WiMAX STATE OF THE INDUSTRY: MID-YEAR ANALYSIS

Trendsmedia Telebriefing, June 21, 2006

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Senza Fili Consulting

WIMAX Trends

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Senza Fili Consulting 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

Data presented today are from our latest report on WiMAX

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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.senzafiliconsutling.com

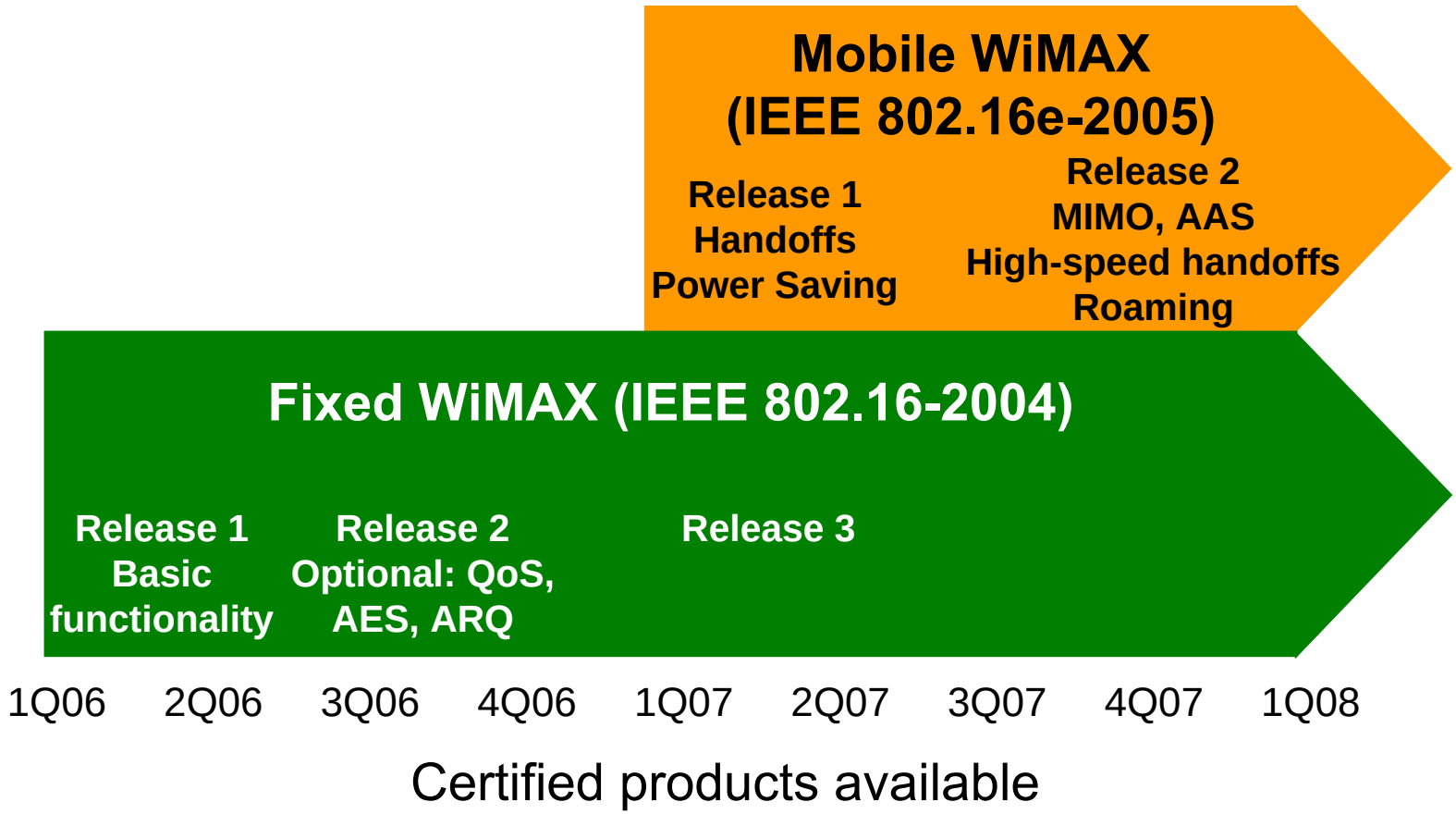
WiMAX has generated strong interest from service providers

The WiMAX timeline

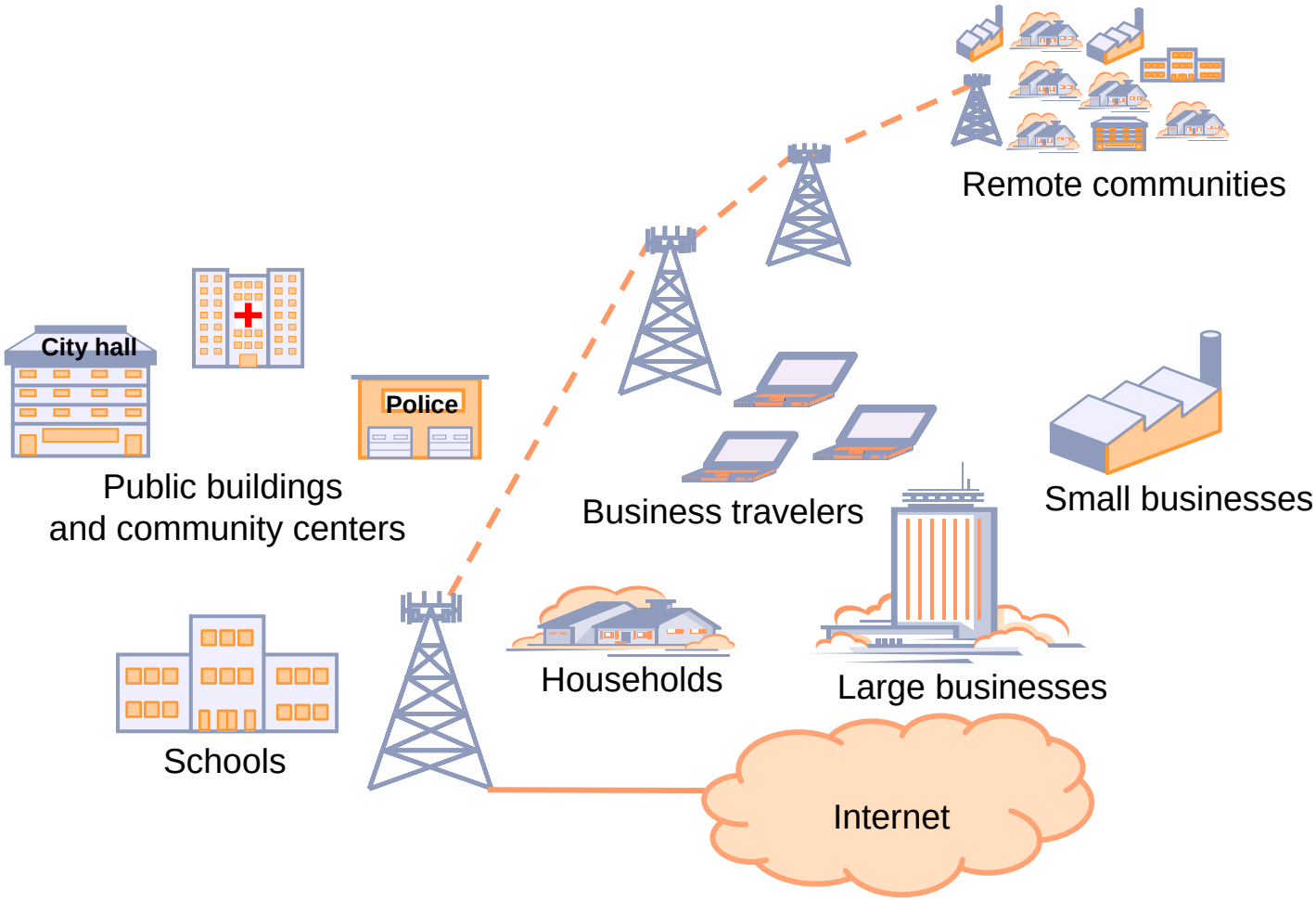
	Fixed access	Portability	Full mobility
Dominating standard	IEEE 802.16-2004	IEEE 802.16e-2005	
Services	Alternative to T1, DSL, cable, satellite, and other BWA technologies	Plus: VoIP, QoS-based applications	Plus: mobile access with handoffs
Subscriber unit form factor	Outdoor/Indoor CPE	Plus: PCMCIA card	Plus: Client built-in	Plus: PDA, smartphone
Subscriber unit price	$300		$150
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

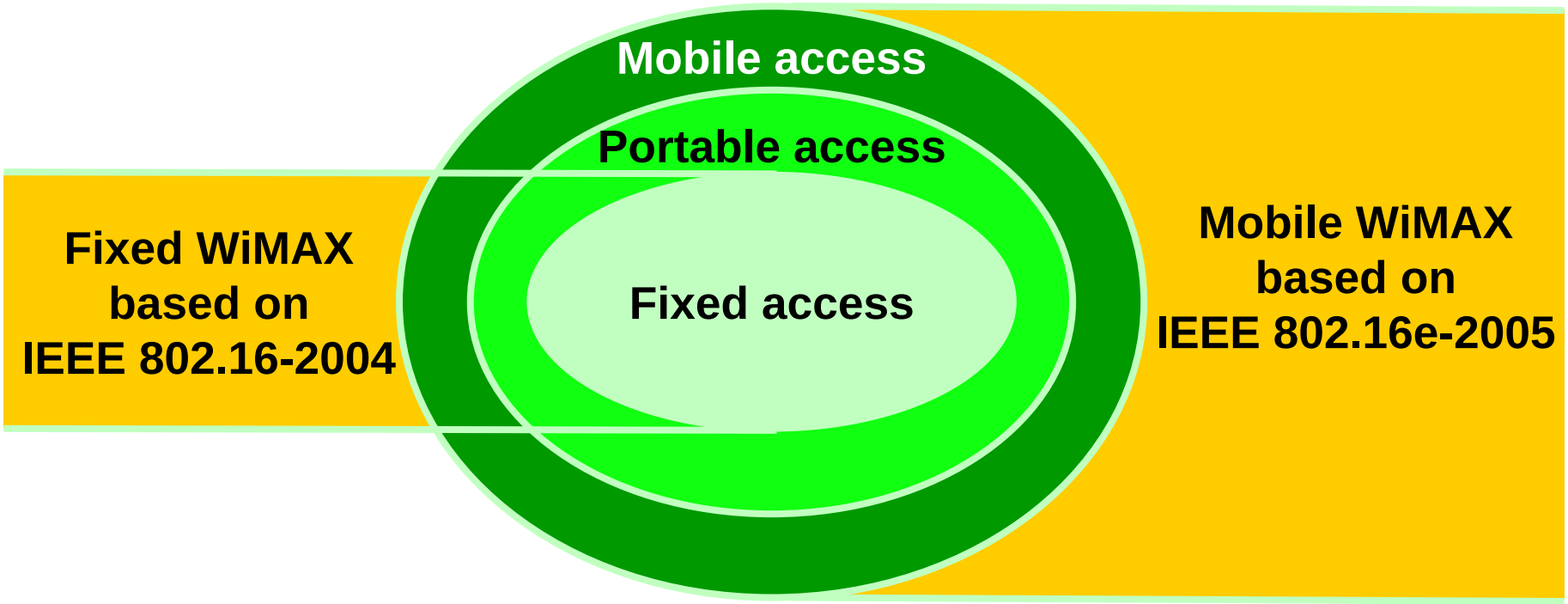


A single WiMAX network can support business, residential, and public services



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

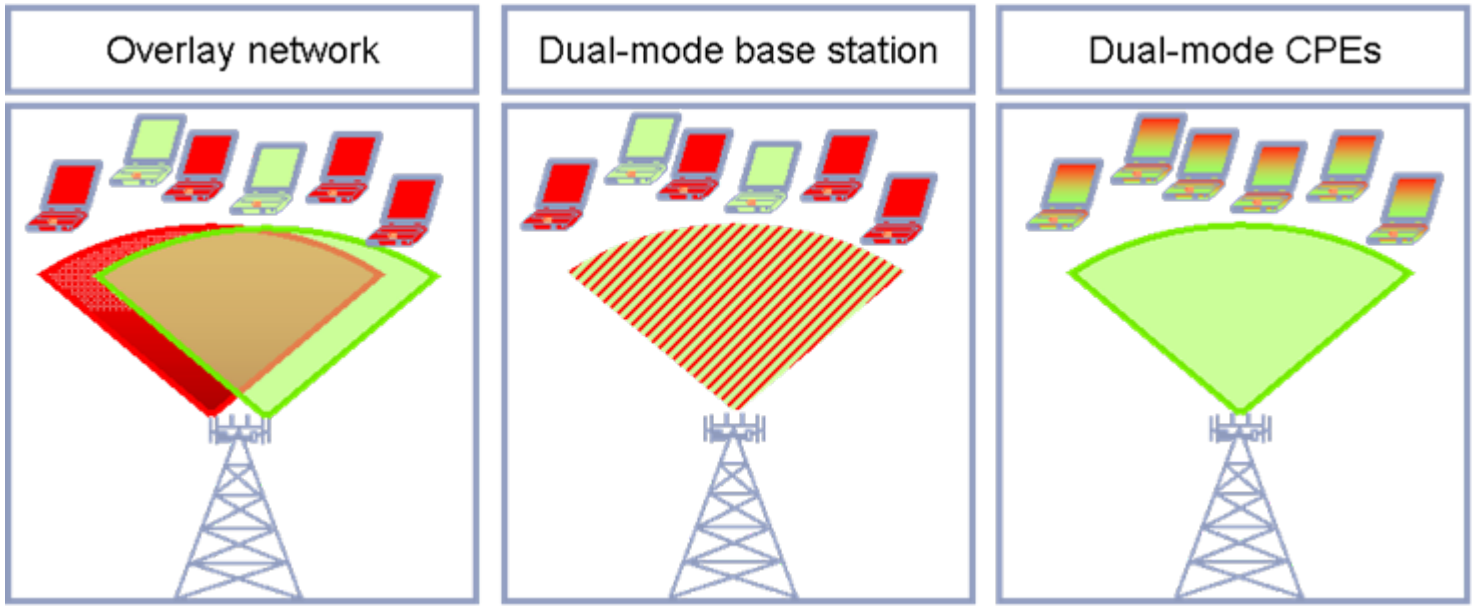
- Faster time-to-market
- Less complex technology
- Comparable performance for fixed services
- Operators are not interested in mobility
- Both FDD and TDD supported
- Unlicensed spectrum
- Business market

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

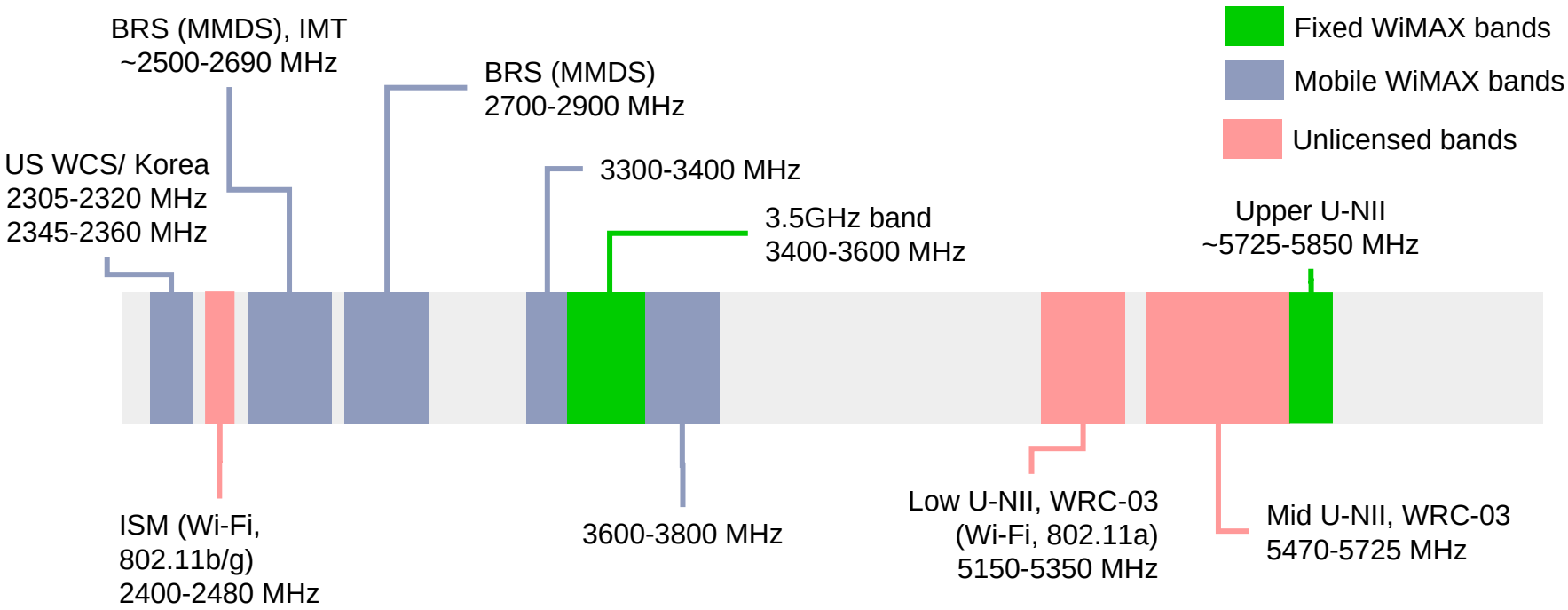
Within a few years, mobile WiMAX is poised to dominate the WiMAX market for fixed, portable and mobile services

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

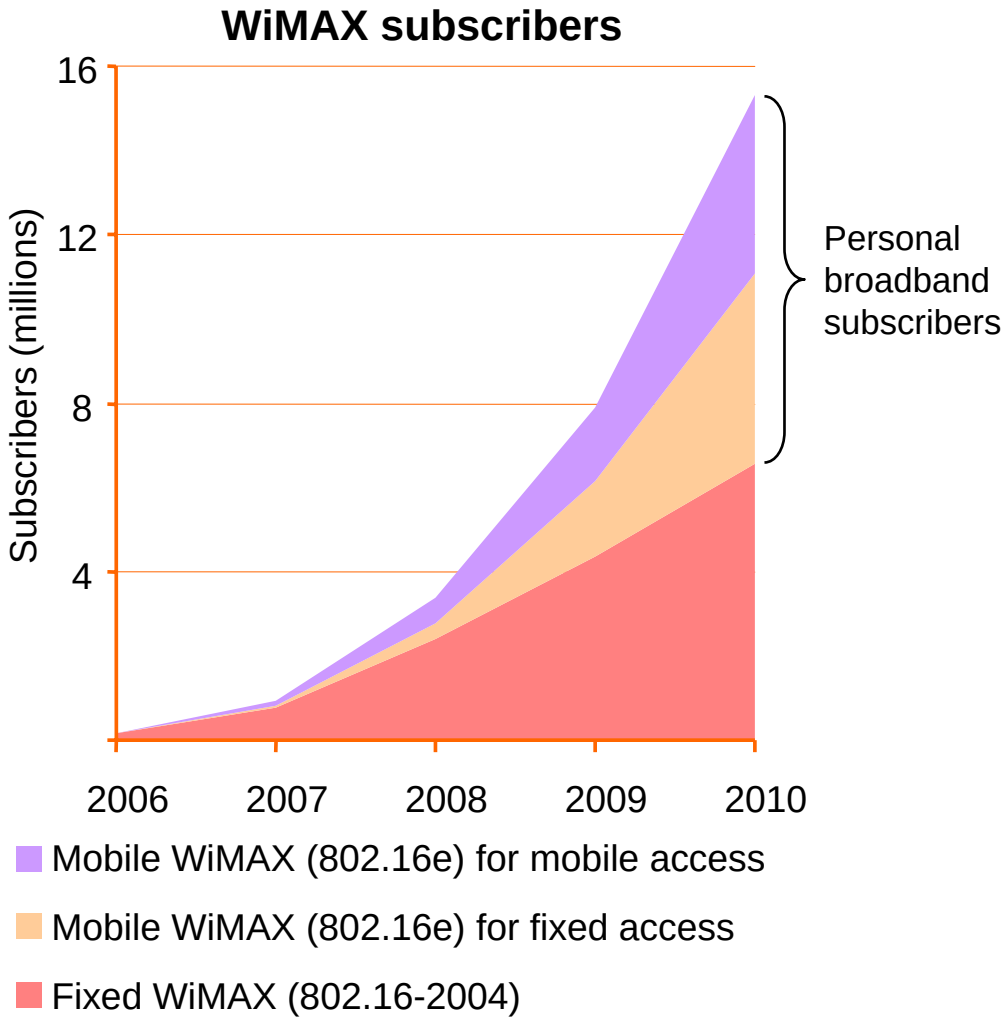
Ultimately, multi-mode devices will be necessary to allow access to multiple networks



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?

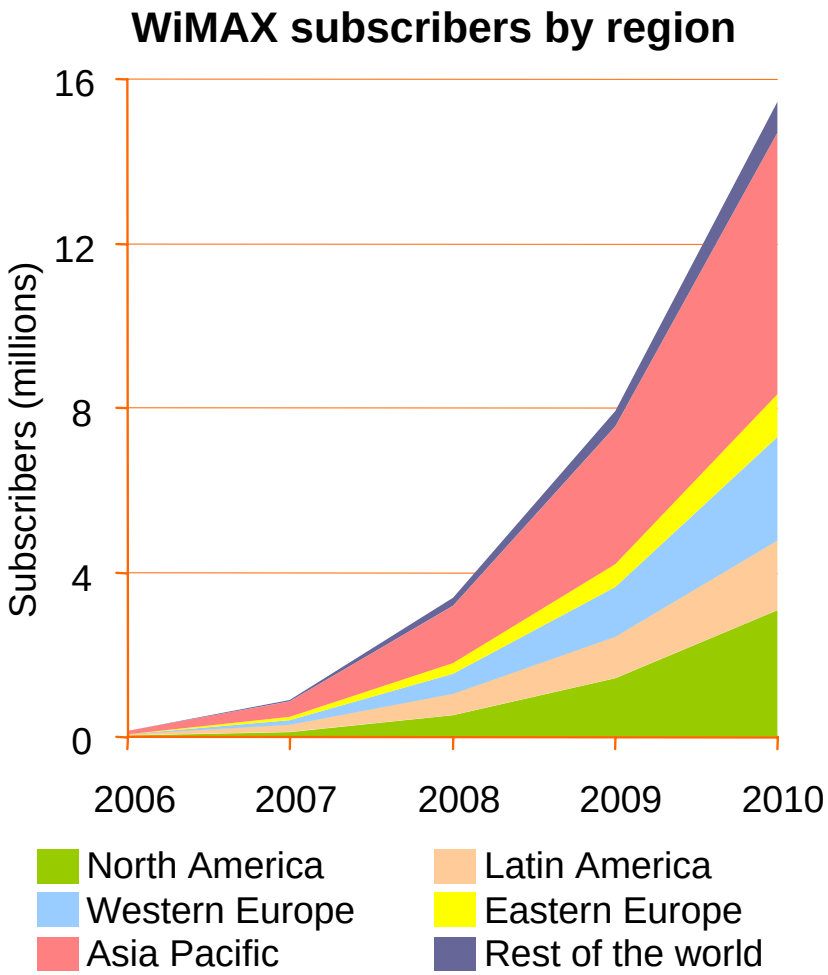
Our forecast predicts that 57% of WiMAX subscribers will be using mobile WiMAX by 2010



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

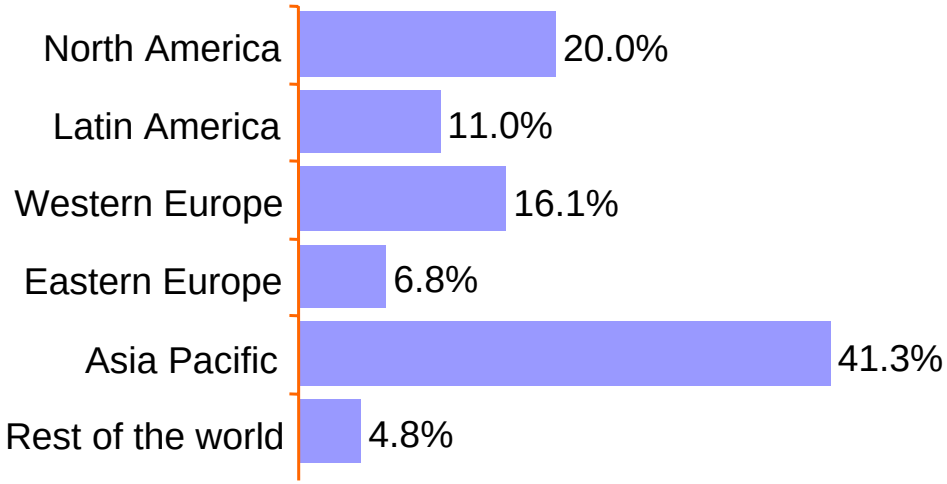


- US$16.5 billion in service revenues
- Drivers to adoption are different in each market
- Asia-Pacific countries will be WiMAX largest market with 41% of subscribers
- The hottest markets:
  - Emerging countries in Asia Pacific, Latin America and Eastern Europe where WiMAX is a cost-effective last-mile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

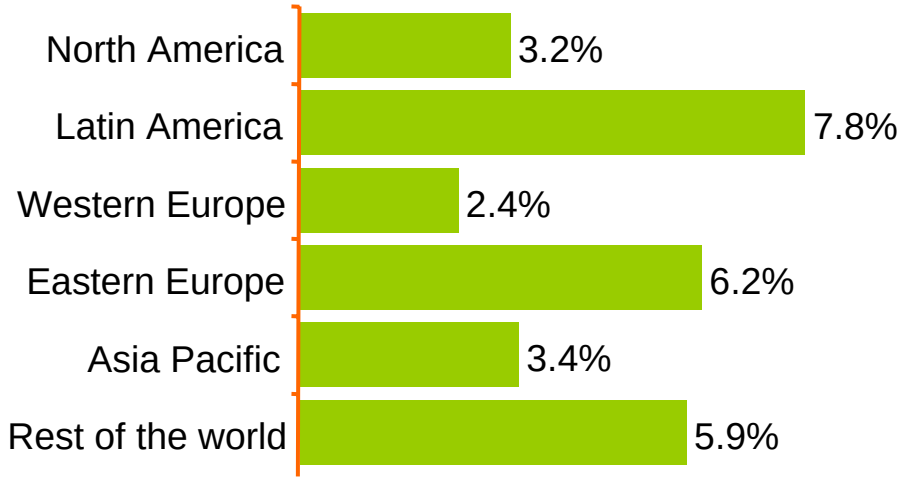
Source: Senza Fili Consulting, "Fixed or mobile WiMAX? Forecasts and assessment for the transition from 802.16-2004 to 802.16e WiMAX"

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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