> BUSINESS MADE SIMPLE

Next Generation Mobility: the WiMAX opportunity

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NORTEL

Wireless Industry dynamics

Voice + Broadband Migration to Wireless

Voice still king – MOU and subscriber growth, *but*

New Wireless Applications

o Broadband devices

o Mobile Video – Entertainment

1. Next Generation Mobility
   - WiMAX 802.16d here today for fixed
   - EV-DO and HSDPA fighting for market in 3G
   - WiMAX 802.16e, Rev C & LTE on horizon
2. Mobile Application Solutions - IMS
   - Voice : Dual Mode with WiFi, Single UI
   - Video : Optimized delivery

Drivers for Broadband Wireless:
Internet exploding and going mobile

o **Users**

- **Devices – not just mobile phones**
  - Embedded wireless – laptops, game devices
  - Massive memory – iPod 60GB
  - Slingbox Mobile Video Player
  - Intel WiMAX 802.16e enabled notebooks

- **Applications – Internet exploding (Video, VoIP)**
  - Interactive Multi player gaming with VoIP
  - P2P Video, Mobile Video, Bit Torrent

o **Needs**

- **Greatest bandwidth**
- **Lowest costs – devices & delivered bit**
- **Seamless mobile applications Experience**

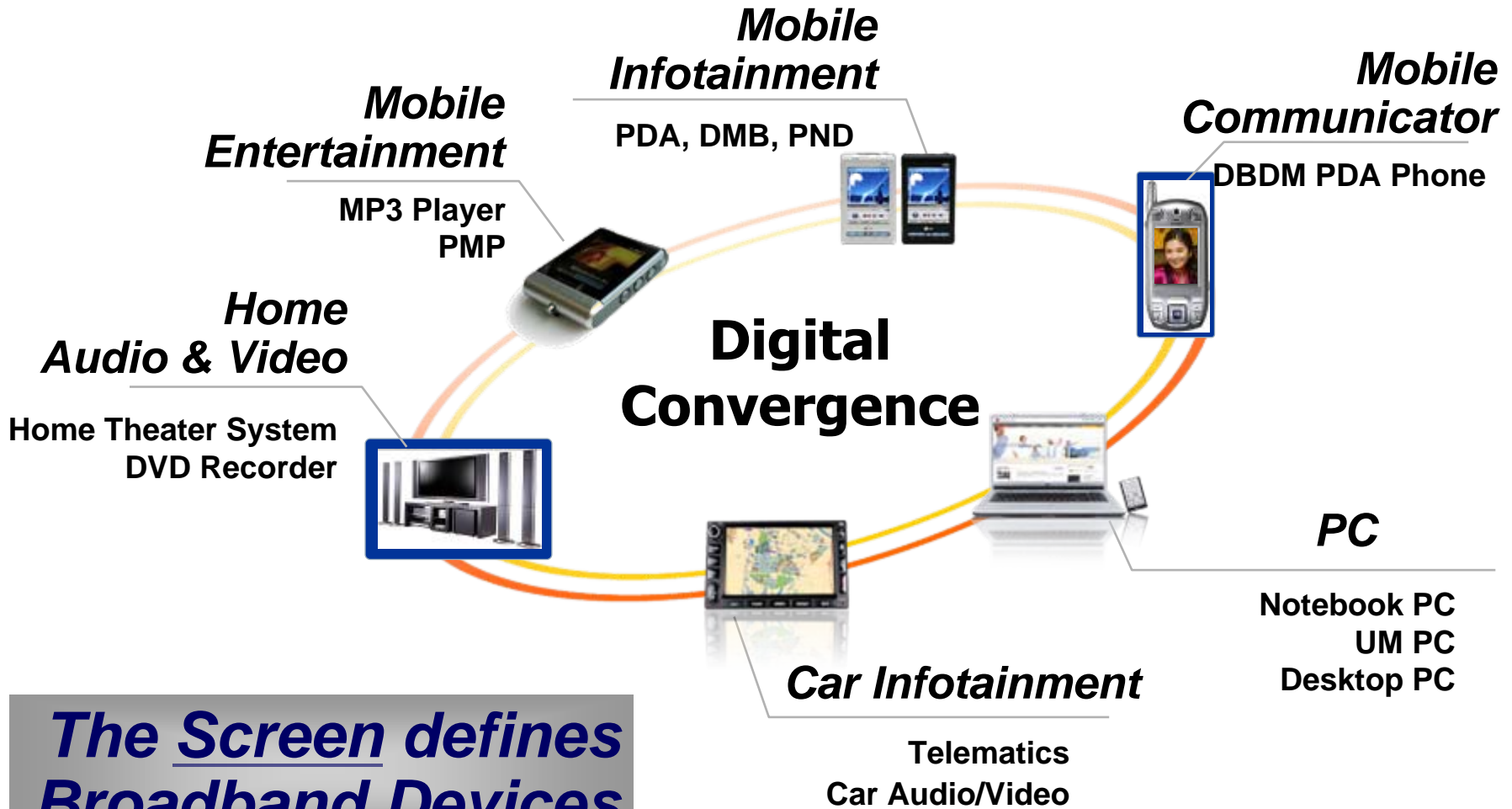## Bandwidth, Cost & Seamless Experience

From Personal Computers to Personal Broadband

	1980's PC	2000 PC	2010 PC	2020 PBs !
Memory	256KB	256MB	8GB	256GB
Disk	10M	10G	320G	10TB
Access Bandwidth	1.2 Kbps (modem)	1.2 Mbps (cable/DSL)	40Mbps	1.2Gbps

o Memory, disk and access bandwidth have all increased by 3 orders of magnitude

o By 2010 "Broadband" access will mean 40 Mbps++ and by 2020 1 Gbps

Mobile Infotainment

PDA, DMB, PND

Mobile Entertainment

MP3 Player
PMP

Mobile Communicator

DBDM PDA Phone

Home Audio & Video

Home Theater System
DVD Recorder

Digital Convergence

PC

Notebook PC
UM PC
Desktop PC

Car Infotainment

Telematics
Car Audio/Video

The Screen defines Broadband Devices

Adapted from LGE

Next Generation Mobility positioning

o Broadband Nomads: PC's & PDA's

- Ease of use & low cost acquisition
- Alternative to home BB ... with mobility

o Not Mobile Voice: that's Cellular

- real time, ubiquitous, urgency, narrowband

o Not Enterprise Mobility: that's WiFi

- bounded geography, best-effort, free (or nearly)

o Not Consumer at Home: that's WiFi too

Mobile Multi-Megabit "Internet Everywhere" without the premium price
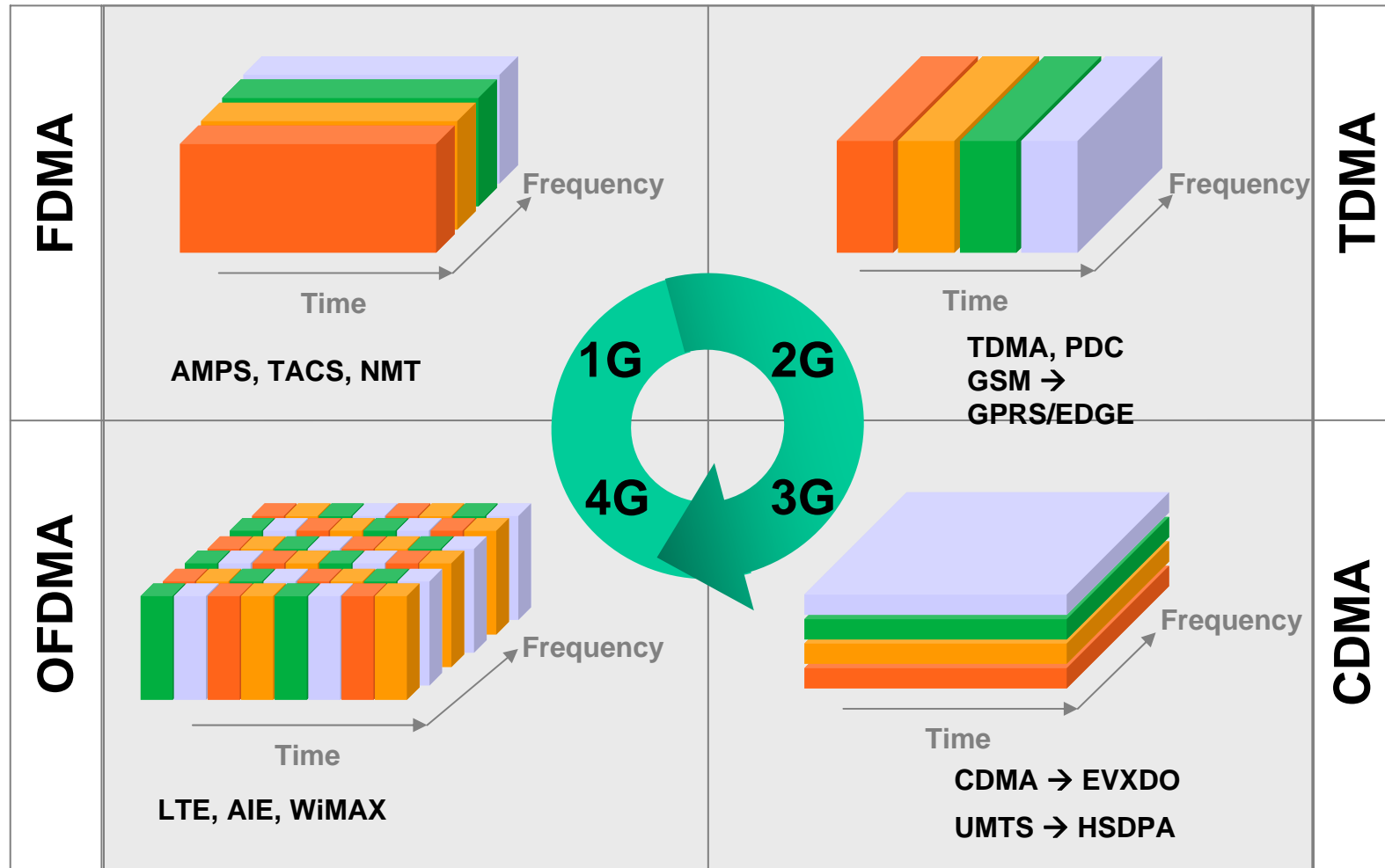
Laptops	PDAs	Gaming & Music	VoIP
Low Cost per Delivered Bit = OFDM / MIMO			
Low Cost Increment to Devices = Embedded Chipsets			

Improving Radio Access Efficiency
Rate, Range & Reliability

FDMA

Frequency

Time

AMPS, TACS, NMT

TDMA

Frequency

Time

**TDMA, PDC
GSM →
GPRS/EDGE**

1G   **2G**

4G   **3G**

OFDMA

Frequency

Time

LTE, AIE, WiMAX

CDMA

Frequency

Time

CDMA → EVXDO

UMTS → HSDPA

What the Industry is saying

"**Although competition, faster speeds, lower prices and new services will remain recurring themes in the broadband market; broadband is becoming a key element of network evolution plans for operators around this world.**"
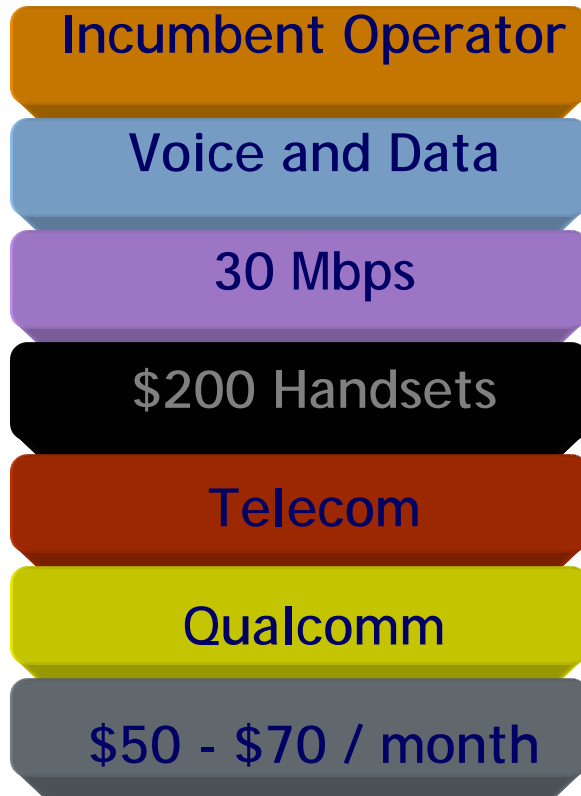
BroadbandTrends.com

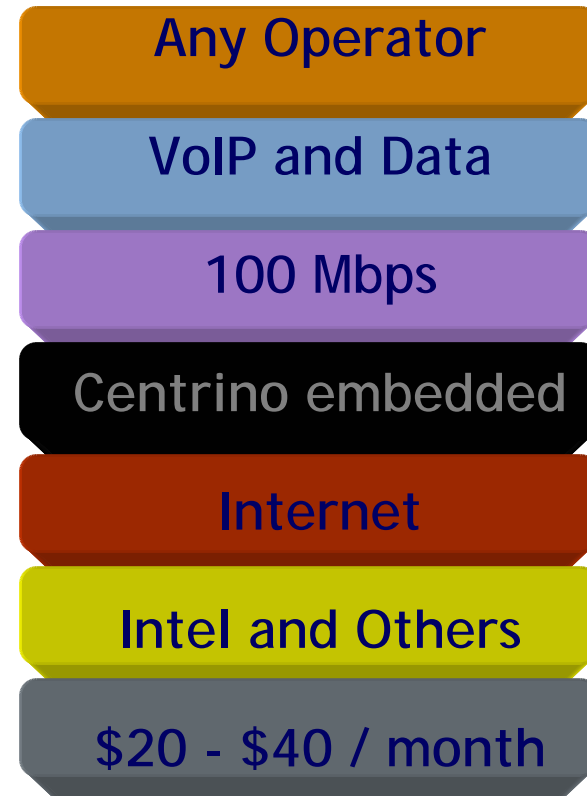"**WiMAX services revenues will reach US $16.5B by 2010.**"

SenzaFili Consulting

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WiMAX: a new Business Case

3G+	WiMAX
Incumbent Operator	Any Operator
Voice and Data	VoIP and Data
30 Mbps	100 Mbps
$200 Handsets	Centrino embedded
Telecom	Internet
Qualcomm	Intel and Others
$50 - $70 / month	$20 - $40 / month

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WiMAX Forum messages

o **WiMAX delivering on its promise**
- Certified 802.16-2004/HiperMAN products readied in Q1'2006
- Multiple 3.5GHz TDD and FDD products during '06

o **WiMAX is getting market acceptance**
- WiMAX Forum membership growth accelerating >350
- Over 175 operators trialing WiMAX: mostly fixed WiMAX (16d) today and transitioning to 16e in next few months, leading up to commercial deployments in mid 2007 in multiple countries

o **WiMAX fast forward**
- Mobile WiMAX Certification lab on track to open in Q3'2006 (TTA/Cetecom)
- Spectrum: 3.3-3.8G, 2.3-2.6G, ?5G, ?<2GHz (5/10/20MHz Channel BW)
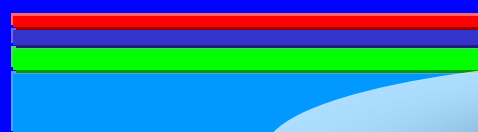- Personal mobile Internet Terminals globally '07-'08

Source: WiMAX Forum
www.wimaxforum.org

WiMAX Forum membership:
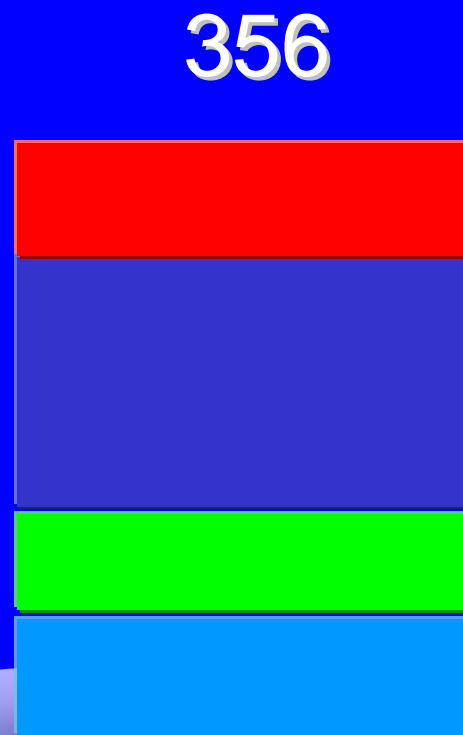## *4 years and growing*

356 WiMAX Forum Members

86 Ecosystem/Applications/Content

121 Service Providers

71 System Vendors

78 Silicon/Component Suppliers

356

46

Spring 2004

Today

Source: WiMAX Forum

WiMAX applications being explored

1. TV Broadcast
2. Homeland Security (Geospatially-Awareness)
3. Video On Demand
4. Highway Patrol
5. Vehicle Tracking
6. Triple-play (video, audio, data)
7. Sports
8. Portable Internet service
9. Mobile Broadband
10. Video Transport/Distribution
11. Video Streaming
12. Mobile (Train)
13. Mobile (Ship), Ad hoc on-demand network
14. Distant Learning
15. Mobile (Airplane)
16. Mobile (Bus)
17. Peer-to-peer video file-sharing
18. Public Safety
19. Security Surveillance
20. Truck Fleet Management
21. Wireless Meter Reading
22. Ad hoc, on-demand network
23. HD Content Delivery
24. Animal care
25. Weather Monitoring, Streaming Video
26. Advertising
27. Sports
28. Oil Rig Connectivity
29. Telematics
30. Wireless Medical PMP (Portable Media Player) Application

WiMAX for Personal Internet

WiMAX has the opportunity to become one of the main stream solutions for new converged personal Internet services

- o different frequencies ; wider channel size

WiMAX enables the new personal, true broadband, real-time applications

- o Portable DSL services
- o Complementary to fixed access at home with seamless mobility
- o Always-on best served
- o WiMAX all-IP infrastructure extending wire line broadband innovation & content
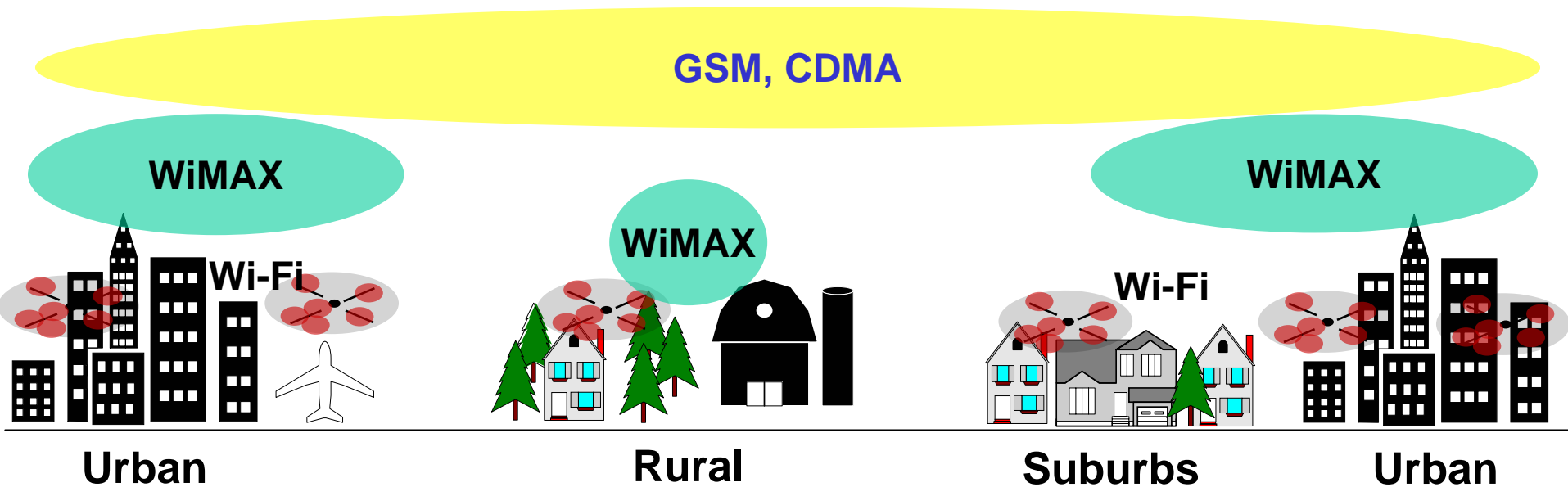
Source: WiMAX Forum

WiMAX fits for any Operator

o Mobile Operators
- Expand in areas where 3G spectrum is not available
- Reduce cost/bit/Hz over the access network
- New applications

o Fixed Network Operators
- An opportunity to offer subscribers mobile broadband services
- More economical "Hot Zone" service
- A mean for fixed mobile convergence

o Cable companies
- Wireless complementary business
- Fit their MVNO model

o Satellite
- Can use the WiMAX as a return channel problem solver
- Wireless complementary business (Hot spot / Hot zone)
- Access to broadband applications and contents

Source: WiMAX Forum

WiMAX is key to always best connected broadband model

GSM, CDMA

WiMAX

WiMAX

WiMAX

Wi-Fi

Wi-Fi

Urban

Rural

Suburbs

Urban

Affordable multi Mbps wireless Internet anywhere

WiMax CPE availability and CPE costs

$500 — Outdoor Antenna

$300 — Modem

$100 — PCMCIA Card

$50 — PDAs — Integrated in high-end mobile phones — Integrated in mainstream mobile phones

$0

2005   2006   2007   2008   2009   2010   2011   2012
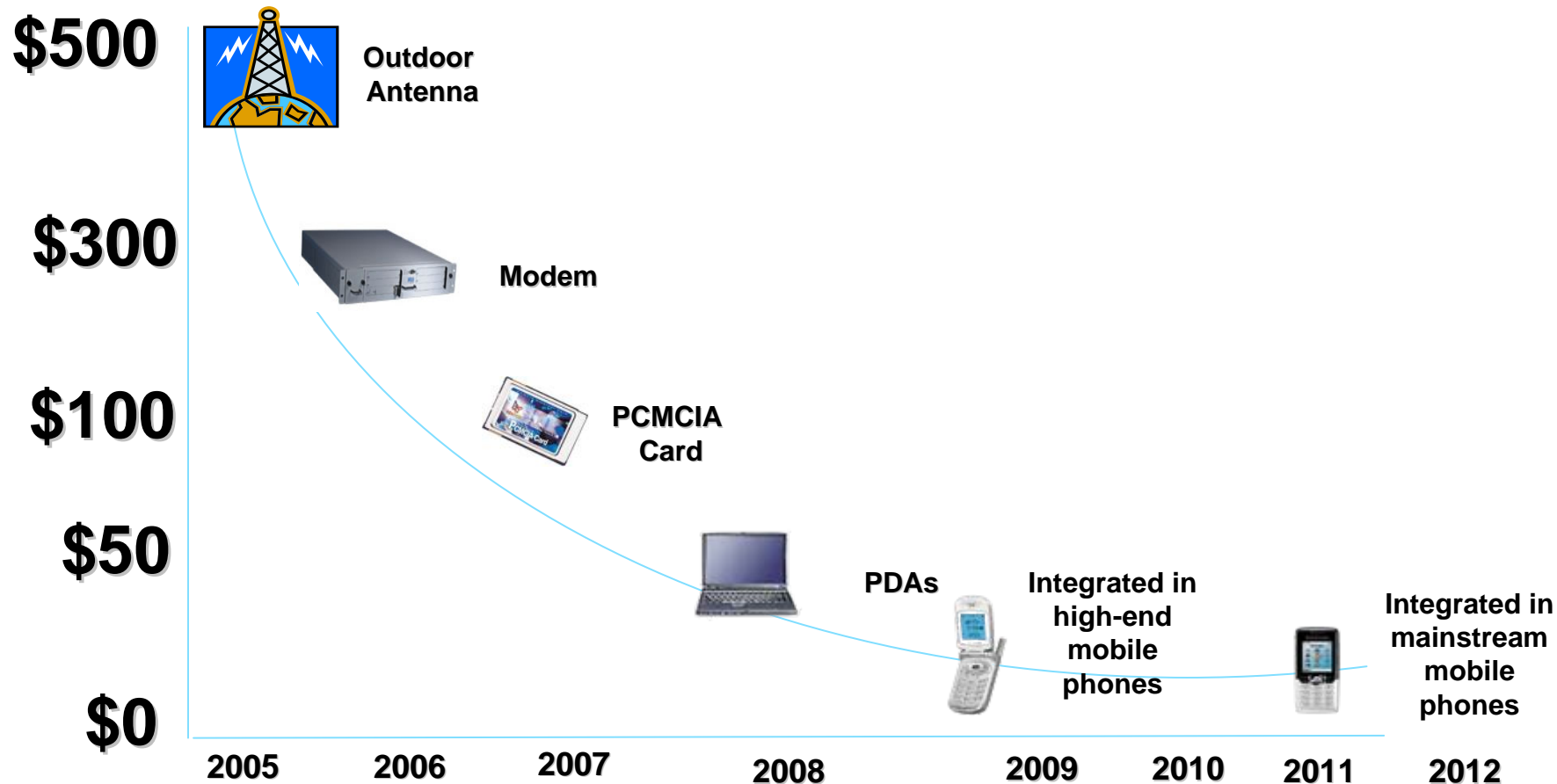
*Source for cost estimates: Alcatel, Alvarion and Intel

Source: Forrester Research Inc

Broadband Wireless Made Simple

> **Video is the 'next voice' to disrupt networks**

> **Applications increasingly drive value**

> **Connectivity for Consumer devices**

Nortel Solution: Broadband Wireless Made Simple with WiMAX, IMS & Metro Ethernet Backbone

o Deliver voice, video, and multimedia applications at broadband speeds across "always on", access-independent, cost-efficient networks

o Improve network efficiency and minimize total cost of ownership by converging networks and reducing backhaul costs

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Africa Internet usage
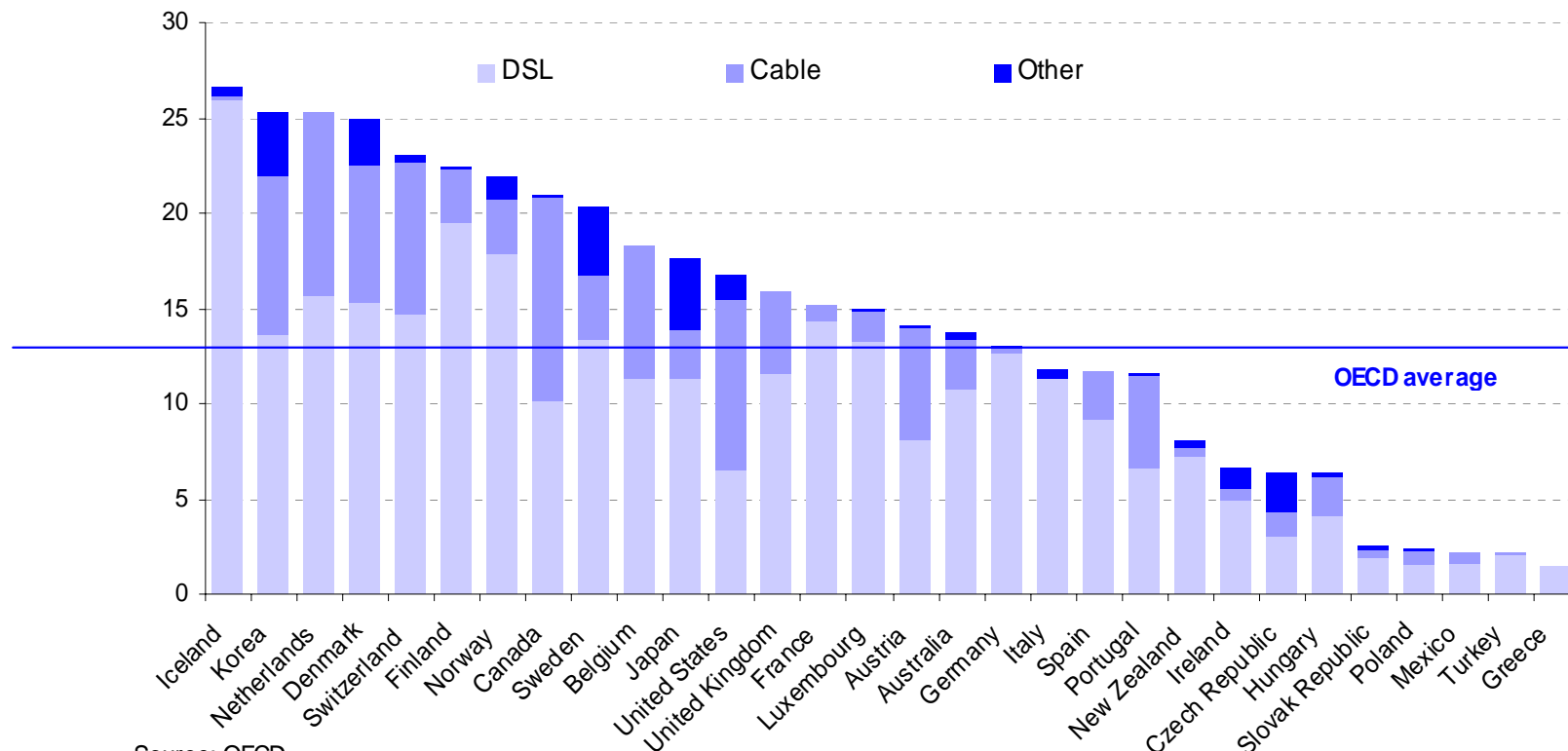## *Growing fast but penetration is low*

2006 Estim.	Population (in Billion)	Pop. %	Internet Users (Million)	Penetration (% of Population)	% Users World	Usage Growth (2000-2006)
Total for Africa	0.915	14%	32.7	4%	3%	626%
Rest of World	5.585	86%	1053.4	19%	97%	196%
WORLD TOTAL	6.5	100%	1086.1	17%	100%	201%

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Huge potential for Broadband Access market

OECD Broadband subscribers per 100 inhabitants, by technology, December 2005

■ DSL   ■ Cable   ■ Other

OECD average

Source: OECD

Countries (left to right): Iceland, Korea, Netherlands, Denmark, Switzerland, Finland, Norway, Canada, Sweden, Belgium, Japan, United States, United Kingdom, France, Luxembourg, Austria, Australia, Germany, Italy, Spain, Portugal, New Zealand, Ireland, Czech Republic, Hungary, Slovak Republic, Poland, Mexico, Turkey, Greece

Broadband Wireless most suitable for Developing Countries with poor DSL/Cable Infrastructure

Summary

1. Next Generation Mobility is upon us

2. Consumer Products are the drivers, not Telecom

3. WiMAX 802.16e first to market

4. Affordable multi Mbps wireless Internet anywhere

5. Broadband Wireless most suitable for Developing Countries with poor DSL/Cable Infrastructure

Thank you for your attention

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