alvarion®
Your Open WiMAX Choice

Wireless Video Surveillance

Opening the Door to the Endless Possibilities and Bringing Surveillance into the Wireless Age

White Paper

WiMAX FORUM
FOUNDING MEMBER

Surveillance Enters the Digital Age

Today, public and urban business organizations have sophisticated geographically dispersed infrastructures which require centralized supervision and the deployment of global security and surveillance networks. Furthermore, as the world becomes more responsive to the subject of security, the market and demand for multi-site surveillance solutions meeting the most rigorous, video-based security standards is growing. One of the most recent challenges the security professionals are facing is the deployment of viable, cost effective security network infrastructures over multiple remote sites.

In recent years, the video surveillance industry has taken giant steps towards infrastructure digitization. This trend continues because digitization enables them to replace the limited capacity and capabilities of analog transmission networks with the innumerable opportunities provided by IP networks. In particular, IP-based systems offer easy integration and interoperability with a multitude of other systems, enabling the development of a range of innovative telecom infrastructures.

IP-based surveillance systems offer much more than simple visual supervision, starting from a single centralized computer, they offer a range of benefits, which include:

- Real-time management and simultaneous surveillance of individuals and merchandise at multiple sites
- Top quality recording of sound and images
- Control of alarm systems

Such IP-based systems require an appropriate broadband network infrastructure. Today, there are a number of different options to obtain the necessary broadband access. This includes wireless broadband, which in many cases offers an excellent solution to bridge the digital divide in areas lacking a wired infrastructure, as well as an alternative to DSL.

The Wireless Alternative: A World of Possibilities

The majority of wired infrastructures, like copper, were deployed long before the arrival of the Internet revolution. DSL technologies can be used with such an infrastructure, however, there are various constraints, such as the availability of DSLAMs, the ability to reach sites remotely located from DSLAMs, and the type of data that can be transmitted. Furthermore, most of the technology's function is in the asymmetric mode, favoring a descending flow.

More recently, some organizations have deployed fiber optic infrastructures. However, such deployments are very expensive and require extensive administrative and technical procedures.

The availability of wireless broadband technologies (wireless local loop) offers an interesting alternative, enabling deployment of broadband communications networks when wired technologies and infrastructures are either unavailable or cannot provide the required performance. Such networks can also be deployed as a complement to existing wired networks, extending coverage and/or capacity and offering new possibilities for modularity and mobility.

Wireless IP for Surveillance Applications

Since wireless broadband access became available, IP radio network technologies have been evolving to provide more bandwidth, more reach and more security – all critical parameters for video surveillance applications. Furthermore, the integration of sophisticated encryption techniques has facilitated the use of wireless technologies for sensitive military and other equivalent applications.

In urban video surveillance applications, it is now possible to quickly and cost-effectively deploy networks of CCTV cameras in a range of areas, such as public places, commercial centers and industrial zones, in order to ensure security. The advantage of such networks is that they can be deployed very quickly on affordable budgets, reducing operational costs.

For markets such as public transport or public security, wireless broadband opens the way to 24/7 surveillance functionality, which is inaccessible to most advanced wired infrastructures. Wireless networks allow patrol vehicles to remotely share bidirectional videos, audio transmissions and other types of data with colleagues or management systems located in a single Security Center. Moreover, the same infrastructure can be used for Internet access, utilizing of the VLAN's feature.

The Economic Motivation – Cost Reduction

Fiber, copper and cable require a significant upfront investment. The CAPEX required for radio equipment is much more economical, as it is directly related to current needs. Radio access networks are modular and can be deployed very quickly. Consequently, wireless guarantees considerable savings in comparison to the deployment of new wired networks, and a return on investment is considerably quicker, particularly when taking into account the recurring costs of leased lines or SDSL links.

Which Wireless Technology?

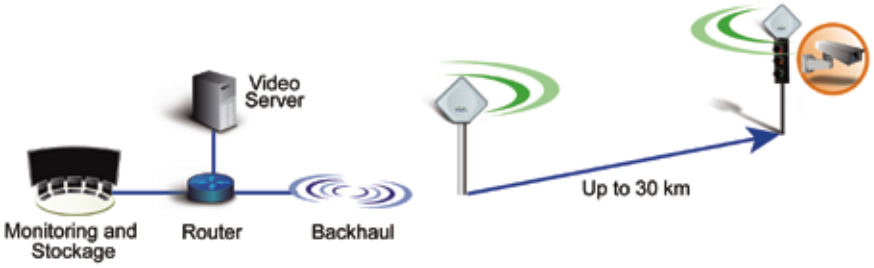
There are a number of wireless technologies in the market today giving the feeling that wireless can make anything possible. This can lead to some confusion for the end user. Specific user precautions and architecture rules need to be considered. The table below summarizes some of the wireless technologies available for ETSI environments; their characteristics and possible suitability for use in urban video surveillance.

	Wireless Technology			
Topology	Wi-Fi (b/g) PTP & PtMP	Wi-Fi (a) PTP & PtMP	WiMAX PtMP only	HiPerLan PTP & PtMP
Frequency band	2.4 GHz	5.x GHz	3.5 GHz	5.x GHz
Modulation	DSSS / OFDM	OFDM	OFDM	OFDM
Interference sensitivity	Strong (3 channels only)	Medium (11 channels)	Low (dedicated frequency)	Low (11 channels)
LOS	Mandatory	Preferable	No	No
Maximum throughput	7 Mbps (b)	20 Mbps (g)	25 Mbps	25 Mbps
Maximum range in LOS conditions	Several hundred m	<5 km	>20 km	PTP: >20 km PtMP: <10 km
Uplink CIR	No	No	Yes	Yes
Quality of service	No	Limited	Yes	Yes
Comments	No QoS. Weak security. Not adapted to video surveillance.	No QoS. Medium security. Small deployments only.	Telecom operator technology using licensed frequencies reserved for telecom uses	License-exempt WiMAX. Total suitability to the demands of video surveillance.

Available Wireless Topologies

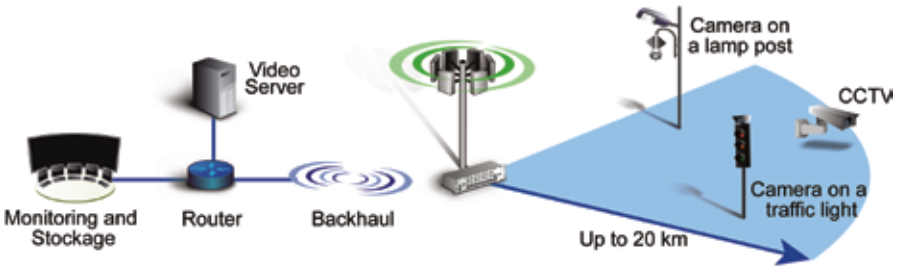
Wireless communications networks use radio modems mounted on public or private buildings, water towers, poles or any other elevated structure in order to optimize transmissions. Area coverage uses **point-to-point (PTP)** and **point-to-multipoint (PTMP)** links, depending on the topology and the required architecture. Coverage can reach several kilometers (up to 30 km and more for a high capacity PTP link) and serve any type of public or private client.

PTP topologies only permit communications between two points. This topology is used either for connecting a single remote camera or for transmitting the flow of a pool of cameras to a remote security PC.



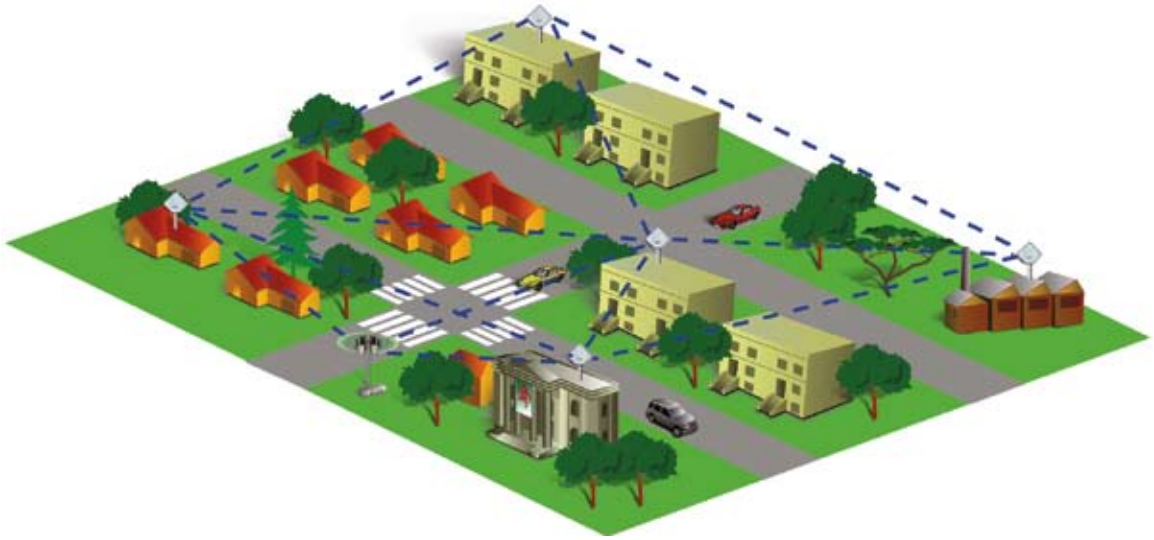
Typical PTP Configuration

PtMP topologies consist of a central base station which concentrates the flow of multiple cameras on remote sites located at a distance from each other. They involve a modular infrastructure – which can evolve according to needs - in terms of capacity and coverage. Remote points can be added as required.



Typical PtMP Configuration

Mesh networks are another wireless topology. These networks are extremely attractive for mobility applications. Mesh networks are not suitable for quality video signals, since quality of service (QoS) cannot be guaranteed in large networks.



Typical Mesh Network Configuration

In actuality all the different topologies mentioned above may be mixed, according to the video surveillance network configuration that will be deployed. In such cases, the project manager is responsible for defining the most appropriate architecture that will provide the best cost/performance ratio.

Suitability of Wireless Topologies to Video Surveillance Needs

The following table summarizes various scenarios for the deployment of a digital video surveillance network and recommended topologies:

Scenario	Recommended Topology	Comments
Connection of a single remote camera	Wireless PTP system	
Connection of a remote site (on which several cabled cameras are grouped)	Wireless PTP system, probably with high capacity	This scenario includes connection of wired cameras to a switch installed at the remote site and wireless transportation of all video flows to a control center located in another building.
Connection of cameras dispersed over an extended urban area	Wireless PtMP system -modular system allowing the installation of additional cameras	Rather than deploying one PTP link per camera, a simple PtMP system serves all the cameras, thus reducing the size of the central infrastructure and installation operations. This system may be completed by a local mesh network to economically reach cameras grouped over a reduced coverage area.
Deployment of several groups of cameras, with each group in a different area and/or direction in relation to the control station	Wireless PtMP system will concentrate the cameras distributed in each area, and a wireless PTP system will carry the flow from groups of cameras to the control station	The combination of two topologies allows a system with more available capacity to be built. It bypasses the possible dilemma of visibility between the cameras and the central site as part of a redundancy solution by overlapping the areas covered by the various PtMP base stations.

Alvarion's Portfolio of Wireless Products

Alvarion has specialized in wireless broadband network infrastructures for more than fifteen years, and is currently a world leader in this market. The company has developed a complete portfolio of products which offer solutions for market, operational and regulatory demands.

Security applications require a high level of reliability, therefore making Alvarion the natural choice for deploying a wireless infrastructure. Using WiMAX and HiPerLan technologies, Alvarion products are designed to work under the harshest environmental conditions. Additionally, Alvarion products are able to overcome the interference problems typically encountered in urban and industrial areas, and facilitate highly secure wireless networks which are particularly suitable for security and protection applications.

The extensive range of Alvarion PTP, PtMP and Local Mesh applications give end users the opportunity to select the best price/performance solution, without having to make any sacrifices on the modularity, security or reliability of their network.

Advice and Assistance

Alvarion offers more than just top performance products, they also provide Certified Partners with a complete professional consultant service for designing and validating the most suitable wireless network architecture. This customized service guarantees the highly competitive offers.

Building a Wireless Video Surveillance Network with Alvarion

As noted above, two types of wireless topologies can be combined or used independently to build different digital CCTV network configurations. The following table presents a number of possible scenarios and the Alvarion solution to meet the customer needs:

Requirement	Recommended Alvarion product	Advantages	Comments
Connection of a single remote camera	BreezeNET® B10/14 (5 GHz, PTP)	1. Immunity to interference 2. Capacity 5/7 Mbps 3. Secure transmission	Uses OFDM technology; robust and efficient in urban environments.
Connection of a remote site (in which several cabled cameras are grouped)	BreezeNET® B14/28/100 (5 GHz, PTP)	1. Extended capability 2. Operational without visibility 3. High capacity (7-70 Mbps) 4. Product evolves through software updates	Uses OFDM technology; robust and efficient in urban environments, where visibility is not always guaranteed. Good entry cost, with evolution of capacity in two phases through acquisition of software license.
Connection of cameras dispersed over an extended urban area	BreezeACCESS® VL (5 GHz, PTMP), with possible addition of BreezeACCESS Wi^2 (Wi-Fi local mesh)	1. Extended coverage 2. Operational without visibility 3. High capacity (up to 25 Mbps) 4. Modular and evolving configuration	High capacity enabling several cameras in the same coverage sector. Uses OFDM technology; robust and efficient in urban environments, where visibility is not always guaranteed.
Deployment of several groups of cameras, with each group in a different area and/or direction in relation to the control station	Combination of BreezeACCESS® VL and BreezeNET® B28/B100	1. Extensive portfolio of products permitting construction of the most economical - made to measure solution 2. Use of public domain frequencies	

Characteristics of Wireless Tools for Urban Video Surveillance

Equipment intended for external installation must meet the following conditions:

- Operational temperature range must be between -40 to +55°C
- Resistance to bad weather and surrounding environment: insulation class IP67
- Integrated surge protection
- AC/DC power supply, CAT5 cable between ODU (Outdoor Unit) and IDU (Indoor Unit)
- Integrated radio alignment tools

Wireless Characteristics and Specifications

The equipment for deployment in urban environments should be resistant to electromagnetic interference, while remaining license free. Consequently, the preferred frequency band is 5.4 GHz, as the 2.4 GHz band is highly congested by innumerable Wi-Fi devices – irrespective of whether they are autonomous, professional or integrated into residential ADSL boxes. Moreover, the wireless characteristics must permit easy installation, regardless of the visibility conditions between the cameras and their focus points.

- Wireless and Modem
  - Frequency: 5.470-5.725 GHz
  - Channel size:
  - Standard: 20 MHz (11 available channels)
  - Optional: 10 MHz (for better spectrum management in a compact environment) and 40 MHz (for optimization of the PTP links)
  - Duplexing mode: TDD (Time Division Duplex)
  - Wireless access method: OFDM
  - Modulation: BPSK, QPSK, QAM16, QAM64 with two levels of code correction per level and automatic adaptation
  - Sensitivity (DBM): -71 for the highest modulation
  - Alignment and integrated diagnostics tools
  - Automatic channel detection
- OFDM modulation
- Access device for CSMA-CA medium with DCF mechanism
- Automatic adaptation of modulation level and rate of flow as a function of the environmental conditions, with 8 intermediate levels of modulation
- Processing capacity: 40,000 packets per second, irrespective of packet size
- Management of bandwidth by user and by direction (upward/downward link)
  - Guaranteed rate of flow: CIR
  - Maximum rate of flow: MIR
- Prioritization on the wireless link

- Ethernet broadcasts filtering
- Automatic transmission power control
- DFS feature compliant with ETSI EN 301 893 V1.3.1 standard (minimum)
- Wireless data rate: 54 Mbps at the highest modulation in PtMP, 108 Mbps in PTP
- Maximum FTP capacity: 40 Mbps per base station sector in PtMP, 70 Mbps in PTP
- Maximum data rate per user: 32 Mbps FTP
- Minimum guaranteed data rate: 2 Mbps in each direction
- Maximum range: 30 km in LOS conditions

Network Characteristics and Specifications

- VLAN support (802.1Q)
  - Trunk mode
  - Access mode
  - Hybrid mode
- QinQ VLAN support
- End-to-end prioritization
  - By VLAN (802.1P)
  - By IP ToS or DSCP (RFC791 or RFC2474) field
  - By UDP/TCP port
- VoIP support with entry control (including fast packet processing)
- Graceful degradation in case of congested sector
- Unused BW can be offered to other users on a best effort basis
- Multicast and IGMP support

Security

- WEP 128 and AES 128 encryption
- Support for FIPS 197 encryption
- Access control of administrative functions
- Protocol filtering (all, PPPoE only, IP only)
- MAC address filtering (authorized or denied lists)
- Blocking of remote Ethernet port

Administration

- Through Ethernet port or wireless link
- Telnet
- SNMP
- Fixed or DHCP addressing
- Remote modification and/or update of the configuration and/or the firmware
  - By unit
  - By lot
- Counters and statistics
  - Traffic statistics (Ethernet and wireless)
  - Traffic by modulation level
  - Indication of the quality of the wireless link

Installation Conditions

- External hardware
  - Temperature: -40°C to 55°C
  - Relative humidity: 5-95%
  - Protection: IP67

Conformance to Standards

- EMC FCC part 15 class B
- ETSI EN 489-1, EN 301-489
- Security UL 1950, EN 60950
- Lightning protection EN 61000-4-5
- Environment
  - ETS 300 019 part 2-3 class 3.2E for internal units
  - ETS 300 019 part 2-4 class 4.1E for external units
- Transportation ETS 300 019-2-2 class 2.3
- Storage: ETS 300 019-2-1 class 1.2E
- Radio FCC part 15, ETSI EN 301 753, ETSI EN 301 021, ETSI EN 301 893 (v1.3.1 August 2005)

Summary

Like many industries which depend on the ability to transfer data among multiple remote sites, digitized wireless networks offer the video surveillance market a number of important benefits:

- Transportation of high quality video and audio signals from remote cameras
- Real time sharing of data among all elements in the surveillance chain
- Real and indisputable alternative to traditional costly wired infrastructures
- Economical solution which integrates naturally into IP environments and offers flexibility and modularity

With more then 3 million units deployed in 150 countries, Alvarion is the world's premier supplier of wireless broadband solutions in PTP and PtMP networks. The company's modular product offering, pay-as-you-grow model and extensive professional consultant services make Alvarion the natural choice for organizations wishing to improve their security systems and benefit from the advantages of a complete and proven wireless broadband access system.

Headquarters

International Corporate Headquarters
Tel: +972.3.645.6262
Email: corporate-sales@alvarion.com

North America Headquarters
Tel: +1.650.314.2500
Email: n.america-sales@alvarion.com

Sales Contacts

Australia: anz-sales@alvarion.com
Brazil: brazil-sales@alvarion.com
Canada: canada-sales@alvarion.com
Caribbean: caribbean-sales@alvarion.com
China: cn-sales@alvarion.com
Czech Republic: czech-sales@alvarion.com
France: france-sales@alvarion.com
Germany: germany-sales@alvarion.com
Italy: italy-sales@alvarion.com
Ireland: uk-sales@alvarion.com
Japan: jp-sales@alvarion.com
Latin America: lasales@alvarion.com
Mexico: mexico-sales@alvarion.com
Nigeria: nigeria-sales@alvarion.com
Philippines: ph-sales@alvarion.com
Poland: poland-sales@alvarion.com
Portugal: sales-portugal@ alvarion.com
Romania: romania-sales@alvarion.com
Russia: info@alvarion.ru
Singapore: asean@alvarion.com
South Africa: africa-sales@alvarion.com
Spain: spain-sales@alvarion.com
U.K.: uk-sales@alvarion.com
Uruguay: uruguay-sales@alvarion.com

For the latest contact information
in your area, please visit:
www.alvarion.com/company/locations

alvarion®
Your Open WiMAX Choice

www.alvarion.com

215104 rev.a

About Alvarion

Alvarion is the largest WiMAX pure player, ensuring customer long-term success with fixed and mobile solutions for the full range of frequency bands. Based on its OPEN™ WiMAX strategy, the company offers superior wireless broadband infrastructure and an all-IP best-of-breed ecosystem in cooperation with its strategic partners. Alvarion has delivered over 200 commercial WiMAX deployments worldwide.