aperto networks

Carrier-grade. Cost-effective. Versatile.

WiMAX FORUM CERTIFIED

Wireless to the MAX

Taking Wireless to the MAX

Aperto® Networks is the leading manufacturer of highly versatile and cost-effective carrier-grade WiMAX Forum Certified infrastructure equipment. Through our award-winning PacketMAX® technology, we enable service providers and enterprises worldwide to profitably deliver affordable wireless voice and broadband data services to businesses, residential customers, and government organizations of all kinds. No company offers more solutions for Fixed and Mobile WiMAX applications than Aperto. Or more support for more frequencies—both licensed and unlicensed—anywhere in the world.

Company Overview

Founded in 1999 in Silicon Valley in California, Aperto Networks quickly established its position as the WiMAX leader with the introduction of PacketWave™, the industry's first 802.16 product family that has evolved into today's powerful PacketMAX solution. PacketWave systems still serve thousands of users around the world.

All the advanced technologies and features that originally distinguished the first generation have been integrated into Aperto's powerful WiMAX Forum® Certified PacketMAX system, along with new capabilities such as multi services-intelligent design, highly scalable capacity and coverage, and dynamic per-subscriber link optimization. PacketMAX became the first WiMAX Forum Certified base station in 2006 and today continues to be the primary base station used for interoperability testing by the WiMAX Forum.

In addition to attaining the status of an acknowledged technological innovator, Aperto has led the WiMAX industry in developing industry standards. Aperto was a founder of the WiMAX Forum, and a founder and lead contributor to IEEE 802.16 and the ETSI-BRAN standards. Today, Aperto continues to lead the industry and holds a seat on the board of the WiMAX Forum. Headquartered in California's Silicon Valley, Aperto Networks is privately held.

Aperto at a Glance

Founded in 1999

Headquartered in Silicon Valley in the U.S.

WiMAX R&D labs in India

Over 400 customers in 90 countries

Founding member and current board member of WiMAX Forum

Technology leader with 16 patents

Worldwide sales and system engineering support

Carrier-grade, Cost-effective...

No WiMAX solution is more complete or offers more options and features than PacketMAX. With PacketMAX, service providers of all sizes can deploy carrier-grade WiMAX networks that fit their needs.

- **COMPREHENSIVE PRODUCT LINE:** PacketMAX offers the widest range of base stations and subcriber units for both Fixed and Mobile WiMAX deployments.
- **SIMULTANEOUS SUPPORT FOR FIXED AND MOBILE WIMAX:** The industry-leading PacketMAX 5000 is capable of simultaneously supporting both the Fixed and Mobile WiMAX standards.
- **FLEXIBLE WIMAX SOLUTIONS:** PacketMAX is designed to provide service providers with a flexible architecture that they can upgrade as they grow without having to completely replace their infrastructure.
- **WIDEST RANGE OF FREQUENCIES:** PacketMAX supports all frequencies available for WiMAX worldwide, including relevant portions of the 2 GHz, 3 GHz, and 5 GHz bands.
- **COMPREHENSIVE APPROACH TO WIMAX:** Through ApertoWiSE, the industry's first and most complete partner initiative, operators and ISPs can deploy an end-to-end network with confidence of interoperability while benefiting from industry-leading PacketMAX technology.
- **COMPREHENSIVE NETWORK MANAGEMENT:** Aperto offers a complete element management system that lets operators centrally provision, monitor, and manage large scale networks.
- **WORLDWIDE SALES AND SUPPORT:** Aperto has a global network of experienced sales and technical support professionals. Aperto's technical assistance centers operate 24x7 and provide on-demand support.

"Many government and municipalities, in addition to service providers, are discovering how they can affordably deploy high speed wireless data and voice networks if they use the right wireless technology. WiMAX Forum Certified products like PacketMAX help these organizations to leapfrog past the limitations of wireline deployments to quickly improve the lives of their citizens."

Caroline Gabriel, Research Director at Rethink Research

...Versatile WiMAX.

Maximize the Business Potential of WiMAX

Aperto has always been at the forefront of WiMAX standardization and certification. PacketMAX moves beyond the standards leveraging more than a decade of R&D dedicated to WiMAX. PacketMAX incorporates industry-leading features critical to optimum network performance today and as WiMAX adoption grows.

Patented Link Management

Patented innovations in MAC scheduler and admission controls combined with 802.16e advancements in OFDMA and MIMO administer the most critical resource, the air interface, leading to superior spectral efficiency.

Quality of Service

Granular packet inspection and support for all WiMAX service classes for 16d and 16e allow subscriber-specific and service-specific priority enforcement on wired and wireless links for true end-to-end QoS.

Advanced Networking Features

Integrate into any service delivery scheme by using IP or ethernet based convergence sublayer (IPCS or EthCS) modes along with rich networking features like bridging, routing, VLANS, and virtual private networking (VPN) on PacketMAX base stations.

Carrier Grade Features

Broad ecosystem engagement allow cost-effective initial service rollout targeting consumers and early WiMAX adopters with carrier grade reliability and scalable performance required for future growth.

Provisioning & Management

An intuitive GUI allows remote management of 16d- and 16e-based networks and seamlessly integrate PacketMAX infrastructure into existing OSS for advanced management and billing functions.

Solution Flexibility

Deploy Fixed, Mobile, or dual mode operation—adherence to open standards make PacketMAX suitable for networks based on 16d, 16e, hybrid networks or migrate from one standard to the other over time.

PacketMAX

"We are constantly looking at new technologies and new ways that enable us to provide improved or enhanced services to our customers. Aperto's industry-leading WiMAX platform gives us the ability to cost-effectively extend our network, expand our product offerings, and attract new customers."

Ian Renshaw, CEO, Wight Cable: UK

PacketMAX solutions provide operators a standard based platform for addressing varied market segments while also establishing a network footprint that minimizes capital and operating expense.

Where availability and cost of acquiring licensed spectrum is prohibitive, competitive operators and WiSPs can turn to License-Exempt WiMAX, lowering the barrier to market entry. Consumers demanding ubiquitous indoor and outdoor coverage appreciate the performance of affordable devices and Mobile WiMAX, extending their use of the network. Similarly, in order to reach far-flung rural and suburban business and residential subscribers with fewer cell sites, the high spectral efficiency of PacketMAX for Fixed and Point-to-Point WiMAX makes a cost-effective rollout of high bandwidth services.

Translate Savings Into Profit

Lower TCO from WiMAX Economies—Network operators greatly benefit from ApertoWiSE broad ecosystem engagement. Manufacturing economies of scale, third-party interoperability, and proven solution integration programs help reduce total cost of ownership.

Pay as You Grow—Modular system design permits operators to add capacity and performance only when required to meet incremental subscriber demands. A flexible pay-as-you-grow capital expenditure model scales cost-effectively with increasing adoption of WiMAX.

Cost-Effective Service Migration—PacketMAX 5000 supports both 16d and 16e in a single platform. This forward-looking design allows delivery a variety of services and applications now and in the future without having to make large investments in additional equipment.

Increase Top Line Revenue

Address Multiple Segments with Tiered Service Plans—Granular traffic classification combined with quality of service enforcement enables differentiated services and premium tariff plans, significantly boosting revenue realization.

Carrier-Grade Reliability Delivers Premium Services—PacketMAX delivers the redundancy and non-stop operation required to meet stringent service guarantees for business and other premium services.

Maximum Revenue from Maximum Coverage and Capacity—Increased system link budget and larger cell range at higher modulations produce higher capacities over more expansive coverage area. This reduces the number of cells required and lowers infrastructure costs.

Accelerated RoI for Network Operators

A fast return on Investment (RoI) and the ability to drive profitable services across the subscriber base are critical success factors for network operators everywhere. Typical solutions deliver payback on PacketMAX capital investment within 6 to 24 months.

PacketMAX Base Stations

Next Generation of Wireless

Through fixed and mobile convergence, the service becomes “access agnostic”. The user becomes “access unaware”. PacketMAX ushers the next generation of wireless—fixed, nomadic, portable and mobile services—offered from a common WiMAX platform.

PacketMAX base stations provide the gateway to a world of interconnected services—voice, video, data, and multimedia—available to subscribers at home, at work, or on-the- go. PacketMAX seamlessly integrates into existing operations and business support structures for wired and wireless service delivery. Standard interfaces and protocols are supported across all PacketMAX products.

PacketMAX 5000—Fixed and Mobile WiMAX Base Station

PacketMAX 5000 is the first base station certified by the WiMAX Forum and remains the industry’s only base station offering the unique combination of Carrier-grade, Cost-effective, and Versatile WiMAX base station. It operates in licensed and license-exempt bands and can host both 802.16-2004 and 802.16e-2005 subscribers within a single chassis—giving providers a flexible platform from which to launch fixed, nomadic, portable, and fully mobile services.

The multi-service, space-saving solution accommodates a large number of deployment options. Individually deployable sector controllers allow variations of redundant and non-redundant 3-sector, 4-sector, or higher capacity cell sites operated from within the 5U indoor unit.

In keeping with PacketMAX Solutions Architecture, PacketMAX 5000 is based on open standards like all-IP, OBSAI, and ATCA. The modular design provides non-stop service delivery and contains operational and capital expense for carriers addressing dense subscriber areas in mature WiMAX networks.

PacketMAX 4000—Mobile WiMAX Base Station

PacketMAX 4000 is the ideal platform for mobile WiMAX rollout. By minimizing capital commitment per site, PacketMAX 4000 allows a profitable initial service offering while consumers and early adopters join the network. At the same time, the system maintains room for growth to full network coverage and capacity.

PacketMAX 4000 drives profits even higher serving business and enterprise users. The system incorporates the technological advances now synonymous with the PacketMAX brand—superior link efficiency, carrier grade resilience, and scalable quality of service—and applies them to the IEEE 802.16e standard. Unique in its class, PacketMAX 4000 is a modular 1-4 sector mobile base station supporting redundancy of all major subsystems including power, backhaul, wireless controllers and radios.

"Due to the large capital investment required, operators are naturally cautious about quickly building out full-scale WiMAX networks. Products like the PacketMAX 4000 give operators an intelligent, cost-effective strategy for introducing affordable Mobile WiMAX services on a pay-as-you-grow basis."

Caroline Gabriel, Research Director at Rethink Research

PacketMAX 3000—Fixed WiMAX Base Station

WiMAX Forum Certified PacketMAX 3000 delivers Aperto's industry-leading WiMAX technology into a single-sector "stackable" form factor. For service providers seeking entry into the WiMAX market or those expanding coverage of an existing network, the PacketMAX 3000 is an economical and elegant solution. Its space-saving design allows operators a carrier-grade platform from which to launch premium voice, multimedia, and data services.

PacketMAX 3000 is the ideal platform for WiSPs and competitive operators offering Fixed WiMAX service to small and medium businesses, SOHO, and residential subscribers. Typical solutions include low cost alternatives to wired DSL and cable offerings and multi-megabit data service.

PacketMAX 2000—Pico Base Station

PacketMAX 2000 leverages Aperto's macro base station features into a compact form factor for use in Mobile WiMAX service. The pico base station has been designed as a lightweight, single-man mount unit with management and backhaul functions suitable for macro networks.

PacketMAX 2000 is the ideal solution for operators wishing to boost capacity to accommodate either temporary or permanent increase in subscribers in specific areas or to add coverage for areas un-served by the macro network. This cost-effective platform offers flexible solutions for all outdoor or indoor deployments.

Key Features

- WiMAX Forum Certification
- IEEE 802.16-2004 and IEEE 802.16e-2005 compliance
- Extensible, open standards-based design
- Patented enhancements for WiMAX QoS and link efficiency
- Advanced L2 and L3 networking functions
- Carrier-grade redundancy for non-stop operation
- Cost-effective deployment with room for growth
- Fixed, Nomadic, Portable and Mobile WiMAX
- Broad interoperability via ApertoWiSE

PacketMAX Subscriber Units

A Spectrum of Applications

PacketMAX gives network operators a powerful, flexible platform for delivering wireless applications to a broad array of customer segments.

Outdoor gateways are ideal for DSL-like services with lower cost and greater flexibility to the customer. PacketMAX combines the benefits of WiMAX with the convenience of WiFi access, voice and advanced features through an array of product offerings. Subscribers upgrade from data-only packages to higher value voice services through advanced services gateways.

Let the user experience high-speed broadband whether indoor, on campus or on the road. All PacketMAX Mobile WiMAX subscriber units are IEEE 802.16e-2005 compliant and support WiMAX Forum Wave 2.0 certification. Superior link management, scalable OFDMA, dual antenna with maximal ratio combining (MRC) ensure optimum usability independent of orientation, interior walls and line of sight to the base station.

Mobile WiMAX and Advanced Services

PacketMAX 400 Outdoor Gateway

PacketMAX 400 outdoor gateway couples the latest WiMAX technology (802.16e-2005) with the benefits of an outdoor gateway for business and enterprise users of fixed services. The result is greater download speeds over longer distances compared to indoor terminals. The system uses an integral antenna or supports optional external antennas for increased gain and operation over even longer distances.

PacketMAX 500 Indoor Gateway

PacketMAX 500 series subscriber units provide an alternative to DSL for all-indoor consumer environments, supporting a complete range of networking functions. Integrated voice and Wi-Fi options make the PacketMAX 500 a single-box solution normally serviced by telephone adapters, WiFi access points, and DSL modems. IEEE 802.16e-2005 Wave 2 compliant PacketMAX 500 series supports MIMO, subchannelization, and auto-provisioning for comfortable, robust indoor use.

PacketMAX 20 Voice Services Gateway

PacketMAX 20 Voice Services Gateway instantly converts a data-only subscriber into higher value voice subscriber. PacketMAX 20 seamlessly integrates with PacketMAX outdoor subscriber units to enable service providers to deploy premium voice services to its residential and commercial customers without costly truck rolls or on-site technical support.

"Our decision to partner Aperto Networks will greatly enhance our ability to offer a wide array of affordable broadband wireless services in Sri Lanka in the years to come."

Shuhei Anan, CEO, SLT: Sri Lanka

Mobile WiMAX PC Adapters

PacketMAX 600 USB

The PacketMAX 600 ushers an era of true freedom from wires. The USB form factor provide the reliability and performance of PacketMAX subscriber gateways in the convenient and power-saving design. The PacketMAX 600 is 802.16e-2005 Wave 2 compliant, with driver-support for all popular operating systems. It turns any laptop or desktop with a standard USB port into a mobile broadband receiver station.

PacketMAX 700 PC Card

The PacketMAX 700 802.16e-2005 Wave 2 compliant PC Cards and Express Cards are handy units that fit into any standard laptop or PDA with a PCMCIA or the newer Express Card slot. The high gain integrated antenna, power-management features and user-friendly installation and connection make the PacketMAX 700 a powerful ally in experiencing the joy of ubiquitous WiMAX.

Fixed WiMAX

PacketMAX 100 Outdoor Gateway

The PacketMAX 100 is economical and delivers the features required to address the SMB, home office, and residential markets. End users can browse web pages, make voice calls, view streaming video, and download files—simultaneously and at multi-megabit speeds. PacketMAX 100 series CPE are compliant with the 802.16-2004 standard and are WiMAX Forum Certified.

PacketMAX Oudoor Gateway

The PacketMAX 300 delivers the entire range of functions required to fulfill the demanding applications of enterprise or any business environment, while supporting high speed service to hundreds of simultaneously connected users. A typical deployment will handle more than 1,000 connected users while differentiating their traffic into prioritized flows of data, voice and multi-media applications. PacketMAX 300 is compliant with the 802.16-2004 standard and is WiMAX Forum Certified.

Key Features of PacketMAX Subscriber Units

- Aperto's industry-proven QoS technology
- Advanced power management modes for longer battery life
- Secure network admission and device management
- SIP v2 based call management
- Multiple encoding and compression techniques for voice and fax
- Lightweight designs that greatly ease outdoor installation
- Audio and visual signal quality indicators simplify correct installation
- Flexible up and down tilt allows the unit to be set up for best reception
- Support multi-branch antenna diversity

Network Management

Key Features

- Manage 16d and/or 16e networks from a single remote location
- Award-winning, intuitive GUI
- Full FCAPS management of PacketMAX networks
- Accelerate time to revenue with rapid service provisioning
- Capitalize on per-subscriber service model with detailed accounting and statistics
- Maximize service uptime and revenue through proactive fault management
- Standard-based north bound interfaces to existing OSS/BSS
- Allows element, network, service and business level management functions

"We have been an Aperto customer for some time and know that PacketMAX is the ideal solution for our offerings... Like many service providers, we are concerned with the cost of deploying and managing WiMAX... with Aperto's WaveCenter EMS product, PacketMAX lets us serve a huge number of customers with exceptional QoS and reliability."

Wassim El Khoury
Network Expansion Manager,
Pesco Telecom: Lebanon

Large Scale Provisioning and Management

WaveCenter™ EMS Pro allows any network to leverage the full power of PacketMAX. Using highly scalable client-server architecture, it's suitable for large-scale carrier networks and intuitive enough for smaller networks requiring less complex management functions. Operators offering fixed or mobile services enjoy simplified provisioning and network and service management.

Those operating dual mode networks or migrating from 16d to 16e leverage the same intuitive GUI into simplified management functions and lower cost of operations. WaveCenter EMS Pro provides full FCAPS management for PacketMAX powered networks and SNMP base management of third party elements.

Fault	Accurate fault localization leads to rapid resolution minimizing service outage
Configuration	Through automated configuration functions elements are provisioned in bulk, immediately ready for service
Accounting	Usage accounting details are colleted and stored for each subscriber, each business and each application
Performance	Remotely monitor vital statistics of thousands of elements receiving alarms at critical performance & capacity thresholds
Security	Subscriber and device identity is authenticated before network admission; security breached are logged and alarmed

WaveCenter EMS Pro acts as a gateway seamlessly connecting PacketMAX into existing management infrastructure and NOC operations. Use standard SNMP for universal network management functions or leverage Aperto-provided northbound interfaces tapping the full power of PacketMAX. Flow through provisioning instructions for voice and other advanced services onto PacketMAX using existing platforms and operational processes.

Standard interfaces lower the cost and time required for system integration. Aperto supplies northbound interfaces based on CORBA and XML/SOAP.

- Rapid and low cost integration
- Operational simplicity
- No additional training
- No additional equipment

Base Station Radios

Widest Range of WiMAX Frequencies

PacketMAX base station radios support the widest range of frequencies, from 2.3 GHz all the way through 5.9 GHz, spanning licensed and license-exempt bands. IEEE 802.16-2004 and IEEE 802.16e-2005 PHY.

PacketMAX allow operators to reuse the same IDU by selecting the outdoor radio for the relevant frequency. For Mobile WiMAX, PacketMAX utilizes Remote Radio Head (RRH) architecture with Open Base Station Architecture Initiative (OBSAI) compliant connectivity to the IDU. An optical interface allows the radio head to be deployed kilometers away from the base station for some specialized applications or for optimal placement of the base station for backhaul cost savings. Aperto support flexible choices in channel sizes, frequency reuse, and output power for 802.16d and 802.16e WiMAX.

Base Station Radios for 802.16-2004	
Type	SISO 1Rx/1Tx
Output Power	17 dBm, 20 dBm, 30 dBm
Frequency	3.3-3.8 GHz, 4.9-5.9 GHz

Base Station Radios for 802.16e-2005	
Type	MIMO 2Rx/2Tx, MIMO 4Rx/4Tx, AAS
Output Power	36 dBm (4W), 40 dBm (10W)
Frequency	2.3-2.4 GHz, 2.5-2.7 GHz, 3.3-3.8 GHz

Key Features

- Fully compliant with WiMAX IEEE 802.16e
- 2X4 Watt and 2X10 Watt output power options
- Multi-carrier per sector offer greater capacity
- Adaptive MIMO (Matrix A/Matrix B)
- Pole or wall mount
- Compatible with PacketMAX 4000 and PacketMAX 5000
- Distributed Architecture

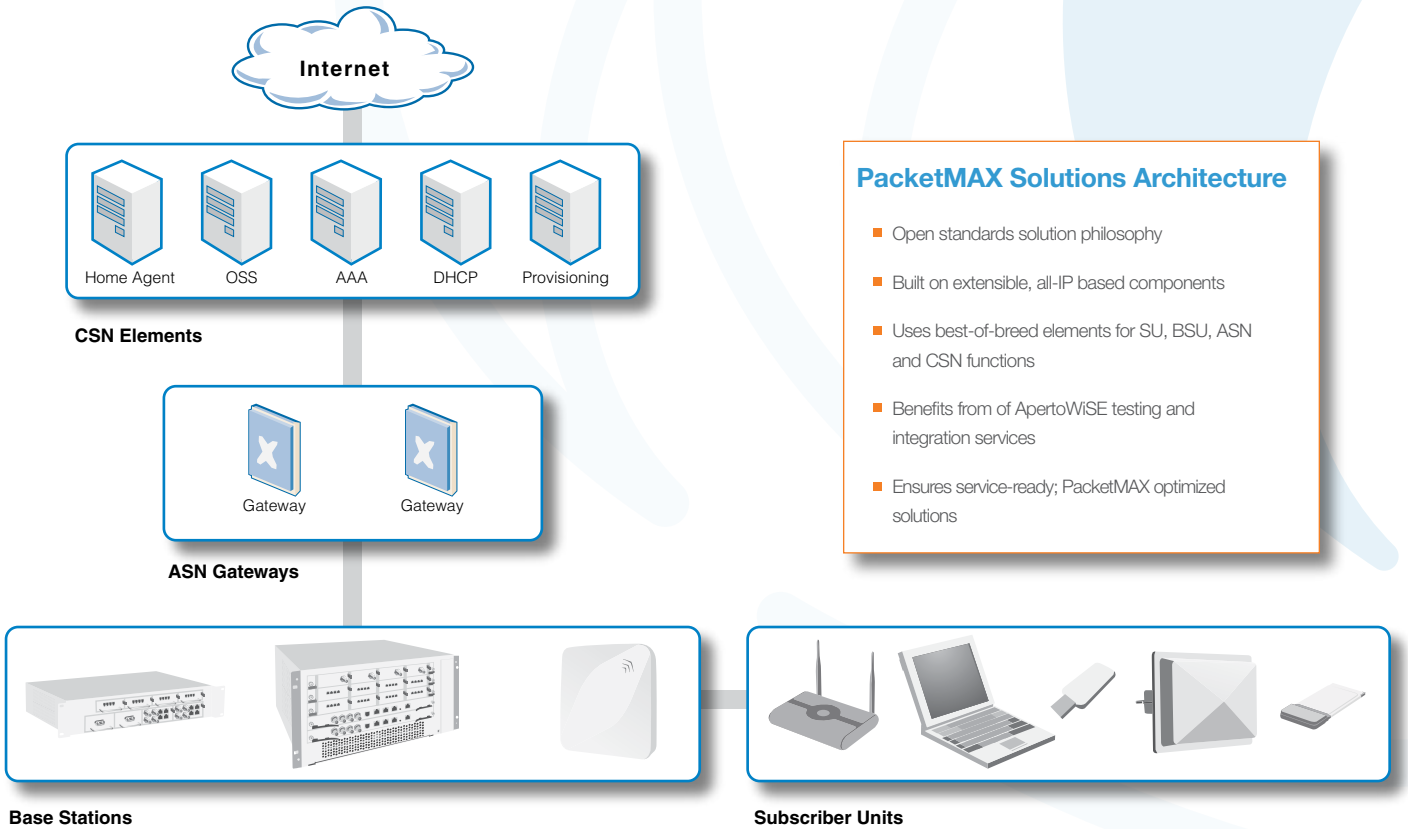
PacketMAX Solutions Architecture

The Vision of Mobile WiMAX includes ubiquitous access to a consistent set of content and services for consumers and business users at work, at home, or on the go. PacketMAX Solutions Architecture is an end-to-end infrastructure approach driving operator choice and CapEx and OpEx advantages. Built on best-of-breed elements with guaranteed interoperability, PacketMAX Solutions Architecture permits operators to make individual selection for each network function.

End-to-end solutions consist of base stations, subscriber units, ASN gateways, and connectivity services network (CSN) elements—all pre-tested and pre-integrated to function within a PacketMAX optimized solution package. Based on open standards, solutions comply with WiMAX Forum NWG standard for 802.16e-2005 networking and relevant interfaces. All solution components are standards compliant and relevant components WiMAX Forum Certified.

PacketMAX base stations are the key enabler of Mobile WiMAX solutions with key technologies defined within the IEEE 802.16e-2005 specification.

- SOFDMA PHY
- MIMO Matrix A/B with 2X2 or 4X4 diversity
- UL/DL Sub-channelization
- Enhanced Quality of Service
- R6 standard interface to ASN Gateway
- R1 interface to subscriber units



PacketMAX Solutions Architecture

- Open standards solution philosophy
- Built on extensible, all-IP based components
- Uses best-of-breed elements for SU, BSU, ASN and CSN functions
- Benefits from of ApertoWiSE testing and integration services
- Ensures service-ready; PacketMAX optimized solutions

"This deployment is an important proof point for Aperto's technology and our services team. The flexibility of PacketMAX in providing multi-sector support and management was crucial. Results have been amazing."

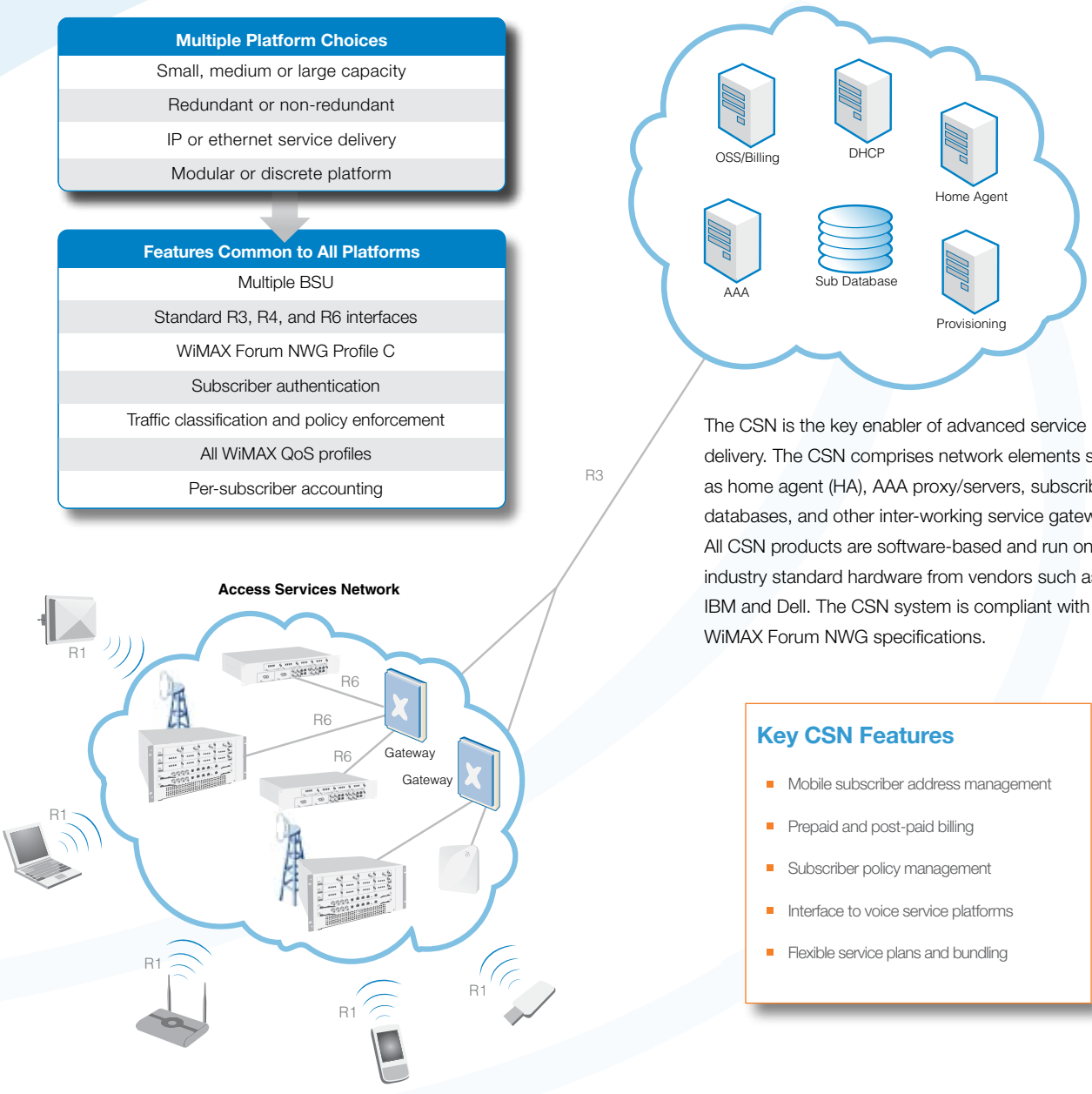
Leszek Pruszynski, Deputy Director of Multimedia Access Development, Biatel SA

PacketMAX Solutions Architecture includes best-of-breed Access Service Network (ASN) Gateways and Connectivity Services Network (CSN) elements enabling IEEE 802.16e-2005 compliant mobility and advanced service delivery.

ASN Gateway choices include systems specifically designed for emerging WiMAX networks as well as large macro networks. All platforms are standards compliant and support the full range of Fixed, Nomadic, Portable and Mobile WiMAX services.

Multiple Platform Choices
Small, medium or large capacity
Redundant or non-redundant
IP or ethernet service delivery
Modular or discrete platform

Features Common to All Platforms
Multiple BSU
Standard R3, R4, and R6 interfaces
WiMAX Forum NWG Profile C
Subscriber authentication
Traffic classification and policy enforcement
All WiMAX QoS profiles
Per-subscriber accounting



The CSN is the key enabler of advanced service delivery. The CSN comprises network elements such as home agent (HA), AAA proxy/servers, subscriber databases, and other inter-working service gateways. All CSN products are software-based and run on industry standard hardware from vendors such as HP, IBM and Dell. The CSN system is compliant with the WiMAX Forum NWG specifications.

Key CSN Features

- Mobile subscriber address management
- Prepaid and post-paid billing
- Subscriber policy management
- Interface to voice service platforms
- Flexible service plans and bundling

Fixed and Mobile WiMAX

"Until recently, network operators have been somewhat perplexed as to when and how they should deploy WiMAX networks, and in what configuration. Should they deploy Fixed WiMAX or wait to implement Mobile WiMAX when the equipment is available? Aperto's extended PacketMAX Solutions Architecture and innovative migration path gives network operators the confidence to take advantage of the Fixed WiMAX market opportunities of today, and the means to capitalize on the Mobile WiMAX market opportunities of tomorrow, seamlessly and cost-effectively, using the same platform."

Berge Ayvazian
Chief Strategy Office, Yankee Group

Deploy 802.16d, 802.16e, or Both

PacketMAX 5000 is the first base station certified by the WiMAX Forum. Now PacketMAX 5000 accommodates 802.16e. Operators can simultaneously host fixed or mobile subscribers from the same base station—or can operate PacketMAX 5000 as a stand alone fixed or mobile base station.

- Macro base station for 16d and 16e
- Fixed and Mobile WiMAX within a single base station
- Migrate from Fixed WiMAX to Mobile WiMAX
- Common management for 16d and16e networking
- Individually deploy1-12 sectors

PacketMAX Provides Flexible Options for Fixed and Mobile WiMAX

Flexible Deployment Options…

- Common synchronization and management used for both "d" and "e" sectors
- Operate as stand alone 802.16d base station
- Introduce 802.16e Mobile WiMAX into an existing Fixed WiMAX deployment for nomadicity or portable service enhancement
- Operate "hybrid" network offering both services
- Migrate from Fixed WiMAX to Mobile WiMAX over time

…Drive Powerful Business Advantages

- Leverage initial investment for Fixed or Mobile WiMAX
- Maintain or increase service offering when migrating from fixed to mobile service offering
- Simplify network operations—common management look and feel

License-Exempt WiMAX

Affordable, Reliable, High Performance

Independent ISPs are looking to broadband wireless access as an effective means to compete with major telcos and mobile license holders. Free and low-cost spectrum open up new service possibilities.

Portions of the 5 GHz band is license-exempt in most countries. The 4.9 GHz band is available for municipal and public safety applications in some countries. The US FCC allows non-exclusive operations in the 3.65 GHz band. However free and low cost spectrum often comes with the challenges of non-exclusive operation. PacketMAX superior non-line of site (NLOS) propagation brings all the benefits of WiMAX to License-Exempt and Lightly-Licensed operation—making these bands attractive for targeting multiple customer segments.

	Licensed	License-Exempt and Lightly-Licensed
Spectrum usage	Exclusive	Non-exclusive, shared use
Area of operations	Spectrum awarded for limited geography (generally)	Nationwide operations (generally)
Spectrum acquisition	Auctions, open market sale, government grants	Fixed, small registration fee (nil for license-exempt)
Cost of spectrum acquisition	High ⟶ Exorbitant	None ⟶ Low
Time to Deploy	Licensing process takes weeks and months	No delays due to spectrum allocation
Return on Investments	Requires premium users to recover high CapEx	Rapid RoI even from low revenue areas
Voice services	Yes	Yes
Business grade services	Yes	Yes
Typical frequencies	2.3, 2.5, 3.3, 3.5 GHz	3.65, 4.9, 5.1, 5.4, 5.8 GHz

"Until now, there has been little to address the equipment needs of operators using unlicensed spectrum within the WiMAX community. The challenge with existing proprietary systems has been that they don't always deliver the performance and QoS capabilities demanded by service providers. Bringing WiMAX technology to unlicensed operators will really change the market dynamics for those operators."

Daryl Schoolar
Senior Analyst with In-Stat

Key Features

- Dynamic Frequency Scanning (DFS) for radar-avoidance
- Automatic Frequency Scanning (AFS) for switching to clear channel
- Spectrum Analyzer (SA) for visually tuning to a clear channel
- Configurable Transmit Power Control (TPC)
- OFDM for non-contention (scheduler) based media access
- Time division duplexing (TDD) for higher spectral efficiency
- Comprehensive WiMAX QoS

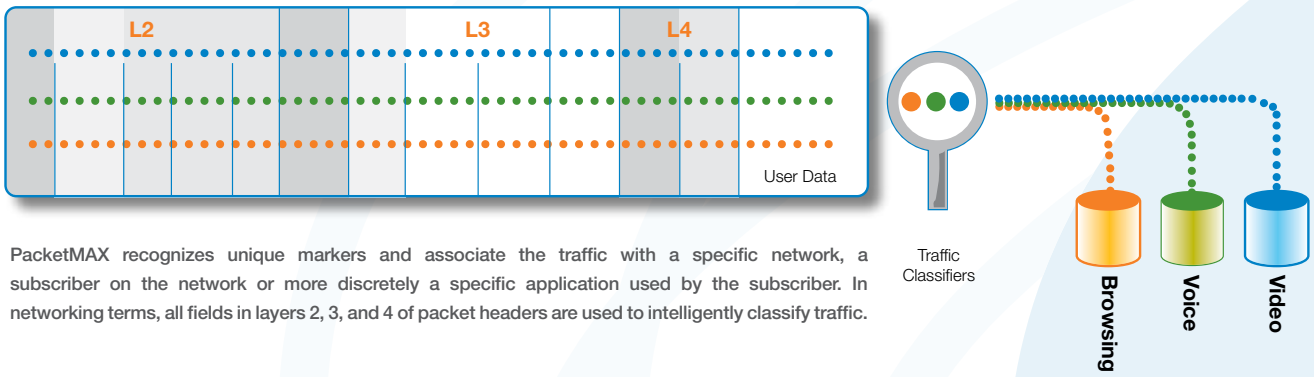
"By extending PacketMAX support to 3.65 GHz, Aperto has given another practical option for service providers who do not own licensed spectrum. Smaller ISPs are able to cost-effectively compete head-to-head with larger providers, by taking advantage of WiMAX in frequencies like the 3.65 GHz spectrum. These types of strategic offerings are vital to regional service providers who want to leverage the benefits of WiMAX."

Emmy Johnson
Founder and Principal Analyst at Sky Light Research

Profitable WiMAX Applications

Real-world applications are the driving motivation behind PacketMAX technology. The result is customers get to focus on their core business without worrying about the wireless link. Key applications powered by PacketMAX Fixed and Mobile WiMAX can add the extra ingredient to your business—profitability.

Profitable service delivery begins with intelligent traffic delivery.



PacketMAX recognizes unique markers and associate the traffic with a specific network, a subscriber on the network or more discretely a specific application used by the subscriber. In networking terms, all fields in layers 2, 3, and 4 of packet headers are used to intelligently classify traffic.

Voice over WiMAX

PacketMAX is the leader for voice over IP service delivery over WiMAX. Effective voice over IP (VoIP) communications require infrastructure that can quickly identify voice traffic and prioritize it to assure high-quality audio and service level adherence. PacketMAX offers key features making voice over WiMAX the “killer app” for many WiMAX networks today.

Service Overbooking. Every voice call has periods of silence when the bandwidth is not needed. PacketMAX assigns the voice channel to the user who needs it. Service overbooking allows providers to associate many voice calls with a single service flow, resulting in efficient use of the spectrum and more revenue.

Intelligent Packet Classifiers. Granular packet inspection can be used to identify VoIP packets from a specific user or network. Plus, PacketMAX can use different service classes—for example UGS for enterprise voice, ertPS for SMB, and rtPS for SoHo/consumers—allowing tiered billing for voice services.

Powerful Protocol Support. PacketMAX telephony supports SIP v2 VoIP protocols. In addition, all VoIP units support multiple encoding and compression techniques, including G.711 (64 Kbps), G.729a (8 Kbps) and G.723.1 (6.4 Kbps and 5.3 Kbps). The system is designed to gracefully accommodate new standards in the future.

Simplified Configuration. Telephony setup and configuration is easy to accomplish. The administrator just selects the encoding standard and number of calls to be processed. Tight integration of VoIP in PacketMAX subscriber units simplifies the conversion of existing data users into premium voice subscribers.

"A nationwide WiMAX network powered by Aperto Networks will enable OTE to offer consumers and enterprises a wide range of value-added, high bandwidth data communications services, such as MPLS, VPN, leased line, and Internet access, as well as VoIP, telemedicine, e-education, e-governance, and e-commerce in remote areas."

Kostas Drossos, CEO, Heletel SA: Greece

Video over WiMAX

WiMAX is the right technology to couple broadband with mobility and fill the growing need for converged video, data, and voice applications. PacketMAX enables this convergence with a suite of features that maintain quality of service over the air interface and into the core network.

Service classes—including UGS, ertPS, and rtPS—are used to support real-time applications with reduced latency and jitter for broadcast quality video and audio. Separate buffer pools within individual subscriber units ensure that applications with stringent bandwidth guarantees are not overwhelmed by traffic transitioning on other service flows.

An all-IP system architecture that supports multicast and broadcast enable a new generation applications such as IPTV and video-conferencing.

WiFi / Mesh Backhaul

Municipalities and some commercial organizations are beginning to take advantage of free WiFi spectrum and zero-cost subscriber acquisition through WiFi-enabled PCs and devices. Hotspots and mesh networks are turned into more efficient hot zones by introducing PacketMAX for backhaul.

PacketMAX Fixed WiMAX is especially suitable for backhauling 2.4 GHz, or 5.8 GHz WiFi or mesh operations, with multiple options for the backhaul frequency co-existing with the WiFi access.

PacketMAX operated in Point-to-Point WiMAX mode is suitable for backhauling densely populated hotspots or mesh clusters where additional bandwidth on the backhaul channel is required.

PacketMAX integrates seamlessly with WiFi networks, providing a common management and configuration interface using IP and SNMP.

Enterprise VPN and Business Applications

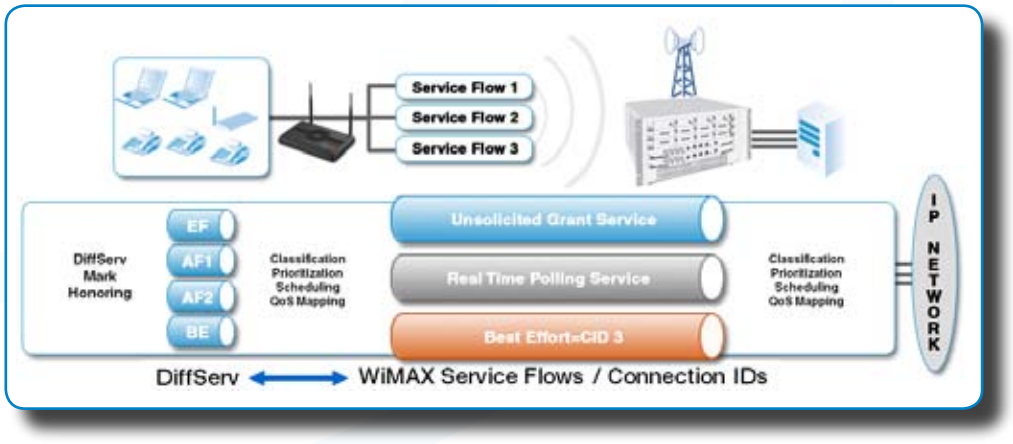
PacketMAX offers true wire-line equivalent of virtual private networking and business data services over WiMAX.

Support for 802.1Q, VLAN tagging, stacking, and smooth MPLS integration provide traffic separation and prioritization between companies and between departments within the same company.

Businesses requiring service guarantees commonly rely on PacketMAX for guarantees of minimal packet loss and maximum service availability for assured service delivery.

Assuring end-to-end quality of service drives revenue

Classified traffic is associated with a relative priority for delivery compared to other traffic types. PacketMAX allows all WiMAX service classes for priority options—UGS, ertPS, rtPS, nrtPS and BE—and maps these to the customers' specific service plan. QoS is carried over from the wireless to the wired network.



Practical Business Solutions

"We plan on using Aperto's WiMAX solutions for many applications in the future—including our Tetra application, video surveillance, voice communications between police stations—and then expanding these applications into other geographical areas in Egypt. We also would like to be the first to adopt Aperto's 802.16e solutions..."

General Mohammed Sadek, General Director of Police Communication with the Ministry of the Interior

Oil and Gas

License-exempt spectrum has tremendous appeal for industrial-based enterprises with huge communication needs. Since copper and fiber lines are often infeasible, wireless provides the perfect alternative. OFDM-based WiMAX technology is inherently resilient to effects of multipath caused by reflection (such as from water, hills, cloud droplets), providing high-availability, rich multimedia services under hostile RF conditions.

Public Safety

Governments operate in both licensed and license-exempt bands for surveillance and security operations. PacketMAX's fully redundant carrier-grade platform provides the high-availability, high-speed, always-on connectivity they demand. CPE mounted on traffic lights and patrol vehicles send real-time video and voice transmissions back to central servers for detecting and recording suspicious activity.

Financial Services

Financial networks continue to demand greater security, manageability, and efficiencies while reducing transaction costs. At the same time, financial institutions are looking to gain competitive advantage and cost savings by migrating from traditional TDM-based services. Traffic management features like virtual private networking (VPN) and MPLS interworking give financial institutions assured delivery of confidential and sensitive information.

Transportation

The key consideration of the transportation sector is coverage—is the communication service available where it is needed? WiMAX fills exactly this need by creating "hotzones" from an entire rail station, rail way or port versus the hotspot usable from the coffee shop.

Diverse Market Segments

PacketMAX enables solutions custom-built to address markets such as defense, hospitality, manufacturing, construction, healthcare, and many more.

Comprehensive Approach to WiMAX

"Aperto must be congratulated for recognizing the importance of identifying, assembling, and collaborating with some of the WiMAX industry's leading ecosystem players. WiMAX operators need support and flexibility. ApertoWiSE helps to deliver on those demands."

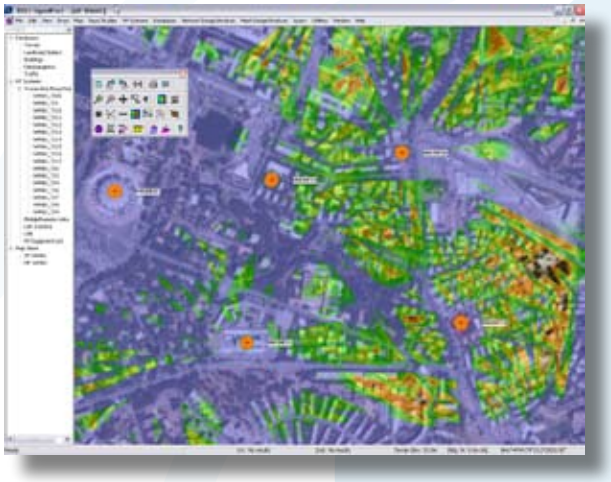
Peter Jarich, Principal Analyst, Current Analysis

Leading edge technology in SoC, radio, and antenna components are the foundation of PacketMAX. Solutions start with WiMAX Forum Certified components that are pre-integrated and validated with network elements from leading suppliers of voice, data, and multimedia applications. Aperto is committed to ensuring the success of WiMAX. This means ensuring the success of our customers and their subscribers. ApertoWISE encompasses a variety of services before and after the equipment sale. Through network planning, design services, business planning, technical, and customer support services Aperto works hand-in-hand with our customers as partners vested in the success of WiMAX.

Aperto Services and Support

WiMAX offers leading edge technologies like OFDM and MIMO. But profitable WiMAX is more than just getting the technology right. Best of breed platforms are complemented by additional ingredients to create the winning formula. A well-crafted business strategy, engineering/design services and pre- and post-sale consultation are all key ingredients.

Aperto helps customers use WiMAX to transform their business. Through our global reach and ApertoWiSE initiative, we have enabled more than 400 network operators and ISPs in 90 countries to profitably deliver WiMAX based services. Aperto is able to commit professional assistance to all phases of network and service rollout: from business planning, to network design, to training and 24X7 customer support. Aperto is dedicated to helping our customers achieve WiMAX success.



"Speed of deployment was crucial to our success. We were upgrading an older wireless network to WiMAX and wanted to avoid having to reapply for spectrum. We had already done extensive testing on PacketMAX and were impressed with its feature set and flexibility. Fortunately, Aperto came through and delivered everything within weeks. "

Andrew Kinnear, CEO of Icosnet: Algeria

RF/Network Planning

Radio planning forms the most critical component of any wireless service model. Aperto has extensive experience in both licensed and license-exempt conditions. This wealth of knowledge combined with sophisticated RF/Network planning tools are used to conduct RF surveys, prepare RF network maps, and perform network capacity modeling and traffic engineering.

Business Planning

Aperto goes the extra-mile and helps our customers study the market demand and create a business case for WiMAX. Using business case tools specialized for PacketMAX, Aperto can help decide on parameters like the type of service, the customer segments, equipment and tariff plans in formulating a winning strategy.

Project Management

Large scale, wireless deployment requires extensive project management, quality assurance, service integration, customer activation, and training. Project Managers represent the customer's interests within Aperto and coordinate all necessary resources and post-sales activities as a single point-of-contact.

Training

As a WiMAX thought leader, Aperto offers training on WiMAX and wireless fundamentals as well as advanced certification on designing and maintaining WiMAX networks. PacketMAX training is delivered in state-of-the-art labs and ranges from introduction to PacketMAX to through understanding advanced concepts and various deployment options, challenges and new features.

Warranty and Support

Aperto has reliable and efficient processes for field equipment under warranty or service contract. Faulty equipment is promptly repaired or replaced based on the terms of the contract. Program administration is regularly monitored ensuring we maintain over 99% success rate.

24x7 Customer Support

Aperto operates a round-the-clock technical assistance center (TAC) manned by experienced network engineers. Regional customer service engineers can be rapidly deployed to provide on-site assistance with the least turnaround time.

Solution Validation

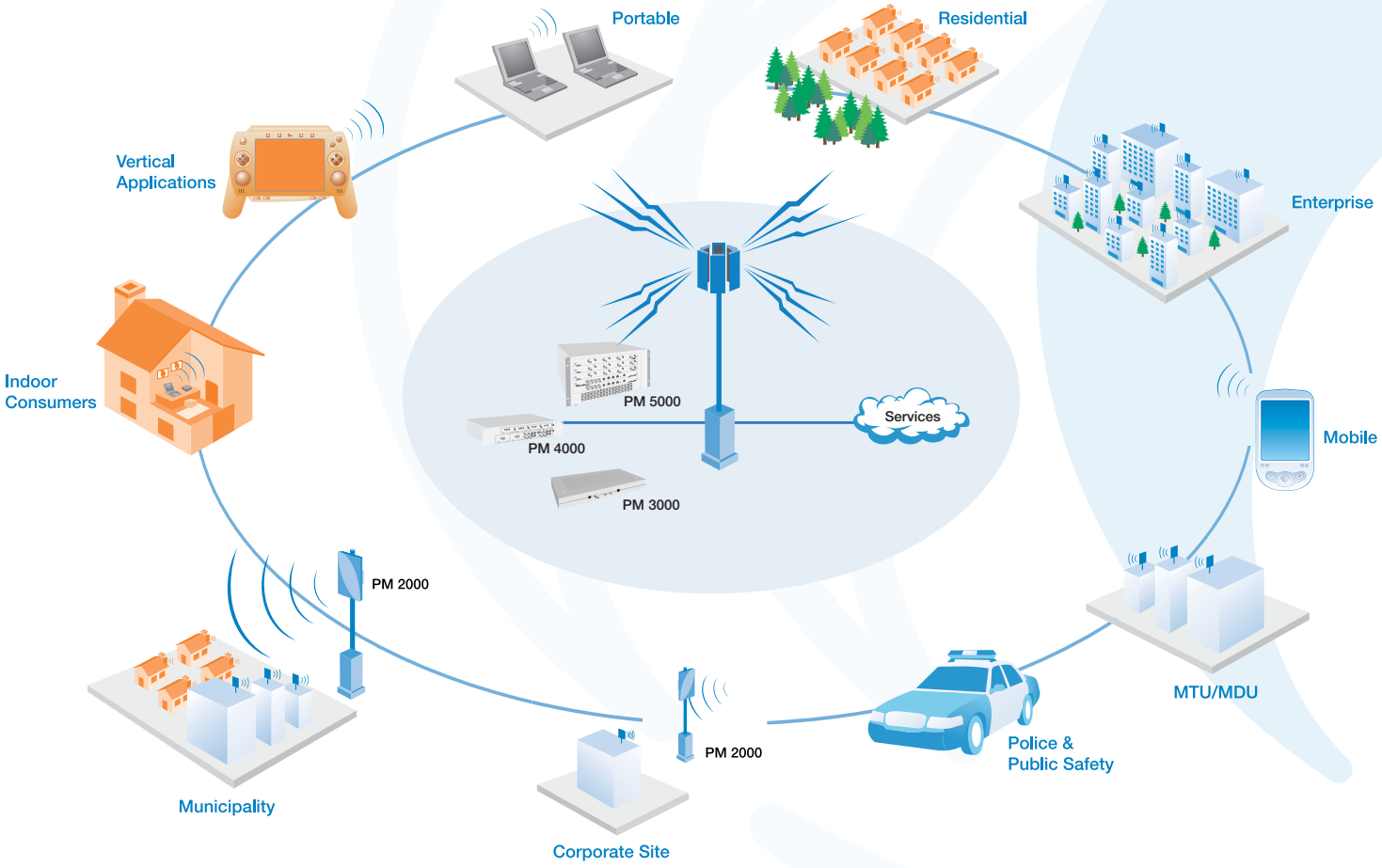
PacketMAX Solutions Architecture validation yields pre-tested, pre-packaged WiMAX solutions for seamless insertion into existing carrier networks. Testing covers WiMAX forum certified subscriber units, base stations and leading vendor's ASN gateways and CSN platforms.

Engineering Services

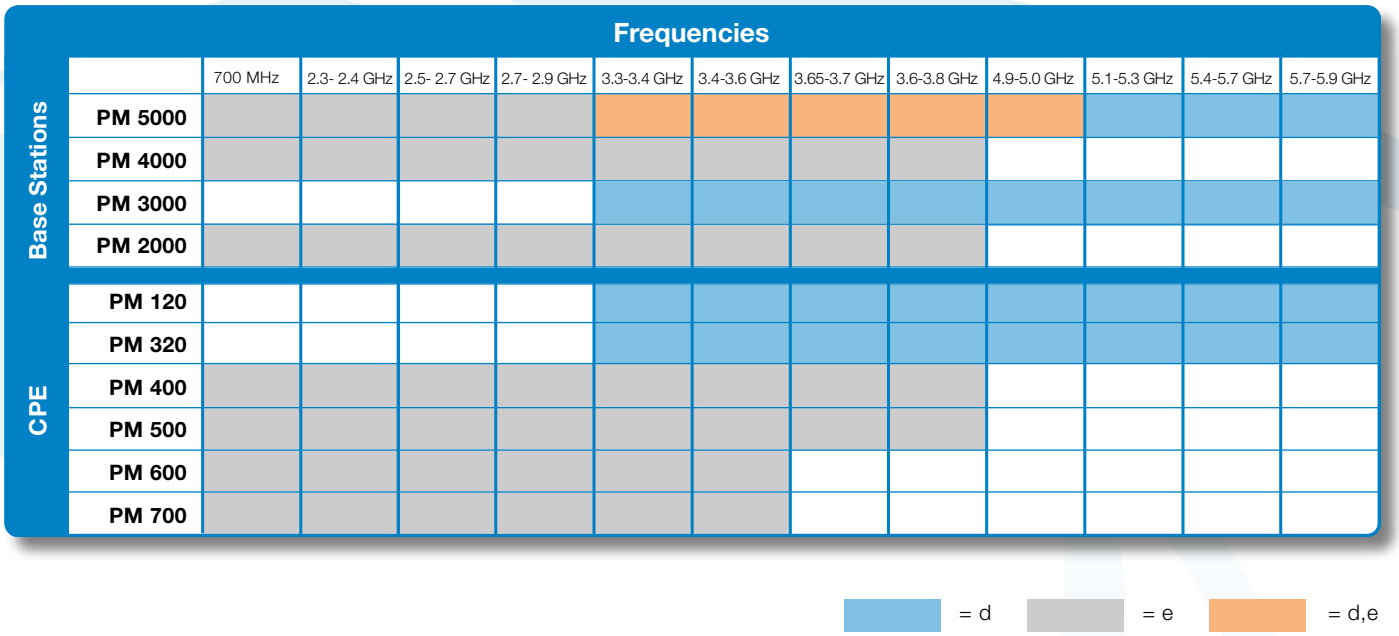
Aperto's team of engineers is available to respond to specials requests for assistance in PacketMAX system commissioning, installation and integration. Professional engineering services also consist of software upgrades, service recovery and custom patch installation.

Uniquely Powerful WiMAX Solutions

PacketMAX delivers the complete range of end-to-end WiMAX services including voice, multi-multimedia and data for virtually any deployment type including fixed, nomadic, portable and mobile. The high performance, high capacity PacketMAX infrastructure scales to elegantly accomodate small initial deployments to very large ones, while limiting capital costs. Base station options include all-fixed services, all-mobile services, or fixed and mobile services within the same chassis. Aperto offers the widest array of WiMAX compliant subscriber units, including units designed for large and medium enterprise, for small businesses and home office users, and for all-indoor residential users.



Frequency and Products



Aperto Solutions		
Applications/Services	**Business/Enterprise**	**Residential/Consumer**
WiFi Mesh Backhaul	Leased Line Alternative	DSL Alternative
Public Safety	Service Guarantees	Multi-megabit Data Service
Video	MDU/ MTU	Indoor Self-Installable
Portable and Mobile Access	Voice Services	Voice Services
Outdoor and Indoor Access	Remote Site Access	Mobile Data

"After a thorough evaluation of several wireless broadband solutions providers, we came to the conclusion that Aperto Networks had the most advanced and the most stable platform. We were especially pleased with the Quality of Service and the routing and advanced networking features built into Aperto's platform. Its flexible architecture ensures a future proof evolution as we implement new subscriber services in the coming months and years."

Ahmed Ebraheem

Managing Director, MADA: Kuwait

www.apertonet.com

Aperto Networks I 598 Gibraltar Drive, Milpitas, CA 95035, USA I Phone: +1.408.719.9977 I Fax: +1.408.719.9970
Visit our website at: www.apertonet.com I Sales and Product Inquiries: sales@apertonet.com

PRODBRO0608