Next Generation Mobility: the WiMAX opportunity

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WiMAX Standards

Standards

•IEEE 802.16.2004 / ETSI Hiperman (June 2004)

(Fixed, Nomadic Application)

•IEEE 802.16e (December 2005)

(Fixed, Nomadic, Mobile)

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WiMAX Key Features

Scalability	Scalable PHY for flexible channel bandwidths (1.25-20 MHz) as global RF band allocations vary (e.g.: 2.3, 2.5, 3.5 GHz) Flexible frequency re-use schemes for network planning
High Data Rates	Larger MAC frames with low overhead, Adaptive Modulation, Advanced FEC, H-ARQ, Beamforming (AAS), Space-Time Transmit Diversity, MIMO
QoS	QoS with Service Flows, Advanced Scheduling Framework, Adaptive Modulation & Coding, ARQ, H-ARQ
Mobility	Secure Handover, Optimized Hard Handover, Multicast, Broadcast, Paging, Power Management with Sleep and Idle Modes
Security	EAP authentication, Encryption with AES-CCM, CMAC Authentication, X.509 Certificates, Key Binding, Mutual Authentication, Device and User Authentication

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WiMAX recognition in the ITU-R

Excellent progress has been made already in ITU-R:

IEEE 802.16d
- Technology recognised in ITU-R Recommendation F.1763

IEEE 802.16e
- Recognised in ITU-R Recommendation M.[8A/BWA]
- Process to include into Recommendation M.1457 (IMT-2000 Family continues)

IMT and WiMAX are on the same technology track!
Technology convergence is under way

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ETSI HARMONIZED WiMAX STANDARDS

HIPERMAN TECHNICAL SPECIFICATIONS

Base standards (fixed/nomadic – v1.3.1)
- ETSI TS 102 177 PHY layer
- ETSI TS 102 178 DLC layer

System Profile (v1.2.1 - 01.2005)
- ETSI TS 102 210 System profiles

DLC Conformance Testing (fixed) (v2.1.2–03.2006)
- ETSI TS 102 385-1 PICS
- ETSI TS 102 385-2 TSS&TP
- ETSI TS 102 385-3 ATS

DLC Conformance Testing (v1.3.1)
- expected mid 2006, ATS architecture in Feb.06

Management (v1.1.1 – 01.2005)
- **ETSI TS 102 389 MIB**

Harmonized with IEEE 802.16-2004 and 802.16e-2005

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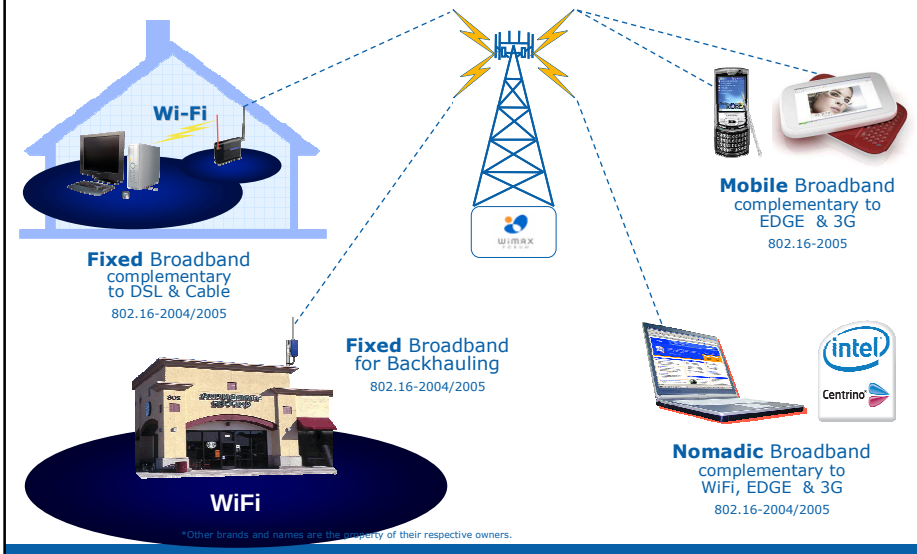
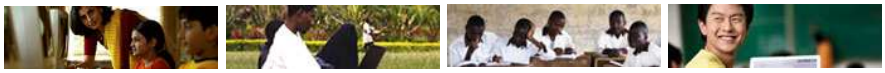
Intel WiMAX Vision



*Other brands and names are the property of their respective owners.

Intel World Ahead Program



•Aims to enhance lives by accelerating access to uncompromised technology for everyone, anywhere in the world through **accessibility, connectivity, education and content.**

•Intel also invests in local companies and works with industry partners to further expand the use of technology in order to support social and economic advancement.

•In the next five years, Intel plans to invest more than USD 1 billion to support this endeavour. Goals are wireless broadband PC access to the world's next billion users while training 10 million more teachers on the use of technology in education, with the possibility of reaching another 1 billion students.

Intel Vision for Mobile Internet

Success of broadband wireline services (Cable/DSL) and short-range portable wireless data (WiFi) has created a killer application: "Mobile Broadband Internet".

Consumers are demanding mobile internet (Cable/DSL like) anytime/anywhere.

No existing standard technology provides a promise for mobile internet.

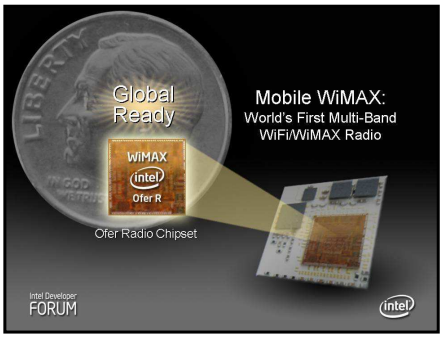
need a wireless broadband IP-based network with similar quality of service as wireline broadband with the addition of mobility.

WiMAX Device Evolution

Client	Desktop + Notebook	Notebook	Full range of Mobile Devices
Modem	Outdoor & Indoor Modems + WiFi	PC-Card + Integration	Full Mobile Integration
Technology	Fixed WiMAX '06	Nomadic WiMAX '07 – '08	Mobile WiMAX '08 – '09

Intel Developing WiMAX Chips

Rosedale-2: Optimized for cost-effective WiMAX modems



Ofer-R: World's First Single Chip Wi-Fi / WiMAX Radio for Mobile Devices

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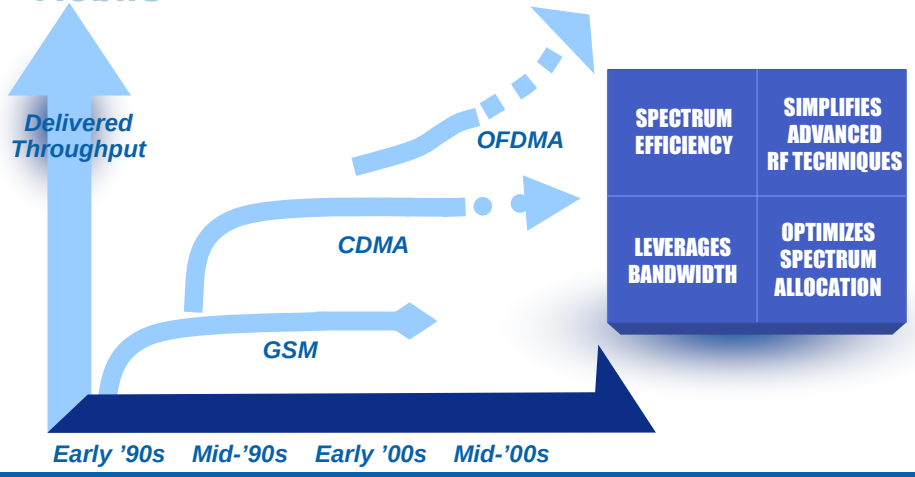
Why WiMAX is such a Big Deal?

It Represents a Shift to OFDM for Fixed and Mobile



CDMA=Code Division Multiple Access, OFDM=Orthogonal Frequency Division Multiplex

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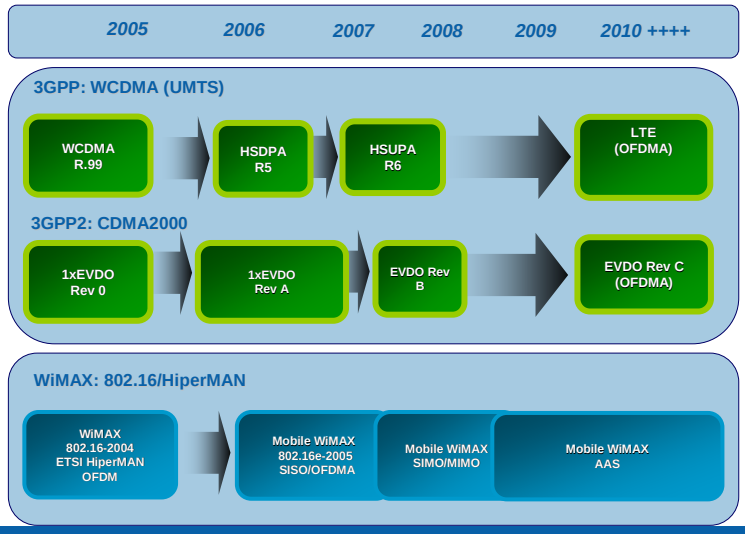
Wireless Broadband Roadmap



WiMAX and 3G are complementary

- **WiMAX and 3G will coexist**
  Each service provider's distinct network environment and business imperatives will determine which technology or mix of technologies best meets their needs.
  - **WiMAX** is optimized for **IP-based high-speed wireless broadband**.
  - **3G** is optimized for **cellular voice and moderate data-rate applications**

WiMAX Forum (www.wimaxforum.org)

- The WiMAX Forum is an industry-led, non-profit corporation
- Formed to promote and certify compatibility and interoperability of broadband wireless products.
- Member companies support the industry-wide acceptance of the IEEE 802.16 and ETSI HiperMAN standards.

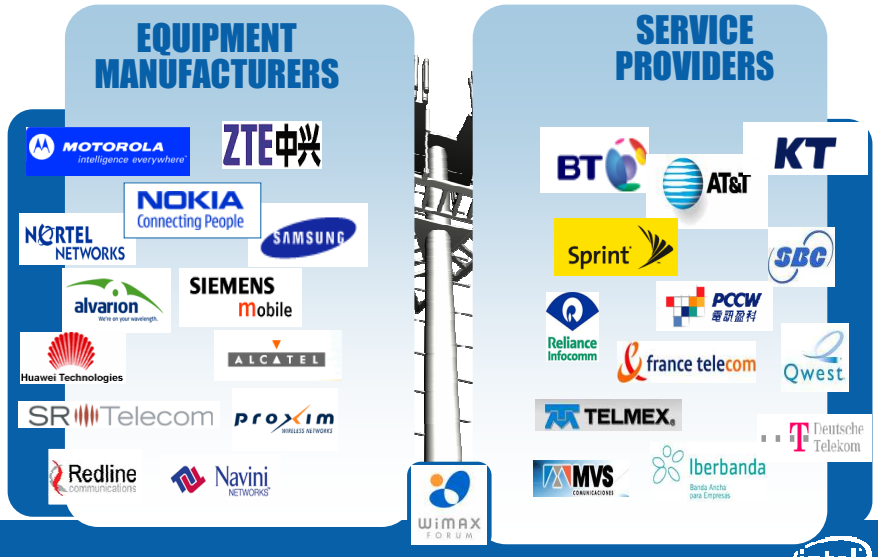
What this means?

For **network operators;** equipment interoperability across vendors

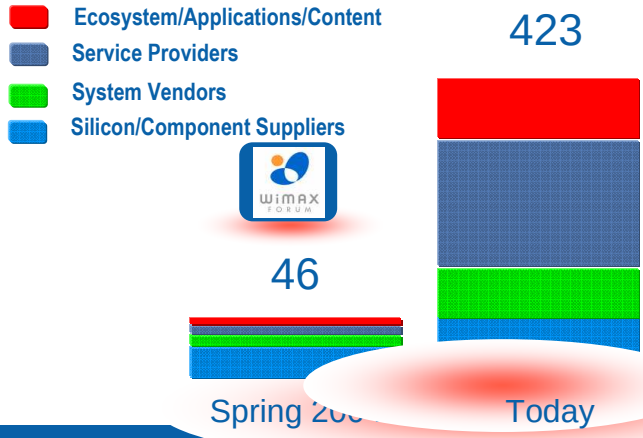
For **component vendors;** fewer product variations and higher volumes

For **end-users;** faster and cheaper access that is more widely available

WiMAX Forum Members



The WiMAX Forum Membership Growing!



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WiMAX Forum Working Groups

Service Provider Working Group (SPWG)	Mobile System Requirements
Applications Working Group (AWG)	Application Requirements/Demos
Network Working Group (NWG)	End to End Network Specifications
Technical Working Group (TWG) (MTG)	Air Interface Profiles & Tests based on 802.16/ETSI
Certification Working Group (CWG)	WiMAX Certification Program
Regulatory Working Group (RWG)	World Wide Spectrum Policy
Marketing Working Group (MWG)	Marketing/Membership/Events
Global Roaming Working Group (GRWG)	Assure and Accelerate Global Roaming

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WiMAX Certification

- Certification program started mid-2005
- Certified products comply with the standards and they interoperate with certified products from other vendors.
- 28 Certified products (fixed/nomadic)
- Mobile WiMAX products are ready and certification will begin in mid-2007.

WiMAX Spectrum

WiMAX (2.3/2.5 GHz, 3.5/3.7 GHz, 5.8 GHz)

Future profiles include below 1 GHz

Current WiMAX Forum Profiles

WiMAX Opportunities

WiFi Hotspots

Education

Economic Vitality
(e-business, e-commerce)

NGN Wireless
Broadband
Connectivity

Digital Govt

Health Care

Bridging the
Digital Divide

Home Usage

Safety & Security

WiMAX
250+ Trials / 70+Commercial Deployments

Mobile WiMAX is real $billions invested….at 2.5 GHz band

Sprint Nextel Corp. (NYSE: S) today [8th Aug '06] announced its plans to develop and deploy the first fourth generation (4G) nationwide broadband mobile network. The 4G wireless broadband network will use the mobile WiMAX (Worldwide Interoperability for Microwave Access) IEEE 802.16e-2005 technology standard.

"Mobile WiMAX…delivers four times the throughput of other wireless technologies at up to one-tenth the cost." *Sprint*

- Sprint PR details
  - –Sprint to deploy mobile WiMAX in '07, launch services in '08
  - –100M+ POPs covered by the end of '08
  - –Intel to supply technology for laptops and other computing devices

We believe this is a "inflection point" for WiMAX deployments worldwide.

Innovative and "WiMAX friendly" technology neutral framework required!

- **WiMAX needs access to licenced spectrum: 2.5 GHz (mobile WiMAX)**
- **WiMAX needs greater access to Licensed spectrum: 3.4 – 3.8 GHz**
- **WiMAX needs some License-Exempt spectrum: 5.8 GHz**

WiMAX is not asking for special treatment; just equality!!

What is an NGN?

ITU-T Study Group 13 Definition
"A Next Generation Network is a packet-based network able to provide telecommunication services, able to make use of multiple broadband, QoS- enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users."

Alternative Definition
All-IP or packet-based integrated networks. In a NGN environment, applications and services will be separated from the transported network *and all kind of applications and services such as voice, data and video can be organized into packets and delivered on an integrated IP network.*

Why NGN?

-Need to converge and optimize the operating networks and the extraordinary expansion of digital traffic (i.e., increasing demand for new multimedia services, increasing demand for mobility, etc.).

-It consolidates both the fixed and wireless world under the same core network so that the same services can be delivered no matter what access technology is used **(Cost and capex reduction per user).**

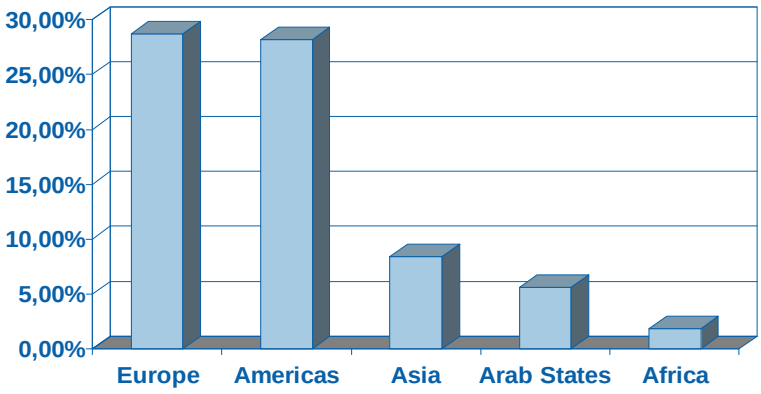
-Accelerate the use of communications for greater socio-economic development, including E-education, E-health, and E-government, and enable countries to boost productivity and growth.

-Network operation is cheap and easy.

-Broadband capabilities with end-to-end QoS and transparency.

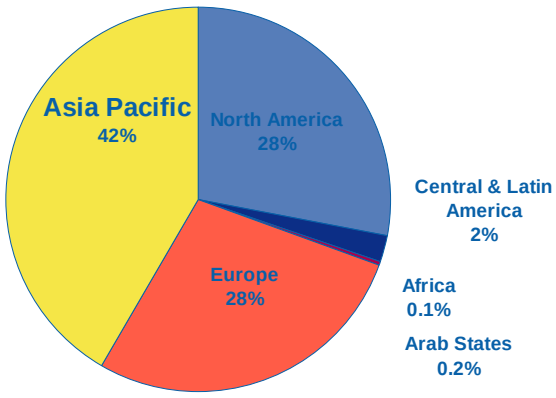
-Converged services between Fixed and Mobile networks.

Internet Penetration



Source: International Telecommunications Union
www.itu.int/ITU-D/ict/publications/wtdr_06/index.html

Distribution of broadband subscribers



Source: International Telecommunications Union
www.itu.int/ITU-D/ict/publications/wtdr_06/index.html

Why WiMAX?

WiMAX offers a combination of both broadband and mobility

Why mobile WiMAX?

-**OFDMA** has clearly emerged as the technology of choice for next-generation IP based broadband mobile networks (higher throughput and capacity, great flexibility in managing spectrum resources, and improved indoor coverage)

-**Advanced IP-based architecture**, which includes 3GGP's IMS (IP Multimedia Subsystem) and 3GPP2's Multi-Media Domain (MMD) support to facilitate a rapid, low cost, rollout of new applications and of interworking with other wireless and wired technologies.

-**Attractive economics,** driven by a standards-based approach, cost-effective infrastructure, mass adoption of low-cost subscriber units, and attractive IPR royalties.

-**Flexibility,** which allows service providers to support multiple usage models, including fixed and mobile access, over the same WiMAX infrastructure and to operate their networks in multiple spectrum bands.

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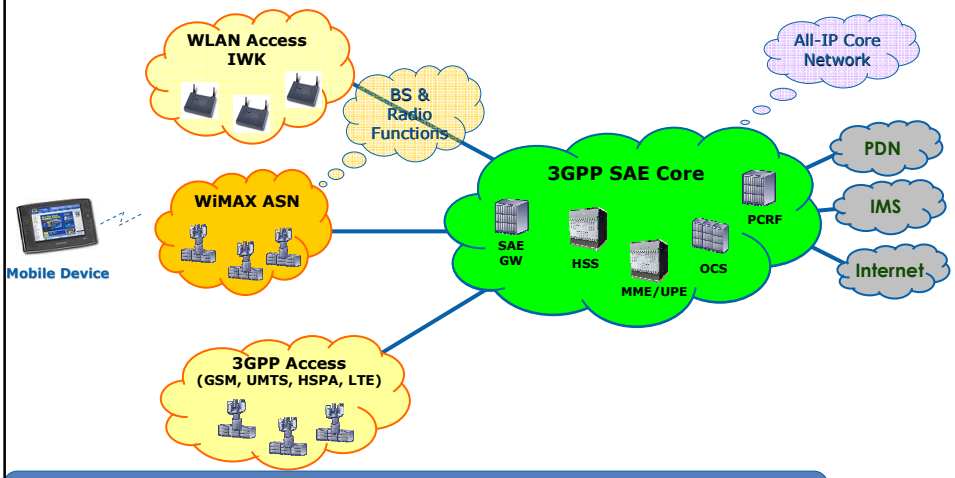
Mobile WiMAX- 3GPP SAE Interworking



SAE integrates WiMAX to operator's core network as other 3GPP access technologies are with seamless vertical mobility

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Why WiMAX?

- The delivery of NGN access is critical in many developing countries and underserved areas of developed countries, where little or no infrastructure is available.
- WiMAX cost effective, fast applicable IP based NGN access technology for rural and underserved areas.
- WiMAX brings solution subscribers that want to be able to use their broadband connection regardless of location, a functionality that DSL and cable modem services do not support.
- Importance of Broadband for Economic development (Proportional growth between telecom and GDP)
- Competition in broadband market (driving end user prices down)

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ITU SURVEY ON NEXT GENERATION NETWORK

Question: Do you think that IP-based NGNs in your country will be different from those in developed economies, who are upgrading their extensive fixed-line networks? How can developing countries best leverage existing mobile networks for this network transformation?

Answer: All most half of the countries assume; Broadband wireless access is most suitable in developing countries to facilitate rapid introduction of NGN. It was also suggested, that **the best way to leverage existing mobile technologies for this network transformation countries should use IP-compliant wireless technologies like WiMAX as a technology mix in their mobile networks.**

Conclusion

- WiMAX technology best meets the demand for personal mobile broadband services. It is based on a next-generation all-IP core network, that offers low latency, advanced security and QoS.
- Low cost, fast applicable NGN access technology based on open standards, vendor interoperability, and favorable Intellectual Property Rights (IPR).
- WiMAX addresses the requirements of those subscribers that want to be able to use their broadband connection regardless of location, a functionality that xDSL and cable modem services do not support.
- WiMAX standards and products are ready and needs technology neutral approach for application in countries.
- WiMAX needs support from administrations for the inclusion within IMT-2000 Family at ITU-R WP8F Meeting, 23-31 May 2007, Japan (www.itu.int/ITU-R/index.asp?category=study-groups&link=rwp8f&lang=en)

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