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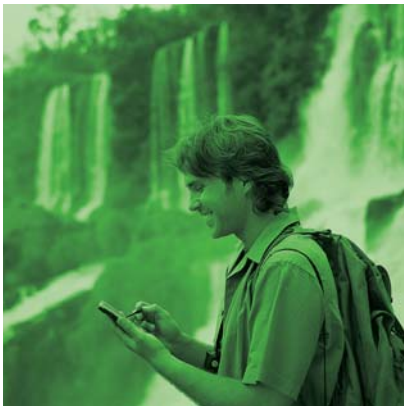

# Personal Broadband Now

## Alvarion's WiMAX / Wi-Fi Hybrid Solution

**Solution Paper**

**Personal BroadBand Now**
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## Introduction

"Broadband Everywhere" is starting to be demanded in many areas of the world. Universal broadband available anytime, anywhere is being driven by an increasingly mobile, connected workforce seeking business efficiencies and lifestyle improvements. And at the same time, more people than ever require access to ever greater amounts of information, easy communication and a wide variety of entertainment services, regardless of location.

To meet this demand for enhanced services delivered in an efficient, effective way, operators of all types are building advanced broadband networks to provide Personal Broadband services. With the deployment, growth and proliferation of such networks, ubiquitous broadband access will be a reality in just a few years.

Regardless of the technology used, high quality Personal Broadband networks are wireless and generally include the following capabilities:

- High speed mobility
- Broadband capacity
- Robust quality of service (QoS)
- Carrier class reliability
- Comprehensive, diversified services and applications

Alvarion has lead the broadband wireless industry since its inception over 10 years ago, and now has more than 200 WiMAX deployments worldwide making it the world leader in WiMAX.

More recently, Alvarion has offered WiMAX carriers and service providers a way to expand their WiMAX networks by leveraging the widespread and inexpensive availability of Wi-Fi components in order to offer Wi-Fi based services as well. This WiMAX – Wi-Fi combination is the start of Personal Broadband services and culminates in migration to full a WiMAX-based Personal Broadband solution as Mobile WiMAX networks become available.

## Mobile Applications and Services

From gaming, music, and youth-oriented applications to the ever-increasing need for city workers to be connected throughout their city, "anytime-anywhere" connection is rapidly become fundamental to today's work and lifestyles.

For example, enterprises and municipalities are constantly looking for ways to increase the performance of their outdoor and remote employees. It is becoming increasingly necessary for their employees to have updated information, so retrieving data in real time regardless of location is starting to be fundamental to the job. For example, certain information services companies with remote access are in a better position to provide enhanced services due to their customers due to having access to real-time data (such as information on available inventory).

Municipalities can improve community services and solve various problems throughout the city with better online information received from the scene of developing situations. Better connectivity in strategic locations can significantly improve the lifestyles of the city residents.

So being able to deliver Personal Broadband services to hand-held devices means that the highest quality of service must be supported by a robust technology designed to address these needs.

## Technology Overview

Wi-Fi, an industry standard based on IEEE 802.11 technology, is the most widely available broadband wireless access technology today. It enables high-speed, broadband services in homes, businesses, and hotspots such as hotels, airports, and even restaurants and cafes worldwide. Embedded Wi-Fi technology in consumer electronic products from notebook computers to PDAs, cell phones, and gaming devices has propelled worldwide sales of these devices.

To date, more than 3,200 different products have been certified with Wi-Fi capabilities. As a result, according to new data released by In-Stat and the Wi-Fi Alliance, WiFi chipset sales will exceed 200 million units in 2006. Further proliferation of Wi-Fi technology into cellphones and other consumer electronics will drive annual Wi-Fi chip sales to nearly $4 billion in 2009.

WiMAX, an industry standard based on IEEE 802.16 technology, is a follow on technology to Wi-Fi providing longer range broadband wireless solutions with QoS. WiMAX can deliver both fixed and mobile broadband services city-wide.

According to a report by Infonetics, fixed WiMAX equipment sales increased substantially to $173.53 million in the third quarter 2006. And upon migration to Mobile WiMAX, expected during 2008, worldwide equipment revenues for WiMAX are forecasted to reach $3.26 billion by 2009.

Combining the two technologies creates a powerful, cost effective solution by leveraging the widespread availability and cheapness of end-user devices of Wi-Fi technology with the greater bandwidth, coverage, and robustness of WiMAX technology. The result is a converged network answering public and private sector needs for public Internet access, traffic management, video surveillance, homeland security, and various nomadic applications.

So operators and service providers already deploying WiMAX today can now extend their service offerings to include Personal Broadband services over Wi-Fi in order to generate an immediate increase in revenues.

## Alvarion's WiMAX / Wi-Fi Hybrid Solution

Alvarion's WiMAX / Wi-Fi hybrid system combines a fully ruggedized outdoor Wi-Fi access point to offer personal broadband services, together with a WiMAX CPE for backhaul.

The Wi-Fi access points create 'hotspots' providing broadband mobile services to all standard 802.11 b/g end-user devices such as laptops, PDAs, smart-phones, and other consumer electronics.

The integrated WiMAX CPE backhauls the traffic from the Wi-Fi hotspots providing broadband services for business and residences in the 2 and 3 GHz bands (for 5GHz bands, a pre-WiMAX CPE is used).

In addition, direct access can be offered using both indoor and outdoor WiMAX CPEs including high performance services such as VoIP and even private network Wi-Fi (again in the 5 GHz bands, a pre-WiMAX CPE is used).

The result is a comprehensive solution offering high capacity and secured connections to both fixed and mobile subscribers, including support for rich functionality such as QoS, VLANs, and enhanced security protocols such as 802.11i and 802.1x. The WiMAX system guarantees performance and QoS by using advanced bandwidth control and other QoS mechanisms, facilitating true 'Quality of Experience' for the end user.

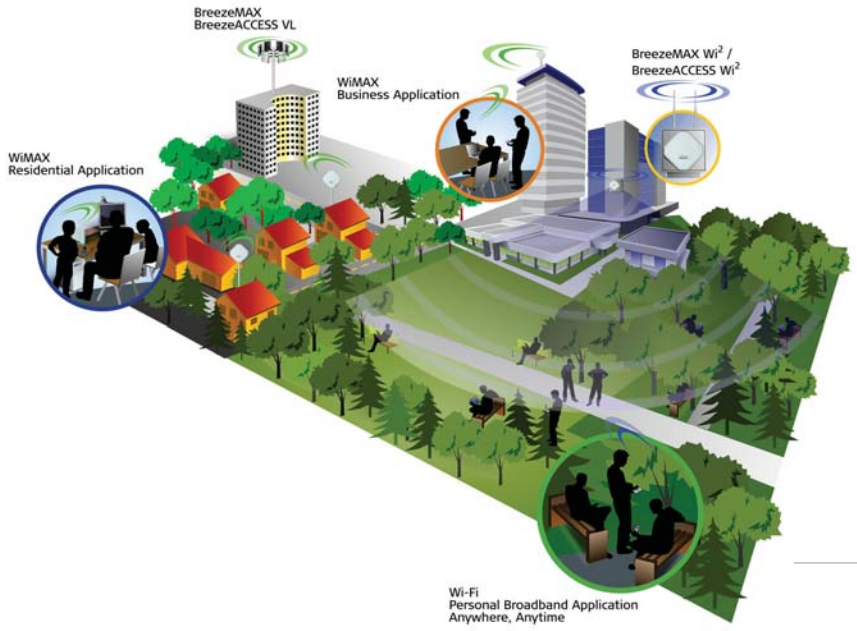


**Figure 1:** Access Everywhere

## Benefits

The immediate availability of spectrum, infrastructure, and end-user equipment for Wi-Fi are key factors in speeding new services to market and gaining quick additional revenues. And using WiMAX to expand network coverage means being able to offer nomadic, portable and mobile services from a single network resulting in several substantial advantages:

- **Diversified service offerings** using a variety of CPE types in both indoor and outdoor deployments
- **Immediate deployment readiness** with standard based, mature, and widespread technology
- **Significant installation and operations savings** with a converged network for fixed and mobile users using mature and readily available systems and products
- **Easy network expansion** for current WiMAX carriers boosting revenues by adding Wi-Fi hotzones to attract Personal Broadband users
- **Migration to future technologies** as 802.16e Mobile WiMAX solutions become available

Providing "broadband everywhere", a WiMAX / Wi-Fi converged network solution supports numerous immediate and diversified application types such as:

- **Enabling users to 'be connected anytime, anywhere'** for secure access services for businesses and the public sector with portable / mobile devices such as laptops, PDAs, and cellphones
- **Providing fixed access to businesses and residences** using WiMAX/pre-WiMAX systems according to the local frequencies
- **Increasing connectivity in more isolated locations** such as industrial areas, oil and gas facilities, and resorts and golf courses
- **Supporting advanced education** and other scholastic, campus programs
- **Creating municipal networks** for more efficient connectivity of indoor and outdoor city workers, remote metering, security camera monitoring resulting in overall cost savings and improvements in public service
- **Increasing effectiveness of outdoor workers**, production floors, factories, and in specific industries such as utility companies and mines
- **Supporting Homeland Security** applications

## Converged WiMAX / Wi-Fi versus Mesh Technology

Unlike the classic 'star' topology of wireless networks including the converged WiMAX – Wi-Fi network solution, the gradually maturing mesh network uses a 'peer to peer'—or many-to-many—connection scheme. Claiming the capability of dynamically updating and optimizing each connection over time, a mesh network theoretically enables all devices in the network to act as a router and repeater for all subscribers. The result is one more 'hops' in the network before reaching the backhaul point to connect to a larger network.

Mesh networks can be deployed in one of two possible configurations: full mesh and partial mesh. In a full mesh topology, each node is connected directly to each of the other nodes; whereas, in a partial mesh topology, each node is connected directly to only some of the other nodes.

When implementing Personal Broadband services, a converged WiMAX / Wi-Fi solution has several substantial advantages over both full and partial mesh networks:

- **Market Presence and Solution Maturity** - both Wi-Fi and WiMAX are proven, mature, and widespread network solutions ready for immediate deployment, while Mesh remains untested in larger scale deployments,
- **Ease of Installation** – set up of Wi-Fi equipment in the converged network solution is simple and immediate requiring no pre-configuration or modification to end-user equipment, while Mesh requires extensive configuration of routing tables and upgrades of end-user equipment.
- **Proven Support for Mobility** – Wi-Fi has a proven track record in providing mobile services, while the dynamic management of Mesh's complex routing information to support mobility has yet to be successfully implemented—a problem not soon resolved given the current battery and processing power constraints of mobile units.
- **Better Cost Structure** – star topology is more simplified, hierarchial structure, while the many to many nature of Mesh networks require numerous network elements with routing capabilities resulting in more investment and higher operation expenses.
- **Improved Service Continuity** – the converged network uses multiple frequencies to minimize interference and as a result can be easily adapted to operate worldwide, while Mesh is susceptible to interference from many different devices from microwave ovens to large obstructions such as trees and buildings.
- **Shorter Delays** – the single 'hop' of Wi-Fi's star topology offers lower latency and better overall throughput, while Mesh uses at least two or more 'hops' to connect meaning much greater network latency reducing the ability to support real time services such as gaming and VoIP while lowering overall bandwidth.
- **Better User Experience** - the converged network uses all the QoS and bandwidth management algorithms inherent in the WiMAX standard for better user experience, while Mesh has no such technologies.
- **Future Proof Solution** - the converged solution is the first step towards a full WiMAX mobile network using 802.16e technology providing a robust infrastructure for the future and shortening time to market for Personal Broadband services.

A converged WiMAX / Wi-Fi network is the ideal choice for creating a quick, cost effective, stable, and future proof Personal Broadband network with advanced services and broadband mobility.

## Alvarion Offers Personal Broadband Now

Alvarion's BreezeMAX™ Wi², and BreezeACCESS® Wi² for the 2, 3 and 5 GHz bands, are comprehensive solutions that combine a robust high power and feature rich Wi-Fi access point with a built-in WiMAX, or pre-WiMAX, CPE for backhaul. The Wi-Fi hotspot provides broadband mobility to standard IEEE 802.11 b/g end-user devices and is integrated with Alvarion's market-leading BreezeMAX and BreezeACCESS VL CPEs. Operating in the 2, 3, and 5 GHz bands, the BreezeMAX Wi², and BreezeACCESS Wi² provide Personal Broadband services to high-end business as well as residential users equipped with Wi-Fi enabled devices.

Carriers using BreezeMAX and BreezeACCESS VL to provide service to commercial buildings and residences can now extend their networks with hotspot coverage using Wi-Fi technology. The result is a single broadband network supporting both fixed and mobile users.

With its extended reach, easy installation and operation, high performance, and rich security and QoS features, the BreezeMAX Wi², and BreezeACCESS Wi² is are ideal for operators, municipalities and communities looking to quickly build metropolitan broadband networks. The result is Personal Broadband services ranging from public Internet access to public safety and Intranet applications.

Alvarion offers the BreezeMAX Wi², and BreezeACCESS Wi² as part of an end-to-end solution that includes central management and billing. Operators and service providers that extend their network can generate immediate revenues from their fixed and mobile networks.

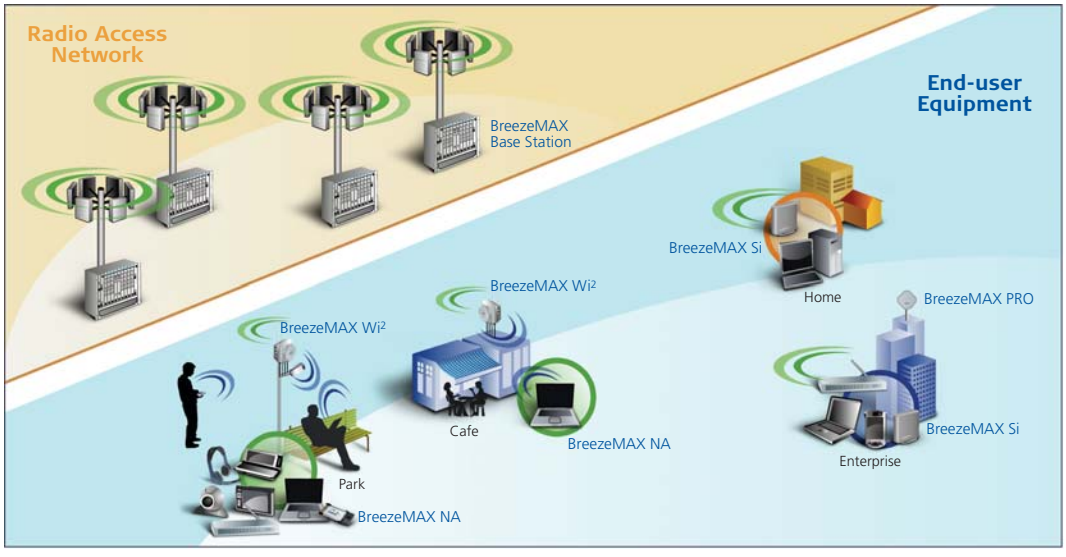


**Figure 2:** Alvarion's Personal Broadband Today

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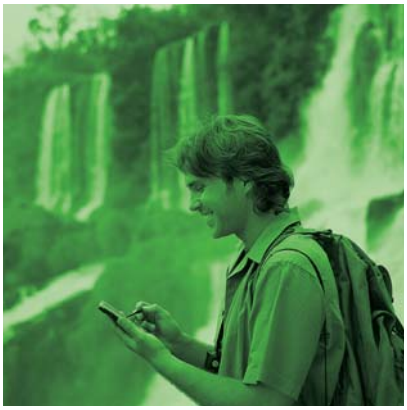

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