

Megatrends in Video Surveillance

A guide to today's leading trends in video surveillance technology and practice.

Milestone White Paper

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Table Of Contents

INTRODUCTION	4
MEGATREND 1: THE MOVE TO IP VIDEO SURVEILLANCE.	5
MEGATREND 2: MORE POWERFUL AND INTELLIGENT VIDEO SURVEILLANCE EQUIPMENT.	7
MEGATREND 3: OPEN PLATFORM SYSTEMS.	10
MEGATREND 4: INCREASING INTEGRATION WITH OTHER SECURITY DEVICES AND SYSTEMS.	11
MEGATREND 5: GREATER RETURN ON INVESTMENT.	12
MEGATREND 6: RAPID GAINS IN PRICE/PERFORMANCE.	13
MEGATREND 7: IMPROVEMENTS IN STORAGE COSTS AND RELIABILITY.	14
CASE STUDY: POLICE IN BELLWOOD, ILLINOIS, USE WIRELESS REMOTE ACCESS SURVEILLANCE TO INCREASE PUBLIC SAFETY.	15
TAKE ADVANTAGE OF THE FUTURE TODAY	17
MILESTONE SYSTEMS	18

Introduction

All over the world, video surveillance continues to grow in importance for everything from security and crime prevention to safety and traffic monitoring. But big changes are in the wind.

The increasing popularity of Internet protocol (IP) networked video surveillance is rapidly spawning innovations that dramatically increase the capabilities, effectiveness, and return on investment (ROI) of video surveillance systems in their traditional uses, as well as new applications.

This paper will introduce you to many of these latest developments, including important innovations like wireless IP surveillance networks, video analytics, biometrics, and integration with access control and other systems. Knowledge of these trends can help you make better decisions as you seek to improve the performance, effectiveness and business value of your video surveillance system. We also include a case study of a police force in the Chicago suburb of Bellwood, Illinois, that is using a wireless IP video surveillance system in novel ways to increase the safety of the city and respond faster to incidents.

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¹ Source: "The EMEA and World Markets for CCTV and Video Surveillance Equipment" IMS Research reports from 2004 & 2005 (published 2006).

Megatrend 1: The move to IP video surveillance.

Video surveillance is becoming increasingly pervasive. According to a recent BBC article, there is a video surveillance camera for every 14 people in the United Kingdom. People in London are caught on camera up to 300 times a day.

Other parts of the world are catching up. Many are benefiting from a significant shortcut to increasing the coverage and quality of their surveillance: IP video surveillance technology. A market study published by IMS Research found that the move from analog CCTV to IP video surveillance is in full swing. In fact, the world market for IP video surveillance products increased by an impressive 41.9 percent in 2006. It is forecasted to continue growing strongly over the next three to five years. According to research firm iSuppli, global revenue for video surveillance equipment (i.e. cameras, embedded digital video recorders and IP video servers) will increase to \$11.9 billion by 2011, up from \$6.6 billion 2006.

Why the growing interest in IP video surveillance systems? Because these systems have so many performance and cost-saving advantages.

- IP video surveillance systems enable you to place cameras anywhere on the network, just as you would a computer or any other network device. Cameras attach directly through standard Ethernet connections or wireless networking technologies such as 802.11 (a, b, g or n).
- There is no need for complicated proprietary hardware and dedicated monitors. You can increase frame rates and storage any time by adding "off-the-shelf" hard drives and PC servers. Live camera feeds can be accessed from any authorized computer, laptop or other device using a wired or wireless Internet connection.
- Many IP video surveillance systems scale easily from one to unlimited numbers of cameras in increments of a single camera — no mandatory 4- to 16-channel jumps like you find in the digital video recorder (DVR) world.
- There is no need for a control room at each location. Monitoring functions for many remote locations can be centralized in a single control room. This enables you to manage a higher level of surveillance with less people.

One key advantage to moving to IP video surveillance is that nearly all companies and organizations already have the trained and dedicated personnel necessary to install IP video surveillance technology. Since this technology is basically IP network hardware and software, your Information Technology (IT) team can install and maintain it. What's more, the interfaces for most IP video management software make it easy to train any experienced computer user to operate it.

The staged approach

Many analog closed circuit television (CCTV) video surveillance users are taking a staged approach to their transition to IP video surveillance, running hybrid digital-analog systems while they wait for their analog systems to reach their natural "end of life." This is particularly easy to do since many IP video surveillance management systems, such as Milestone Systems' XProtect™, can integrate digitized video from analog cameras and surveillance systems using DVRs. This enables you to manage all your video from a single IP surveillance software platform. Capabilities like these make it easy to phase in your transition and leverage legacy devices.

One disadvantage of analog equipment is that the cameras are streaming all the time and consequently tying up bandwidth. To conserve bandwidth, IP video surveillance systems can employ edge analytics (see next section) and on-demand solutions.

Megatrend 2: More powerful and intelligent video surveillance equipment.

More powerful cameras. While the majority of surveillance cameras installed and in use today are analog, this is rapidly changing. According to the industry analyst J.P. Freeman and Company, IP network camera sales will exceed analog sales by 2008. The reasons for this are many.

IP network cameras provide up to 16 times the resolution of traditional analog cameras. They also cover larger areas, and offer superior digital zoom capabilities. In fact, today's IP network cameras give rich enough detail that you can read the numbers on a license plate or the name on an ID badge.

These cameras continue to get better. The future will bring more megapixels for greater detail and better video codecs for improved data compression. (Codecs are software that encode a data stream for transmission or storage and decode it for viewing and editing.) A good example of these newer codecs is H.264. This codec delivers the same quality as the compression format MPEG-2 (MPEG stands for Moving Picture Experts Group, an organization that develops video and audio encoding standards) at a third to half the data rate and up to four times the frame size of MPEG-4. For IP surveillance systems, this means sharper images, as well as reduced bandwidth and storage requirements.

More intelligent cameras. Cameras are getting a lot smarter than simple motion detection and the reason is *video analytics*. This technology enables cameras to identify and track objects. Cameras can be programmed with video analytics to recognize whether an animal or person has moved into the viewing area. They can recognize whether two people are hugging or struggling. They can identify particular kinds of shoplifting, such as taking multiples of a single-purchase item. They can recognize whether someone is holding out a credit card or a gun. There's no real limit yet to what video analytics can "see" and react to. In fact, through artificial intelligence, it will soon be possible to have a camera watch a scene for a month and get a "feel" for what's normal and abnormal, and respond accordingly.

Of course to perform these feats, a camera has to be part computer. This means IP network cameras.

One reason video analytics (and IP network cameras) has taken off in recent years is that it provides a cost-effective substitute for paying security guards to watch video monitors for hours on end. Security forces become more effective when the cameras do the watching and the guards remain on the floor, ready to respond. Alerts from the camera can even be sent to guards via cell phone or other handheld device.

Many video analytics — such as facial recognition, people counting for crowd control, and automatic zoom-ins on license plates — are already commercially available. Much more is to come. The big news is that

video analytics has gone from being a “science experiment” to being a serious tool used by many organizations around the world.

More intelligence at the edge. Commercial video analytics began as a technology running in a server attached to a camera. Having video analytics capabilities built into the camera makes more sense. It puts the intelligence out at the edge of your network rather than at its core. That way you don't have video feeds from hundreds of cameras coming into your data center for analytics and tying up too much bandwidth and too many servers.

With edge analytics, one server can handle many cameras. In fact, each camera acts as its own server. In many setups, cameras are programmed to record continuously, but only save video recorded right before, during and after an incident. This video can then be transferred to a central server for safe storage. Transporting only video “of interest” reduces both video transport throughout the network and storage requirements.

Other advantages of pushing analytics to the edge include the ability to capture and analyze higher quality images at the source and reduce time-consuming false alarms. Since you don't have to continuously stream video to a server, you can deploy much higher quality cameras. These higher quality cameras enable higher quality video analytics at the source. The result is fewer false alarms through more accurate identification of real incidents.

An open door to biometrics. Biometric methods of identification work by measuring unique human characteristics to confirm identity. Examples include fingerprint or iris scanning, dynamic signature verification, and facial recognition. The future of biometrics holds great promise for law enforcement applications, as well as for private industry uses. By measuring facial geometry, for instance, video surveillance systems could identify suspects against characteristics stored in the security system's database.

Biometric products are no longer “sci-fi.” The reality is that they are an important part of the future of the security industry. Biometrics will provide extra security at the checkout counter, guard against unauthorized access to cars, computers and cell phones, and enable guard-less entries that can positively identify every person who comes and goes.

Coming soon are facial-recognition passive surveillance systems that use hidden surveillance cameras to monitor an entrance to a building. These systems will be able to accurately identify a potential suspect or terrorist against a database of millions of images in less than one second. Alerts will then be transmitted to security personnel in real time.

Integration with badge entry systems is already possible. Instead of a guard being responsible for matching faces with ID badges as they are scanned, IP video surveillance cameras perform the task.

Better management. The trend in video surveillance management software is to provide a comprehensive solution that enables cameras

to be dynamically managed from anywhere on the network and intelligently distributes alarms, alerts and associated video to the appropriate decision makers and devices (such as cell phones or PDAs) wherever they are located. This empowers more effective collaboration and timely response to emergency situations.

Innovative video surveillance management software such as Milestone XProtect™ Corporate provides many advanced capabilities.

- Ability to support unlimited cameras, devices, users and servers.
- Control of all daily operations from a single interface. Cameras, devices and users can be managed in groups, eliminating many time-consuming repetitive tasks.
- Intuitive interfaces that simplify the configuration and management of large and complex video installations.
- Simple commands for viewing live and multiple video images.
- Fast digital search and retrieval functions with just a click of the mouse.

Megatrend 3: Open platform systems.

A key technological advantage in the migration to IP video surveillance technology is that it's an open platform. An open platform frees you from "proprietary jail." It decouples software from hardware so you are no longer tied to the product line of a specific manufacturer and the limitations of proprietary technology.

With an open platform, disparate systems can be integrated into efficient and effective solutions. You can buy card readers from one manufacturer, control hardware from another, surveillance cameras from a mix of vendors, and software from a third or fourth, and then combine them together to create a best-of-breed solution tailored to your operation. It's complete freedom of choice.

No longer do you have to orchestrate a massive equipment switchover to utilize new technology or try to integrate systems. With an open platform, all the devices use a common standard of communication so new can communicate with old. This gives a much longer lifespan to your security system and "future proofs" your investment.

As the IT and security industries continue to converge, the open platform advantage of IP technology will act as a multiplier of real world benefits. It will be the crucial enabler for:

- Advancing video asset management and storage.
- Reducing the cost of expansion and maintenance.
- Ensuring the interoperability with new systems and devices designed to add greater efficiency and effectiveness to your security operations.

Megatrend 4: Increasing integration with other security devices and systems.

Imagine a video surveillance system capable of identifying an intruder and locking all adjacent doors to seal the intruder in until police arrive. Or imagine a video surveillance system that recognizes unauthorized personnel in a corridor and sends an email alert to security, plus “instructs” each camera in the network to follow their movements and relay them to security.

A big advantage of IP video surveillance systems is that since they are connected to the network, they can use the network and interact with other network devices. A major trend in the near future will be finding innovative ways to leverage this connectivity to improve security, reduce risk, and increase the overall value of the surveillance system.

Since most IP network cameras have digital inputs and outputs (I/O), it is also easy to integrate them with other security devices, such as alarms, sensors, lighting, gates and doors. For example, alarm devices or sensors could trigger cameras to start recording and transmitting images to a specific destination, or request that e-mail alerts complete with video clips be sent to a mobile phone. Camera outputs could be used to enable cameras to turn on lights, set off alarms, close or open doors, or other actions.

Integration with Point-Of-Sale (POS) devices could pinpoint an action, such as the swipe of a credit card or the cancellation of a transaction to alert the immediate IP network camera to save the six seconds of video both before and after the action. This collects only the data a security or loss prevention team is interested in, and can even categorize it by the checker on duty or other criteria.

Megatrend 5: Greater return on investment.

IP technology is doing more than revolutionizing security surveillance. It is providing opportunities for video surveillance capabilities to be leveraged by other parts of your organization. Imagine what marketing, human resources or training could do with access to high quality video from all areas of your operations. With the ability to search hours of video from thousands of cameras in mere minutes for specific events, it would be easy to also use surveillance video for everything from market research to training videos.

With video analytics and fast search capabilities, IP video surveillance makes possible all kinds of new uses and applications.

- Marketing research companies can study real consumer reactions to POS display and other shopping behavior.
- Building designers can study traffic flow to improve interior design.
- Retailers, libraries, and other organizations can monitor in real-time the number of customers and the length of lines to provide alerts when more staffing is needed.
- Cameras can provide alerts when shelves need restocking, spills have occurred, or aisles are obstructed.
- HR departments can monitor employee/customer interactions to improve service, detect gaps in training and management, spot and praise good behavior, and identify employees avoiding customer contact or shirking other responsibilities.
- Training departments can collect clips for training videos on everything from how to spot common shoplifting behaviors to ways to more effectively help customers. (Video analytics and advanced search capabilities make it easy to collect and find usable clips.)
- Facial recognition systems can provide higher levels of security for buildings, including recognizing repeat offenders targeting chain stores.
- Airports and train stations can have cameras “watch” for unattended baggage or other suspicious behavior.

What's exciting is that this is only the beginning. Having centrally controlled, intelligent IP network cameras that can be monitored by a variety of analytical applications not only enhances security, but also enable organizations to make more accurate and predictive decisions in sales, marketing, HR, supply chain systems, and other areas. In fact, as data mining techniques improve and move into the mainstream, it will become easier for organizations to search video for patterns, relationships and trends that will help them improve their customer service, interactions, and responses to a wide variety of events.

Megatrend 6: Rapid gains in price/performance.

There is nothing like competition in the marketplace — particularly when it involves an open platform such as IP networking. Intense competition is driving down the price of IP hardware, such as IP network cameras, servers and storage, while performance continues to improve. Every year, it is possible to get more megapixels, more gigabytes, and more processing power for your dollar. This is a trend that will continue. Moving to IP networking opens up an enormous marketplace of choices in COTS (commercial-off-the-shelf) servers, storage, switches, cameras, video servers, and other devices that can be connected via open platform software. Through competition in the marketplace, you are assured of getting the best selection, products and pricing for your needs.

Based on current growth rates of IP video, we predict that “between 2010 and 2015, the volume of video traffic will overtake voice and other data running over the Internet.” This shift will drive further improvements in bandwidth capacity and compression technologies with the goal of increasing video quality and streaming speed.

Wireless video surveillance technologies will also continue their rapid growth and competitive pricing. Mesh networking and the recent introduction of the 802.11n protocol (which increases performance in both the range and transfer rate of wireless signals) is putting cameras where they haven't been before and making available real-time transmissions, as well as recording.

A good example is the Chicago Transit Authority's recent transition to a wireless system using a mesh framework. Their transit police can access video in real-time if an incident on a bus is occurring anywhere in the system.

Phoenix police are also deploying wireless cameras in “camera hides” — ordinary street objects that disguise cameras — to keep watch in crime hot spots. Officers can view real-time video on handheld devices via the Internet. Using this technology, the department has been able to scale from 30 surveillance officers down to two.

Megatrend 7: Improvements in storage costs and reliability.

A big advantage for organizations moving from analog to IP video surveillance is that digital video storage is less costly and requires less space than analog video storage. This represents significant savings for surveillance operations that need to record massive amounts of surveillance video. Casino security systems are a prime example. Until recently, casinos required a room full of VCRs to record the video feeds from the dozens of cameras keeping an eye out for cheaters. Today, small stack of video servers can replace a room full of VCRs.

Running video surveillance on an IP network also enables greater archiving capabilities and storage reliability. Recorded video can be transferred over the network to off-site storage. IP storage components also make it less expensive to increase redundant infrastructure (server and storage architecture) to provide backup storage. In general, the use of standard server and network equipment makes redundant systems and replacement considerably less expensive and time-consuming than proprietary solutions.

New innovations are making video surveillance storage options even better and more reliable. The latest installations are using Small Computer System Interface (SCSI) drives for first-day recording and Serial Advanced Technology Attachment (SATA) arrays for archiving. This improves both write performance and reliability since SCSI drives are fast and more reliable for applications that frequently write to disk, such as first-day recording. SATA drives, though less expensive, are not designed for the frequent (24/7) writing to disk required in first-day recording. They are best deployed as a cost-effective solution for long-term archiving.

What is next? Solid state drives built entirely from flash memory that have no moving parts and offer dramatically improved performance. These drives have read and write speeds that approach 100 Mb/s (many times faster than today's fastest hard drives), plus having no moving parts for greater reliability and resistance to impact. Mean time between failure (MTBF) is almost 2 million hours (nearly 228 years!). Solid state drives are ideal for first-day storage. They also make great edge device storage, consuming about half the power of a standard hard drive.

Case study: Police in Bellwood, Illinois, use wireless remote access surveillance to increase public safety.

1. The Challenge

This Chicago suburb of more than 20,500 citizens has neighboring communities with high crime that have potential to spill over into the adjacent areas. Gang activities, guns, drugs, robberies, and even murder are threats to the safety of both citizens and police. Bellwood has a total of 60 sworn officers and typically receives 28,000 emergency calls to 911 yearly.

2. The Solution

Current Technologies Corporation, a Certified Milestone Partner and Cisco Premium Partner, has installed a variety of different wireless technologies to reach into neighborhoods and completely cover the town with a pure IP video surveillance solution.

This system uses a mix of IP network cameras from Sony, Axis, JVC and IPIX. Milestone XProtect

Enterprise software is the video management tool used for scheduling the cameras, viewing live and archived images, searching the archives, and exporting evidence for court proceedings.



The police cars in the force are equipped with monitors and keyboards that are wirelessly connected to the surveillance system for mobile use and instant views of multiple locations. The radio dispatch people who handle 911 emergency calls monitor the city's cameras, acting as a central control room and identifying situations as they develop. This provides the opportunity to be proactive, enabling police to respond quickly to incidences that might have progressed into something worse.

3. The Advantages

Crime visibility has been significantly increased, and the overview of multiple locations has enabled the police force to act faster to developing situations. Cameras can be moved or added as needed, and the IP networking allows integration with developing technologies. According to Roy F. McCampbell, Comptroller/Chief Financial Officer for Bellwood, Illinois: "It's important that we're putting in the IP technology and wireless network that allows you to look at all the

options for adding more as you go along. We want this kind of technology built in for future flexibility. It sets up the connectivity for the whole community.”

The 21 original surveillance cameras have grown to over 40 in the risk areas identified by the police: major parkways, public gathering places, and higher crime locations they want to keep an eye on. Many other locations are slated to receive cameras, with an initial goal of more than 60 cameras. The plan is to have surveillance spread throughout the entire community. Camera detail is so good that the face of a wanted suspect was able to be identified from behind a glass door by a camera two blocks away.

Citizens, property and officers themselves feel safer — and the town's image has improved notably. In 2005, Chicago magazine published a lead article titled 'How Healthy Is Your Town?' that diagnosed the well-being of 191 Illinois suburbs and featured Bellwood as one of ten communities to be watched over the coming year for its visionary approach to video surveillance.

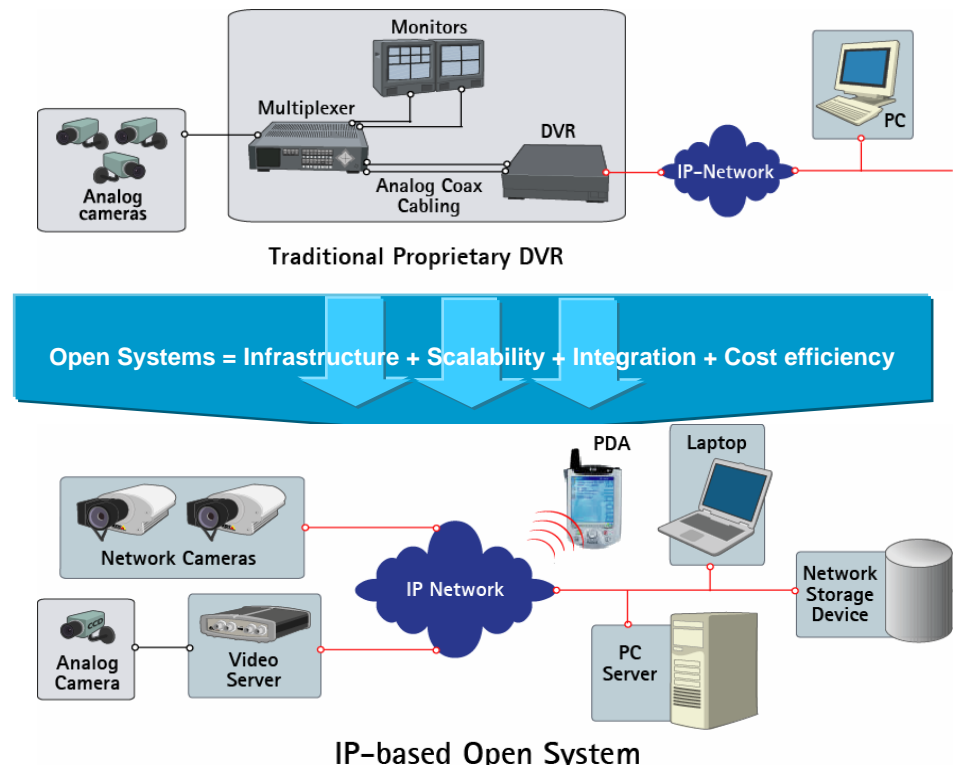
Take advantage of the future today

There is a good reason every one of the megatrends mentioned here involve IP technology. IP video surveillance is the technology of today and tomorrow. Now is the time to invest in it for the extra business value and the capabilities this technology provides and promises for the future. These include further advances in video analytics, camera intelligence, wireless technologies, mesh networking, IP network cameras, video surveillance management software, and network storage. All are going to continue to improve in price/performance and expand the ways video surveillance can be used by an organization.

It simply does not make sense to invest in a sunset technology such as analog video surveillance when all the innovation and energy is directed at a superior technology offering greater business benefits. Thinking of it on a purely personal level, what kind of camera would you buy today — film or digital?

Many organizations with large investments in analog video surveillance can begin to reap the benefits of IP video surveillance by turning their systems into hybrid solutions that digitize analog feeds. The ability of IP video surveillance management systems such as Milestone Systems' XProtect to integrate digitized video from analog cameras with digital camera data enables you to manage all your surveillance operations with a single solution.

Reaping the benefits of IP-based video surveillance by making the transition to a hybrid system.

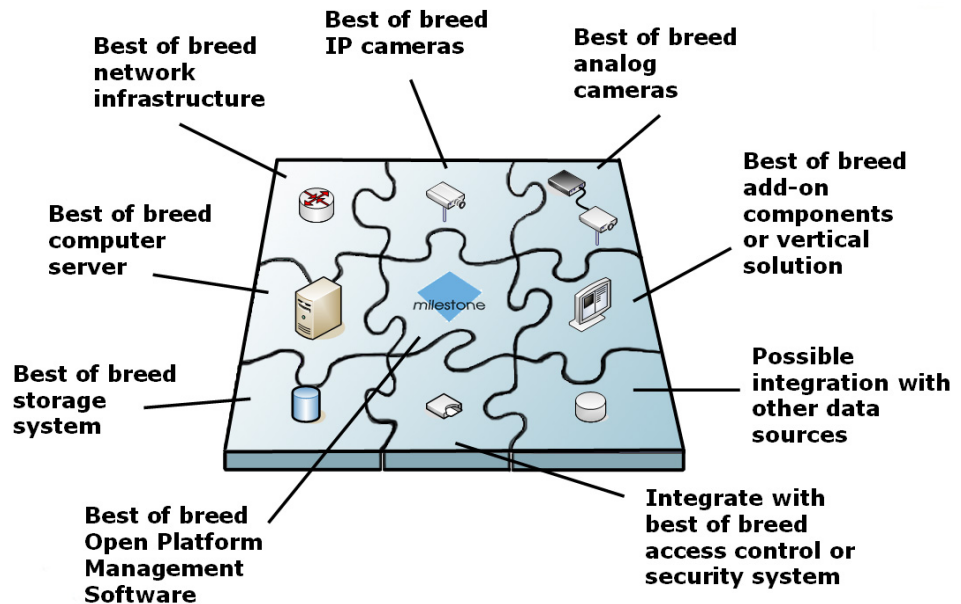


Milestone Systems

Market leader. Milestone Systems is the global market leader in open platform IP video management software. Milestone's XProtect products operate as the core of your surveillance systems: connecting, sharing and managing all devices through a single interface that is easy to learn and operate.

Easy to use. The XProtect platform is easy to use, proven in operation and scales to support unlimited devices. XProtect products support the widest choice of network video hardware and are designed with an Application Programming Interface (API) that integrates seamlessly with other manufacturers' systems.

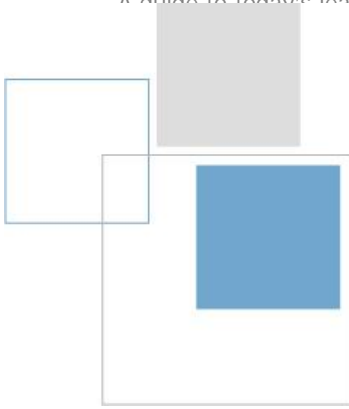
Best-of-breed. Using XProtect, you can build scalable, "best of breed" solutions to video enable your business, reduce cost, optimize processes, protect assets and ultimately increase value in your company's products and services.



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Milestone is the global market leader for open platform IP video management software. Our XProtect™ platform is easy to use, robust and proven in operation at 25,000 customer installations around the world.

With support for the industry's widest choice in network hardware and seamless integration with other systems, the XProtect range gives you best-of-breed solutions to video enable your business, reduce costs, optimize processes, protect assets and ultimately increase value in your company's products and services.

Milestone solutions are sold through authorized partners in 63 countries.

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