

Concluding remarks

Emerging market trends for WiMAX

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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

Our latest report on WiMAX was recently published

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

Where is WiMAX heading?

Technology

Geography

Market segments

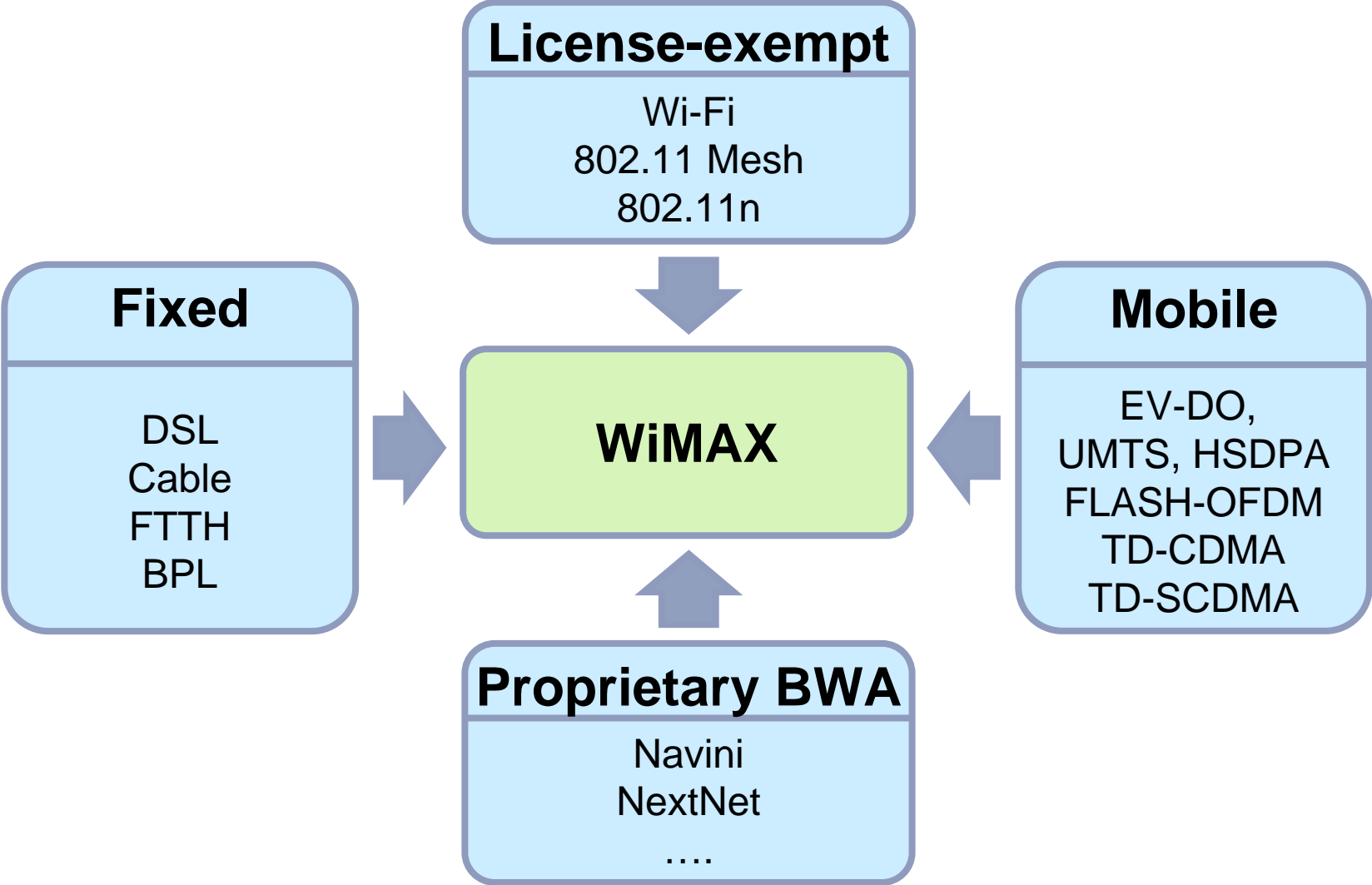
The two versions of WiMAX are not compatible

	802.16-2004 WiMAX	802.16e WiMAX
Standard	802.16-2004 (June 2004)	802.16e (December 2005)
Access	Fixed, nomadic	Fixed, nomadic, portable and mobile
Modulation	OFDM	OFDMA
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
Certification start	July 2005	2H2006
Certified products	January 2006	1H2007 (Expected)
Commercial availability	1H2006	2007 (Expected)

Only 802.16e supports portability and mobility

Access type	Devices	Locations/ Speed	Handoffs	802.16- 2004 WiMAX	802.16e WiMAX
Fixed access	Outdoor and indoor CPEs	Single/ Stationary	No	Yes	Yes
Nomadic access	Indoor CPEs, PCMCIA cards	Multiple/ Stationary	No	Yes	Yes
Portability	Laptop PCMCIA or mini cards	Multiple/ Walking speed	Hard handoffs	No	Yes
Simple mobility	Laptop mini cards, PDAs or smartphones	Multiple/ Low vehicular speed	Hard handoffs	No	Yes
Full mobility	Laptop mini cards, PDAs or smartphones	Multiple/ High vehicular speed	Soft handoffs	No	Yes

WiMAX faces tough competition from wired and wireless technologies



WiMAX specifications are similar to those of 3G

802.16e WiMAX, FLASH-OFDM and 3G: throughput

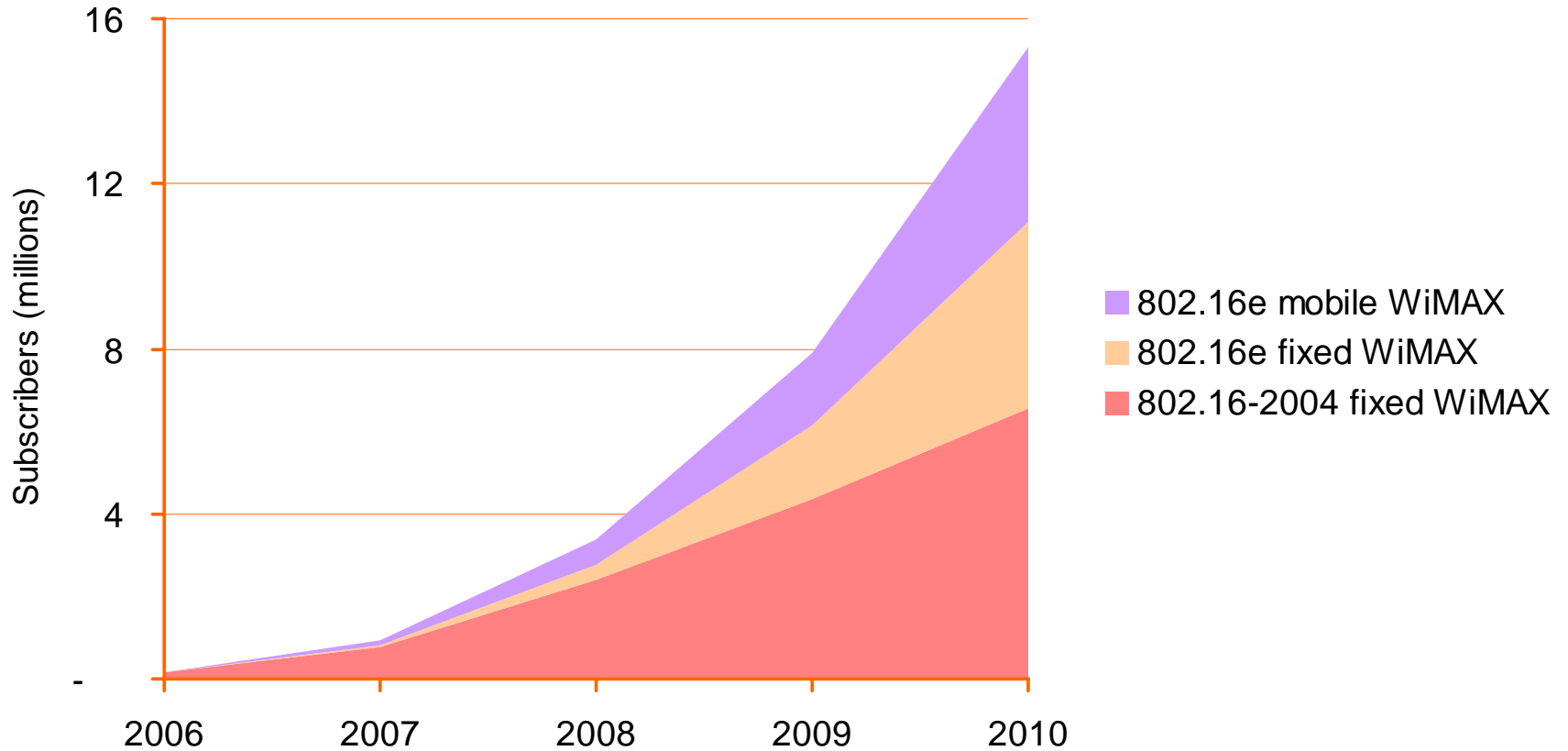
Technology	Max throughput (downlink)	Max throughput (uplink)	Average downlink	Channel size
802.16e WiMAX (**)	15 Mbps (5 MHz channel)		1 Mbps (*)	1.25–20 MHz
WCDMA	2 Mbps	384 Kbps	150-200 Kbps	3.84 MHz
HSDPA	14 Mbps	384 Kbps	0.5-1 Mbps	3.84 MHz
EV-DO	2.4 Mbps	154 Mbps	300-500 kbps	1.25 MHz
EV-DO Rev A	3.1 Mbps	1.5 Mbps	400-600 kbps (*)	1.25 MHz
FLASH-OFDM		3.2 Mbps	300-500 kbps	1.25 MHz
TD-CDMA		2.4 Mbps (HSDPA 7.3 Mbps)	600-700 kbps	1.25, 2.0, 5, 10 MHz

(*) Expected (**) Does not include MIMO, AAS

Success of WiMAX depends more on demand and business logic than on technology

- Fixed operations
 - Facilities-based approach
 - Alternative service provider with superior service
- Portable operations
 - Differentiating factor for fixed operator
 - Expand range of services, addressable market, ARPU
- Mobile operations
 - Give network operators ability to offer mobile services
 - ... but 3G operators are unlikely to deploy WiMAX

Our forecast predicts that 57% of WiMAX subscribers will be using 802.16e by 2010



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

Our key findings

- 15.4 million WiMAX subscribers worldwide
- US\$16.5 billion in service revenues
- 57% of WiMAX subscribers will be using 802.16e
- Drivers to adoption are different in each market
- Asia-Pacific countries will be WiMAX largest market with 41% of subscribers
- The hottest markets will be emerging countries like China and Mexico where WiMAX is a cost-effective last-mile solution, and countries like Korea with a high demand for portable and mobile services

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
- Demand for broadband connectivity is still mostly limited to urban areas
- Residential market segment is still in its early days
- Lower competition, but regulation may not favor new entrants

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

Network operators will focus on different areas in the target market



Source: TowerStream



Source: NextNet



Source: Eurescom

Central city areas **(high density)**

- High density of base stations
- High capacity
- Good coverage
- Indoor CPEs for residential users
- Support for mobile users

Suburban areas **(medium density)**

- Fewer base stations
- Good throughput
- Higher percentage of outdoor CPEs
- Satisfactory coverage
- Limited support for mobile users

Rural areas **(low density)**

- Ad hoc deployments in partnership with local government and businesses
- Micro base stations and hybrid WiMAX/Wi-Fi networks used to reduce costs
- Outdoor CPEs dominate
- WiMAX may bring first voice and data services

Urban and suburban markets are a bigger opportunity—but one that is more difficult to exploit

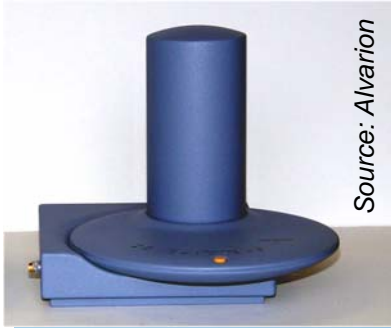
Rural market

- Low density of demand
- Limited bandwidth requirements
- Predominantly residential and small business users
- Limited demand for mobility or portability
 - Key market is wireless DSL
- Less competition
 - Dialup may be the only connectivity option
 - Market is likely not to support more than one service provider
- Municipal involvement more likely
- Subsidies may be available (and needed) to service providers

Urban/suburban market

- Head-to-head competition with fixed providers, with a brand, an existing infrastructure and often deep pockets
- More mature market
 - Sophistication means customers who are more demanding, but also more critical of incumbents
 - Mobility and portability are key part of service offering
- Higher density of demand for broadband connectivity
 - Market share of wireless will crucially depend on fixed providers track record and ability of new entrant to offer better service

WiMAX can serve the business, residential and mobile segments



Source: Alvarion



Source: Airspan



Source: Vodafone, Toshiba, Airspan



Source: Alvarion



Source: Redline



Residential users

- Basic voice services and low cost domestic and international calls
- Basic (dialup speed) to advanced (over 1Mbps) data connections
- Bundled voice and data services

Business users

- Basic data connectivity (from dial-up to T1) for small businesses
- Advanced data services to medium and large businesses
- Feature-rich, low cost voice services (VoIP)

Mobile users (mobile WiMAX only)

- Data connectivity for mobile workforce
- Data connectivity for international visitors

Business, residential, mobile segments: which one is the more attractive?

Business market

- Higher margins, higher ARPU
- SMEs are ideal targets and they are often an underserved market
- Easier to identify potential customers
- Easier to compete with fixed alternatives
- More sophisticated market
- More demanding, but needs less handholding
- Cost of CPE more quickly amortized
 - Cost can be passed on to customer
- External CPE not a problem
 - Often desirable to improve reliability and data rates

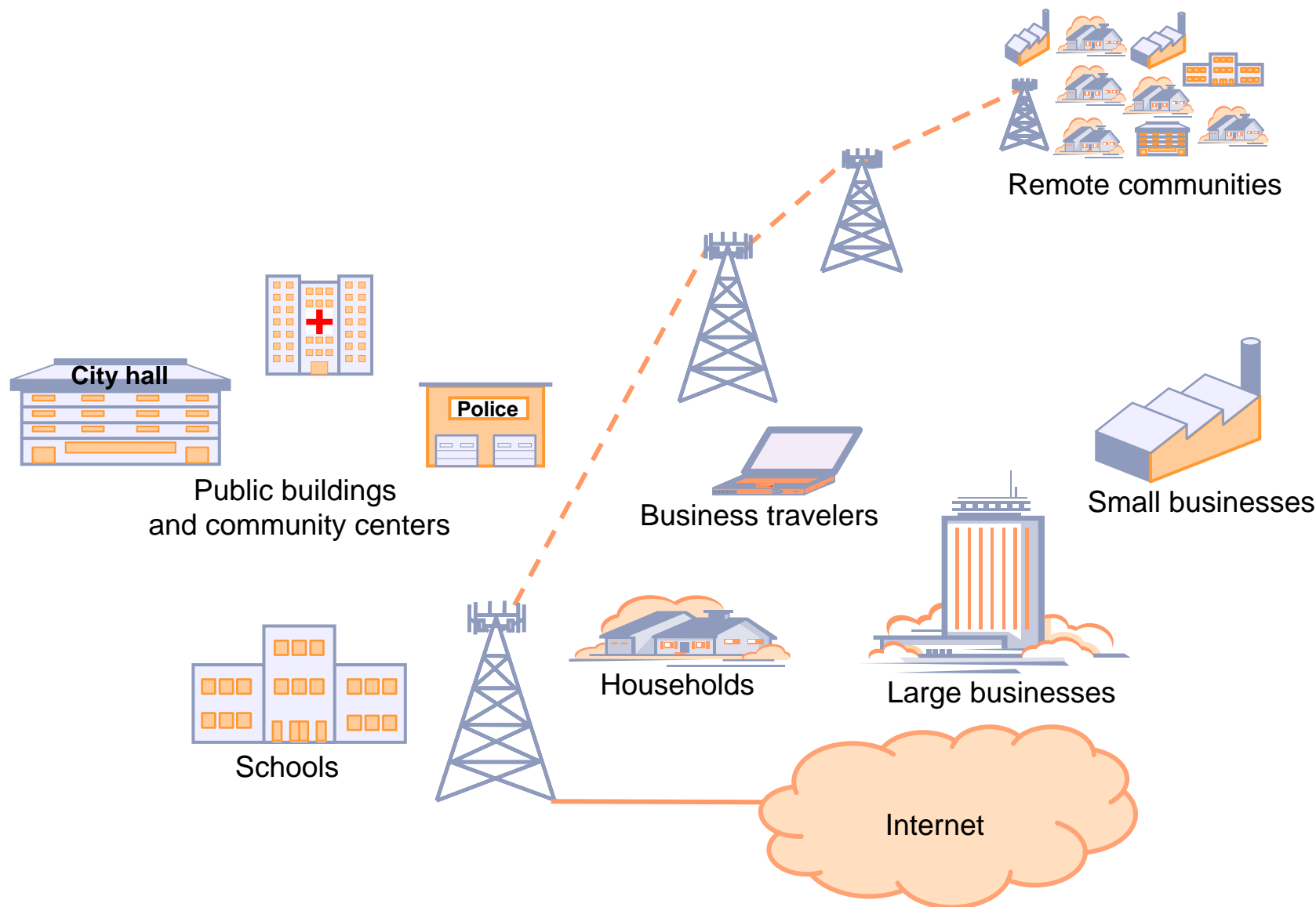
Residential market

- Lower margins, price sensitive
- Long term demand growing more quickly
- Initially need to identify promising areas
 - But demand typically is clustered in metro areas, where DSL is available
- Customer support can be a significant cost
- CPE price is extremely important
- CPE form-factor also important
 - Self-installable, indoor unit required for urban/suburban markets
 - Outdoor units suitable only for rural areas

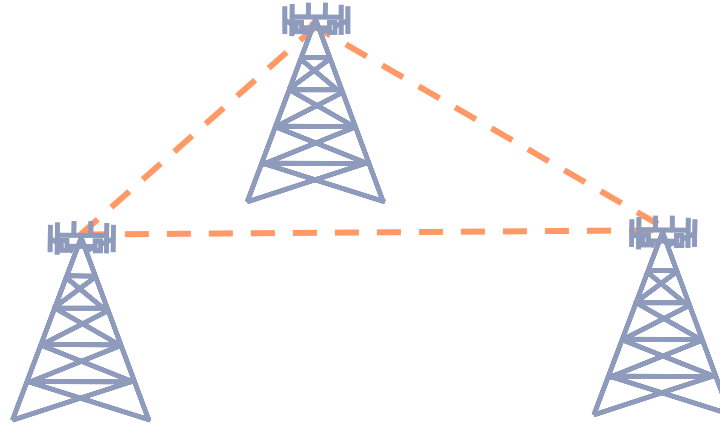
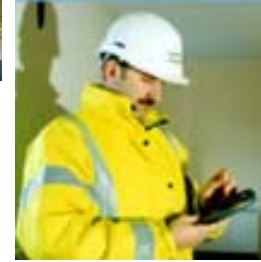
Mobility represents a big challenge for WiMAX

- Market will start in 2008
 - Mobile devices not available until then
 - Full mobility not initially supported by WiMAX
- 3G meets demand for mobile wireless broadband where available
 - 3G performance and coverage is improving
 - Demand for laptop- and PDA- broadband is met by existing technologies
- Business case for mobile access as a stand-alone service is not good
 - Mobility will be offered by operators that want to add mobile data access to their fixed services

WiMAX can support public agencies services over a single network



...and safety, monitoring and surveillance applications



Conclusions

- The big opportunity for WiMAX depends on 802.16e
 - 802.16e will be deployed for fixed and mobile services
 - Fixed-only 802.16-2004 will serve a niche market
- WiMAX will not kill DSL or 3G
 - It will have to coexist and compete with them
- During the next five years, fixed and portable access will dominate
 - The business case for mobile-only WiMAX is not yet convincing
- Developing markets are the most promising ones
 - Asia-Pacific will capture 41% of WiMAX subscribers

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