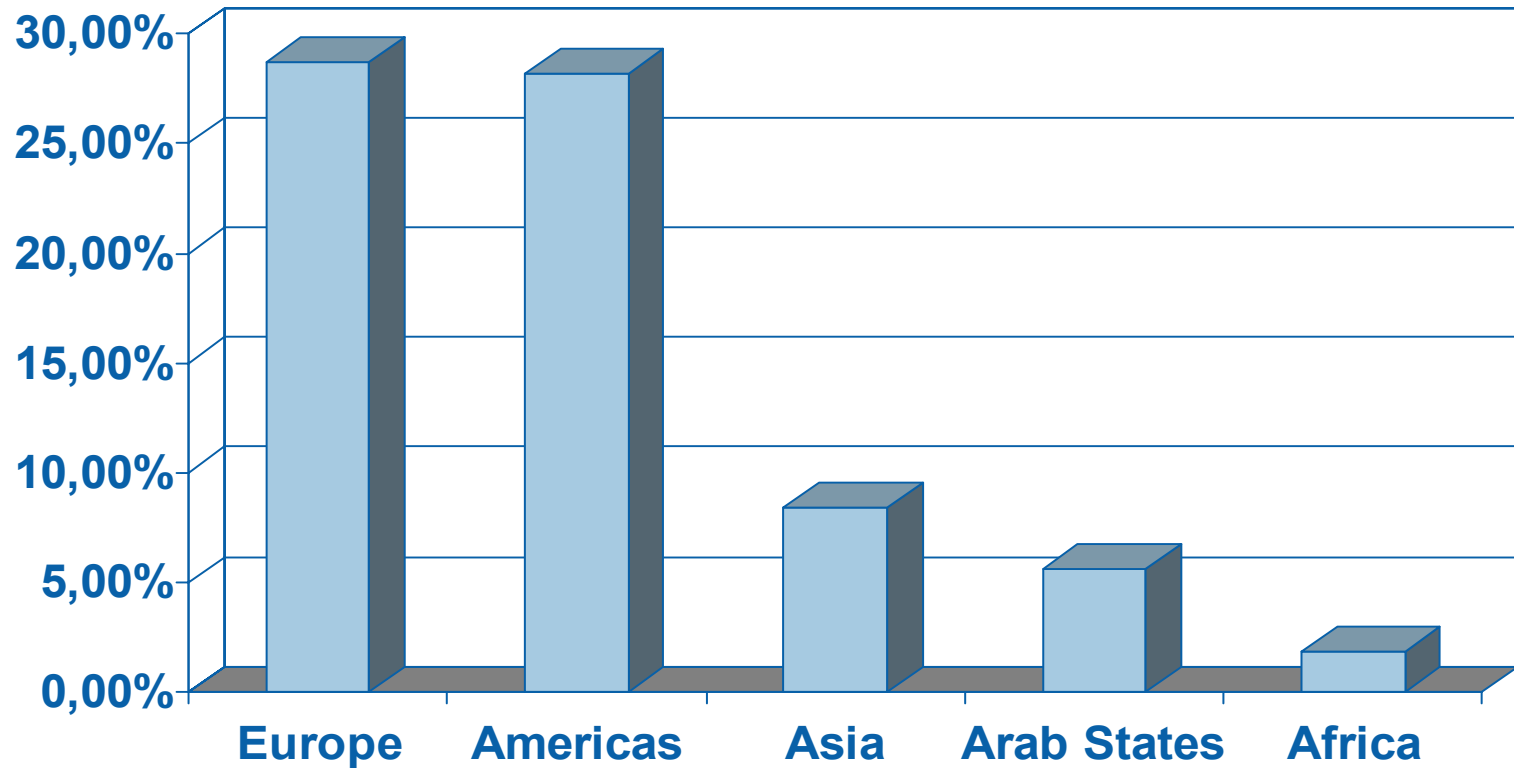# Benefits of WiMAX Standards (IEEE 802.16 – Broadband Wireless Metropolitan Area Networks)

The 4TH IEEE GCC Conference
11-14 November 2007, Manama, Kingdom of Bahrain

Turhan MULUK
Wireless Standards & Regulations Manager
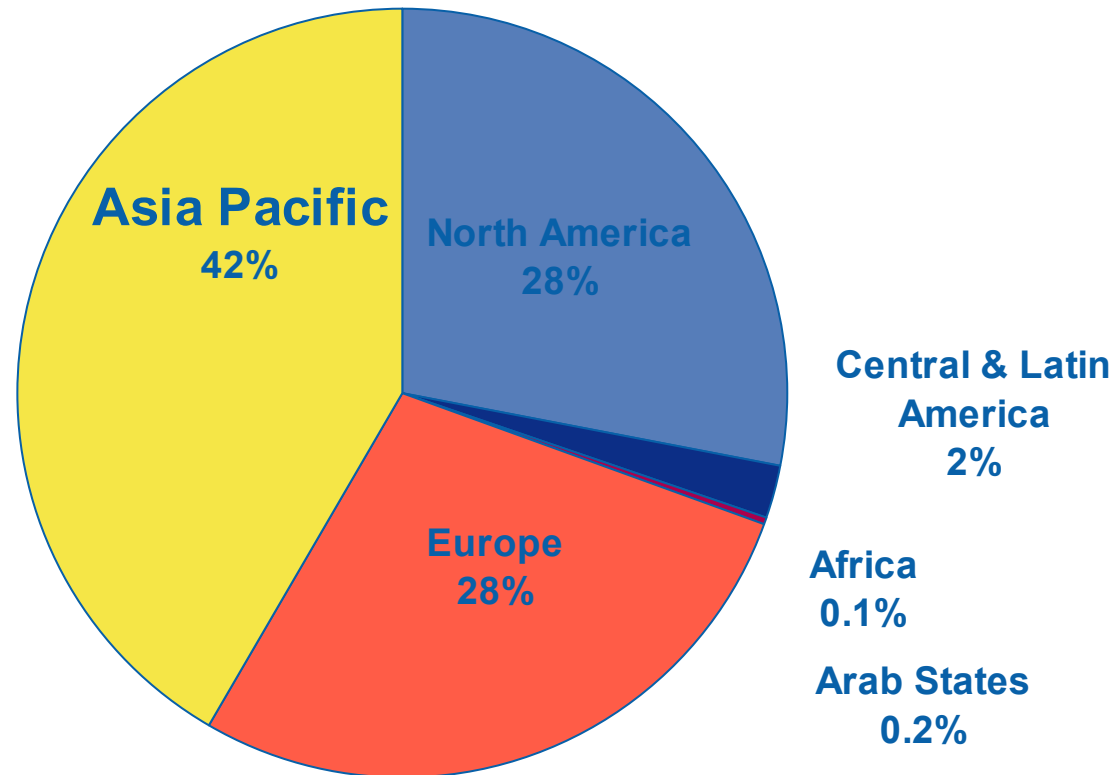Government Affairs
Middle East, Turkey, Africa

Internet Penetration

Source: International Telecommunications Union

www.itu.int/ITU-D/ict/publications/wtdr_06/index.html

Distribution of broadband subscribers

- Asia Pacific 42%
- North America 28%
- Central & Latin America 2%
- Europe 28%
- Africa 0.1%
- Arab States 0.2%

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

Intel's Spectrum Policy

- **Sufficient Spectrum for operators**

- **Technology Neutrality**

- **Open, competitive licensing process**

- **Flexibility within licensed use**

- **Foster competition and innovation**

WiMAX Standards

WiMAX is defined as 'Worldwide Interoperability for Microwave Access' by the WiMAX Forum, officially known as WirelessMAN.

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 recognition in the ITU

Excellent progress has been made already in ITU:

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

IEEE 802.16e
- Recognised in ITU-R Recommendation M.1801

IMT-2000 Family

- IEEE submitted a proposal to ITU WP8F in January 2007 for the inclusion of Mobile WiMAX within the IMT-2000 Family.

- On 18th October 2007, ITU took a decision of global importance to include WiMAX technology in the IMT-2000 Family.

IMT-2000 Standards (six radio interfaces)

IMT-OFDMA TDD WMAN
- also known as **WiMAX**

IMT-DS Direct-Sequence
- also known as **W-CDMA** or **UTRA-FDD**, used in **UMTS**

IMT-MC Multi-Carrier
- also known as **CDMA2000**, the successor to 2G CDMA (IS-95)

IMT-TC Time-Code
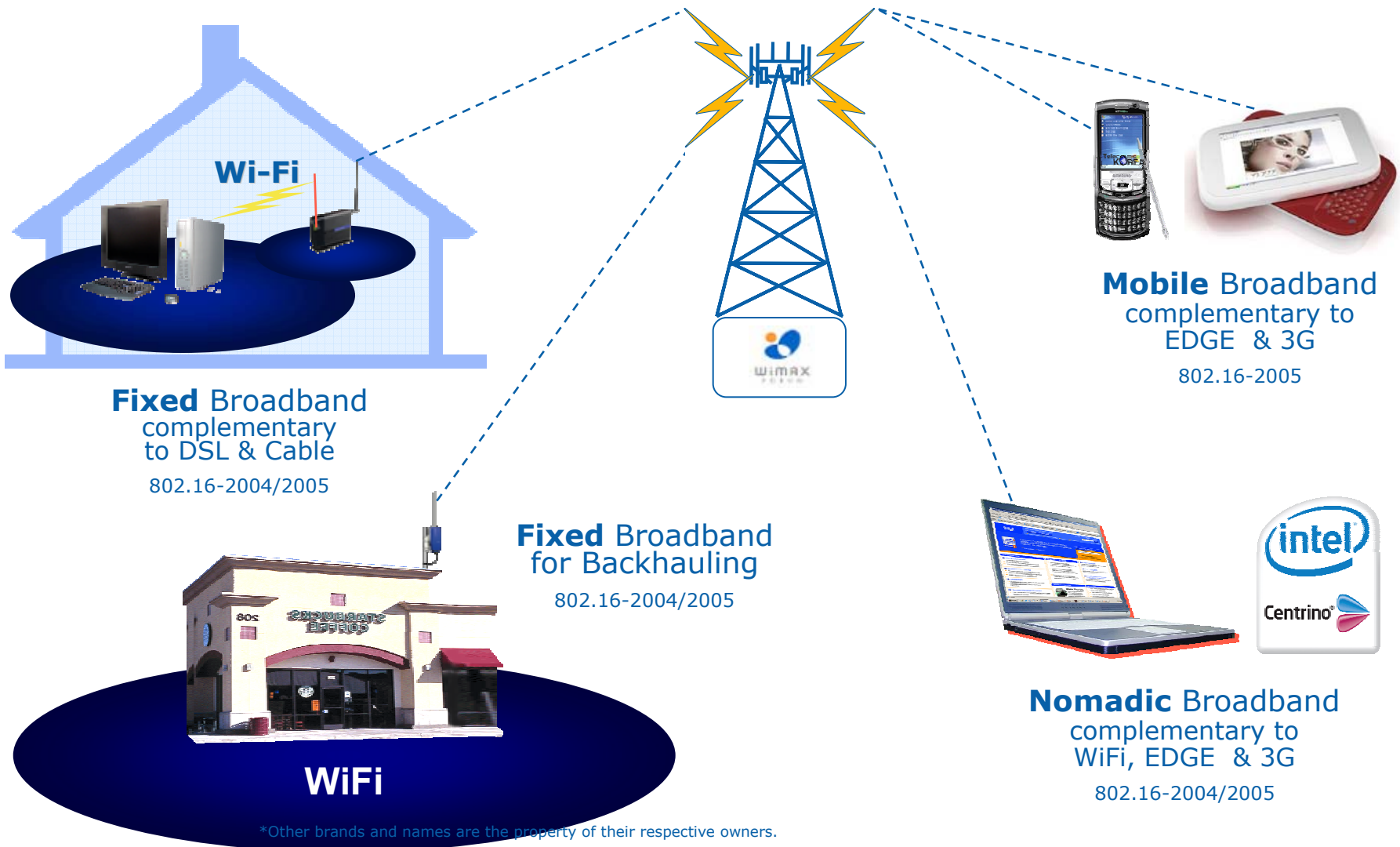- This comprises: UTRA TDD, TDD-SCDMA

IMT-SC Single Carrier
- also known as UWC, the best known implementation is **EDGE**

IMT-FT Frequency Time
- also known as **DECT**

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WiMAX Applications

Wi-Fi

Fixed Broadband
complementary
to DSL & Cable

802.16-2004/2005

WiFi

Fixed Broadband
for Backhauling

802.16-2004/2005

Mobile Broadband
complementary to
EDGE & 3G

802.16-2005

Nomadic Broadband
complementary to
WiFi, EDGE & 3G

802.16-2004/2005

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

IMT-2000 technologies (3G) are complementary

WiMAX and other 3G technologies 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.

- **Other 3G** technologies optimized for
  cellular voice and moderate data-rate applications
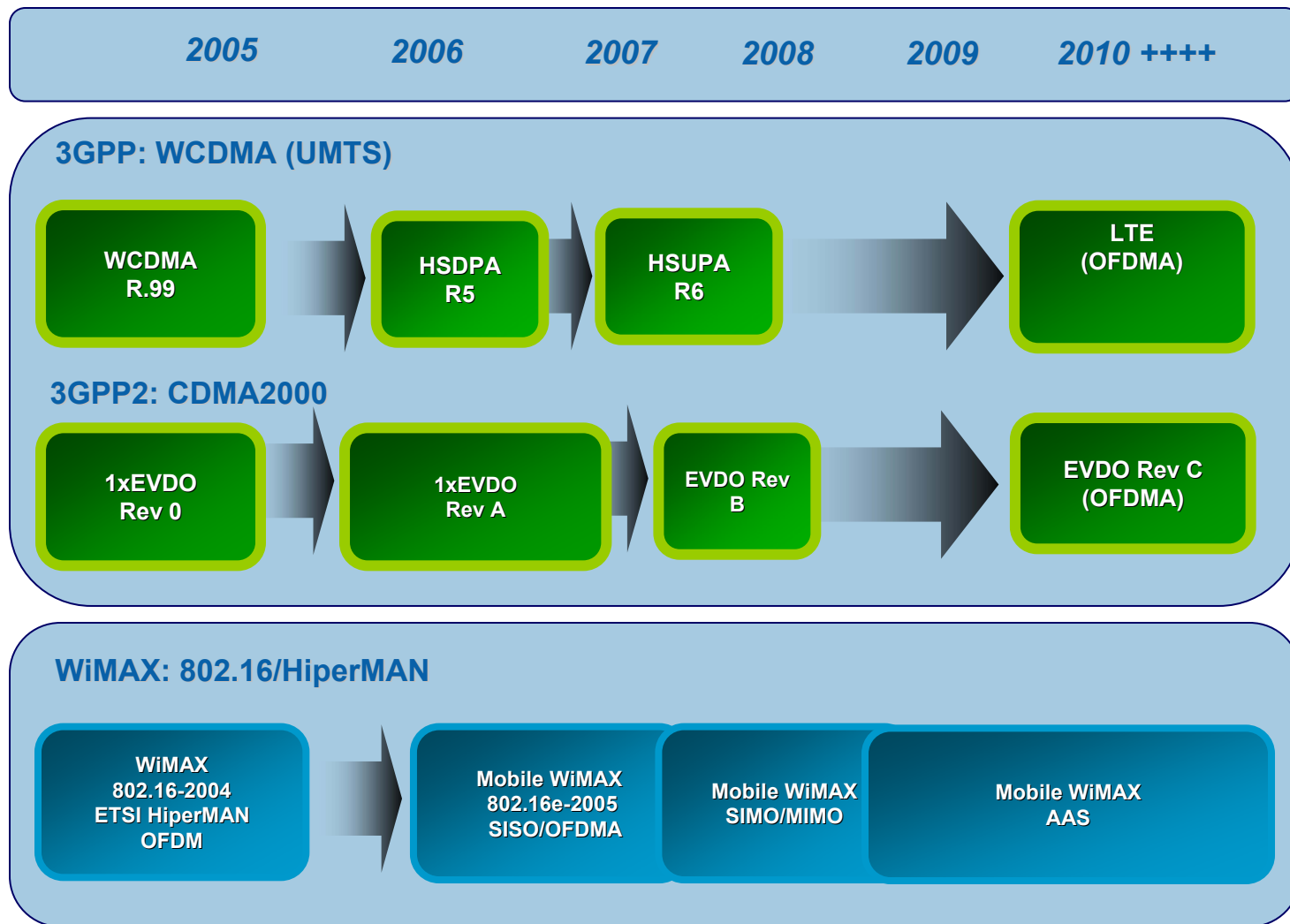
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Data Rate Comparison of 3G technologies
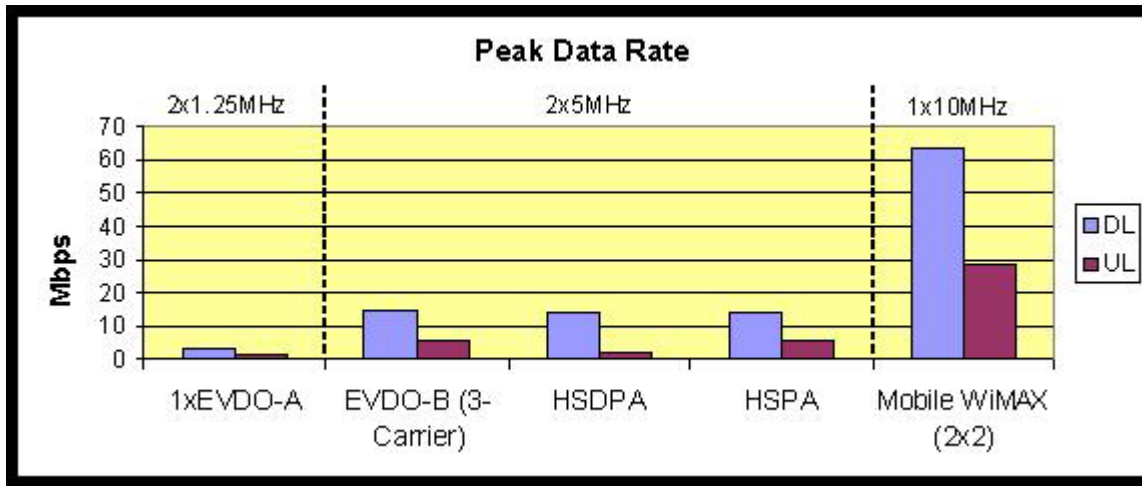
Peak Data Rate

WiMAX peak data rates are 5X better than other 3G+ Technologies on systems tested

Fast upload and download speeds.

Source: WiMAX Forum (www.wimaxforum.org)

Wireless Broadband Roadmap

| 2005 | 2006 | 2007 | 2008 | 2009 | 2010 ++++ |

3GPP: WCDMA (UMTS)

WCDMA R.99 → HSDPA R5 → HSUPA R6 → LTE (OFDMA)

3GPP2: CDMA2000

1xEVDO Rev 0 → 1xEVDO Rev A → EVDO Rev B → EVDO Rev C (OFDMA)

WiMAX: 802.16/HiperMAN

WiMAX 802.16-2004 ETSI HiperMAN OFDM → Mobile WiMAX 802.16e-2005 SISO/OFDMA → Mobile WiMAX SIMO/MIMO → Mobile WiMAX AAS

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Why WiMAX is such a Big Deal?
It Represents a Shift to OFDM for Fixed and Mobile

Delivered Throughput

OFDMA

CDMA

GSM

SPECTRUM EFFICIENCY	SIMPLIFIES ADVANCED RF TECHNIQUES
LEVERAGES BANDWIDTH	OPTIMIZES SPECTRUM ALLOCATION

Early '90s   Mid-'90s   Early '00s   Mid-'00s
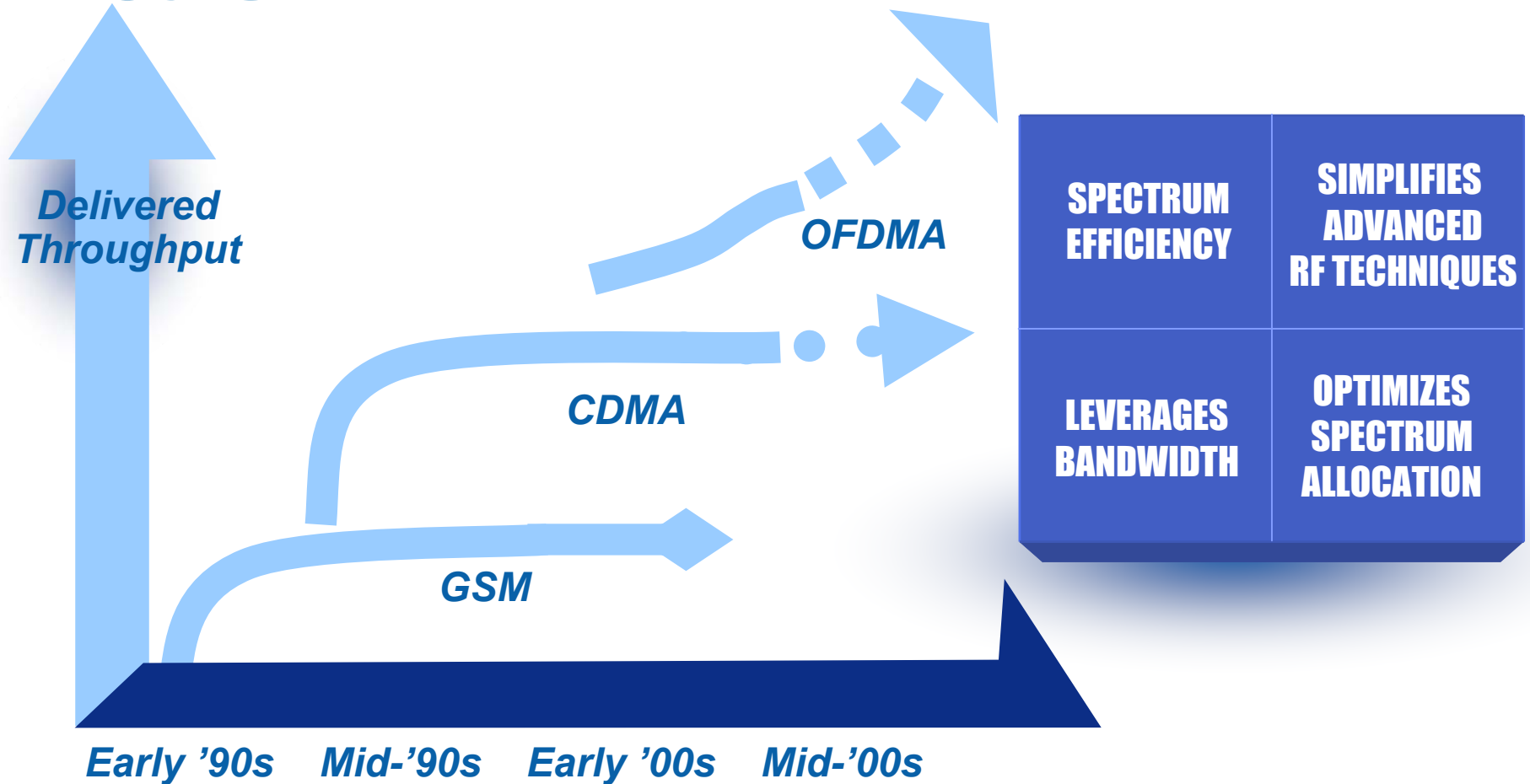
CDMA=Code Division Multiple Access, OFDM=Orthogonal Frequency Division Multiplex

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Why WiMAX?

Established Customer Demand

Broadband, but Fixed

Mobile, but Narrowband

WiMAX Will Meet Emerging Customer Needs

Offering varying levels of Broadband Data, Voice, & Video for Multiple Devices and Usage Models

WiMAX offers a combination of both broadband and mobility

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WiMAX Device Evolution

Client

Desktop + Notebook

Notebook

Full range of
Mobile Devices

Modem

Outdoor & Indoor
Modems + WiFi

PC-Card
+ Integration

Full Mobile
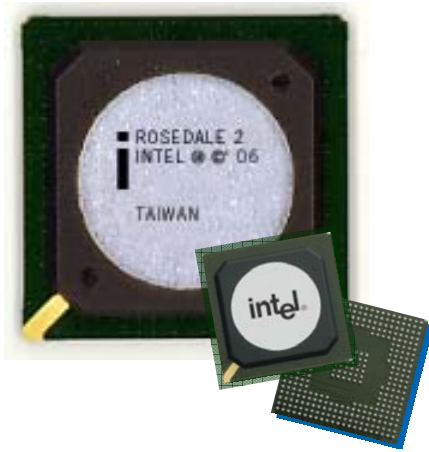Integration

Technology

**Fixed WiMAX
'06**

**Nomadic WiMAX
'07 – '08**

**Mobile WiMAX
'08 – '09**

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All Roadmaps, features, timelines, and code names are subject to change without notification.

Intel Developing WiMAX Chips

Rosedale-2: Optimized for cost-effective WiMAX modems

Global Ready

Mobile WiMAX:
World's First Multi-Band WiFi/WiMAX Radio

WiMAX
intel
Ofer R

Ofer Radio Chipset

Intel Developer
FORUM

intel

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

Baxter Peak: For Mobile Internet Devices (UMPC)

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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
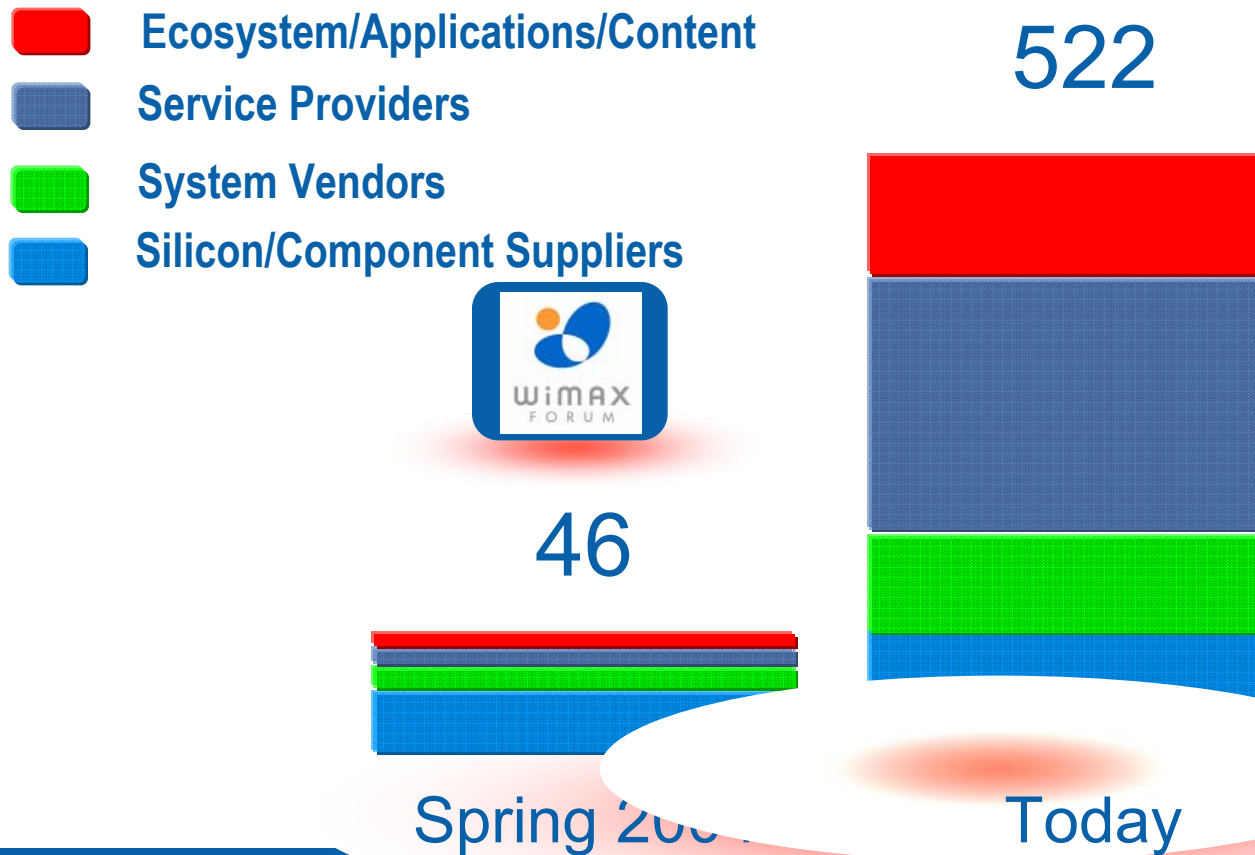
WiMAX Forum Members

Equipment Manufacturers   **Service Providers**

Plus others not specifically listed here

The WiMAX Forum Membership Growing!

Ecosystem/Applications/Content

Service Providers

System Vendors

Silicon/Component Suppliers

522

46

Spring 2004

Today

intel

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 Spectrum

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

Licensed
2.5 GHz
Mobile

Licensed
3.5 GHz
Fixed / Nomadic
(mobile)

License
Exempt
5.8 GHz
Fixed / Nomadic

Plans for profiles include below 1 GHz

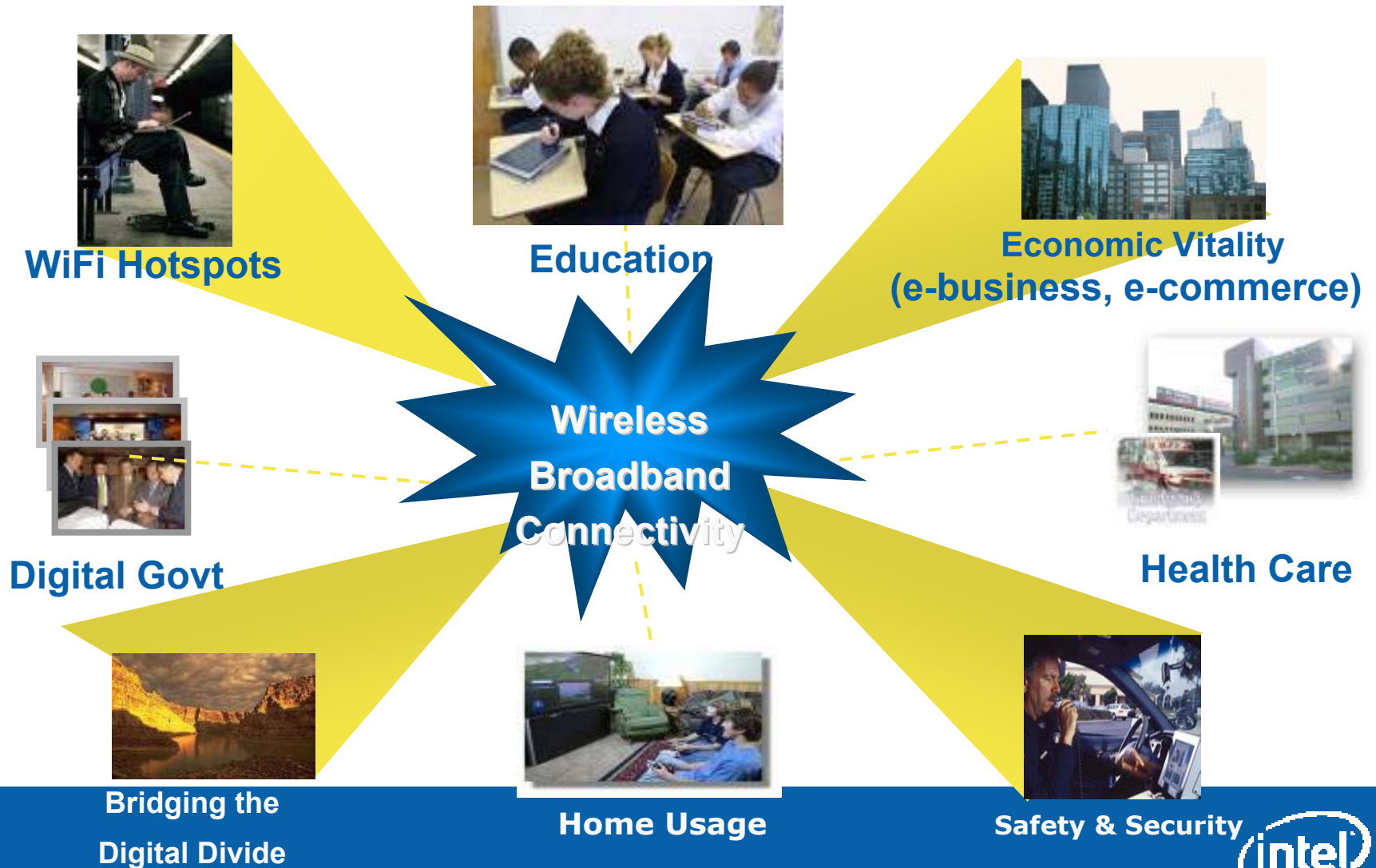**Current WiMAX Forum Profiles**

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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.

- 31 Certified products (fixed/nomadic)

- Mobile WiMAX products are ready and certification will begin in first quarter of 2008.

Certification Labs

- **AT4 Lab (Spain) – Lead Lab Opened August '05**

- **TTA(Korea) – Oct '07**

- **AT4 (US) – Oct '07**

- **CATR (China) 16d – April '07 , 16e – Nov '07/Dec'07**

- **ADT Taiwan Lab – Nov '07, 2nd Lab July '08**

- **Additional Labs in '08: India, Japan**

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WiMAX Opportunities

WiFi Hotspots

Education

Economic Vitality (e-business, e-commerce)

Wireless Broadband Connectivity

Digital Govt

Health Care

Bridging the Digital Divide

Home Usage

Safety & Security

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Mobile WiMAX Ambulance Demo (Triple Play Service)
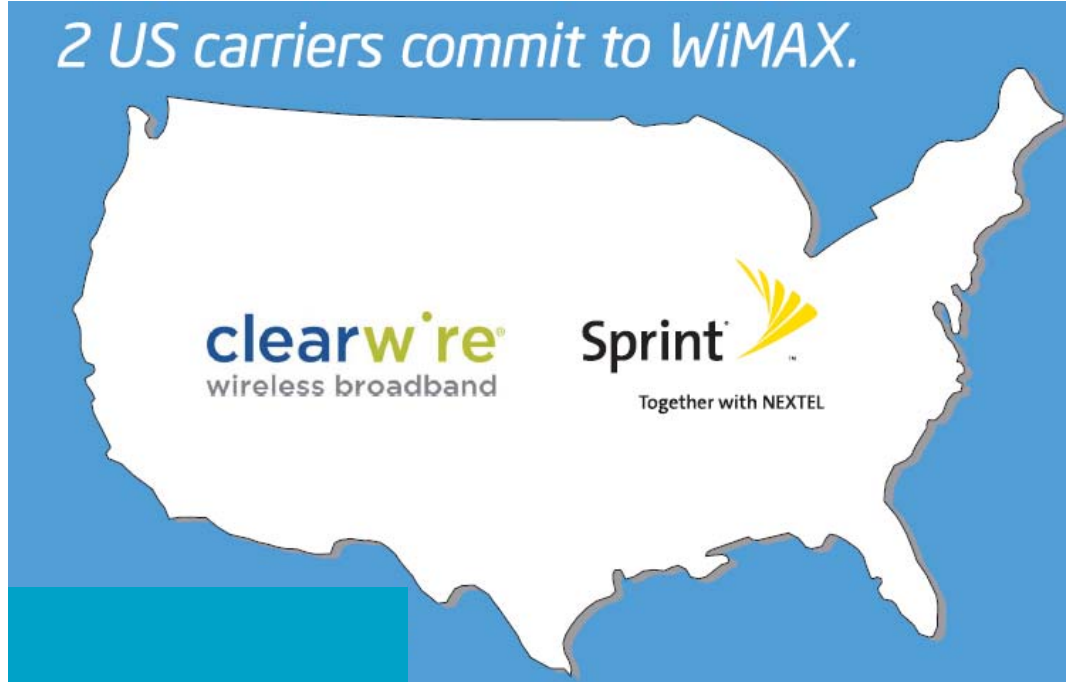
WiMAX
300+ Trials / 100+Commercial Deployments

Mobile WiMAX Status

- Commercial service in Korea

- Sprint launching early '08

- Japan licenses end of '07

- UK licences next year

- Norway licenses next year

- Sweden licences next year

- Austria Public Consultancy

- and others…

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

2 US carriers commit to WiMAX.

clearw're
wireless broadband

Sprint
Together with NEXTEL

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 mobile WiMAX deployments worldwide.

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KT (Korea Telecom) Mobile WiMAX Application

Commercial Mobile WiMAX service since June 2006

Mobile TPS (Triple Play Service)

- Communication : Fixed mobile convergence communicator
  including SMS, MMS, chatting, VoIP, video conferencing
- Data : Mobile internet access
- Media : Real-time media service (VoD, MoD),
  Personal media blog

Fixed, Nomadic and Mobile ITU-R Recommendation F.1399-1

4.1.2 Fixed Wireless Access

Wireless access application in which the location of the end-user termination and the network access point to be connected to the end-user are fixed.

4.1.3 Mobile Wireless Access

Wireless access application in which the location of the end-user termination is mobile.

4.1.4 Nomadic Wireless Access

Wireless access application in which the location of the end-user termination may be in different places but it must be stationary while in use.

Strict implementation of this definitions constrain innovations / limit convergence

Innovative and "WiMAX friendly" technology neutral framework required!

- **WiMAX needs access to licenced spectrum: 2.5 GHz (mobile WiMAX)**

- **WiMAX needs 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!!

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Conclusion

- Broadband is vital for the development.

- Economical, easy, faster high performance solution (IPR-Intellectual Property Right advantage).

- WiMAX is the solution for personal true broadband mobile service.

- WiMAX is real, not hype. Deployed and changing lives.

- Approved by ITU as IMT-2000 standard (3G).

- WiMAX can be applied simultaneously, both in developing and developed countries.

- Competition at broadband market (driving end user prices down)

To benefit, regulations and spectrums should be ready.

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