

## Wireless IP Surveillance

### Introduction

Today's heightened requirements for security, public safety, and crime prevention have created an unprecedented worldwide demand for cost-effective, flexible, and reliable video surveillance systems.

This paper introduces the benefits of using wireless technology based on Internet Protocol (IP) for video surveillance.

We begin by describing the benefits of IP-based networking compared to traditional Closed Circuit TV (CCTV) technology, and the benefits of wireless networking. We point out that by combining IP and wireless technologies for their video surveillance solutions, companies and organizations can realize the benefits of both. We go on to introduce some of the important technical aspects of surveillance technology, and describe the main challenges involved in delivering surveillance services—challenges that have been addressed by EION's own wireless surveillance solutions. Next, we describe the opportunities created by the new technologies for enterprises and security companies. Finally, we describe how EION, a leader in wireless IP-based networking, is spearheading the movement to wireless IP surveillance with innovative solutions based on their best-of-breed wireless networking products.

#### Advantages of wireless IP video surveillance:

- Less expensive than wired solutions
- Can use existing IP network for video surveillance
- Can be used to monitor remote locations
- Can be set up, reconfigured, expanded or disassembled quickly to add video surveillance to special events
- Video images can be transmitted over secure Internet connection or private IP network for little or no cost.
- Scalable—can be expanded at little cost without having to lay wire or cable
- Can be integrated with solutions that provide surveillance in high-speed mobile environments (commuter trains, buses)

### Wireless IP Surveillance—the Benefits of Both IP Networking *and* Wireless

The trend toward using IP networks for surveillance purposes is part of a larger drive to move more and more types of services (video, voice over IP, in addition to data services) to IP. By now, the benefits of IP-based networking are probably familiar:

- Earlier technical challenges regarding quality of service, throughput, and processing performance have been addressed, making IP a sound alternative to traditional analog and privately owned or controlled communication mediums.
- Transmitting video, data, and voice messages over the Internet or a Virtual Private Network (VPN) costs much less than traditional alternatives, allowing enterprises to reduce their telecommunications costs, and service providers to add more subscribers and deliver more diverse services for a relatively low rate.

The benefits of wireless communications are also widely recognized:

- Wireless networking has allowed many companies, organizations, and even countries to make Internet access, as well as applications such as telephony widely available to both urban and remote rural areas without assuming the expense involved in laying cable lines or copper wires.
- Wireless technology has advanced to the point where the quality of the services delivered over wireless networks is equivalent to that of wired alternatives.

Now wireless technology can be combined with IP-based networking to deliver advanced data, video, and voice services wirelessly, simultaneously achieving the benefits of both IP and wireless technology. In addition, this powerful convergence of wireless and IP is revolutionizing surveillance services as well—making cost-effective new solutions available for users and providers of video surveillance.

## What is Wireless IP Surveillance?

IP surveillance can be contrasted with the CCTV systems that dominated the electronic monitoring and surveillance markets for many years. CCTV systems rely on analog video cameras connected with cables to TV monitors and (if recording and storing the images is required) video recording devices. By contrast, wireless IP Surveillance involves connecting video equipment to devices that transmit the video signals across a wireless connection to an IP network. From there, the signals can be transmitted securely as far as the network extends—across a small local LAN or over the Internet.

Such systems generally include five elements:

- Network Video Camera— analog camera with a digital encoder, or digital video camera with an Ethernet port
- Subscriber Unit—a small device located on the premises that transmits wireless signals to an access point device usually located offsite
- Access Point—relays video signals to other network locations
- Digital Recording Device—PC or server used to store video images
- IP Network—the Internet, intranet, or VPN

Many different types of implementation are possible. In a simple example (Figure 1), cameras capture the video images in a digital format that is suitable for transmission over the IP network. In this example, the cameras are used to perform surveillance on a remote oil pipeline and an oil well belonging to a company whose head office is located in a remote city. The cameras transmit the images via short-range wireless connection such as Bluetooth to a

subscriber unit located near the monitored facility. The subscriber units then transmit the images to an access point device. The access point device relays the images over the Internet to a control centre at the head office of the organization. The images are then monitored and stored on a server.

## Benefits

### Reduced Cost Compared to Both Traditional CCTV and Wired IP Solutions

Wireless IP Surveillance is less expensive to implement than traditional closed-circuit TV. With traditional CCTV, organizations had to add an expensive network of cable and hardware on their premises to connect the cameras to a control centre on the premises. In addition, connecting them to a remote offsite control centre is even more expensive. With wireless IP surveillance, organizations can leverage their existing IP networks by connecting the network cameras and monitoring and recording apparatus to them.

Wireless IP surveillance is also more cost-effective than surveillance systems that depend on wired IP, particularly in situations where wired IP infrastructure is lacking, such as in new facilities or on temporary outdoor sites.

### Remote Locations

Since wireless IP surveillance can use the Internet as the medium through which to transmit the video images, the control centre can monitor and record video images from any site within reach of wireless IP access—almost anywhere.

### Quick Setup

Surveillance systems that depend on cables or wires can take a long time to implement, often requiring special

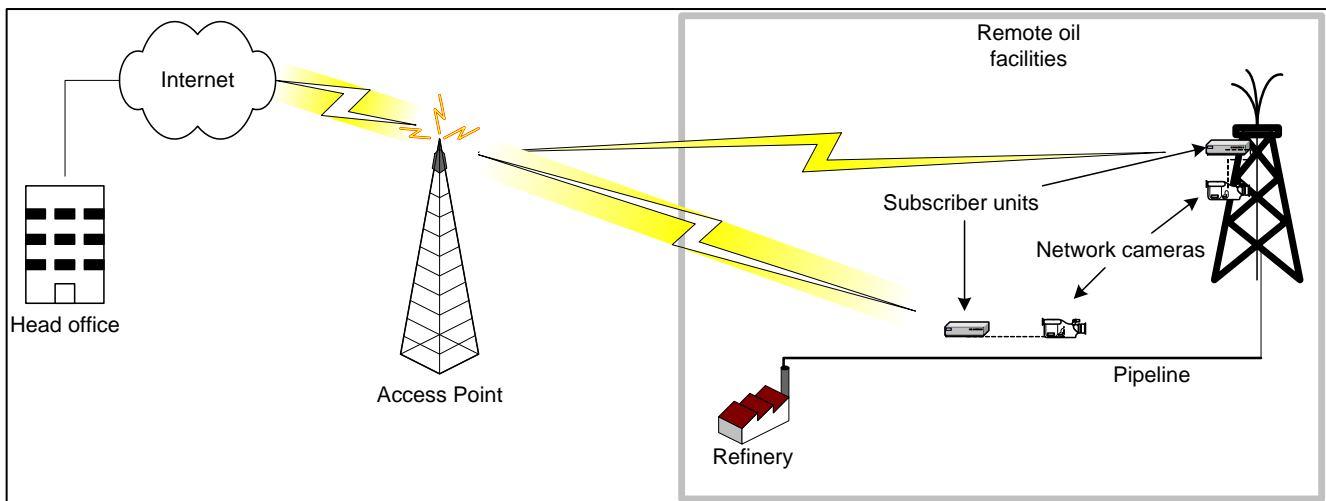


Figure 1: A Wireless IP Surveillance of Remote Oil Facilities

permits or municipal council approvals to dig, lay cable, rewire buildings, and so on. Laying wire in rural, environmentally sensitive areas usually requires approval from environmental agencies and government bodies at the national level. In addition to the time it takes to obtain approvals, the actual digging and laying takes still more time. In fact, installing a line leased from an incumbent Telco typically takes six to eight weeks.

By contrast, wireless installations can often be done in a day. Setting up a wireless network is simply a matter of installing and configuring individual hardware devices on the premises to be monitored and (if needed) in selected locations in the surrounding area. Permissions may be required to install some wireless devices, but because wireless technology is so much less disruptive than the wired alternatives, permissions are much easier and faster to obtain.

Wireless technology also makes it possible to conduct surveillance in settings where it would otherwise be impossible or extremely impractical to do so. For example, its speedy setup makes wireless ideal for surveillance solutions that can be used to monitor special events—often located outdoors or in venues that lack existing surveillance infrastructure. Wireless IP surveillance equipment can be set up quickly on site, and connections established to an IP network permitting video images to be transmitted to a remote command centre. After the event, the surveillance network can be moved to another site, repurposed for a permanent installation, or removed if necessary.

### Secure Transmission

Like data transmitted over the Internet, video images transmitted over an IP network can be rendered secure using advanced encryption/decryption methods.

### Scalable

Wireless IP surveillance systems can be expanded easily without having to lay cable or copper wire.

### Surveillance in High-speed Mobile Environments

Wireless IP surveillance systems can be integrated with advanced surveillance systems designed for high-speed mobile environments such as on transit systems—allowing the overall system to cover both fixed locations like train stations and bus stops, as well as on the transit vehicles. In addition, because the underlying communications medium is based on IP, much of the equipment used for the surveillance system can also be used to deliver advanced value-added services to transit system users.

## Markets

Wireless IP Surveillance can be effectively applied in the following applications:

- Traffic monitoring
- Oil and gas
- Homeland security
- Forest industry
- Roads, bridges, dams
- Military installations
- Office buildings
- Water management
- Public safety
- Perimeter, border security
- Schools
- Special events

## Selecting Vendors

Selecting the right wireless technology vendor is critical. To take full advantage of the best innovations in wireless IP networking, service providers should select a vendor with as much expertise as possible with the technology—that is, with a long-term record of accomplishment of resolving technical issues around the wireless transmission of multimedia services like video over IP.

## Assessment Criteria

When evaluating candidate wireless IP surveillance solutions, organizations should consider the following factors:

**Radio Interference**—The growing number of wireless connections using the same frequencies within unlicensed bands increases risk of radio interference. In a surveillance application, interference must be kept to a minimum. Customers should seek vendors with technology that minimizes interference.

**Range**—Hardware with longer ranges helps further reduce the cost of the system by reducing the number of access point devices that must be used for a given geographical area.

**Reliability**—The reliability of a communications system is typically defined in terms of the percentage of uptime one can expect the system to provide over a one-year period. The current industry standard is 99.999 per cent uptime over the course of a year, which is equivalent to approximately five minutes of downtime. Customers should seek solutions that meet or exceed this standard.

**Weather Resistance**—IP surveillance solutions typically involve using hardware stationed outside. The components should be designed to withstand the rigours of exposure to inclement weather without requiring the construction of additional enclosures to protect equipment (which is expensive and makes a solution impractical for surveillance of special events).

**Capacity**—Capacity refers to the amount of video data an access point device can process without disruption. The greater the capacity of each device, the fewer devices will need to be deployed, reducing the ultimate cost of the system. Customers should seek a solution that relies on high-capacity access point devices.

## The Leader in Wireless IP Surveillance

Key Advantages of EION Wireless IP Surveillance:

- Cost-effective alternative to traditional CCTV surveillance systems
- Allows mix of video, voice, and data traffic on one network
- Flexible, engineered solution means reduced effort and risk for the customer
- Easy integration with existing IP infrastructure
- Protects investment in current and legacy equipment
- Available from EION Wireless, a vendor with over 10 years of wireless and IP intelligence experience
- Based on EION’s reliable, project-proven Ultima 3, VIP 110-24 and Libra families of wireless networking products

At EION, we’ve been perfecting solutions for wireless IP challenges for a long time. EION has become a recognized industry leader for reliable cutting-edge solutions using emerging technologies like WiMAX and wireless VoIP.

## Simple, Reliable, and Cost-effective Wireless IP Surveillance Solutions

EION’s equipment can be used to create efficient and reliable wireless IP surveillance solutions without the complex multiple-box configurations required by competing systems. Our solutions can be used for a broad range of networking needs—from small point-to-point corporate networks to large point-to-multipoint systems operated by major carriers. And all of them are capable of delivering surveillance over IP with reliability and performance that meets or exceeds comparable wired systems, for a much lower cost. EION’s solutions are based on the VIP, Ultima, and the Libra family of products—products that were designed with demanding applications like video over IP and other multimedia applications in mind. A table in the appendix compares EION’s product lines, and indicates the surveillance situations to which each product line is best suited.

## A Record of Successful Wireless IP

Feature	Benefits
Maximum reliability: products with 99.999 per cent uptime—reliability numbers that meet or exceed the industry standard	Critical for ultra time-sensitive surveillance applications.
Largest range in industry—up to 70 kilometres in point-to-point systems and 38 kilometres in point-to-multipoint applications	Substantially lowers the costs of an IP surveillance system.
Weather Resistant Form Factors	EION’s product lines, including the VIP, Ultima and Libra are designed for all weather environments and require no additional outdoor protective enclosures. Our products are designed to perform well in both frigid arctic conditions and hot desert environments, and everything in between.
Orthogonal Frequency Division Multiplexing (W-OFDM) to resist interference	Increases spectral efficiency and maximizes resistance to multi-path interference leading to better performance in non-line-of-sight (NLOS) conditions.
Multi-code Direct-Sequence Spread Spectrum (MC-DSSS) to resist interference	Increases spectral efficiency and makes signals stronger at the receiving end than surrounding white noise. Mature, robust, and cost-effective technology.
Allows mix of video and data traffic on IP network	Reduces overall cost of ownership—both video and data can be transmitted using only one network.
Combines benefits of wireless networking and IP	Allows for both relatively easy and inexpensive network expansion and the cost savings associated with IP.
High packet-per-second processing performance	Reduces latency and maximizes the number of simultaneous video transmissions an access point device or subscriber unit can handle.
Includes built-in "traffic prioritization" for QoS (Quality of Service)	Time-sensitive video packets are given priority over other data packets—critical for effective video over IP applications.
Low latency	Makes products effective for time-sensitive applications like video and voice traffic.
Products designed for large, mid-sized, and small applications	Customers can select the right solution for their needs and budget.
Provides flexible, engineered solution	Reduces risk and effort for the customer.
Provides high capacity	Our radios can deliver up to 24 Mbps effective throughput, which can easily support multiple video streams.
Simpler than competing solutions	Reduces costs of implementation and maintenance.

## Surveillance Projects

With successful wireless IP networks deployed around the globe, including the United States, Europe, India, China, South Africa, and many other locations, our experienced engineering teams know what works—and what doesn't. When we encounter a unique challenge, chances are good that we've seen it before and know what needs to be done to address it. Our list of successful surveillance or monitoring implementations includes applications for traffic monitoring in Detroit, Calgary, as well as flood management in China.

### VIP 110-24 delivers a Low-cost Wireless IP Surveillance Solution—the Swindon Council Surveillance System

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A municipal council, in England, was faced with the problem of needing to implement an improved and expanded Closed Circuit Television [CCTV] operation.

With traditional cabled solutions, the key issues facing Swindon Council were the high costs of installation and high on-going annual CCTV leased line charges. Leased line charges were eating into over £30,000 of Swindon Council's annual budget and set to rocket with the increased demands for public security.

Swindon Council consulted Initial Electronic Security (part of Rentokil Initial Plc), and 802 Distribution (a value-added specialist in the UK wireless security and IP CCTV marketplace) on how to meet the growing demands for security while containing costs. Based on these consultations, Swindon Council decided to introduce wireless technology for a complete, high-performance, secure, wireless IP-based CCTV solution, which completely removes on-going leased line charges.

Swindon Council set up five new wireless IP CCTV sites covering a home for the elderly, hostels and shopping areas and will be migrating their existing leased line CCTV sites to an EION wireless solution. They chose EION VIP technology, with its own patented protocols and chip sets to create an inherently secure network. The EION solution also met the project's criteria for modular expansion and fast, simple deployment.

There are currently an estimated 300,000 cameras covering shopping areas, housing estates, roads, car parks, hospitals, and public facilities, with most British towns and cities facing increased CCTV surveillance requirements.

With CCTV becoming an integral part of crime control policy and community consciousness, promoted by both police and politicians, Initial Electronic Security anticipates high interest from local governments around the UK.

## Ultima 3 Keeps Traffic Moving During a Construction Project

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Interstate-496 (I-496) is a nine-mile stretch of freeway that moves approximately 66,000 vehicles a day. In April 2001, the Michigan Department of Transportation (MDOT) began a five-month project to repair and rehabilitate I-496 that runs through the city of Lansing, Michigan. Throughout this significant highway construction project, the MDOT was committed to moving motorists efficiently and with the least possible inconvenience. AVD Technologies (AVD), a Michigan-based audio, video and data integration company, was contracted to erect and monitor 17 cameras and 22 radar detectors at various locations along the I-496 freeway, and to construct a large deployment of unlicensed frequency in a big city by using a multipoint wireless product. The cameras were to provide broadcast quality, streaming video to monitor congestion and provide the city's motorists with up-to-the-minute updates on problem spots and alternative routes off of the freeway.

To accomplish its task, AVD needed a multipoint wireless product that could supply the bandwidth necessary for the broadcast quality video that AVD was contracted to provide. The Ultima 3 satisfied these needs perfectly. It would ensure that the necessary quality, bandwidth, and multipoint capabilities were available for the MDOT to meet its communications needs throughout the I-496 rehabilitation.

The project used the 2.4 GHz version of the Ultima 3: 26 AWE 120-24 advanced wireless Ethernet bridges and ten 22-24 advanced wireless Ethernet bridges. The bridges were placed at various locations along I-496, providing dedicated wireless links to the cameras. The Ultima 3 proved to be a cost effective solution that was fast and easy to configure, and EION's reliable technical support made the setup painless. Now streaming video, supplying 'real-time' images and updates, are transmitted to a central monitoring room where AVD observes congestion and reports it to the MDOT. Due to the capabilities of EION products, there are places in the network where a single base is receiving signals from multiple remote camera locations. The MDOT uses this information on portable message signs that instantly update motorists on upcoming congestion, and alternate routes they can take to avoid it.

EION's innovative wireless solution enabled the MDOT to warn motorists of traffic problems and notify them of alternative routes—easing the motorists' headaches, and helping to keep traffic moving efficiently and safely.

## EION's Commitment to Wireless IP Surveillance

At EION, we've recognized the substantial opportunities wireless IP surveillance represents for both enterprises and surveillance solution providers. We're committed to helping enterprises realize the cost savings achievable through wireless, and to helping surveillance solution providers leverage this technology to begin delivering advanced wireless solutions to their customers.

We produced the first commercially available video surveillance product for use in mobile environments, which are among the most challenging environments for surveillance applications.

We have solutions for surveillance challenges of every size and type. Whether you need the high capacity offered by our Libra product family, the unsurpassed range of Ultima 3, or a highly effective low-cost solution made achievable with VIP 110-24, we have the answers to your video surveillance needs.

All of our solutions are based on the most reliable, field-tested backhaul products available, and all of them are ideally suited to wireless IP surveillance—with rugged designs that allow fast, low-cost setup and dependable service in even the harshest outdoor environments.

And we're committed to further development of industry-leading wireless IP surveillance solutions. Enabling our customers to deliver, video, voice, and other advanced applications over wireless networks in cost effective ways is the cornerstone of our business.



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## Appendix A: IP Video Surveillance Radio Characteristics

	VIP 110-24	Ultima3	LibraPlus
Surveillance applications best for...	Harsh environments	Rural settings, applications requiring extended range	Multi-camera backbone links, special events, applications requiring superior throughput and capacity
Advantages	Cost-effective, dependable solution	Superior range, ruggedness, robustness, and solid performance	Highest throughput and capacity and rapid deployment
Throughput (raw/effective)	11 / 8 Mbps	12 / 10 Mbps	Up to 45 Mbps
Maximum range	Up to 60 km (37 miles) point to point, 22 km (14 miles) point to multipoint	75 km (45 miles) point to point, 38 km (24 miles) point to multipoint	50 km (32 miles) point to point
Frequencies	2.40 - 2.50 GHz	5.725 to 5.850 GHz	5.15 to 5.85 GHz
Weather resistance	Yes	Yes	Yes
Number of subscriber units supported	100	1000	1000
Technology	MC-DSSS	MC-DSSS	OFDM
Security	Data scrambling: Data security password: network attachment is password protected Configuration security: password protected	Data scrambling: user configurable up to 4 x 10 <sup>9</sup> Data security password: 20 byte security password (>1048 combinations) Configuration security: password protected	WPA, WPA-EAP (TKIP AES), WEP (64, 128, 154) MPPE