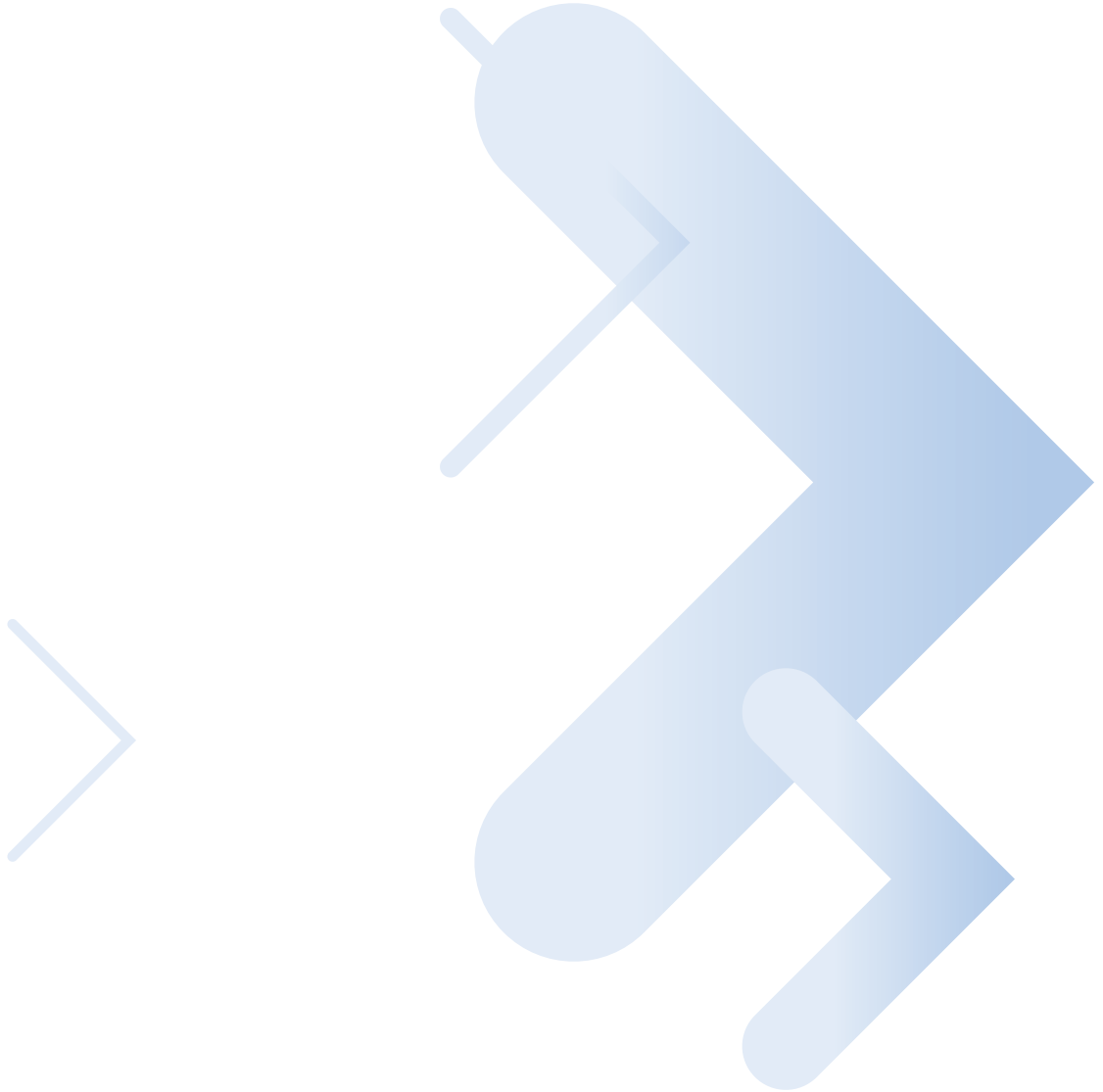




# WiMAX Opens the Door to New Communications Markets

Fresh Opportunities for New Industry Entrants



WiMAX technology offers particular advantages to innovative, entrepreneurial new industry entrants. These new entrants typically are agile, venture groups with access to capital and spectrum resources. They have diverse operator profiles such as ISP/WISPs, media content owners, utilities, global education entities, retailers, and governments. While industry incumbents such as wireless and wireline operators may be encumbered with legacy infrastructure and back office systems, new entrants are nimble and can speed new services to market.

## WiMAX Opens the Door to New Industry Entrants

The telecommunication industry has evolved more rapidly in the last decade than at any time in history. Mobile telephony and the Internet have been embraced by populations around the globe. This rapid change in the way we communicate and get information will continue to accelerate as the demand for mobile broadband grows and evolves. WiMAX fixed and mobile broadband is already a reality that presents tremendous opportunity to new industry entrants who are poised to capitalize on it (Fig. 1).

WiMAX opens doors to new players by offering new frequency allocations, global open standards, new networks and new business models. WiMAX networks are inherently simple, spectrally efficient and easy to deploy. Because WiMAX is a cost effective, standards based, wireless technology, it has already given rise to next generation applications, new chipsets and new devices.

This paper explores how new industry entrants can gain early market share and benefit from a number of new opportunities to bridge the digital divide, capitalize on roaming fees, and extend connections to small and medium enterprises. This paper also discusses why WiMAX technology has specific advantages such as cost effective solutions, simple system integration, affordable spectrum and access to available devices - that make these business opportunities possible in ways that few other technologies have done before.

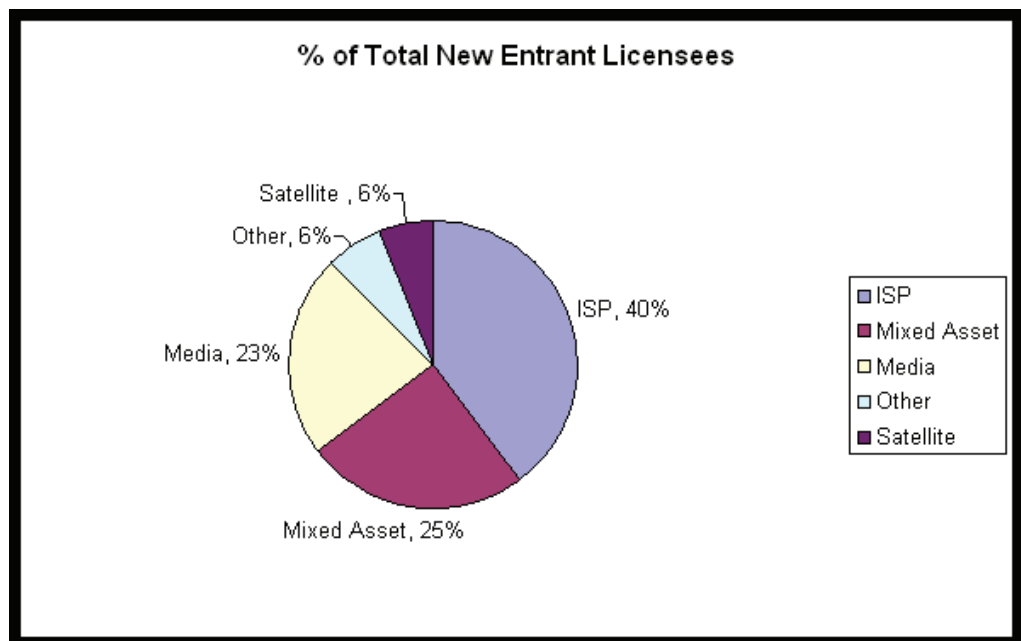


Figure 1: New Entrant WiMAX License Owners. Source: Motorola Research



## Opportunities for New Entrants

There is untapped demand for wireless broadband that ranges from basic connections to rich, personnel content. WiMAX, with advanced wireless and digital technology, a minimal foot print and low cost of ownership, provides a means to offer compelling new content and differentiated services. WiMAX provides true wireless broadband with multi-megabits of throughput in downlink and uplink. WiMAX also supports low latency applications such as VoIP and gaming. New entrants have a window of opportunity to capture true wireless broadband market share and reap high margins since many less nimble, industry incumbents are committed to legacy technology that is not equipped to meet the growing wireless broadband demand.

WiMAX technology features spectral efficiency, advanced antenna technologies, open standards, cost advantages, and flat IP architecture that new entrants can use to bridge the digital divide, provide next generation mobile broadband applications, extend connections to small offices/home offices and capitalize on roaming fees. New entrants who use WiMAX to seize these opportunity will experience the greatest, earliest success as they introduce fixed and mobile broadband services.

### Bridging the Digital Divide

Governments around the globe are allocating frequencies in the WiMAX spectrum and encouraging new entrants to use this spectrum to bridge the digital divide. New entrants have an opportunity in both developed and emerging markets to tap millions of new subscribers by accelerating the broadband penetration. Broadband penetration is close to 1% in most emerging markets and averages only 20% in developed markets. For example Mexico, an emerging market, has 3.5% broadband penetration, while the USA, a developed market still only has 20% penetration<sup>1</sup>. WiMAX, with its next generation wireless technology can extend miles of broadband coverage quickly, easily and cost effectively.

Recent OECD broadband statistics shows that broadband penetration and GDP per capita have a significant correlation of 0.649<sup>1</sup>. There is increased regulatory support for WiMAX and easy access to spectrum globally. Many countries have already allocated frequencies in the WiMAX spectrum and 90% of them have chosen 3.5 GHz, 2.5 GHz or 2.3 GHz band as their WiMAX frequency [Motorola Research].

There are significant opportunities for new entrants to offer extended coverage to underserved rural areas by providing economical fixed/mobile broadband. WiMAX is an ideal technology to accomplish this because it offers wide area, cellular-like coverage, higher throughputs and a broad range of service platforms. There is even greater growth potential in emerging markets. For example Wateen's nationwide WiMAX network in Pakistan was quickly deployed and widely accepted. While it is prohibitively expensive to extend copper in emerging market, new entrants can see relatively quick return on investment with a cost-effective, WiMAX network.

Furthermore, new entrants can pioneer innovative, flexible service offerings in these markets. WiMAX technology is particularly versatile so a new entrant can offer mobile or fixed broadband service. By offering a fixed system now and mobility later, the service provider can maintain a competitive edge by easily adapting the WiMAX network to the evolving demands of customers.

### Meeting Demand for Mobile Broadband:

There is tremendous demand for mobile broadband and subscribers are ready to pay a premium for wireless broadband. New entrants have an opportunity to offer differentiated services based on WiMAX high throughput capacity and mobile broadband. To do so, consumers today move between home, vehicle, hot spots and office while remaining connected, but they must use different access media such as Ethernet, PC card, PDA and technologies such as DSL/Cable, Wi-Fi/CDMA/UMTS. Business users need to increase productivity wherever they operate around the globe. Both consumers and business users want one, simple communication solution that offers ubiquitous coverage, high capacity, and mobility. With quick, easy to deploy 802.16e standard based WiMAX technology, new entrants can meet this demand for high-speed, high-throughput mobile broadband.

New broadband applications with rich personnel content require gigabytes of capacity and demand ubiquitous coverage. Today a single, high resolution photo can be 0.5 gigabytes or more. This type of file is usually uploaded at a wireline terminal. We call this a “stop and go” mechanism – the user must wait until they have time to stop at their wireline terminal to share large files. WiMAX replaces “stop and go” with “broadband on the go” coverage.

While current mobile cellular systems have insufficient capacity or coverage to handle bandwidth intensive activity, WiMAX, with cellular-like mobility and coverage, provides a true mobile broadband experience with throughputs that are many times greater than traditional cellular networks.

#### Introducing Niche Services

WiMAX provides a great opportunity for new entrants to target a particular segment of the broadband market and provide a branded niche services because it offers a broad range of devices and chipsets, common IP core and five classes of wireline-like QoS. Previously, an operator was dependent on an incumbent for a differentiated service with unique application. With WiMAX, new entrants can introduce niche services directly to the end user. For example, scarce, healthcare professionals must move constantly between hospitals. A real time, mobile healthcare service using a WiMAX, multi-modal device could provide healthcare workers visual access to remote patients, connection to other healthcare professionals, access to healthcare data, and communication with administrative staff. Multi-modal devices, for example a device that operates with both GSM and WiMAX, can support voice and broadband connections and will be a niche service that a new entrant can directly offer using differentiated applications, devices and chipsets.

In emerging markets, new entrants can pioneer innovative, flexible new models of deployment. New entrants can model their operation from the outset on a mobile broadband network principal. This differentiated services model can provide a competitive advantage for many years while generating flexible ARPU (Average Revenue per User) that is based on the priorities of the end user.

Finally, there are untraditional new market segments that are not served. An emerging youth market requires mobile broadband for education, entertainment, gaming, video, and daily communication. Parents want location based services to monitor their children’s activity. An emerging ethnic market has unique communications demands as citizens of various countries travel around the globe in search of jobs and opportunity. In order to stay in touch with friends and family at home, they demand high throughput mobile broadband solutions where niche services can be introduced with WiMAX which can be deployed in multiple countries at the same time.

#### Extending Connections to Small Medium Enterprise

Small and Medium Enterprises demand fixed and mobile broadband to support their businesses at home and in remote locations. There is untapped opportunity to serve the SME with a “broadband on the go” solution. This “broadband on the go” solution will give the SME a competitive advantage and more time for customers. [2] 60 to 70% of jobs in the OECD countries are from small medium enterprise (SME) and in developed country like US [3] home-based businesses make up 53 percent of the small business population and serve as incubators for many growing businesses. SME and home-based businesses represent a tremendous opportunity for a new entrant who can offer high capacity broadband as well as flexible broadband connections. Currently, SME and home-based workers are dependent on costly E1/T1 connections for their broadband. E1/T1 connections are not universally available and they require long set up times for routers, switches and other network equipment. In comparison, WiMAX broadband connections, which use PCMCIA cards, are easy and quick. This means faster time to service for the end user and faster time to ROI (Return on Investment) for the new entrant service provider.

#### Capitalizing on Roaming Fees

New entrants can capitalize on impressive ARPU opportunities from travelers roaming in their licensed territory. This is like early cell phone days when users paid a premium to have their connection while roaming. WiMAX networks are already being deployed around the globe. The promise of WiMAX is clearly becoming the reality of WiMAX as major device suppliers, equipment vendors and service providers join forces to create the new WiMAX ecosystem. As WiMAX service spreads and the number of WiMAX users grows, business travelers and global tourists will expect to take their wireless broadband connections with them wherever they travel. Also, the proliferation of multi mode devices will make this opportunity even greater as users travel between Wi-Fi, GSM/CDMA and WiMAX networks. Roaming opportunities from mobile broadband travelers will speed the new entrant’s return on investment.

WiMAX is uniquely suited to meet the needs of new entrants because it is cost effective and quick and easy to deploy. It also offers simple system integration, affordable access to spectrum and access to a broad range of next generation devices.

## The WiMAX Technology Advantage

WiMAX is a flexible, brilliant technology that offers both coverage and capacity advantages. Its easy scalability will allow networks to evolve for the needs of tomorrow. WiMAX is uniquely suited to meet the needs of new entrants because it is cost effective and quick and easy to deploy. It also offers simple system integration, affordable access to spectrum and access to a broad range of next generation devices.

### Cost Advantages:

Since WiMAX technology is based on a globally accepted standard, WiMAX delivers great cost advantages - both CAPEX and OPEX. The WiMAX Forum™ currently has 400 members representing broad industry participation and worldwide adoption with participation from not only WiMAX vendors and operators but also from academia, application developers, content developers, and component suppliers.

Because this is not a proprietary technology, equipment and subscriber devices will benefit from economies of scale since large chipset and silicon vendors will offer competitive pricing – similar to Wi-Fi equipment pricing.

WiMAX offers the industry a very capable platform by which to deliver the demanding service requirements for mobile broadband today and tomorrow. With the added support for a variety of advanced multi-antenna implementations such as MIMO (multiple in multiple out) and beamforming, WiMAX offers the new entrant considerable edge compared to incumbents in meeting their demands and achieving higher performance, fewer sites, less spectrum, and reduced CAPEX.

The WiMAX Forum uses a common WiMAX reference architecture (Fig. 2) with four modular areas that make up the WiMAX ecosystem. Devices and infrastructure developers, operators, media and content providers, and application developers use this architecture to achieve interoperability. This process is enforced with certification standards to assure WiMAX is a cohesive, cost effective solution.

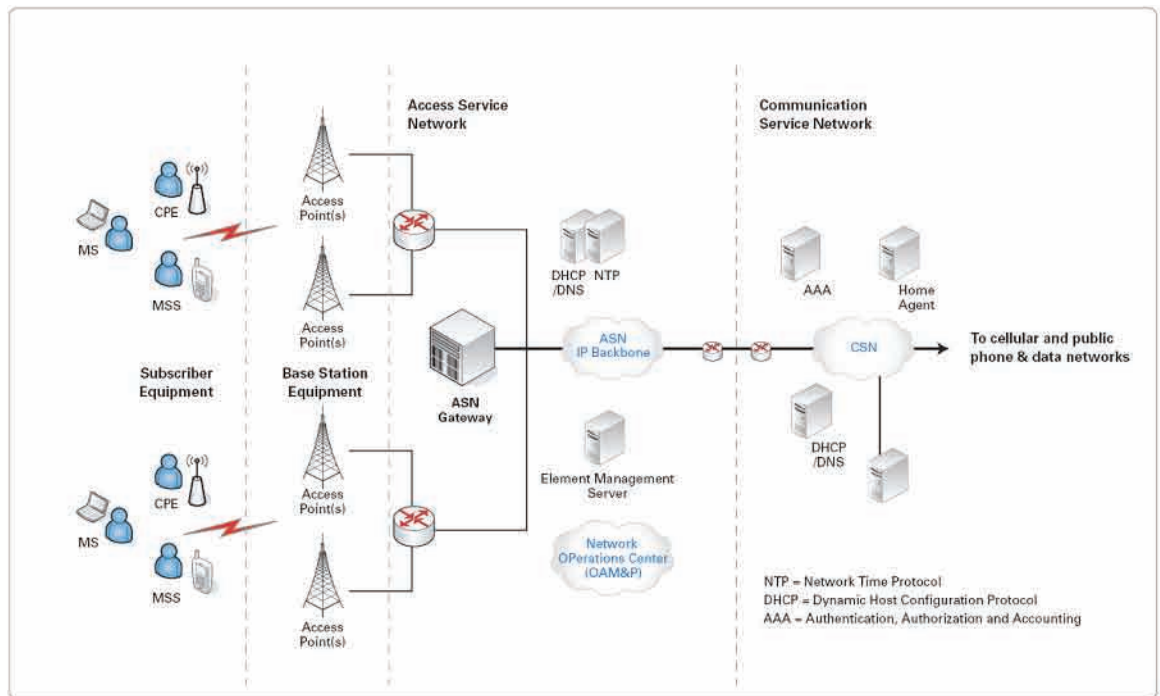


Figure 2: WiMAX Reference Architecture's modular view

## WiMAX CAPEX and deployment risks can be reduced when working with a vendor that offers expertise and end-to-end solutions including devices, access points, ASN-Gateway, core network, applications, end-to-end services and proven deployment experience

WiMAX infrastructure uses all the advantages of the most efficient wireless and digital technologies – while remaining smaller and more economical. WiMAX typically uses light infrastructure and can be deployed in speeds never imagined before. WiMAX offers cost savings by utilizing backhaul with IP interface, high speed wireless interface and tower top access points with zero footprint implementations. A light infrastructure, WiMAX network that is easy to install and easy to manage allows new entrants to quickly realize profits and reduced CAPEX & OPEX.

Furthermore, selecting the right partner can reduce the cost of a WiMAX deployment. WiMAX CAPEX and deployment risks can be reduced when working with a vendor that offers expertise and end-to-end solutions including devices, access points, ASN-Gateway, core network, applications, end-to-end services and proven deployment experience. A partner with managed service experience in WiMAX can take care of daily operations and maintenance and provide performance guarantees resulting in significant OPEX reductions. This frees the new entrant to focus on business objectives & core competencies

### Simple System Integration

The WiMAX distributed architecture is a simpler, more powerful alternative to traditional hierarchical cellular networks based on complex layers of control. WiMAX networks and supplemental solutions take maximum advantage of the power of IP technology, utilizing the latest advancements in mobility management and providing a robust and versatile services platform.

WiMAX is simpler and more efficient, providing both “Broadband-on-the-Go” capabilities and significantly reduced CAPEX and OPEX. Cellular data traffic must go through the equivalent of an MSC (Mobile Switching Center), SGSN/GGSN in a GPRS/EDGE network or through a PDSN in a CDMA network. In contrast, the WiMAX network has a flat IP architecture that connects to high throughput backhaul using Ethernet (10/100/1000 Base T Ethernet) and common core IP. This simple architecture makes WiMAX deployment and management remarkably easy and significantly reduces CAPEX and OPEX. (Fig. 3)

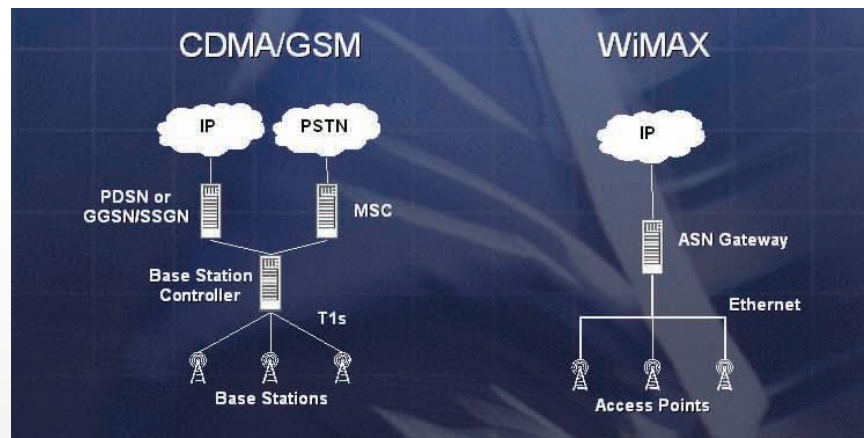


Figure 3: Comparison of wireless networks

### License Spectrum is Available at an affordable Cost

WiMAX has support from regulators worldwide because it is the one of the fastest and most cost effective mechanism that can bridge the digital divide. WiMAX spectrum allocations are completely different from large auctions of cellular spectrum. WiMAX licenses are made available globally at significantly low prices compared to cellular licenses. WiMAX operates in the licensed spectrum and hence avoids interference and guarantees services to subscribers. The WiMAX Forum has approved licensed spectrum in 3.5GHz, 2.5GHz and 2.3GHz frequency bands. The WiMAX Forum conducts regular plug-fests to ensure interoperability among vendors in a given band. In addition, regular certification tests conducted separately confirm the use of products in the commercial market. The WiMAX Forum continues to expand the band of frequencies. Recognizing the correlation between wireless broadband and GDP per capita, WiMAX spectrum has been allocated globally and there are approximately 1000 WiMAX spectrum license holders worldwide [Motorola Research]. These new spectrums are easily available and affordable. The availability provides a competitive edge to WiMAX broadband operators and provides opportunity for independent deployment models.

### Access to Devices

WiMAX vendors have developed a broad portfolio of high-performing, feature rich WiMAX devices as part of their end-to-end WiMAX solutions suite. The embedded base of WiMAX enabled devices including laptops, mobile phones, PDA, vehicles, billboards and other machines is growing tremendously. This large embedded base will drive the demand for WiMAX infrastructure globally and provide a significant advantage over cellular and wireline broadband solutions. The device portfolio includes outdoor subscriber units with unobtrusive profile and robust coverage and capacity, desktop subscriber units that receive signals through building walls and can be self installed, PC cards that bring the WiMAX connection directly to the laptop, and handsets featuring multimode/multi-band operations with cellular-like mobile performance with broadband-like data throughput.

The WiMAX entry level devices with sleek styles and reduced cost are tailored to appeal to end-users. They deliver fast, reliable, high-speed wireless broadband connectivity with no wait for installation, no complex configuration and no operator intervention. The simple, low-profile, appealing form-factor manages to pack tremendous technology capabilities including multi-antenna operations and sophisticated signal processing, flexible and reprogrammable hardware for over-the-air updates, and a series of features that include embedded WiFi and VoIP capability.

A key success factor in wireless broadband is easy access to devices and chipsets. Today there is a growing variety of WiMAX CPEs (Customer Premises Equipment), WiMAX devices, PCMCIA cards, and chipsets. These devices are next generation, cost efficient devices with multiple screens for various applications. They are multi-modal (WiFi/WiMAX, GSM/WiMAX) to capitalize on roaming fees. They have high storage capacity and high throughput for rich personnel content. In addition there are commitments from various large and small vendors to develop chipsets that could be embedded not only in devices but also in machines which will change consumer life styles and enterprise operations and management.

In contrast, the WiMAX network has a flat IP architecture that connects to high throughput backhaul using Ethernet (10/100/1000 Base T Ethernet) and common core IP. This simple architecture makes WiMAX deployment and management remarkably easy and significantly reduces CAPEX and OPEX.

### WiMAX Offers Differentiated services:

WiMAX provides new entrants a platform that can deliver differentiated services in a way that pays.

New entrants to the wireless industry have already successfully capitalized on roaming fees and basic connections. There are many examples of new entrants who have introduced differentiated services like Push-to-Talk, VoIP and multimedia quite profitably. In most cases they succeeded because incumbents had difficulty replacing or providing a differentiated service that could compete with the enterprising new entrant.

However, there have been occasions when new entrants have not been able to establish themselves compared to larger new entrants or incumbents. For example, some providers whose business models were purely based on price points rather than differentiated services were not successful.

WiMAX provides new entrants a platform that can deliver differentiated services in a way that pays. WiMAX ground up support of QoS makes it easy for new entrants to implement multiple, differentiated services and prioritize them based on the requirement of the end-user. (Fig. 4)

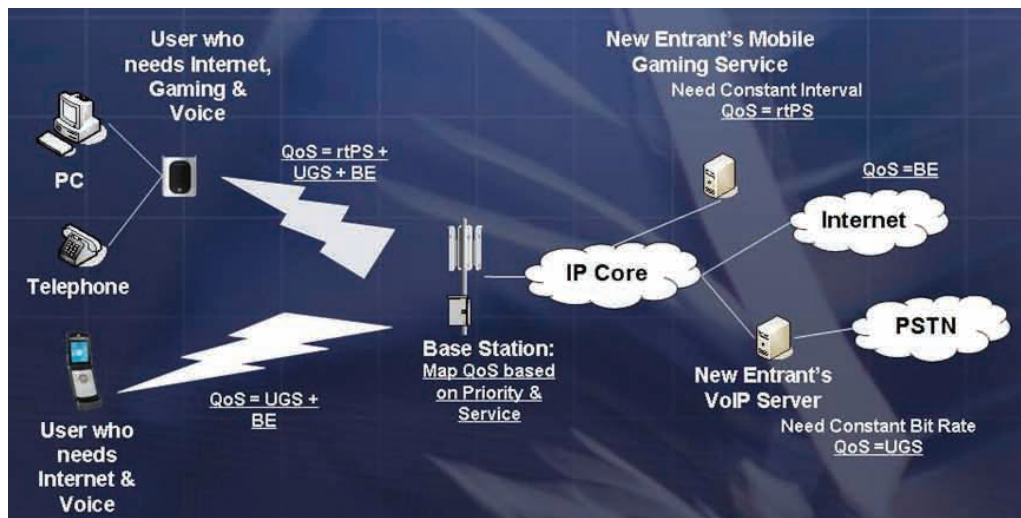
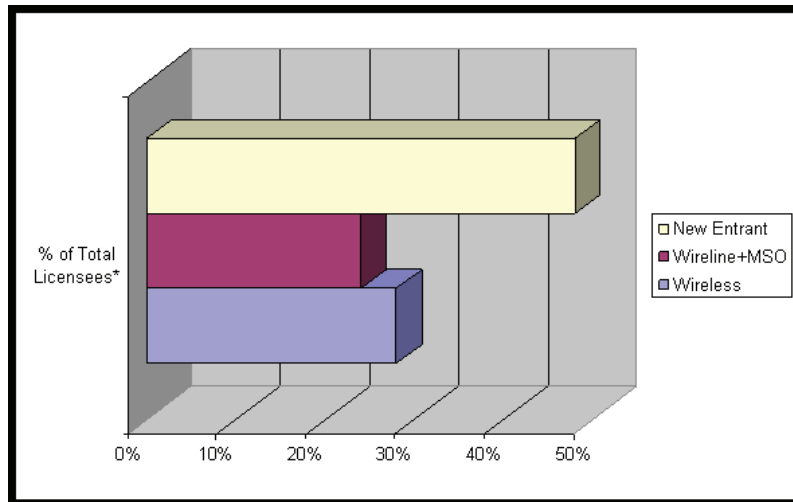


Figure 4: WiMAX QoS assignment based on differentiated services

New entrants who have deployed WiMAX already are experiencing high penetration rates.

## Conclusion: Delivering Seamless Mobility

New entrants who have deployed WiMAX already are experiencing high penetration rates. WiMAX differentiated devices and applications are being introduced in cities across the world and end users are getting connected to high throughput fixed or mobile broadband networks that they never imagined possible. Countries like Pakistan, with low internet access are now quickly bridging the digital divide. Countries like the US are poised to become some of the highest broadband penetration countries in the world with WiMAX deployments in multiple cities. A large share in this WiMAX presence is due to new entrants. As shown below, new entrants are ahead of incumbents in WiMAX Spectrum allocation and the ability to deliver differentiated services to end customer directly. (Fig. 5)



**Figure 5: WiMAX License owners by Segments, Motorola Research**

Just as new entrants seek to effect the business transformations necessary to compete effectively in a new, digital, converged, mobile IP world, WiMAX arrives to play a key role in their transformation strategies.

The Internet enabled a dramatic shift in how end-users connect and communicate and how global business and commerce is conducted. WiMAX mobile broadband is creating a new landscape again. End-users will have ubiquitous broadband connections that follow them wherever they are for ready access to bandwidth-intensive, personalized, rich-media content.

The IP-based distributed architecture of the WiMAX network, is inherently more interoperable—in large part because the design is not encumbered by the requirement to support a number of proprietary components. This makes interconnectivity more agnostic when integrating common subscriber management, messaging and other services.

Supporting full mobility applications and effective service delivery, the flexibility of the WiMAX architecture also facilitates core network integration. Through its converged IP core, the network can connect across the new entrant's full portfolio of differentiated solutions and connect to the end user in any environment by the most capable network and best device – delivering on the promise of Seamless Mobility.

### Reference:

[1] Source OECD: <http://www.oecd.org/sti/ict/broadband> accessed on 05/05/2007

[2] Source OECD: <http://www.oecd.org/dataoecd/10/59/2090740.pdf> accessed on 05/24/2007

[3] Source US Small Business Administration: <http://www.sba.gov/advo/press/04-36.html> accessed on 05/24/2007



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