at the Edge is ideal for high-quality recorded video, but it does not solve the challenge of viewing live video over a restricted network. Bosch encoders support dual streaming. This is a concept that enables the encoder to deliver two totally independent streams of video, separately configured for different frame rates and video resolutions.

Typically for limited bandwidth networks, one high-quality stream is used for local recording while a lower-quality (lower bit rate) stream is used for viewing live. For high bandwidth networks, the same stream is used to record locally and centrally, and Automatic Network Replenishment fills any gaps in the centralized recording due to network interruptions.

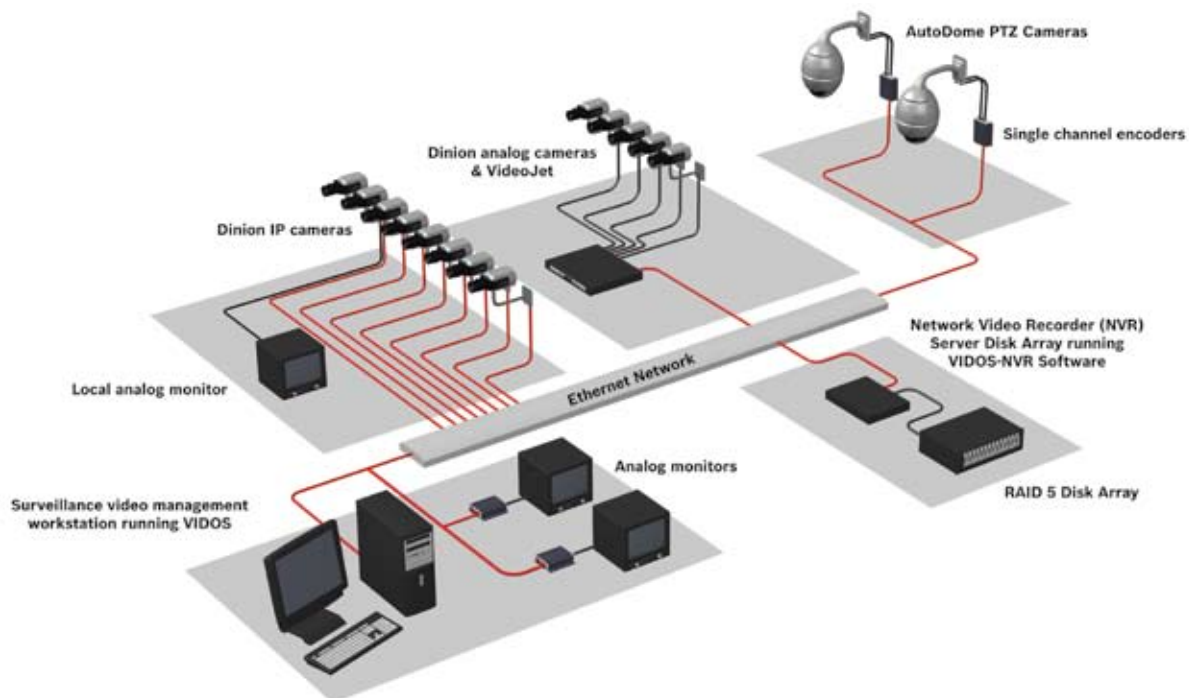
Economies of Scale

A major justification for centralized storage is that we can use enormous RAID disk arrays, reducing the cost per Terabyte. Until now these cost savings from an NVR perspective had to be weighed against the advantages of Recording at the Edge. Now with the VIP X1600 and the iSCSI RAID recording solution from Bosch Security Systems you can directly attach an iSCSI RAID to the encoder and record Terabytes of video without ever touching the network.

Another option is to seamlessly combine both approaches - when the network bandwidth is available and reliable, then use centralized NVR-based RAID; but when it is severely limited or intermittent, then use iSCSI RAID-based Recording at the Edge.

System Management

Another significant benefit of centralized systems is the relative simplicity of system management, because everything is co-located in one room or data center rather than dispersed across hundreds or thousands of miles. For Recording at the Edge to be a pragmatic solution, it is critical to have centralized monitoring and associated system management utilities. These include SNMP compatibility to network management systems such as Tivoli and HP OpenView, and the ability to reconfigure and upgrade multiple units simultaneously.



Types of Recording at the Edge

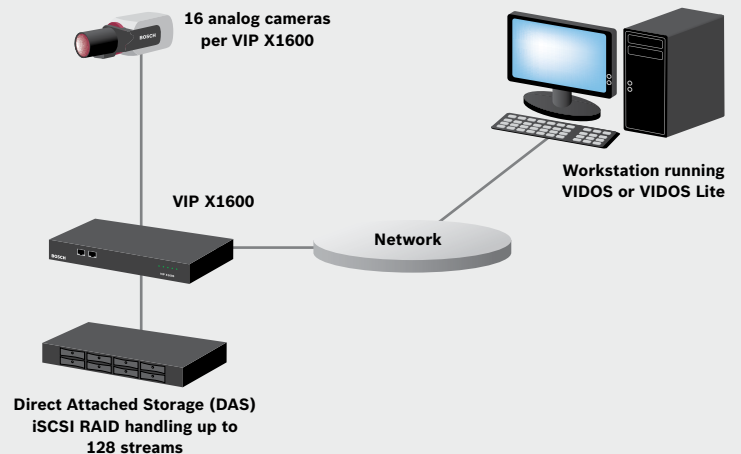
Embedded Recording at the Edge

In this mode, the encoder has internal memory. In the case of the VideoJet 8004/8008 this is an internal hard drive up to 800 GB. At the other extreme the VideoJet 10 has a removable Compact Flash card that has a capacity between 256 MB and 4 GB. The VIP X1600 also supports Embedded Recording at the Edge, providing 32 MB per four cameras, although this is commonly used for transient applications such as ANR or pre-alarm recording rather than long-term storage.



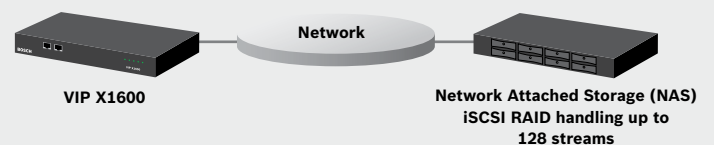
Direct-Attached Recording at the Edge

In the Direct-Attached mode, the encoder has an interface to a storage medium that is totally independent on the IP network. In the case of the VIP X1 and VIP X2 this is an external USB 250 GB hard drive. At the other extreme the VIP X1600, with its dual network ports and internal switch, can be directly attached to an iSCSI RAID, delivering up to 6 TB storage.



Network-Attached Recording at the Edge

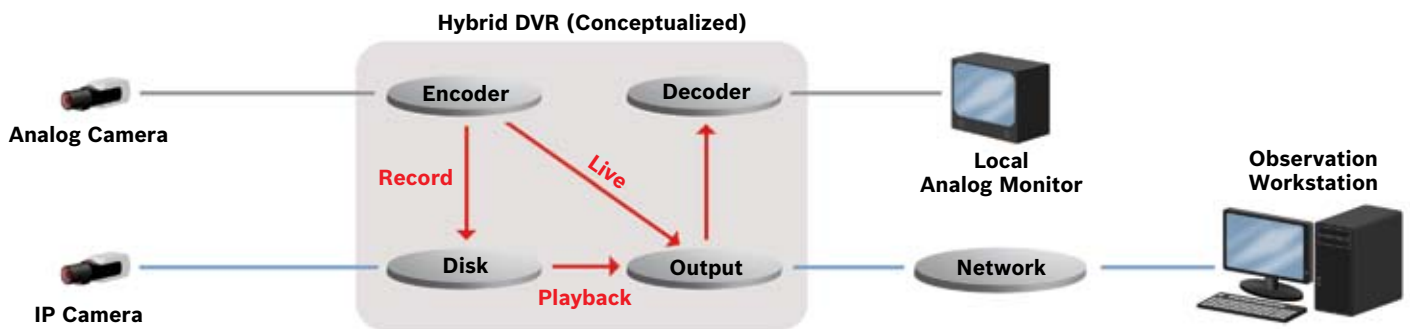
While this is not true Recording at the Edge it is very closely related. In the Network-Attached mode, the encoder sends video to a device somewhere across the network. Due to bandwidth limitations this is either very low quality streams if the network is a WAN, or high quality for LANs. However, conventional NVR technology can render LAN-based storage quite expensive for many small clusters of cameras due to the hardware and software overhead involved in running an NVR. The VIP X1600, VIP X1 and VIP X2 have the exceptional capability to stream directly to an iSCSI RAID (6 TB storage), without the need for an NVR or additional software, whilst retaining the major advantage of sharing a large and reliable storage mechanism.



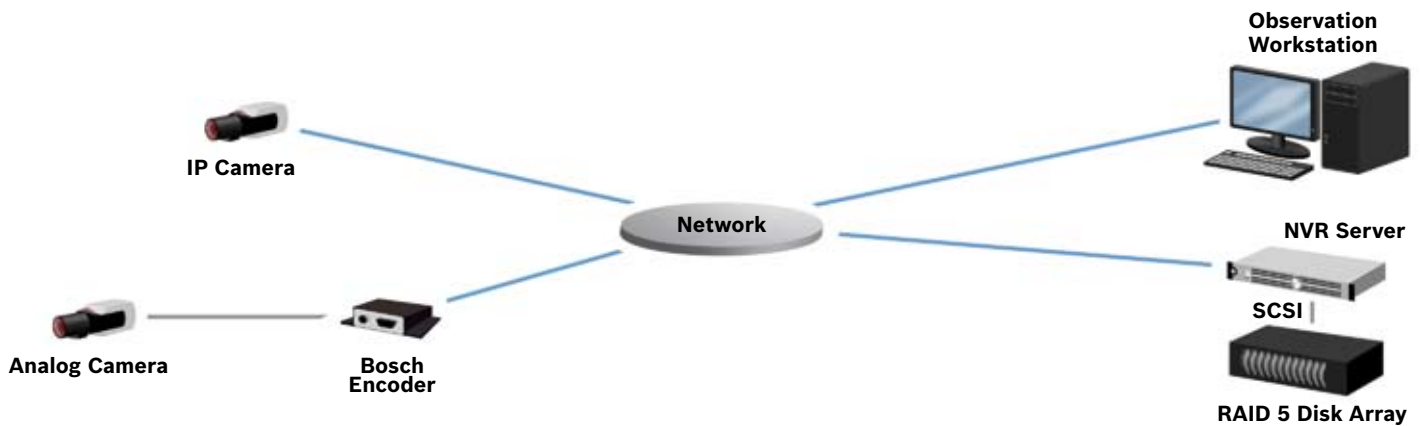
Why is this different from a simple DVR?

Most modern DVRs, like the Bosch Divar, use Recording at the Edge. Analog cameras plug into the DVR, video is compressed into a digital format, and then it's typically stored on a hard drive within the unit. Hybrid DVRs (e.g., the Bosch DiBos) take this one step further by allowing the unit to accept either analog or IP video inputs.

The DVR usually has IP connectivity so that a remote viewer can play back recorded video from across the network or view live video.

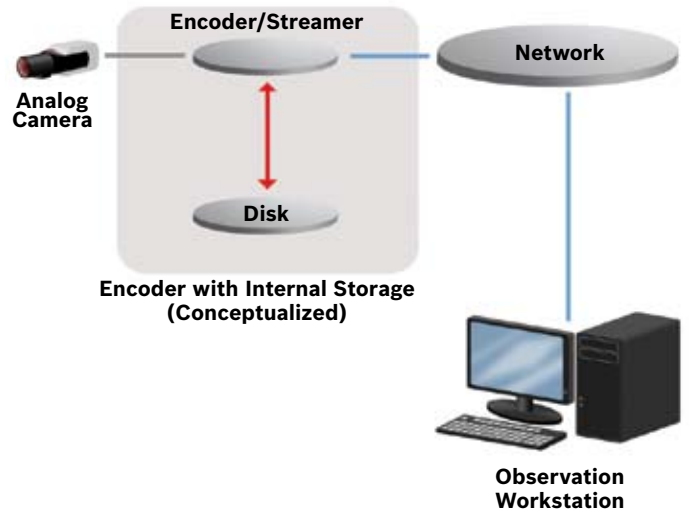
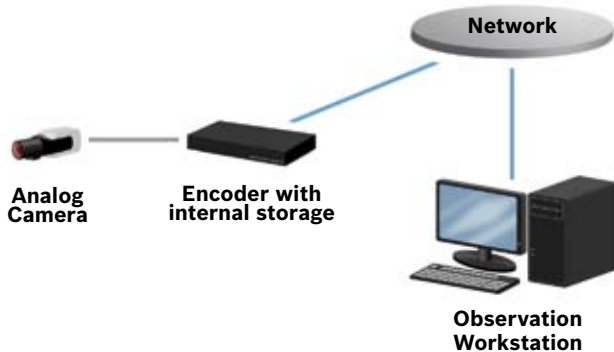


This figure shows the primary elements of a DVR. It accepts both analog and IP cameras, and delivers video to a local analog monitor and a remote workstation.



This figure shows how IP video streams are sent across a network to either a workstation or a centralized recorder. This powerful architecture suffers when the network becomes overloaded or fails. Under these circumstances, you may not be able to record video.

Recording at the Edge combines the benefits of the DVR approach with the flexibility and power of modern IP-based CCTV. Examples of Bosch encoders with local storage capabilities include the single-channel VIP X1 and X2 with an external 250 GB USB hard drive, the eight-channel VideoJet 8004 and 8008 with up to 800 GB internal hard drive, and the VIP X1600 with both internal DRAM as well as iSCSI RAID support for both direct-attached (off the network) and network-attached (streaming across the network) storage.



This figure shows how Recording at the Edge sends only live IP video streams across a network to a workstation. Recording is done locally within the encoder or with an external storage device directly attached to the encoder.

“Recording at the Edge” Product Selection Guide

Model	Capacity	Compression	Description
VideoJet 8004	160/250/600/800 GB	MPEG-4	Mid-range performance, eight-channel unit with internal HDD, with 30 FPS at 2CIF or 15 FPS at 4 CIF
VideoJet 8008	160/250/600/800 GB	MPEG-4	High-performance, eight-channel unit with internal HDD, with 30 FPS at 4 CIF
VideoJet 8000	160/250/600/800 GB	MPEG-2	Eight-channel unit with internal HDD
VIP X1/X2	250 GB External USB Drive	MPEG-4	Single/Dual-channel high-performance unit with 30 FPS at 4 CIF with direct-attached USB HDD support
VIP X1600	32x4 MB or External iSCSI RAID	MPEG-4	4x4-channel modular encoder with iSCSI RAID support for both Direct-attached and Network-attached configurations
VideoJet 10	256 MB, 2/4 GB	MPEG-4	Single-channel unit with compact flash card
VideoJet XPro	240/600 GB	MPEG-2/4	7U rack-mount chassis supporting up to 20 eight-channel video blades, or 160 channels, with the option of replacing some of the blades with HDD blades

In summary, IP-based CCTV is rapidly evolving as the means by which video is captured, transmitted, and viewed. The pace is accelerating – with an ever-increasing number of properties laying down a dedicated network infrastructure and IT progressively taking responsibility for surveillance and security infrastructures.

This architecture has proven to be very successful when the network infrastructure does not fail, and where there is adequate bandwidth in all situations. However, more video is being sent over networks every day (especially over WANs and the Internet), and the load is at risk of becoming unmanageable. Under these circumstances, Recording at the Edge allows us to store video before it hits the network, and only use the network for playback.

In an optimum-performance IP-based CCTV system, it is likely that the best performance will be achieved by combining both centralized and local – or Recording at the Edge – storage.

For more information on the Hybrid IP CCTV portfolio, visit www.boschsecurity.us or contact Bosch at 800.289.0096.