

WiMAX STATE OF THE INDUSTRY: MID-YEAR ANALYSIS

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WiMAX Trends

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experience in wireless data



Technology focus

- Wireless data technologies and services:
- Wi-Fi, WiMAX, proprietary BWA, cellular (GSM, WCDMA, EV-DO, HSDPA) technologies
 - Data and VoIP services

Approach

- Provide a bridge between technologies and services, assisting vendors and service providers
- Quantitative analysis, with an international perspective
- Carrier, enterprise and residential markets

Services

- Business plans and financial modeling
- Business development and strategy
- Market research and forecast
- Due diligence
- Publications and training

Fixed or mobile WiMAX? Forecasts and assessment for the transition from 802.16-2004 to 802.16e WiMAX

- In-depth market global forecast of demand and revenues
 - 15 countries
 - 6 regions
- Assessment of 802.16-2004 and 802.16e
 - Fixed and mobile services
 - Competing technologies
- Business models and drivers towards adoptions
 - Market segments
 - Geographic markets
 - Regulation

Available at www.wimaxtrends.com and
at www.senzafiliconsulting.com

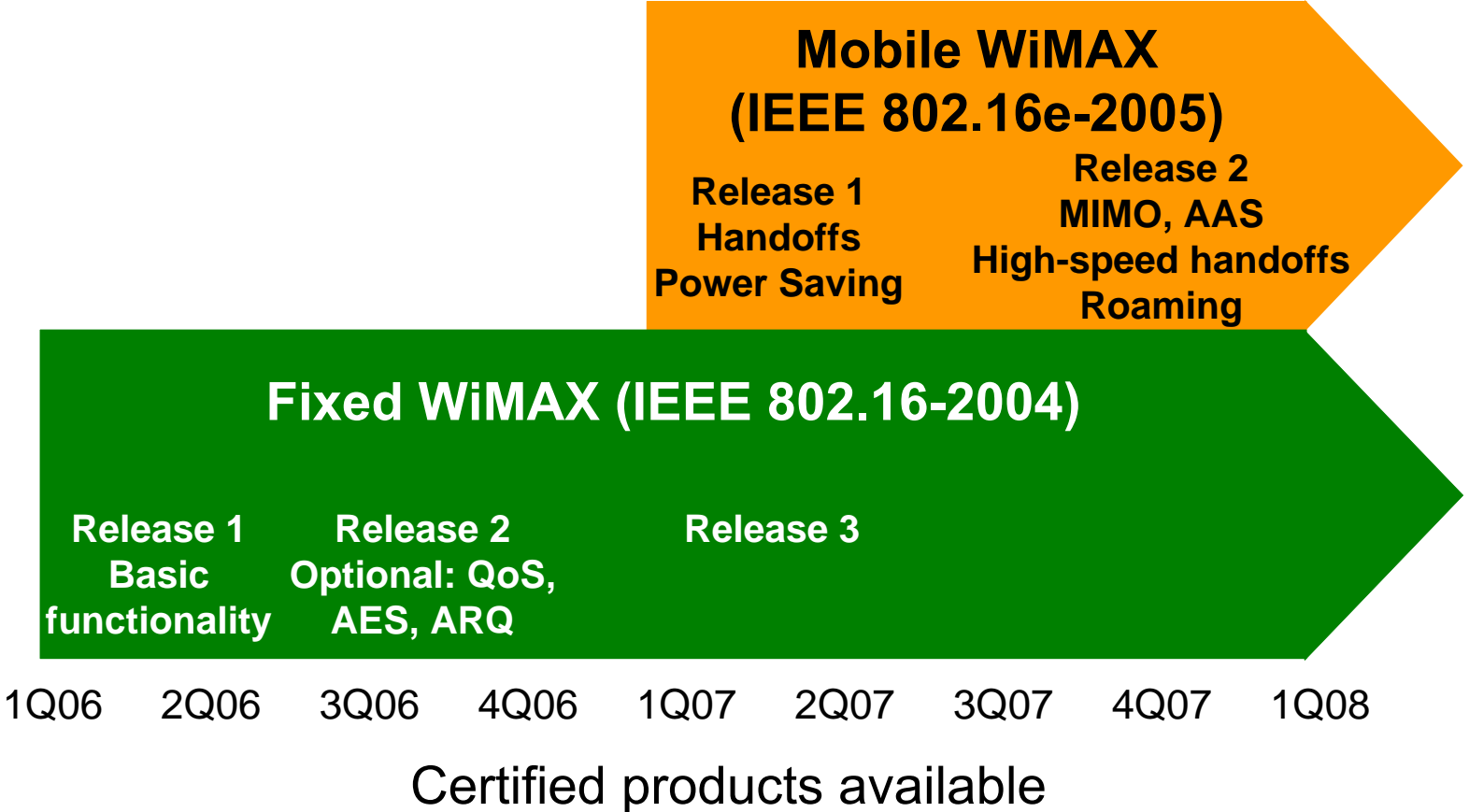
WiMAX has generated strong interest from service providers



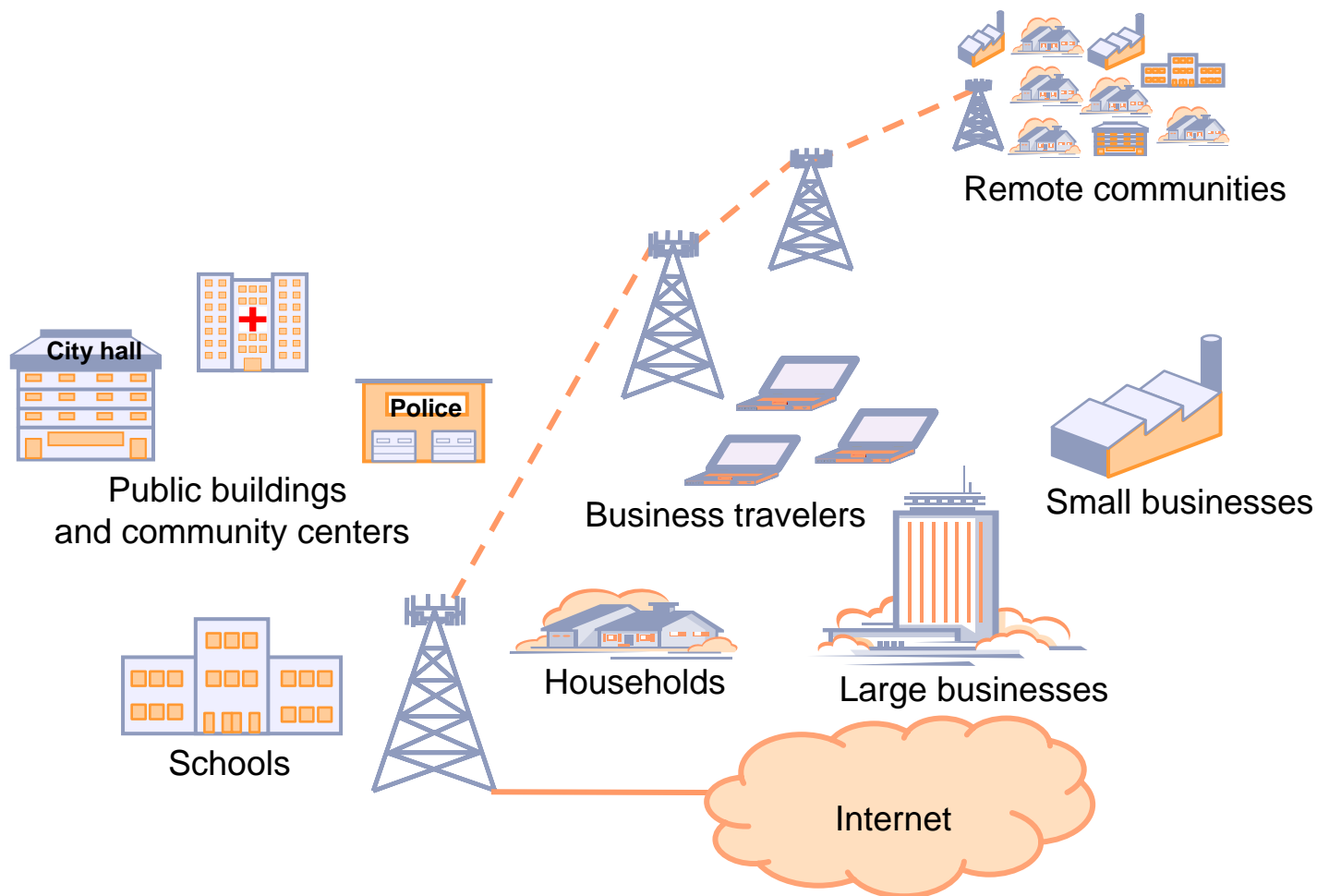
The WiMAX timeline

| | Fixed access | Portability | Full mobility | |
|-----------------------------|--|------------------------------------|-----------------------------------|------|
| Dominating standard | IEEE 802.16-2004 | IEEE 802.16e-2005 | | |
| Services | Alternative to T1, DSL, cable, satellite, and other BWA technologies | Plus: VoIP, QoS-based applications | Plus: mobile access with handoffs | |
| Subscriber unit form factor | Outdoor/Indoor CPE | Plus: PCMCIA card | Plus: Client built-in | |
| Subscriber unit price | \$300 | | Plus: PDA, smartphone | |
| Market segment | Business and residential fixed access | Plus: portable access | Plus: mobile access | |
| Geography | Emerging markets, underserved areas | Plus: competitive areas | Plus: dense urban areas | |
| | 2006 | 2007 | 2008 | |
| | | | | 2009 |

WiMAX certification is important to establish interoperability

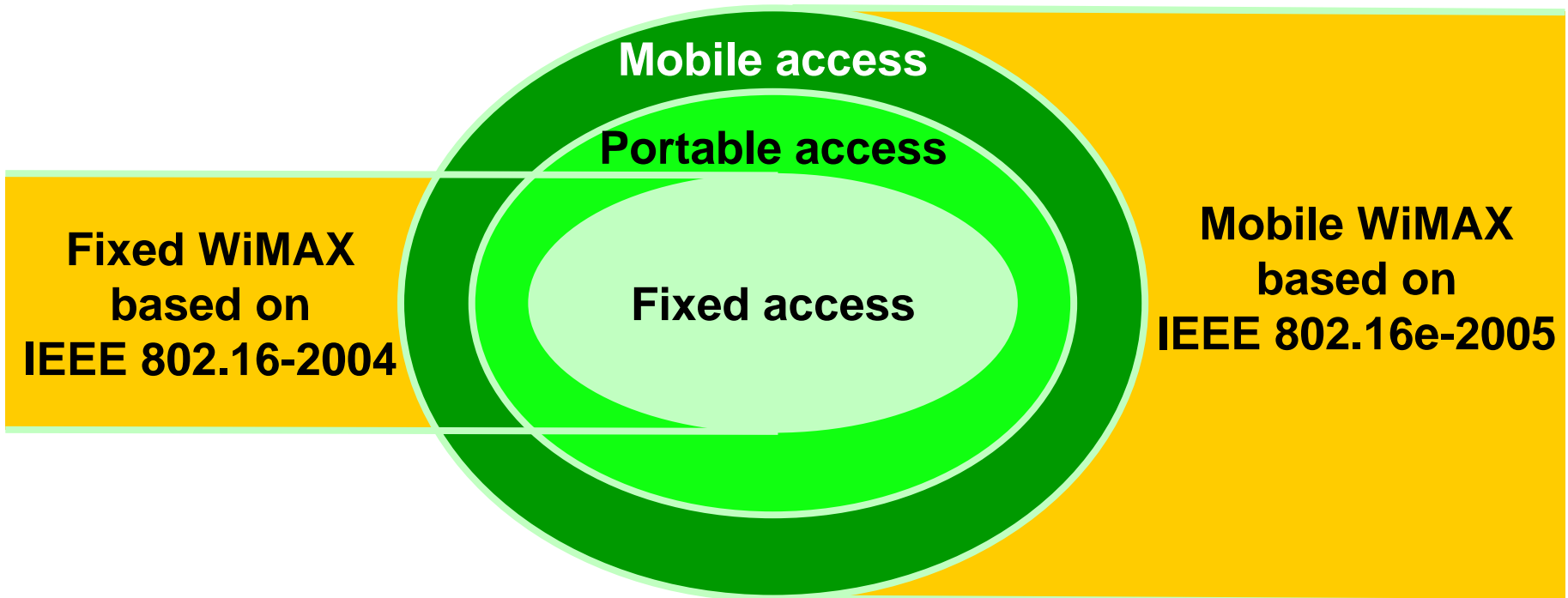


A single WiMAX network can support business, residential, and public services



The same infrastructure can support both fixed and mobile access

Two versions of WiMAX address different markets



Personal broadband requires a wireless interface that supports fixed, portable and mobile access

Fixed or mobile WiMAX?

| | Fixed WiMAX | Mobile WiMAX |
|-----------------------------------|--|--|
| Standard | 802.16-2004 | 802.16e (a.k.a. 802.16-2005) |
| Access | Fixed | Fixed, portable and mobile |
| Modulation and duplexing | OFDM TDD, FDD | SOFDMA TDD, possibly FDD |
| Handoffs | No | Yes |
| Service providers targeted | DSL and cable modem service providers, wireless and wired ISPs | Mobile operators, DSL and cable modem service providers, wireless and wired ISPs |
| Subscriber unit | Outdoor or indoor CPE, eventually PCMCIA card | Indoor CPE, PCMCIA card, mini-card built in laptops, mobile devices, phones |
| Spectrum bands | 3.5 GHz, 5.8 GHz | 2.3-2.4 GHz, 2.5-2.7 GHz, 3.3-3.4 GHz, 3.4-3.8 GHz |
| Certified products | January 2006 | 1Q2007 (Expected) |

Is mobile WiMAX worth the wait?

Deploy now fixed WiMAX

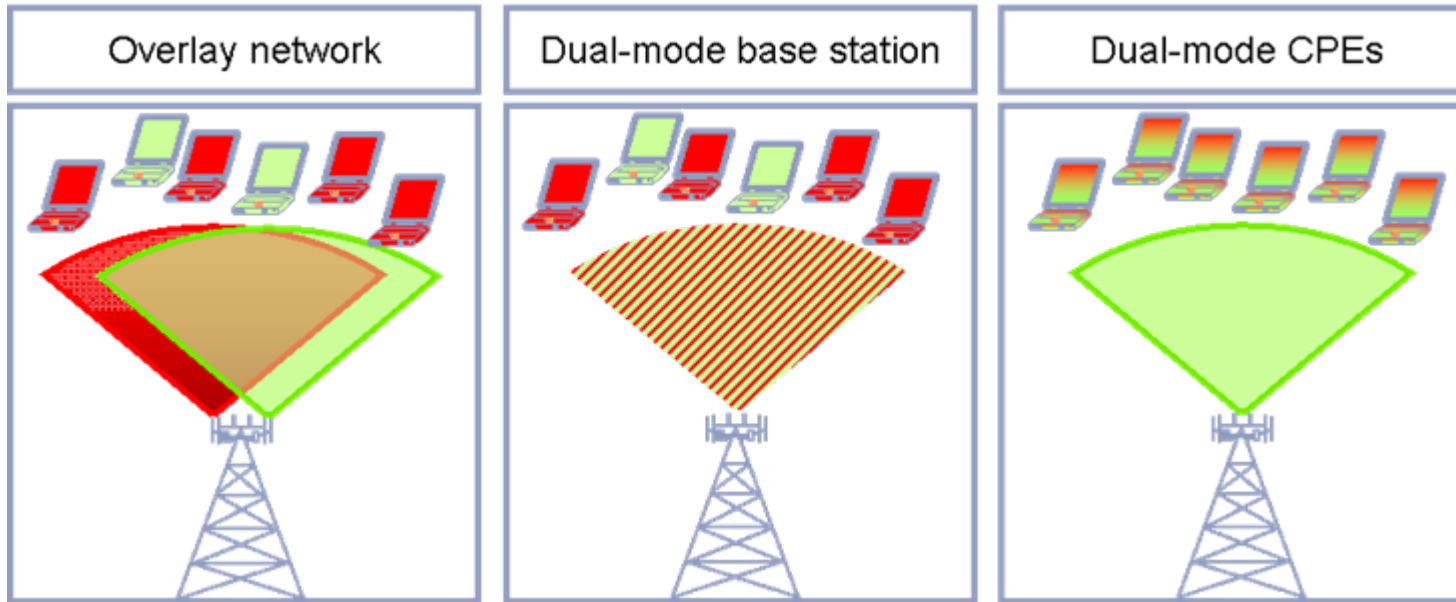
- Faster time-to-market
- Less complex technology
- Comparable performance for fixed services
- Operators are not interested in mobility
- Both FDD and TDD supported
- Unlicensed spectrum
- Business market

Wait for mobile WiMAX

- More advanced technology with better support for indoor coverage
- Plan to offer portable and mobile services
- TDD required (FDD may be supported)
- Licensed spectrum below 3 GHz
- Residential deployments

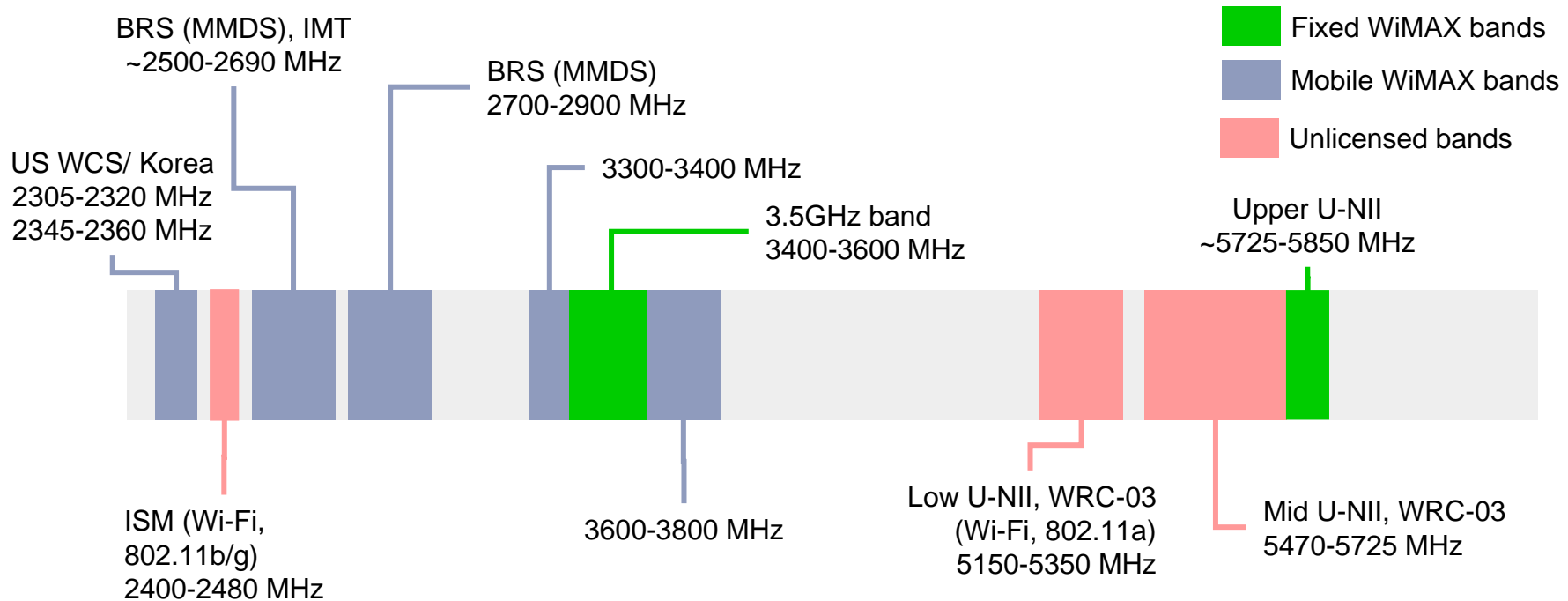
Within a few years, mobile WiMAX is poised to dominate the WiMAX market for fixed, portable and mobile services

The transition path from fixed to mobile WiMAX



- For most operators the choice between fixed and mobile WiMAX is dictated by spectrum availability
 - Scope for transition mostly limited to the 3.5 GHz band
- Best transition path depends on:
 - Spectrum channels available
 - Funding available
 - Timing and service requirements

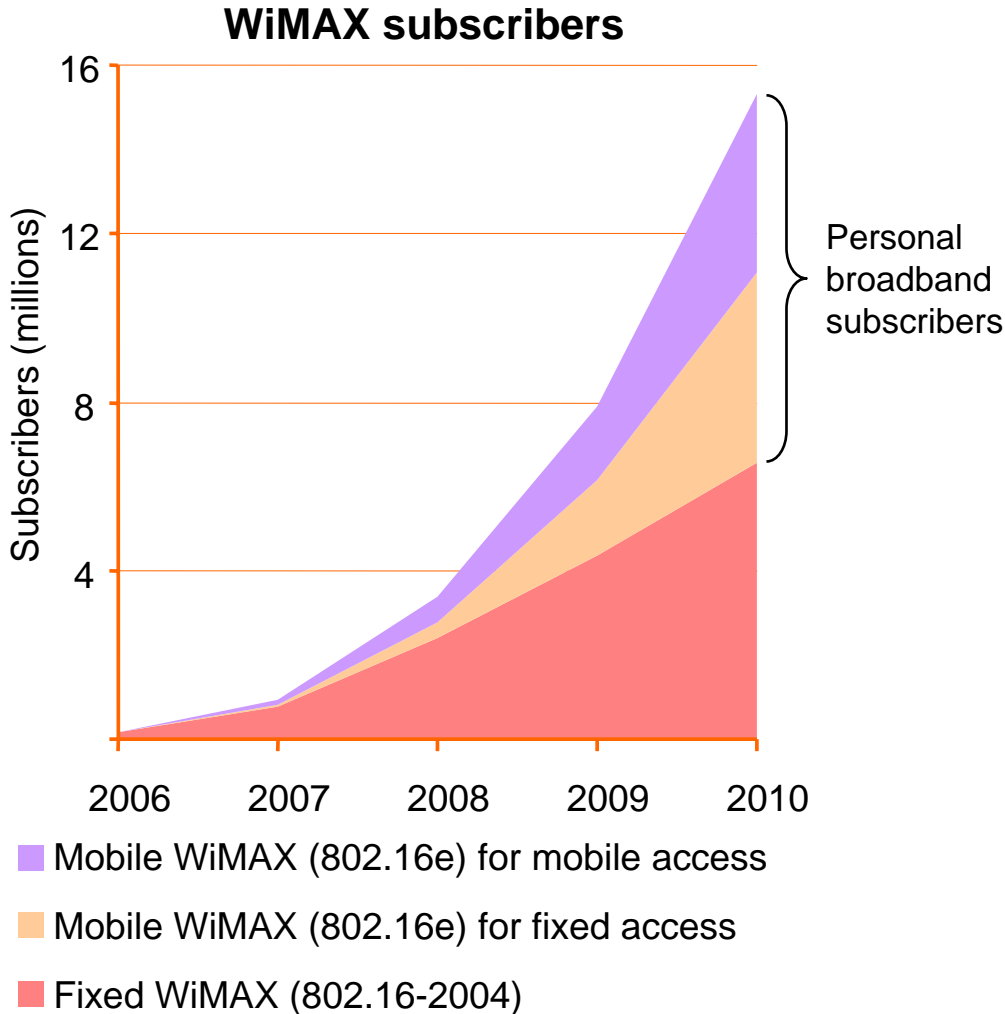
Ultimately, multi-mode devices will be necessary to allow access to multiple networks



Which profiles multimode devices will support is still unclear:

- Which frequencies should be included first?
- How many frequencies and channel bandwidth can a subscriber unit support cost effectively?
- Which new bands will be supported in the future?

Our forecast predicts that 57% of WiMAX subscribers will be using mobile WiMAX by 2010

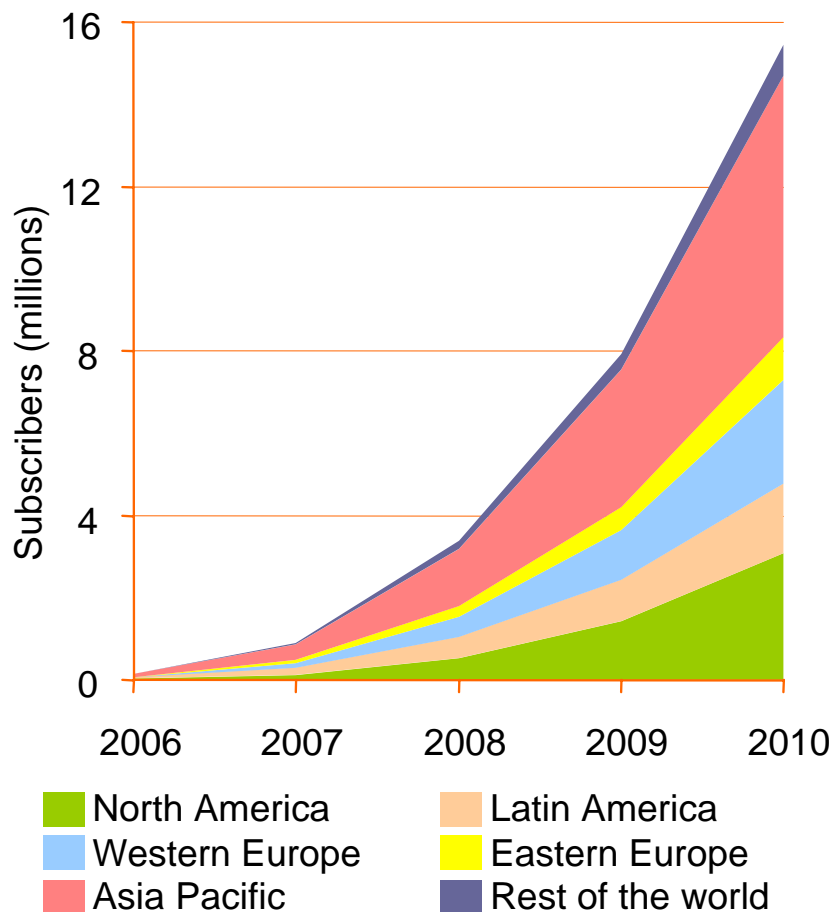


Source: Senza Fili Consulting, "Fixed or mobile WiMAX? Forecasts and assessment for the transition from 802.16-2004 to 802.16e WiMAX"

- Mobile WiMAX can be used for both fixed and mobile access
 - Initially fixed access will dominate, as mobile devices will be introduced later
 - In the long term, mobility will become more important
- The distinction between fixed and mobile access will disappear with personal broadband services
- Fixed WiMAX addresses the demand for fixed-only deployments

Our forecast predicts 15.4 million WiMAX subscribers worldwide by 2010

WiMAX subscribers by region

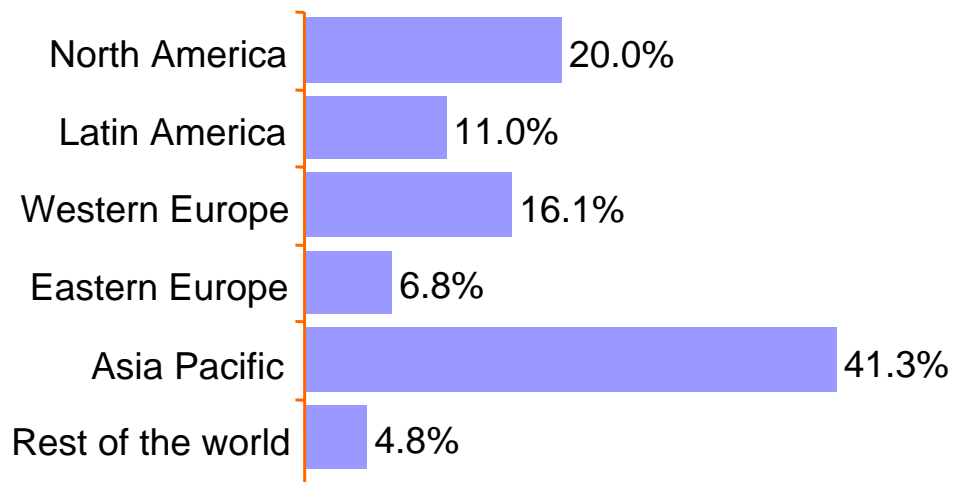


- US\$16.5 billion in service revenues
- Drivers to adoption are different in each market
- Asia-Pacific countries will be WiMAX largest market with 41% of subscribers
- The hottest markets:
 - Emerging countries in Asia Pacific, Latin America and Eastern Europe where WiMAX is a cost-effective last-mile solution
 - Countries like Korea with a high demand for portable and mobile services

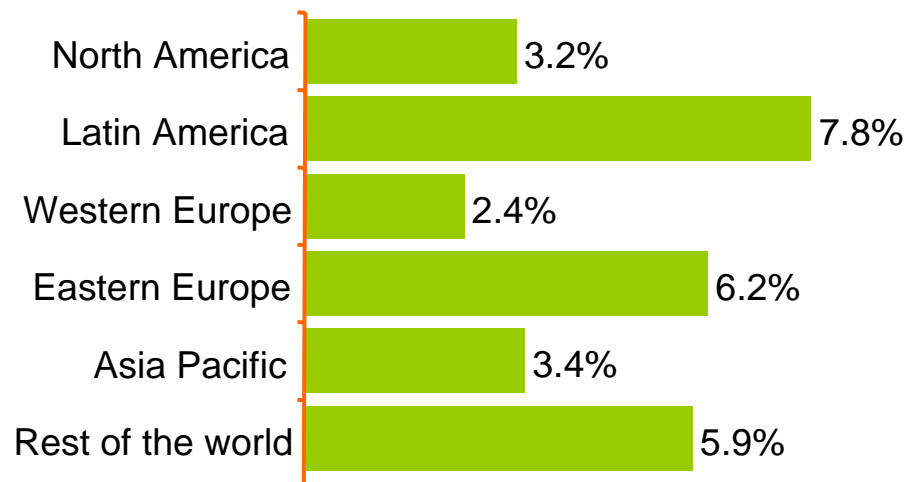
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Emerging economies are the best WiMAX markets

Percentage of WiMAX global subscribers



Percentage of WiMAX among broadband subscribers in the market



Source: Senza Fili Consulting, "Fixed or mobile WiMAX? Forecasts and assessment for the transition from 802.16-2004 to 802.16e WiMAX"

- Percentage of WiMAX global subscribers depends on population and broadband penetration
 - Large countries capture a large market share of worldwide subscriptions
- Ratio of WiMAX subscribers measures WiMAX penetration within a country
 - A high ratio indicates success of WiMAX within country

Developing markets represent the fastest growing market for WiMAX

Developing markets

- Opportunity for WiMAX operator to gain (and retain) a dominant position in the market
- Wireless infrastructure may get established first
 - Wired networks may become unnecessary in low density areas
 - Wireless infrastructure easier to deploy, maintain and secure
- Residential market segment is still in its early days
- Lower competition, but regulation may not favor new entrants
- Ability to address demand for voice and data in low density, rural areas

Developed markets

- Larger market, greater demand and willingness to pay for broadband connectivity
- Competition with fixed networks is inevitable
 - Even where DSL is not currently offered, it may be introduced soon
- Established market with a slowing growth rate
 - WiMAX service providers needs to be able to go beyond first time users and lure subscribers away from DSL
- Increased demand for mobility and popularity of wireless connectivity will spur demand for WiMAX

WiMAX is encouraging an innovative approach among telecom regulators worldwide

Challenges

- Spectrum harmonization
- Larger spectrum allocations
- Technology neutral approach
- Lower spectrum revenues than cellular
- Service supported in a band
- Secondary market
- TDD/FDD option
- License-exempt spectrum allocation
- Promotion of both rural and urban deployments
- Manage competition among service providers

Opportunities

- Increased broadband penetration
- More cost-effective solution for rural areas
- Facilities-based alternatives
- Increased competition (without overcrowding the market)
- Move to a next-generation IP-based technology
- Low cost infrastructure leading to low cost services
- Easy and cost-effective transition path from fixed to mobile access

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