

WiMAX

(Wireless Interoperability for Microwave Access)

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What's in there?

- State of the art Wimax
- Predecessors 2G AND 3G
- 3G v/s 4G and current progress
- Microwave access
- Wimax Architecture - OFDM AND OSI
- Wimax v/s Wi-Fi
- Deployments
- Applications
- Future

State-of-The-Art WiMAX

- Wimax forum describes Wimax as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL"
- 7 trillion serving seven billion by 2017⁽¹⁾
- Wimax Forum is a industry led nonprofit forum
- 583 members from 150 nations ⁽²⁾
- Interoperable & compatible Wimax products .
- Familiarity of Wi-Fi with the mobility of cellular.
- Personal mobile broadband that moves with you
- Wireless backhaul technology for 2G, 3G and 4G networks

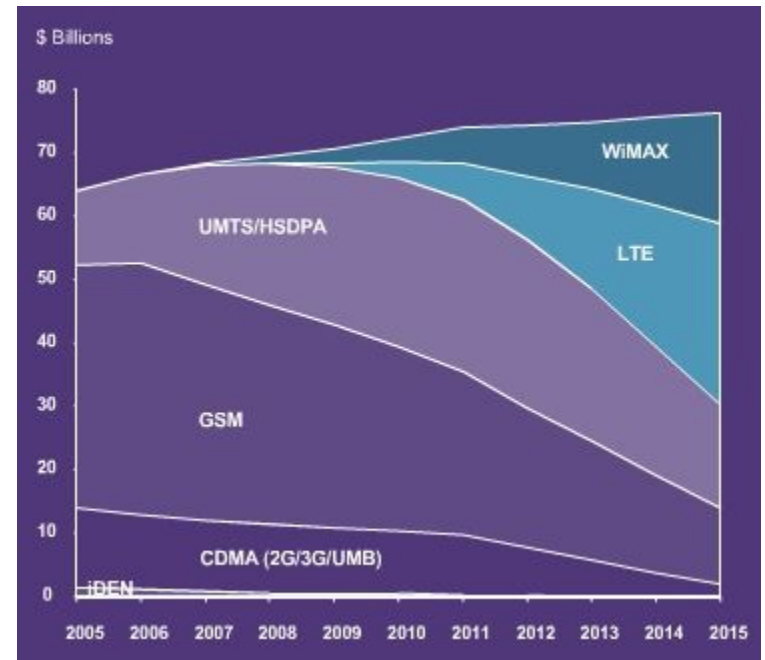
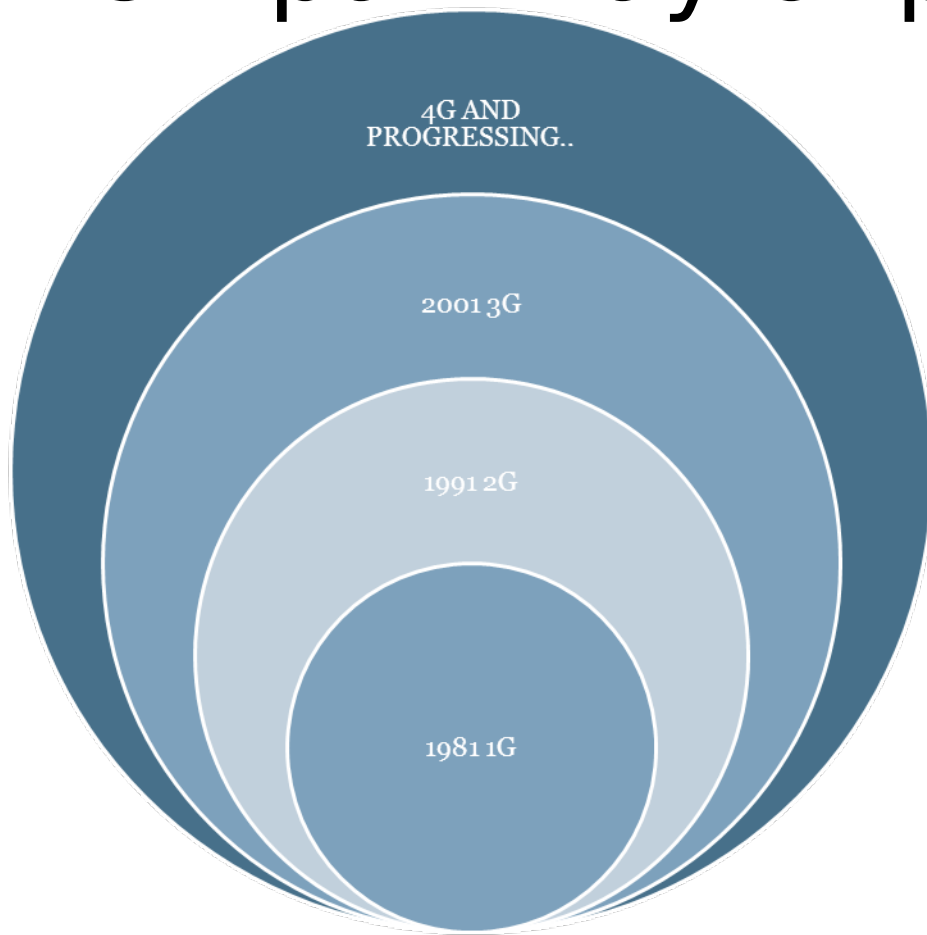
2G & 3G

- Launched on the GSM standard in Finland by Radiolinja in 1991.
- Three primary benefits of 2G networks :
 - Digital encryption
 - Far greater penetration levels. (TDMA & CDMA)
 - Data services for mobile.
- 3G launched by NTT DoCoMo in Japan in May 2001.
- Standards for mobile telecom services fulfilling the IMT-2000 specifications by the ITU
- Providing peak data rates of at least 200 Kbit/s.
- W-CDMA, HSDPA AND EDGE
- Wireless voice telephone, mobile Internet, video calls and mobile TV, all in a mobile environment.
- A new generation every tenth year since 1G systems in 1981/1982.

3G v/s 4G

	3G (Including 2.5G, Sub3G)	4G
Major requirement driving architecture	Predominantly voice driven data was always add on	Converged data and voice over IP
Network Architecture	Wide area cell-based	Hybrid: Integration of wireless LAN (WiFi) and wide area Network
Speeds	384 Kbps to 2 Mbps	20 to 100 Mbps in mobile mode
Frequency Band	Dependent on country or continent (1800-2400 MHz)	Higher frequency bands (2-8 GHz)
Bandwidth	5-20 MHz	100 MHz (or more)
Access Technologies	W-CDMA, HSDPA, EDGE	OFDM and MIMO

On pathway of progress

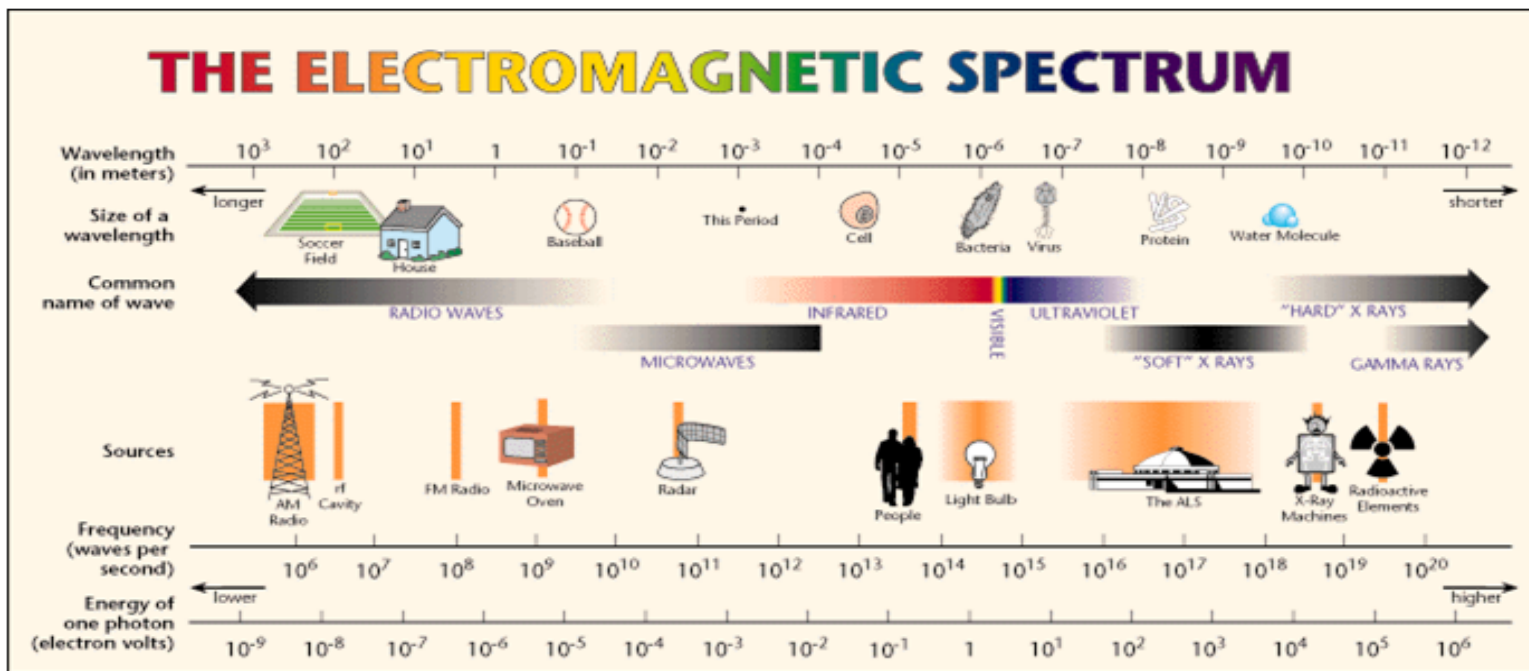


4G

- 4G data rates will be between a few Mbps and 100 Mbps
- Apart from World Wide Web, Email, etc. it will support the high QOS become on-demand infotainment services.
- Video-conferencing services will be of high quality.
- Ad-Hoc networking (dynamic formation of wireless networks between wireless devices without any central infrastructure or administration)
- It will allow in-house networks to perform various activities autonomously.



Microwave access



802.16a 2 to 11 GHz Mesh network

802.16b 5 and 6 GHz

802.16c 10 to 66GHz

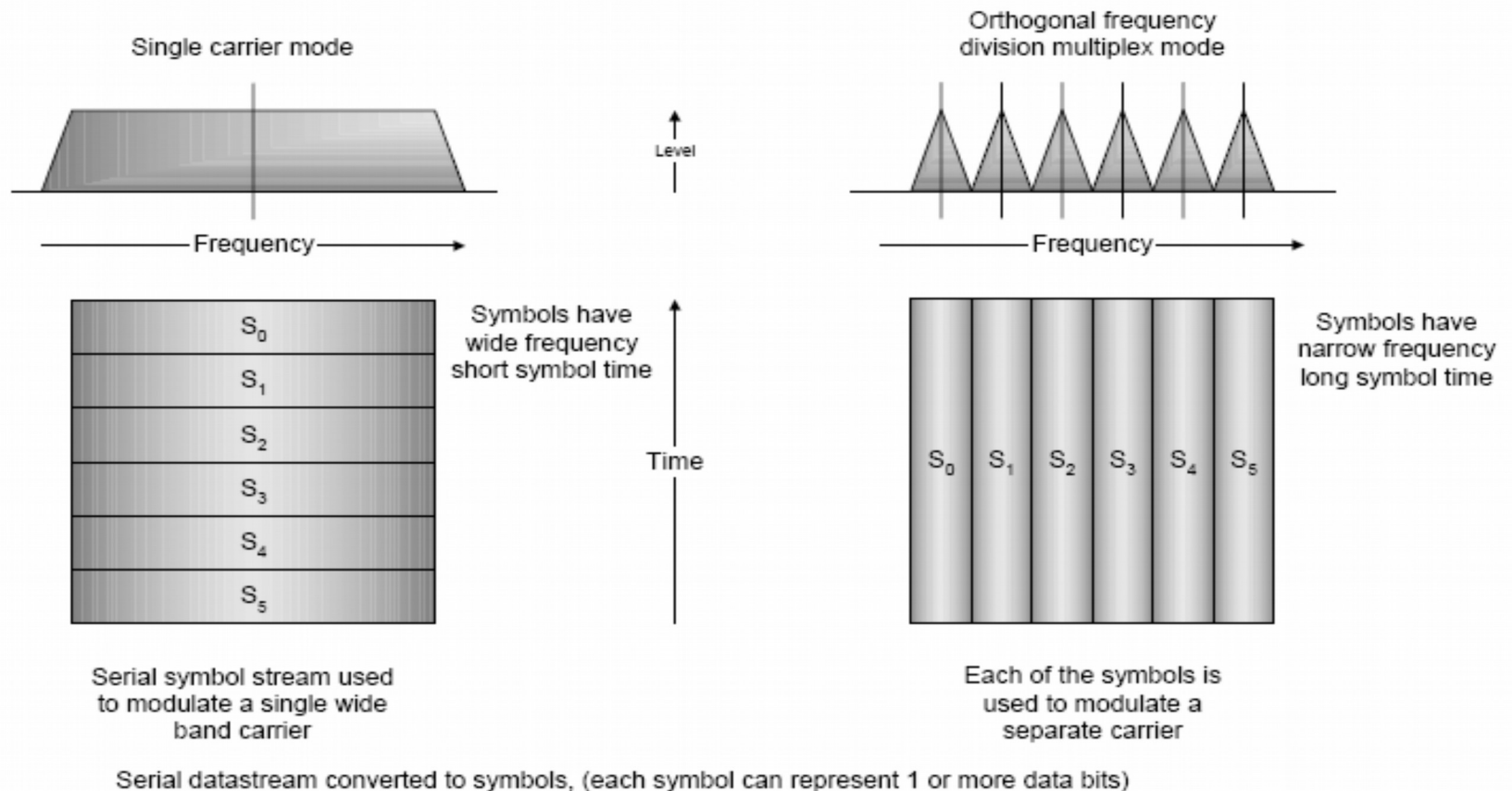
Wimax architecture & operation

- OFDMA(Orthogonal Frequency Division Multiple Access)
- MIMO
- Using a large number of parallel narrow-band subcarriers instead of a single wide-band carrier to transport information.
- Robust again narrow-band interference.
- Very easy and efficient in dealing with multi-path.
- Its ability to cope with severe channel conditions (for example attenuation of high frequencies and frequency-selective fading due to multipath) without complex equalization filters. Channel equalization is simplified

Disadvantages

- Sensitive to frequency offset and phase noise.
- Peak-to-average problem reduces the power efficiency of RF amplifier at the transmitter.

Orthogonal frequency division multiple access



OSI model

- The IEEE 802 committee designed standards for the physical layer and the Data link layer in February of 1980, and called it 802.
- The IEEE standard divides DATA LINK LAYER into two sub layers, Logical Link Control and Media Access Control.

Logical Link Control

Media Access Control

802.16 Evolution

802.16
Dec 2001

- **Original fixed wireless broadband air Interface for 10 – 66 GHz**
- **Line-of-sight only**
- **Point-to-Multi-Point applications**

802.16a
Jan 2003

- **Extension for 2-11 GHz**
- **Non-line-of-sight**
- **Point-to-Multi-Point applications**

802.16d
Oct 2004

- **Revised and replaced previous versions**
- **WiMAX System Profiles**

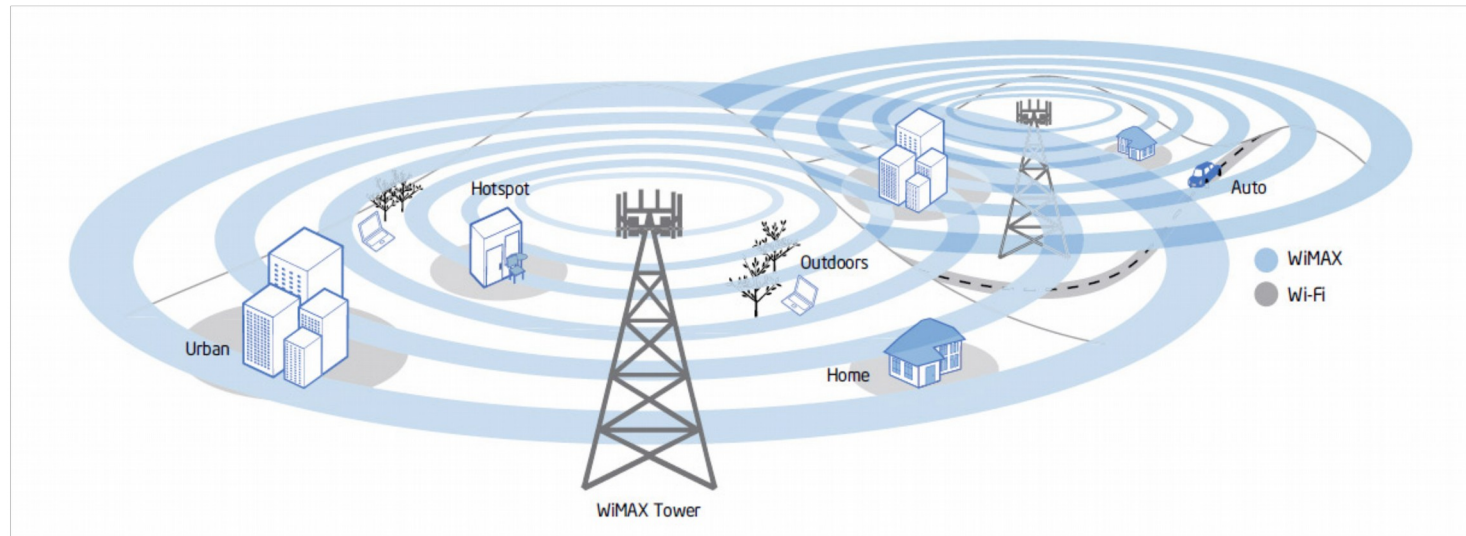
802.16e
Dec 2005

- **MAC/Physical layer enhancements to support subscribers moving at vehicular speeds**

IEEE 802.16a physical layers

- 802.16a 2 to 11 GHz frequency spectrum and NLOS.
- Range of 30 to 50 miles and data rate of 70 Mbps.
- IEEE 802.16m, standard for the next generation of Wimax may deliver speeds of more than 300Mbps
- IEEE 802.16m is also known as Wireless MAN-Advanced or WiMax-2. The new standard was more than four years in the making.

Wimax v/s Wi-Fi



- Wimax Can be called as Wi-Fi on steroids.
- Up to 30 miles for fixed stations, and 3 - 10 miles for mobile stations.
- Wi-Fi is limited in most cases to only 30 - 100m.

Deployments

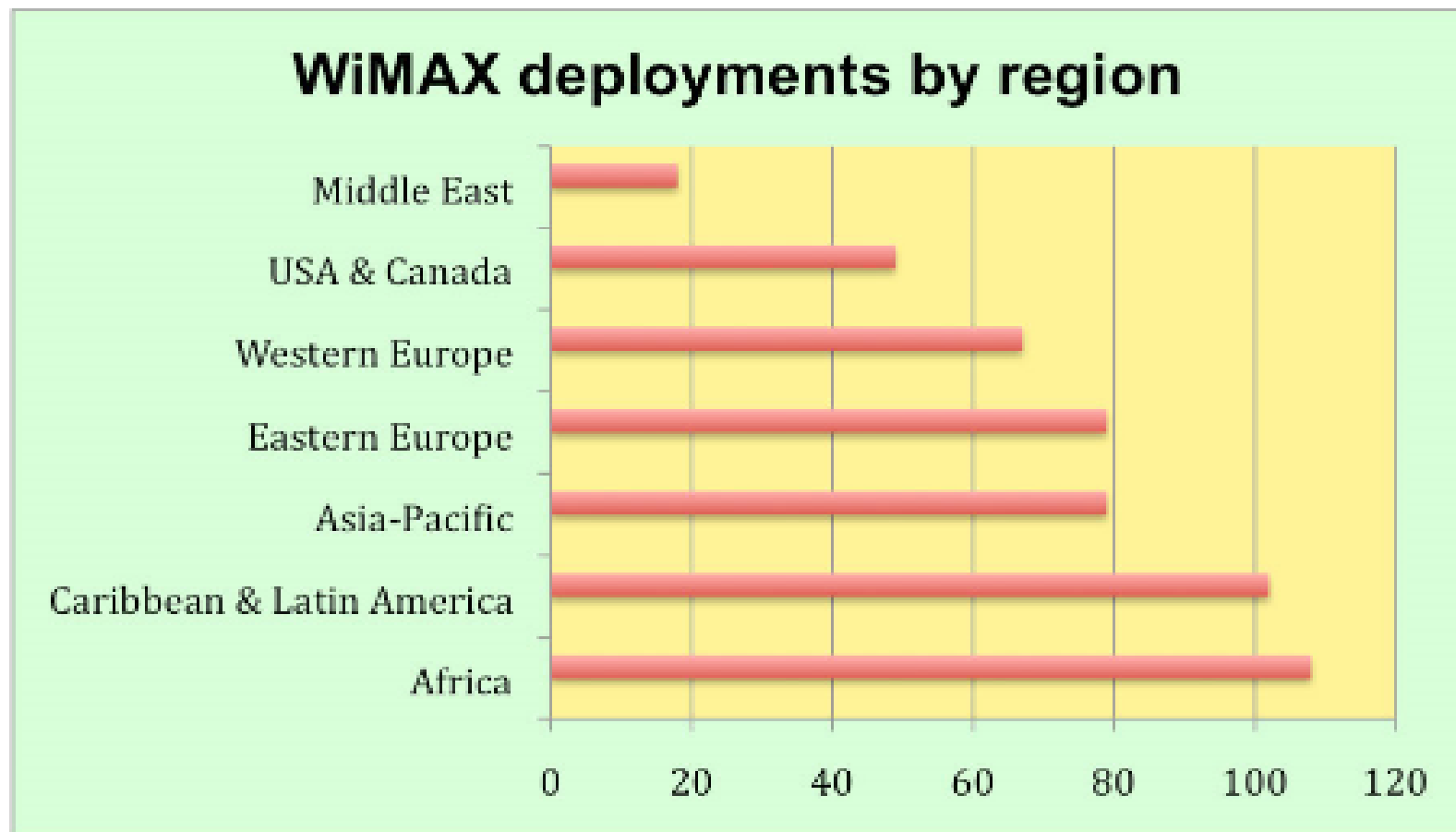
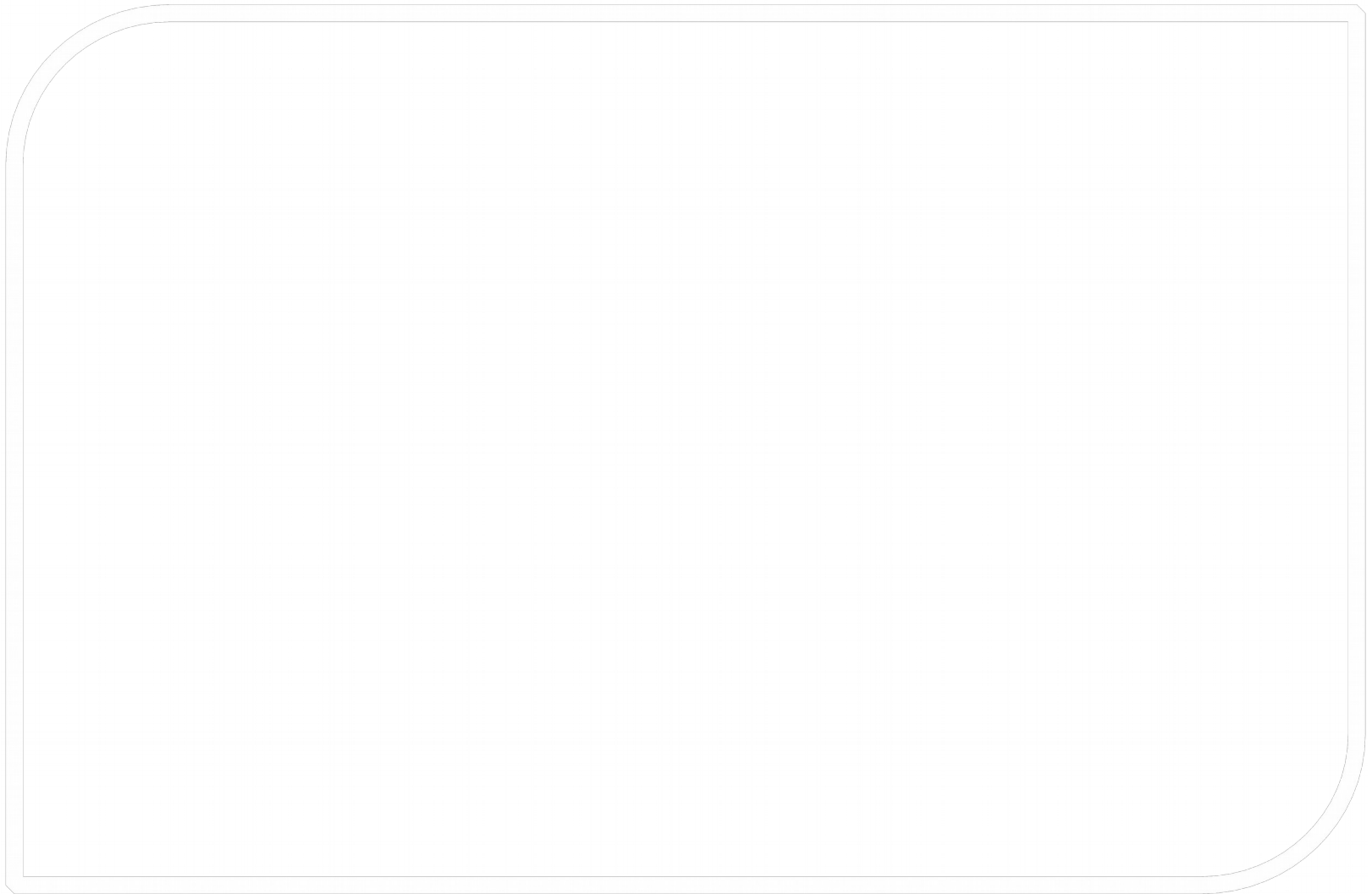


Chart 1: *WiMAX deployments by region (source: WiMAX Forum, 8/2009)*



Applications



Future

- Seamless Roaming
- Mobile Intelligent Internet
- Onwards to (Ultra) Wideband Wireless IP Networks
- IMT-2000 CDMA technologies for more efficient available frequency spectrum.

References

1. Wireless world research forum
2. www.wimaxforum.org
3. Wimax evolution by Katz and Fitzek (Wiley Publications)
4. Mobile broadcasting with Wimax by Amitabh Kumar
5. Roger Marks "IEEE 802.16 Wireless MAN Standard: Myths and Facts". Presentation at 2006 Wireless Communications Conference. Washington, DC: ieee802.org.

Thank You

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