


Reaching sustained growth in the WiMAX market

A survey of WiMAX operators, with a subscriber forecast for 2009–2014



Strong subscriber growth over the past year has demonstrated the appeal of WiMAX technology. Now operators are aggressively expanding their networks to keep up with the growth in demand.

- By 2014, we expect to see more than 90 million subscribers worldwide, with 47% of them in Asia Pacific.
- Service revenues will reach \$24 billion, with ARPUs at \$22 per month, with the highest ARPUs in North America and the lowest in Asia Pacific.
- WiMAX operators will increasingly push mobile services and devices. Today 66% of subscribers use WiMAX as a fixed broadband service. By 2014, only 47% of subscribers will. The rest will increasingly use WiMAX as a mobile service, using dongles (31%), embedded laptops (7%), or phones or other devices (27%).

Introduction

The WiMAX market has entered a stage of sustained growth. Operators have moved from the slide deck and vendor selection stage to the more demanding jobs of building networks and signing up customers. A couple of years ago, the focus of operators' attention was on the fundamentals—which type of equipment worked best and how fast the price of subscriber units would decrease. Today operators are asking vendors for a wider variety of devices that will enable them to increase the capacity and reach of their networks, and new base station form factors that will give them the flexibility they need as they expand their networks. They are also experimenting with new services and new ways to reach their subscribers, and to make the services more attractive.

The feedback from subscribers. The fast growth in subscribership and traffic per user demonstrates that WiMAX operators have got the attention of subscribers in their markets. Yota in Russia has signed up 500,000 subscribers in less than a year of operation, with most subscribers from two cities, Moscow and Saint Petersburg. In Malaysia, P1's major challenge is to roll out enough base stations to meet demand. P1 has 180,000 subscribers and is the country's second-ranking broadband operator in terms of net subscriber adds. In the US, Clear was close to reaching the one million subscriber mark at the end of 1Q2010, signing up almost 100,000 subscribers per month. Equally impressive has been the growth in per-user traffic, with many operators in emerging markets reporting monthly average usage levels over 10 GB, well above the 7 GB average traffic generated by Clear subscribers in the US.

The present and the future of WiMAX. We have conducted a survey of WiMAX operators to illustrate market progress to date and as the basis for our forecast of how the market will evolve during the 2009 to 2014 period. The survey covers Mobile WiMAX (Institute of Electrical and Electronics Engineers [IEEE] 802.16e, also simply referred to as WiMAX in the rest of this paper) operators with over 1,000 subscribers worldwide, split into six geographical regions.

This paper reports on subscribership, service revenues, usage models, devices, traffic, base stations deployed, and plans to move to the next generation of WiMAX—WiMAX 2. Based on IEEE 802.16m, WiMAX 2 is set to become an International Mobile Telecommunications (IMT) Advanced Fourth Generation (4G) technology.

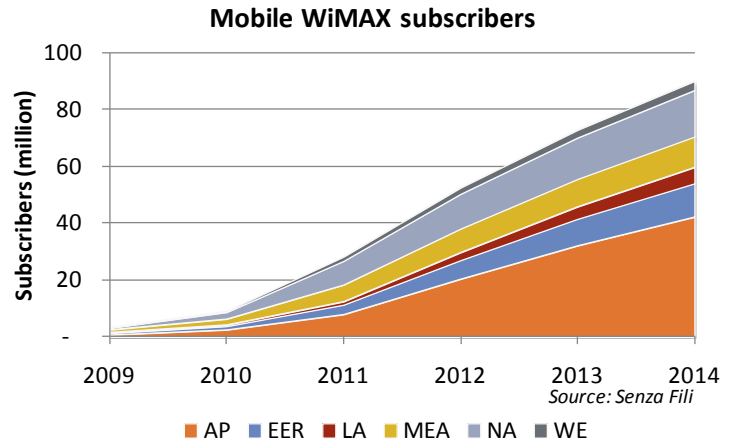
Moving on from Fixed WiMAX. In our survey, we counted 65 Mobile WiMAX operators with over 1,000 subscribers, already surpassing the number of Fixed WiMAX (IEEE 802.16d) operators only a year and a half after Sprint's launch of the service in Baltimore, before it joined its network with Clear. Mobile WiMAX networks are also larger (45,000 subscribers on average) than Fixed WiMAX networks (averaging 31,000 subscribers), because Mobile WiMAX operators tend to have a wider geographical target and deeper pockets. Furthermore, wide coverage is a requirement for providing a true mobile service and this requires a more aggressive rollout than that of many Fixed WiMAX operators, which target niche markets in selected regions.

Targeting full mobility. WiMAX operators are still mostly focused on providing fixed broadband connectivity, with 66% of subscribers still fitting a fixed subscriber usage model (i.e., subscribers access the network from a single location throughout the billing cycle). For most WiMAX operators, this is a deliberate choice that allows them to sign up subscribers and gain revenues while they expand their network, when they do not yet have nationwide coverage to provide a truly mobile service. Almost invariably, however, mobility is the end game, although the service proposition and the timeline for the rollout of mobile services vary greatly across markets and operators.

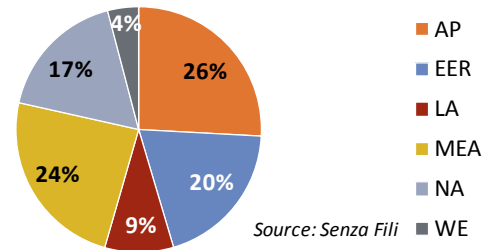
Subscriber growth

Accelerated growth in 2010. At the end of 2009, there were slightly more than 3 million WiMAX subscribers. Midyear results from operators indicate they are well positioned to reach the 9 million subscriber mark we forecast by the end of the year, with a growth rate of 195%. This growth rate is not sustainable in the long term; we expect the compound average growth rate (CAGR) over the 2009 to 2014 period to be 97%. But for now, this aggressive growth rate is linked to three key factors:

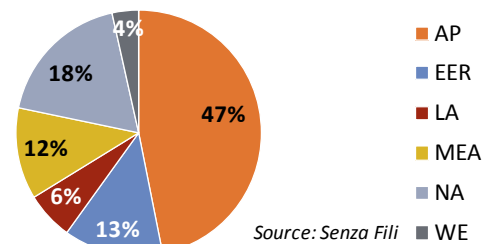
- Many WiMAX operators have finished building their networks, and they either have launched services or plan to do so during 2010. For instance, the Taiwan market will take off during 2010, with most operators committed to a launch this year.
- The largest WiMAX operators, such as Clear (US), Yota (Russia), P1 (Malaysia), and UQ (Japan), are aggressively expanding their footprint and launching service in new markets. They have met good success and very strong subscriber growth, with their subscribers increasingly drawn to the services by the appeal of mobile broadband access—not simply by the chance to switch away from their wireline digital subscriber line (DSL) or cable connection.
- A wider choice of devices at more affordable price points is available, allowing operators to offer more flexible usage models to their subscribers. In Russia, for instance, Yota offers its subscribers a choice among several dongles, desktop modems (some with Wi-Fi), a smartphone, and over 50 laptops or notebooks with an embedded WiMAX modem.



Subscribers by region in 2009



Subscribers by region in 2014



Forecast regions	
AP: Asia Pacific	MEA: Middle East, Africa
EER: Eastern Europe, Russia	NA: North America
LA: Latin America	WE: Western Europe

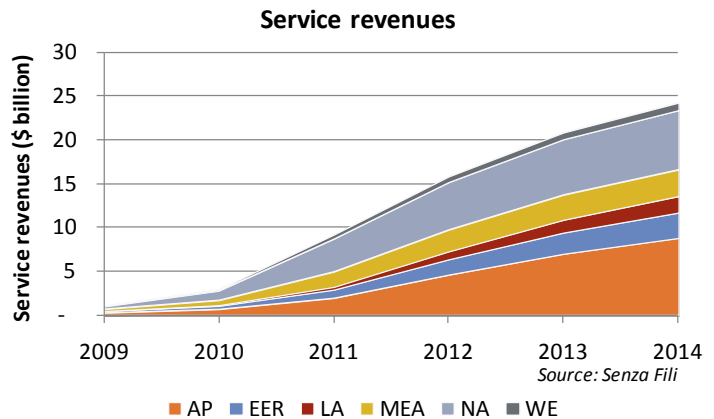
Market development to 2014. By 2014, WiMAX operators will serve over 90 million subscribers. Growth will be driven by increasing demand for both fixed and mobile connectivity, and sustained by further expansion of the footprint of WiMAX networks and by a wider choice of affordable devices. Furthermore, we expect that vertical applications (e.g., health care, transportation, safety) will further drive usage, as will new services that rely on new device form factors, such as digital music players and book readers, and car modules with built-in wireless connectivity.

Subscriber distribution by region. The greatest push for WiMAX comes from developing countries—albeit with strong support from the US. Previous wireless technologies, such as 3G and Wi-Fi, spread in developed countries first instead. Only when they became established there did they become adopted in emerging countries.

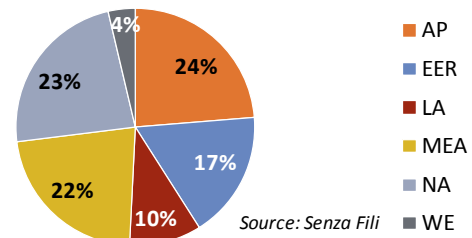
This reversal in market dynamic is very beneficial to WiMAX, making it is a more innovative, faster-moving technology. Emerging markets are the ones with fastest growth and innovation. Demand—and usage—for both fixed and mobile services is expanding quickly, driven by affordable service plans. But increasing competition from wireline and wireless players, combined with subscribers’ price sensitivity, is leading to harsh price competition in most markets. To protect their ARPU, operators are developing innovative product offerings closely tailored to their markets.

Emerging markets account for 65% of subscribers today. This figure will grow to 76% by 2014. Asia Pacific will increase its share of global subscribers from 26% in 2009 to 47% in 2014. Growth will also remain strong in other emerging markets.

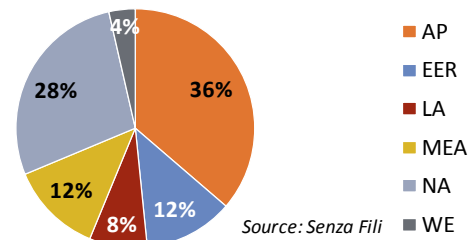
The Middle East and Africa is the region where WiMAX will have the strongest role in increasing broadband penetration. By 2014, WiMAX subscribers in this region will represent almost 7% of fixed broadband connections, compared to a worldwide figure of 4%.



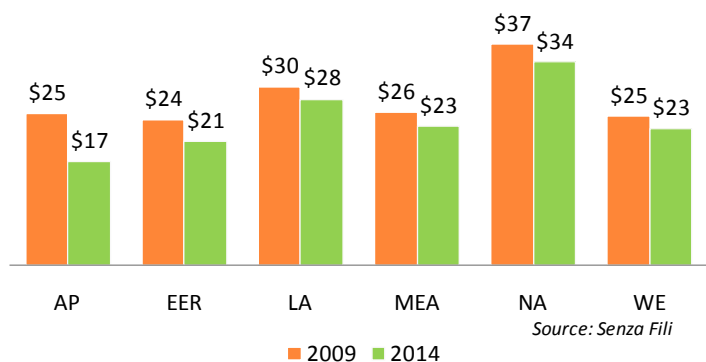
Revenues by region in 2009



Revenues by region in 2014



ARPU in 2009 and 2014



The most difficult market for WiMAX remains Western Europe, with a few exceptions like Ireland, where competition in the broadband market is low, and the incumbent that has been ineffective at meeting demand for broadband connectivity. In other countries, WiMAX operators' spectrum ownership is mostly concentrated in the 3.5 GHz band, available in most countries for a long time, but still underutilized. Cellular operators are the most likely to win spectrum in the 2.6 GHz band in the upcoming auctions, and in countries like Germany, they have done so already. They plan to use LTE in this band, so WiMAX will be mostly confined to the 3.5 GHz band, which is a band that is not well suited for mobility outside high-density urban areas.

Most WiMAX operators in Europe are greenfield and do not have the type of funding and spectrum holdings that, for example, Clear has in the US. As a result, many WiMAX operators focus on tier-two, underserved cities or even small villages, and a higher portion of them still use Fixed WiMAX. When they operate in urban areas, the availability of service from multiple operators puts intense pressure on the pricing of service plans from both fixed and mobile providers.

ARPU and service revenues. As a technology, WiMAX competes with both fixed and mobile broadband access technologies. This gives operators flexibility in marketing the service, but it also increases the pressure to keep prices competitive on both fronts, intensified by the increased availability of both wireline (DSL, fiber-to-the-home) and mobile (High Speed Packet Access [HSPA], LTE) broadband access. We expect WiMAX operators to launch prepaid and/or lower-cost plans that are more affordable to reach wider segments of the addressable market. As a result of these trends, we expect to see ARPU erosion over time, with global monthly ARPU declining from \$28 to \$22 over the period from 2009 to 2014. Even in the Middle East and Africa, where operators have been able to keep ARPU levels high in the past, intensified competition—sometimes among WiMAX operators—has resulted in a downward trend in ARPUs. North and Latin America are more resistant to ARPU erosion, because they tend to have overall higher telecommunication prices due to relatively lower competition and less stringent regulation.

Fixed WiMAX as a niche technology. WiMAX operators worldwide—and especially the large ones with better access to funding—have largely shifted their support to Mobile WiMAX, leaving Fixed WiMAX to serve business customers or provide service in rural areas. Some smaller operators are transitioning from Fixed WiMAX to Mobile WiMAX as well. We expect the market for Fixed WiMAX to keep growing, with 1.9 million subscribers in 2009 and reaching 3.6 million in 2014, but at a slower pace of growth than that of Mobile WiMAX, so that Fixed Mobile's 39% share of total WiMAX subscribers in 2009 will shrink to 4% by 2014.

Using WiMAX: usage scenarios and devices

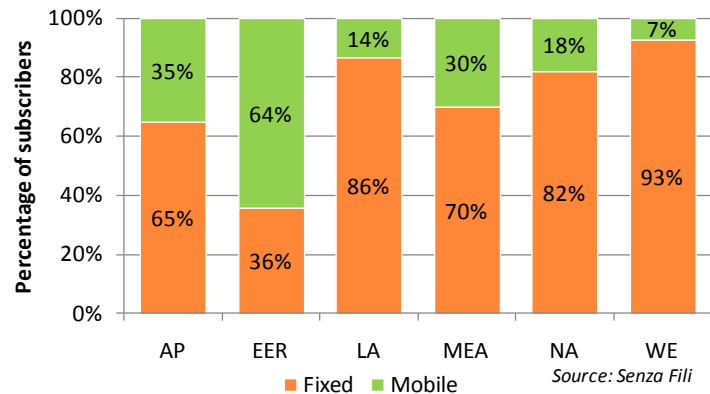
A mobile technology, initially driven by fixed service adoption. WiMAX supports vehicular mobility, allowing subscribers to keep their connection as they sit in a car, bus, or train. However, for most data applications, and especially in countries where public transportation is not pervasive, most of the usage—around 80% for many operators—comes from indoor subscribers, sitting at a desk, at home on a sofa, or at a coffee shop table, or waiting for a meeting to start.

The majority of WiMAX usage today, however, does not fall in this category. Around the world, 65% of subscribers use WiMAX as their main broadband connection to the home, as a DSL or cable modem replacement. For around a third of them, WiMAX is the first broadband technology available in their neighborhood. In developed countries, WiMAX gives many households in underserved areas a chance to upgrade to broadband. In emerging markets, it is often the first connection to the home, where individuals may have a mobile phone but no fixed copper telephone line.

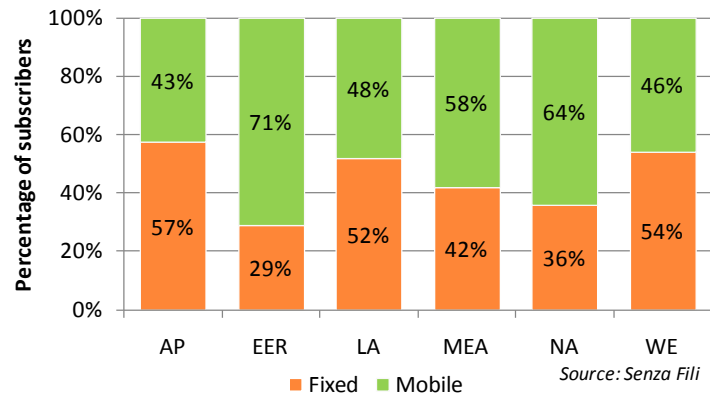
Serving two markets. The ability to offer both fixed and mobile services over the same technology is a boon to WiMAX operators, who often start marketing fixed services initially, when their footprint is still limited, and plan to add mobility as coverage increases. This is the strategy followed by P1, Clear, some Taiwanese operators, and even Western European operators like Imagine in Ireland.

With the exception of Eastern Europe and Russia, in all regions WiMAX usage follows a prevalently fixed usage scenario. The highest fixed usage is, perhaps surprisingly, in Western Europe. This is due to the fact that WiMAX adoption there is low and mostly confined to smaller providers focusing on underserved markets or on small businesses.

Subscribers usage model in 2009



Subscribers usage model in 2014



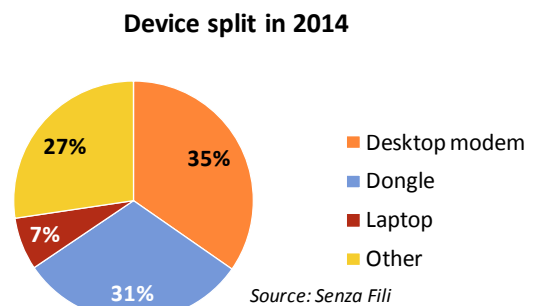
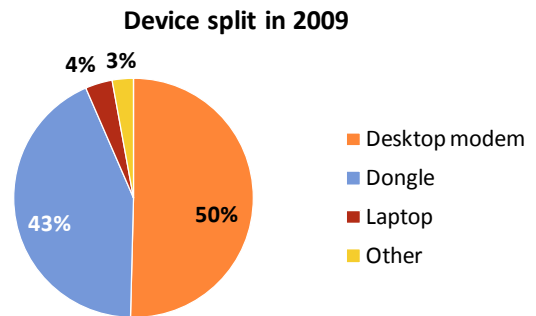
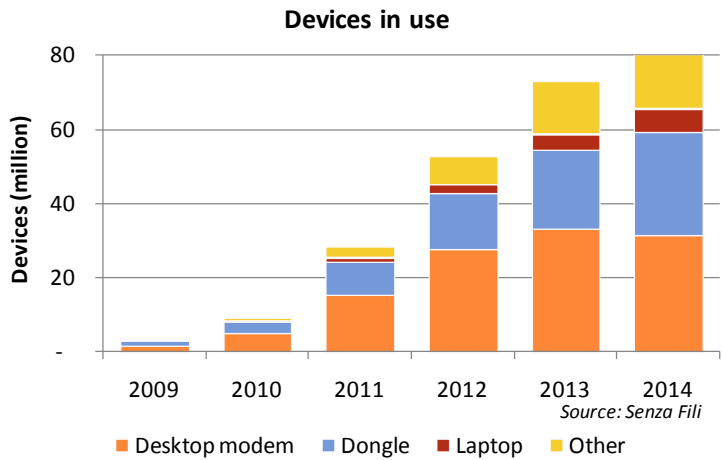
Even in the US, the majority of Clear subscribers still used a desktop modem, and through the first half of 2010, did not have the option to use a WiMAX smartphone. At P1 in Malaysia, 90% of subscribers use a desktop modem. In Saudi Arabia, at Mobily, desktop modems are still the only option, although dongles will be offered soon (the operator is not currently allowed to support mobile services).

Exceptions to this trend are KT in South Korea, UQ in Japan, and Yota in Russia. These operators have heavily targeted the nomadic and mobile market since launch.

The path toward mobility. By 2014 we expect to see a shift toward mobility, but fixed usage will still be strong, driven by emerging countries, where basic broadband connectivity will still be a main line of business for operators. The boundaries between fixed and mobile usage models, however, will become blurrier as we go on. Many subscribers might sign up primarily for a fixed service plan but use a dongle, take it with them as they travel, and use it on multiple devices. Across the world, we predict that 53% of subscribers will be primarily mobile by 2014, with mobile subscriptions being most widespread in Eastern Europe and Russia, where 3G services have appeared late and LTE is likely to be delayed as well. The lowest percentage of mobile users will be in Asia Pacific and Europe, because in many countries in those regions, broadband connectivity will remain the main driver for WiMAX services.

Decreasing market share for fixed devices. The split among WiMAX devices in use largely mirrors the move from fixed to mobile usage, and is dependent on the availability of mobile subscriber devices in a market. For instance, WiMAX smartphones will be introduced earlier in markets where WiMAX operators use 2.5 GHz, leaving 3.5 GHz markets somewhat behind in the move to mobility, as global demand for mobile access is more limited for the 3.5 GHz band.

The trend toward increased mobility among WiMAX subscribers translates into a diminishing market share of desktop modems, from 50% in 2009 to 35% in 2014.

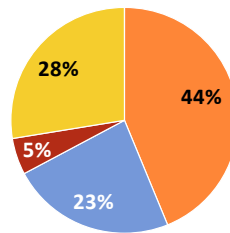


The region with the lowest desktop modem penetration in 2014 will be Eastern Europe and Russia (15%), driven by early and sustained growth of the mobile market segment. The highest percentage of desktop modems will be in Asia Pacific, where by 2014, 46% of WiMAX subscribers will still use desktop modem.

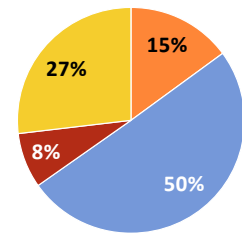
WiMAX-embedded laptops, smartphones, and other mobile devices to gain a larger market share. The market share of laptop dongles will also decrease, from 43% in 2009 to 31% in 2014, as the market share for WiMAX-embedded laptops and other devices increases. Embedded laptops will become more widely available over the next few years, and they will account for 4% to 7% of the WiMAX devices in use.

Other devices include smartphones and tablets, as well as modules for specific applications (e.g., modems in cabs with passenger applications, digital book readers, and automotive modules for direction and traffic information or car maintenance diagnostics). These devices will increase their market share at an even faster pace than laptops, from 3% in 2009 to 27% in 2014.

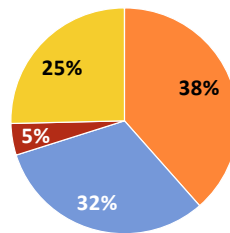
Device split in 2014: AP



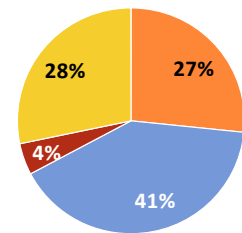
Device split in 2014: EER



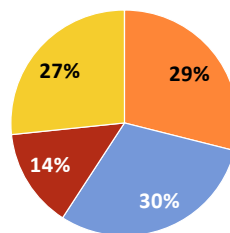
Device split in 2014: LA



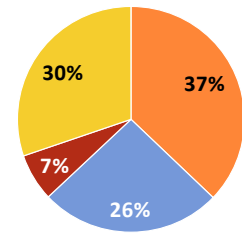
Device split in 2014: MEA



Device split in 2014: NA



Device split in 2014: WE



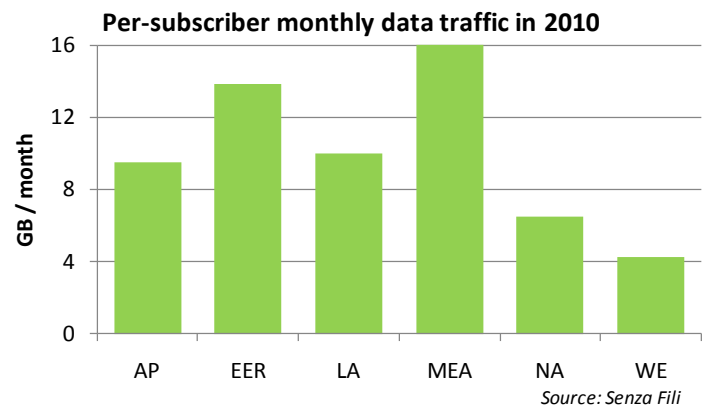
Legend: Desktop modem (orange), Dongle (blue), Laptop (red), Other (yellow)

Traffic, coverage, and capacity

Unlimited bandwidth—for how long? One of the selling propositions of WiMAX, especially in markets where traffic caps are widespread, is that it provides unlimited bandwidth at an affordable price. But some operators are having second thoughts after seeing how much traffic their subscribers generate, and how quickly both that and new subscribers are causing overall network traffic to grow. Operators realize they need to take action to avoid bandwidth congestion and ensure a fair distribution of network resources.

Highest traffic levels in emerging markets. Among operators that were able to share information on monthly traffic, it was 10 GB per subscriber on average. Usage rates were consistently higher in emerging markets. This trend, which goes counter to the accepted wisdom about internet usage being more intensive in developed countries, is likely fueled by several factors:

- In developed countries, heavy users are likely to select wireline technologies like fiber that are more expensive but provide faster speed. These subscribers may use WiMAX or other wireless broadband technologies as a secondary connection. Heavy users are a minority in all markets, but they contribute a huge percentage of traffic across technologies (less than 10% of users may contribute 70% to 80% of overall traffic; 3% of smartphone users account for 40% of AT&T network traffic in the US).
- In emerging countries, WiMAX often is the only broadband technology available or affordable, so heavy users are more likely to gravitate toward it.
- Some operators also mentioned that, in emerging markets, WiMAX is for many subscribers their first broadband connection. The operators have seen a slight usage decrease after the initial subscription



period for these users, presumably after customers got used to the service.

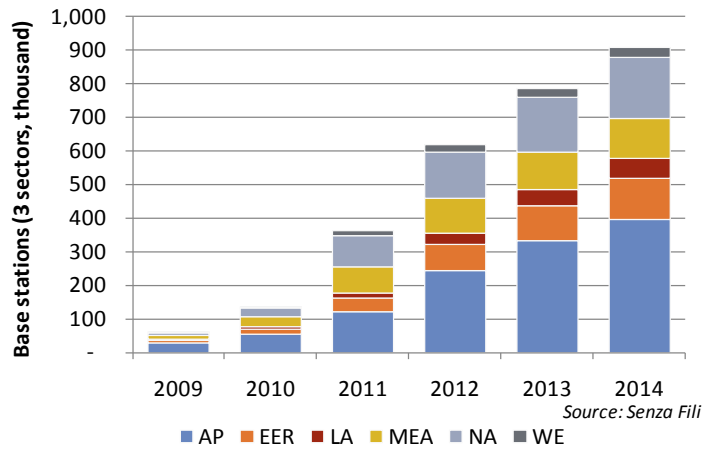
- A major factor in emerging markets is the more limited availability of content through other channels (e.g., cable TV) and a stronger interest in content from international sources, which is less commonly available over broadcast networks.

The major offenders: peer-to-peer and video. It is quite challenging for a single subscriber to generate 10 GB of traffic with email, texting, web surfing, and uploading a few photos. In most cases, operators are quick to identify elsewhere the culprit of heavy traffic: peer-to-peer and video traffic. Peer-to-peer traffic accounts for 50% to 85% of network traffic in some networks; video traffic accounts for 30% to 60%.

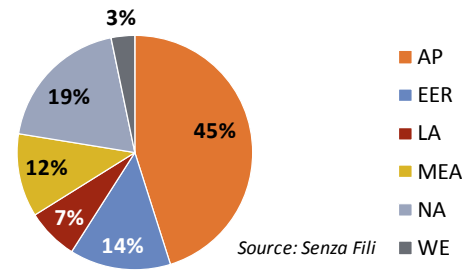
With email, texting, web surfing, or voice calls, the subscriber needs to be actively engaged. The limitations in time that can be spent using a phone or a laptop create natural barriers to heavy traffic through these applications. This is not the case for peer-to-peer and other video downloads, because they run in the background, unsupervised by the user. For this reason, operators are justifiably worried about the rise of this type of traffic, and have started to manage this type of traffic actively by throttling or imposing traffic caps.

From coverage to capacity. In the early phases of a deployment, WiMAX operators strive to achieve reliable coverage across their footprint. In many markets, they are still in this phase. To meet the increased traffic load on their networks, an increasing number of operators have shifted from a coverage-driven to a capacity-driven approach and are aggressively deploying new base stations to increase capacity.

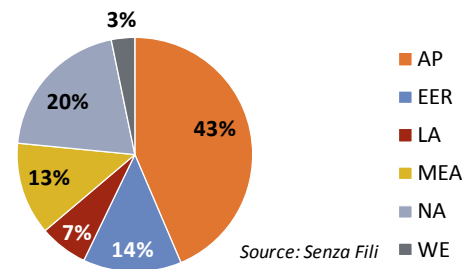
Installed base stations by region



Installed base stations by region in 2009



Installed base stations by region in 2014



A combination of coverage- and capacity-driven deployments will generate an increase from 60,000 base stations at the end of 2009 to over 909,000 in 2014. In 2009, the percentage of base stations in Asia Pacific and in the Middle East and Africa was higher than the percentage of subscribers (i.e., Asia Pacific had 26% of subscribers worldwide, but 50% of base stations worldwide). This is due to the presence of many WiMAX operators that have deployed large networks but have only recently launched service or are about to launch it now. For these operators, the overall ratio of subscribers to base stations is much higher than it is to be expected in more mature networks.

Too much of a good thing? Traffic growth initially was hailed as a sign that subscribers value and enjoy the service. Although this is true, operators have limited amounts of spectrum and funding. Operators cannot lavishly expand their network capacity by simply adding more base stations to meet demand, because subscribers are not willing to pay a substantial premium for bandwidth allowances above what they currently pay for flat-fee unlimited plans.

Instead, adding base stations is just the first step in an emerging strategy to manage traffic more actively, both to protect networks from abusive users and to ensure that the bandwidth available is equitably shared by subscribers. Fair use policies have been in place for a long time, but they have seldom been enforced. For a long time, cellular operators have tried to avoid attention of potential subscribers to the fine-print usage policies. Recently, however, many cellular and WiMAX operators have started to advertise them and to seek to enforce them gradually in reaction to the massive data traffic growth.

Another line of action is the active management of traffic, limiting the bandwidth available to heavy users during peak hours at cell sites running at capacity. Traffic caps or tiered service plans are also under consideration by many WiMAX operators. But operators are still treading carefully in this area, and are cautious about divulging their traffic management plans. To date, the need for bandwidth management is still limited, but operators agree that if traffic continues to grow at the current rate, they will be forced to adopt traffic management tools more widely.

Moving on: The transition to WiMAX 2

The demands of the present—expanding coverage and capacity of their network, gaining market share, offering a wider choice of devices, and developing new services—absorb the complete attention of WiMAX operators these days. With their resources overstretched, operators are eagerly awaiting the new version of WiMAX—WiMAX 2—which will be based on IEEE 802.16m. And in most cases, they do not see the need for extensive trials or for planning for the upgrade.

The upgrade to WiMAX 2 is expected to be a software upgrade. This allows operators to continue deploying the current version of WiMAX, and then upgrade whenever they need to, at their own pace. The IEEE standard-setting process for 802.16m is expected to conclude in the second half of 2010, with the first WiMAX Forum–certified products planned for the end of 2011. The International Telecommunication Union (ITU) has already accepted WiMAX 2 as a candidate for IMT-Advanced technology designation; like the IEEE standard, the ITU decision on WiMAX 2 inclusion among IMT-Advanced technologies is expected in the second half of 2010. The WiMAX 2 commercial deployment is slated for 2012.

The top expectation among operators is that WiMAX 2 will bring increased capacity and lower per-bit cost. The wider 20 MHz channels will enable operators to squeeze more traffic through the same number of base stations. The frequency reuse of 1:1 will enable them to increase the efficiency of spectrum usage—a crucial improvement for most WiMAX operators, which are rapidly outgrowing their spectrum assets. The lower latency and improved voice performance will enable them to widen their mobile service offering. And some operators look forward to multi-hop relay station support to expand their coverage, especially in difficult-to-reach rural areas.

The prevailing attitude among operators is that WiMAX 2 will be instrumental in solving some of the challenges they have started to see in their networks—mostly the need to ensure capacity and coverage through cost-effective networks. They look forward to the upgrade, but do not yet see a need to start planning in detail for it, since they expect the evolution of the technology will be mostly driven by vendors. WiMAX operators' main objective right now is to sustain growth and maintain high levels of subscriber experience.

About Senza Fili



Senza Fili provides advisory support on wireless data technologies and services. At Senza Fili we have in-depth expertise in financial modeling, market forecasts and research, white paper preparation, business plan support, RFP preparation and management, due diligence, and training. Our client base is international and spans the entire value chain: clients include wireline, fixed wireless and mobile operators, enterprises and other vertical players, vendors, system integrators, investors, regulators, and industry associations.

We provide a bridge between technologies and services, helping our clients assess established and emerging technologies, leverage these technologies to support new or existing services, and build solid, profitable business models. Independent advice, a strong quantitative orientation, and an international perspective are the hallmarks of our work. For additional information, visit www.senzafiliconsulting.com or contact us at info@senzafiliconsulting.com or +1 425 657 4991.

About the author

Monica Paolini is the founder and president of Senza Fili. She is an expert in wireless technologies and has helped clients worldwide to understand technology and customer requirements, evaluate business plan opportunities, market their services and products, and estimate the market size and revenue opportunity of new and established wireless technologies. She has frequently been invited to give presentations at conferences and has written several reports and articles on wireless broadband technologies. She has a PhD in cognitive science from the University of California, San Diego (US), an MBA from the University of Oxford (UK), and a BA/MA in philosophy from the University of Bologna (Italy). She can be contacted at monica.paolini@senzafiliconsulting.com.

© 2010 Senza Fili Consulting, LLC. All rights reserved. This white paper was prepared on behalf of Samsung Electronics Company Ltd. The views and statements expressed in this document are those of Senza Fili Consulting LLC, and they should not be inferred to reflect the position of Samsung. The document can be distributed only in its integral form and acknowledging the source. No selection of this material may be copied, photocopied, or duplicated in any form or by any means, or redistributed without express written permission from Senza Fili Consulting. While the document is based upon information that we consider accurate and reliable, Senza Fili Consulting makes no warranty, express or implied, as to the accuracy of the information in this document. Senza Fili Consulting assumes no liability for any damage or loss arising from reliance on this information. Trademarks mentioned in this document are property of their respective owners.