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WiMAX Roll out in Greece

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Agenda

Wi-Fi & WiMAX vs 3G & HSDPA: a Winning Combination

WiMAX

WiMAX Broadband Services

Where are we now?

Mobile WiMAX

EU and Greek Regulatory Framework

EETT Role

FWA Licenses, Trials, Consultation and Auction

WiMAX Licensing

Issues for discussion

WiMAX Regulations – state of play

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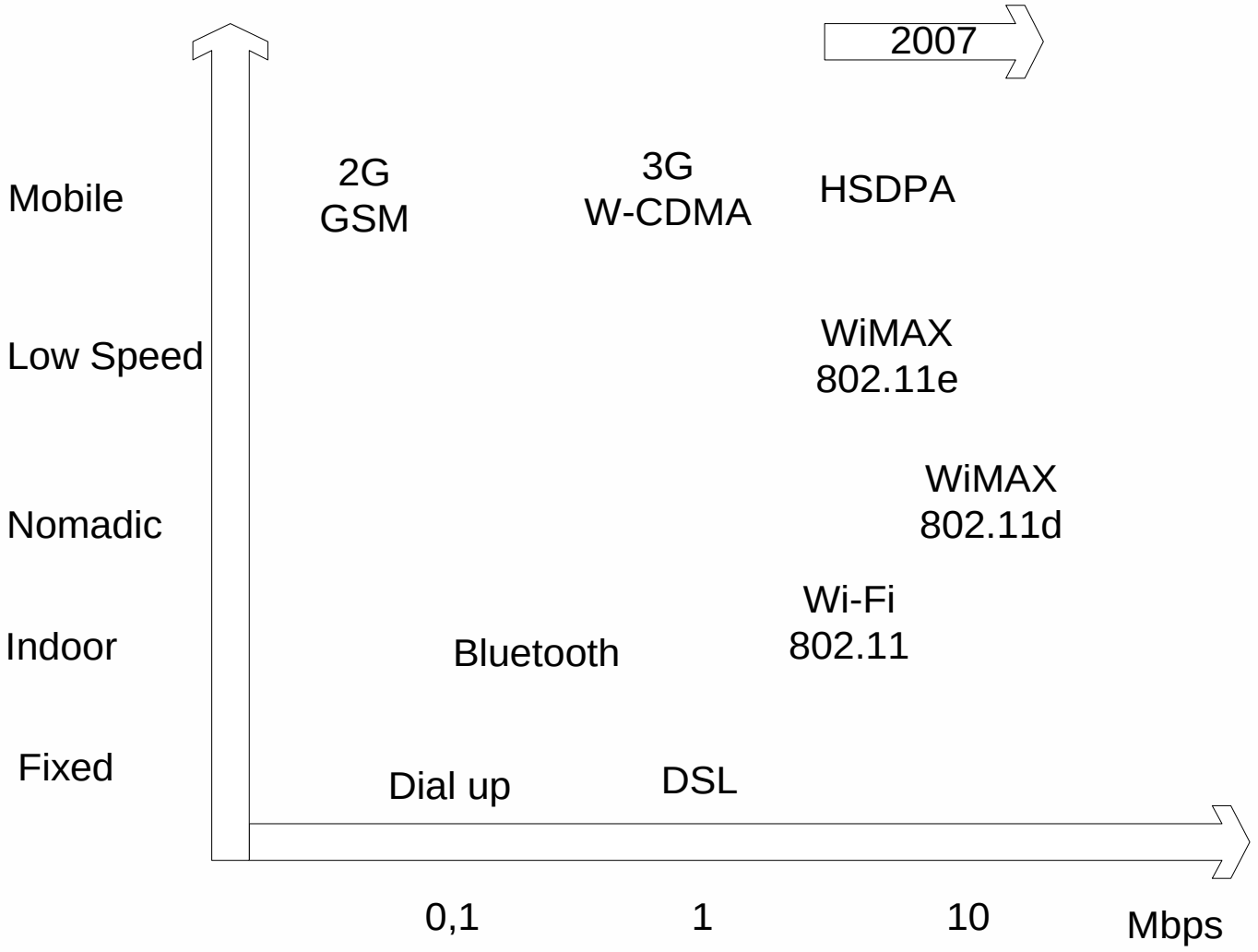
Current Status in Mobile and Wireless Access



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Broadband Access Development

- Next Generation Broadband Mobile Access Networks:
  - ➔HSPDA with full power of W-CDMA
  - ➔WiMAX
- Equipment Manufacturers, Operators (Mobile and Fixed), Regulatory Authorities are moving in that direction
- Goal
  - ➔Bridge the Broadband Gap
  - ➔Increase Broadband Penetration

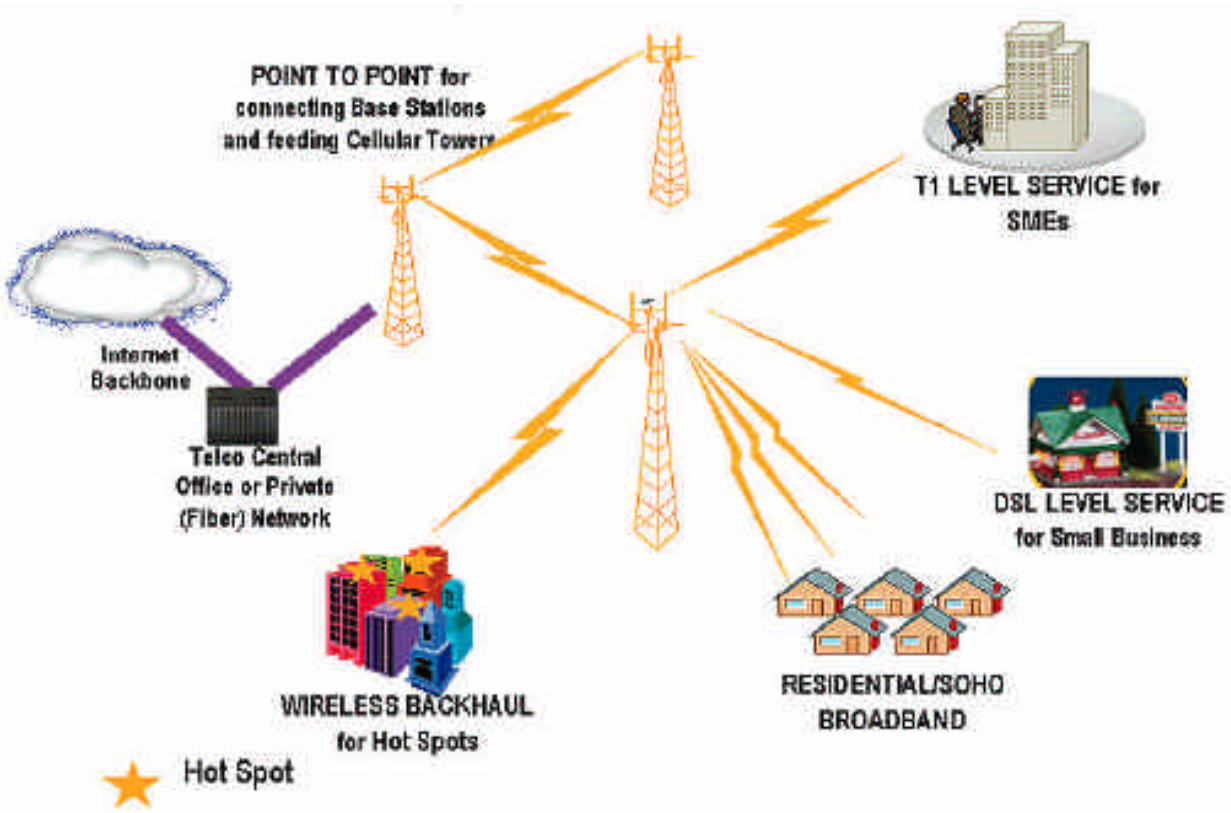
Leading to…

- Multiple Spectrum Usage
  - ➔ Many different services at the same time in the same area
  - ➔ Increasing background noise

- Multimode devices (GSM, UMTS, Wi-Fi, WiMAX, HSPDA)
- Economy Scale: one terminal one card (end 2007 probably)
- IP Network – Mobility enabled
- Personal Interactive Broadband Multimedia Services
- 5 MHz → 50 Mbps (WiMAX)
- 5 MHz → 14.04 Mbps (HSPDA)
- Triple Play
- Decrease cost of services and equipment
- Bridge Broadband Gap in regions with insufficient broadband access

WiMAX Overview

WiMAX (Worldwide Interoperability for Microwave Access): Broadband Wireless Access **solution** including Fixed, Nomadic and Mobile use to residential or professional subscribers



Profile

- Fixed: Outdoor and Indoor CPEs (802.16d)
- Nomadic: Indoor CPEs, PCMCIA cards (802.16d)
- Mobility: PCMCIA cards, PDAs, Smart phones (802.16e)

- World wide WiMAX frequency bands (licensed and unlicensed):

1452 – 1492 MHz
2300 – 2500 MHz
2496 – 2690 MHz
3300 – 3400 MHz
3400 – 3600 MHz
3600 - 3800 MHz
5470 – 5725 MHz
5725 – 5825 MHz

so no harmonised frequency band but…

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WiMAX Technology

…120 operators of fixed and nomadic WiMAX world wide

- 5 – 15 Mbps (in practice)
- 3 - 20 km coverage
- 256 FFT OFDM radios for true NLOS fixed and nomadic operation
- Point to Point (backhaul) and Point to Multipoint (access)
- Full 802.16-2004 delivered
- Ideally 30 MHz or more for a full country coverage
- 1.25 MHz – 20 MHz typical bandwidth used
- For regional licensing 2x10 MHz or 2x15 MHz may be sufficient
- WIMAX Backhaul with Last Mile Wi- Fi or DSL (complements Wi-Fi)
- 802.16-2005 continued (mobile WiMAX)
- OFDMA better performance against multipath fading (mobile WiMAX)

WiMAX Broadband Services

- Information and entertainment (triple play):
  - ➔ High speed access, music, video, games
  - ➔ High speed internet access
  - ➔ Basic voice services via Voice-over-IP
  - ➔ Personal Broadband – Always on
- e-business, e-commerce, teleworking:
  - ➔ Increase efficiency and improve contacts to customers
- Public services:
  - ➔ e-government, e-health, e-learning
  - ➔ Improve services and decrease costs

Where are we now?

- The market is moving in 3 directions:
  - ➔ Fixed WiMAX based on IEEE 802.16 2004 mainly in EU @ 3.5 GHz for home/nomadic usage. 19 equipment certified by CETECOM. **Technology delivered**
    - 70 million notebooks by end 2008 including Wi-Fi (Source: WiMAX Forum)
    - 120 operators world wide (Source: WiMAX Forum)
    - Usage in the unlicensed spectrum @ 5.8 GHz and 5.4 GHz
  - ➔ Cellular/ Wi-Fi/ WiMAX single chip (2006 – 2007)
    - Trials
  - ➔ Mobile WiMAX based on IEEE 802.16-2005 (depredating on spectrum, regulation etc.)
    - Commercially available 2008

Mobility (1/2)

- Personal Broadband
- End of 2007: mobility chip. Now trials and preliminary delivers (Source: WiMAX Forum). Tunable devices by software (Intel, Motorola, Fujitsu)
- End of 2008: device for international roaming (anywhere the world) (Source: WiMAX Forum)
- 802.16e initially at 2.3 GHz, 2.5 GHz, 3.3 GHz, 3.4 – 3.8 GHz
- Fixed Vs Mobile

	Multiplexing	Duplex Method	Modulation
Fixed WiMAX	256 OFDM	TDD, FDD, H-FDD	QPSK, 64 QAM
Mobile WiMAX	OFDMA (30 MHz at least)	TDD	QPSK, 64 QAM

Mobility (2/2)

- Few mobile trials. University of Portugal and Italy during winter Olympic Games
- 2 - 5 km coverage. NLOS achieved (OFDMA)
- Peaceful coexistence with MOs (3G)
- Low frequency bands better
- Regional Roaming

But

- The transaction from 802.16d to 802.16e is about consideration
- Recent suspension of 802.20. 180 miles per hour mobile connections 500 – 700 kbps. Difficulties in standardization of technology
- We don’t know when mobile WiMAX will be commercially available
- Real capabilities won’t be demonstrated until end 2008
- No WiMAX mobile equipment certified yet

Regulatory Framework in Greece

Ministry of Transport and Communications:

- Law 3431/2006: Electronic Communications. Harmonization of the EC Directive Framework on Electronic Communications
- GG 399/3-3-2006: National Frequency Allocation Table

Hellenic Telecommunications and Post Commission (EETT):

- EETT Dec. 390/3/13-6-2006: Regime on General Authorization
- EETT Dec. 390/1/13-6-2006: Regime on Authorization of Spectrum Usage
- EETT Dec. 399/34/16-8-2006: Terms of Spectrum Usage
- EETT Dec. 384/1/27-4-2006: Exclusion of customer premises antenna equipment (including Wi-Fi and WAS/RLAN) from antenna construction license
- EETT Draft Dec.: Spectrum Trading. Under study

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Participating

- CEPT/ECC (45 Countries)

  ECC/DEC/(05)05: ECC Decision of 18 March 2005 on harmonised utilisation of spectrum for IMT-2000/UMTS systems operating within the band 2500-2690 MHz.1/1/2008 spectrum available for Next Generation Mobile Networks

- IEEE

  802.16d and 802.16e projects

- CETECOM

  Equipment Certifications. Notifications

- WiMAX Forum (350 members)

  WiMAX World Europe, 22-24 MAY 2006, Vienna

- Other NRAs

  France, Sweden, UK, Finland, Belgium, Italy, Austria etc.

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Frequency Band Allotments in Greece

According to NFAT:

- 1452 – 1492 MHz: Committed for DAB
- 2400 – 2483.5 MHz: ISM Band (WLAN)
- 2500 – 2690 MHz: Committed for MOs NGN
- 3.4 – 3.6 GHz: Fixed Wireless Access – Suitable for WiMAX
- 3.6 – 3.8 GHz: Point to Point Links (up to 2012)
- 5150 – 5250 MHz: ISM Band (WAS/RLAN) – Not suitable for WiMAX
- 5470 – 5725 MHz: ISM Band (WAS/RLAN) – Suitable for WiMAX
- 5725 – 5850 MHz: No Usage due to Radar systems
- 10.0 – 10.68 GHz: Mainly for SAP/SAB applications

More information in:

http://www.eett.gr/export/sites/default/sites/EETT/Electronic_Communications/Radio_Communications/TermsOfUse/FEK399.pdf

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FWA Licenses

- 3 Licenses allocated 2000 @ 3.5 GHz for LMDS
  - ➔ Minimum obligations imposed:
    15 years duration
    20% coverage of the population
    Participation in 4 districts
  - ➔ Low penetration. Corporate customers and operators' backhaul links
    Due to :
    Equipment cost (base stations, antenna installations etc)
    Competitive products (ADSL, UMTS)
    Unlicensed spectrum
- 5 Licenses allocated 2000 @ 24 GHz for LMDS
  - ➔ Similar roll out obligations. Corporate customers

WiMAX Trials and Public Consultation in Greece

- WiMAX Trials in 2006:
  - 19 companies
  - 25 experimental base stations, sectors of 60 – 90^{o}
  - Duration 3 plus 2 months extension
- 19 companies at public consultation about FWA remaining license for WiMAX (March 2006):
  - 11 Domestic Operators (Fx and Mob)
  - 4 Telecoms industry
  - WiMAX Forum
  - 3 Equipment Retailers
- Consultation key points:
  - 512/128 kbps
  - National license
  - Same roll out obligations with other FWA licenses

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WiMAX Auction in Greece

- July 2006: 7 companies participated in the multiple round auction
- Starting Bit: **1,650,000 €**
- One National License 2 x 14 MHz @ 3.5 GHz
- Final Bit: **20,475,000 € -** 18 rounds
- Cost of License: 0.73 €/Hz

  EU average: 0.033 €/Hz (with 14% broadband penetration)

  * 15 times greater than EU average *
- Minimum coverage obligations imposed:

  10 Years duration - 20% coverage in 7 geographical areas @ first 4 years
- The 3 FWA licenses modified for technology neutrality. Operators should have free choice of technology to offer WiMAX services as well

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3400 – 3600 MHz FWA Licenses

Four National FWA Licenses for Fixed and Nomadic usage:

CRAIG (2x28 MHz)
3410.0MHz – 3438.0 MHz
3510.0MHz – 3538.0 MHz

OTE (2x14 MHz)
3441.5 – 3455.5 MHz
3541.5 – 3555.5 MHz

COSMOLINE (2x14 MHz) 7/2006
3459.0 – 3473.0 MHz
3559.0 – 3573.0 MHz

Q Telecom (2x21 MHz)
3476.5MHz – 3497.5 MHz
3576.5MHz – 3597.5 MHz

Mobility not available yet

WiMAX Preferably @ 3.5 GHz band in EU

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Issues for discussion (1/2)

- Issues for mobile WiMAX:
  - ➔ Device development (Smart antennas with resistance to fading, MIMO, power consumption, etc.)
  - ➔ Semiconductor industry – Chipset Revolution
  - ➔ Network Interoperability
  - ➔ Free choice of technology. FDD or TDD (TDD High Interference Risk)
  - ➔ Inter – operator coordination to solve interference problems
  - ➔ Ultra Wide Broadband in future @ 3.7 GHz. ECC decision is expected at the end of 2006
  - ➔ To many base stations and CPEs. Environmental and construction issues
  - ➔ Handovers for roaming. Achieve time delay less than 50 msec, like real time VoIP

Issues for discussion (2/2)

- Also:

  - ➔ WiMAX in unlicensed spectrum? You can not control QoS in the unlicensed spectrum
  - ➔ WiMAX Certified Equipment only, in order to ensure Network Interoperability
  - ➔ Competition with mobile TV?
  - ➔ After 2-3 years?

Regulatory Basics for a successful market penetration

- Roaming. Pan European coverage and rules for domestic roaming, in case of regional licensing
- National Frequency Allocation Table needs modification in order to enable Mobility
- Interconnection rules to existing infrastructures and to other operators' capacity. Fees
- Spectrum Trading (regional opportunity for WiMAX)
- Frequency Harmonization. Uniform spectrum allocation
- More allocated spectrum to operators
- One standard - common platform. Beneficial for equipment vendors and consumers
- Second though about 2.5 GHz (Re – regulated?)

Questions?

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