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# **The Potential of WiMAX:** *Short Trip to the Wireless World*

**Jaroslav K. Ponder**

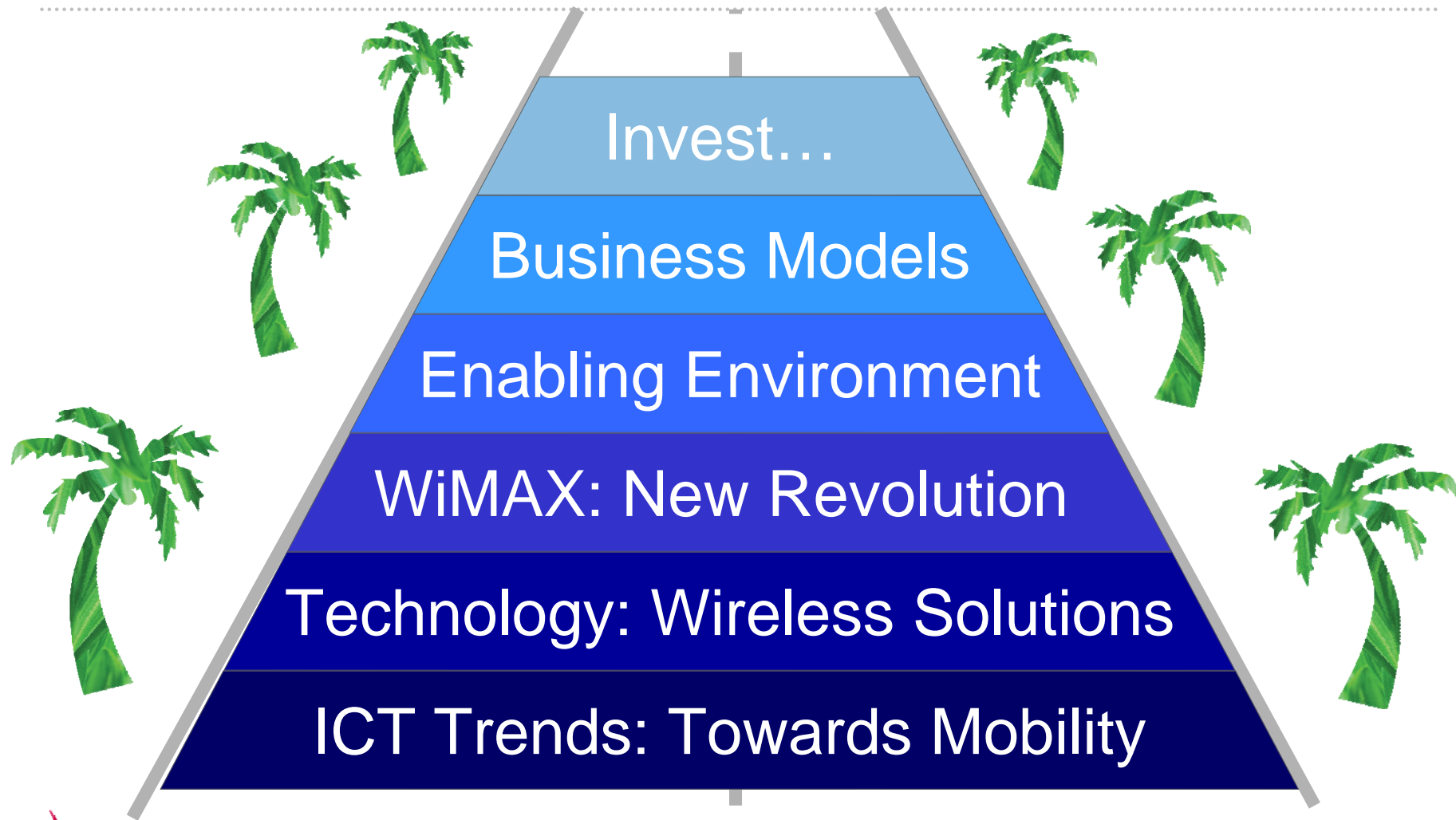
Focal Point for Europe, a.i.  
International Telecommunication Union  
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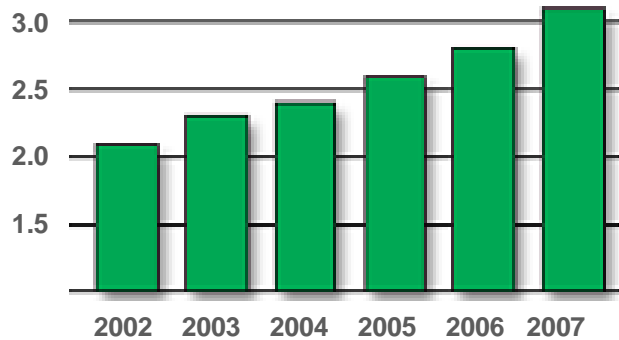
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# Short Trip to the Wireless World

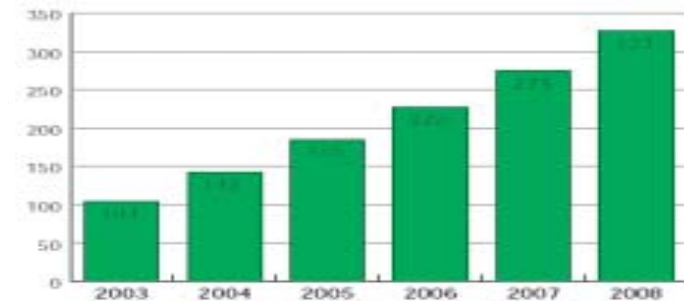


# Telecom Business drivers are: Wireless, Broadband & IP

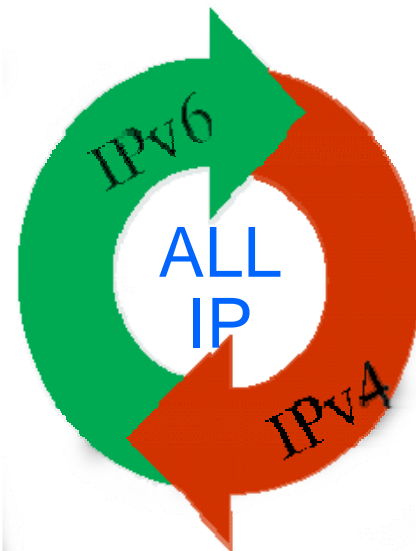
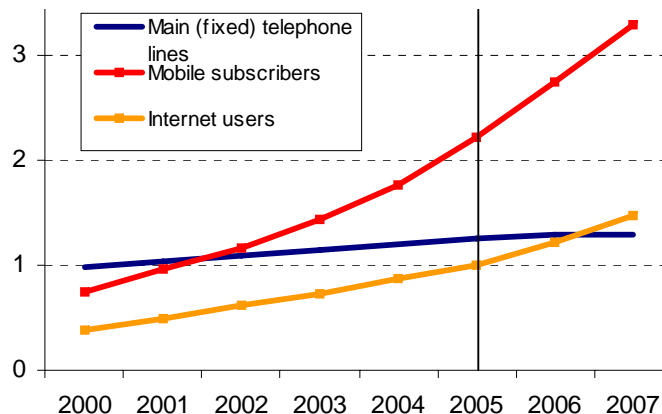
More than 3 Billion Mobile Phones in use Worldwide and growing



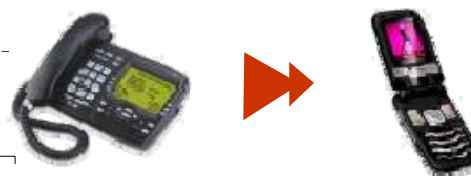
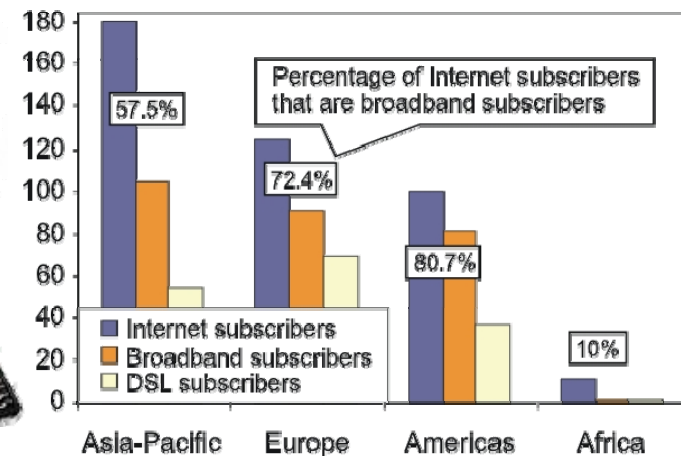
More than 350 Millions Broadband lines worldwide and growing



## Wireless



## Broadband



Subscribers switching from fixed to Mobile services.



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# Wireless Industry Dynamics

Voice Still King

*but*

New Wireless Applications

- **Broadband Devices**
- **Mobile Internet Access**
- **Mobile Video – Entertainment**



**Voice + Broadband  
Migration to Wireless**

1. Next Generation Mobility

- **WiMAX 802.16d** here today for fixed
- **EV-DO & HSDPA** “arms war” in US
- **WiMAX 802.16e, Rev C & LTE** on horizon

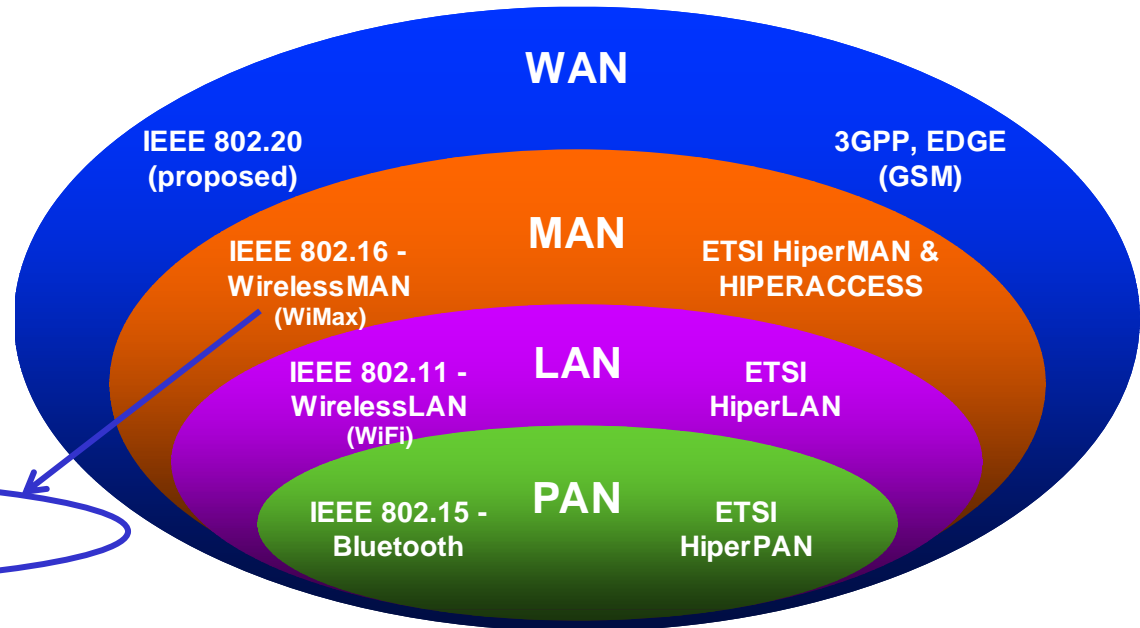
2. Mobile Application Solutions - IMS

- **Voice** : Dual Mode with WiFi, Single UI
- **Video** : Optimized delivery

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# WiMAX: New Revolution

**W**orldwide  
**i**ntegration  
**M**icrowave  
**A**ccess  
**X** technologies



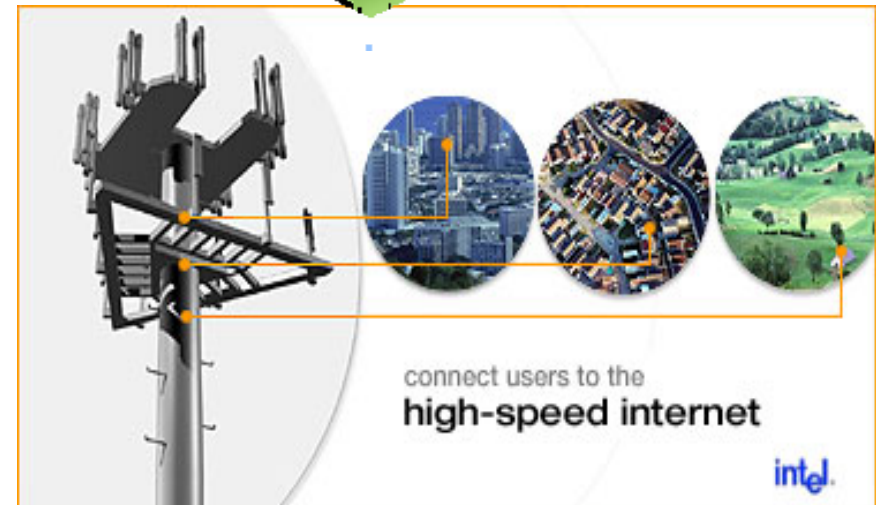
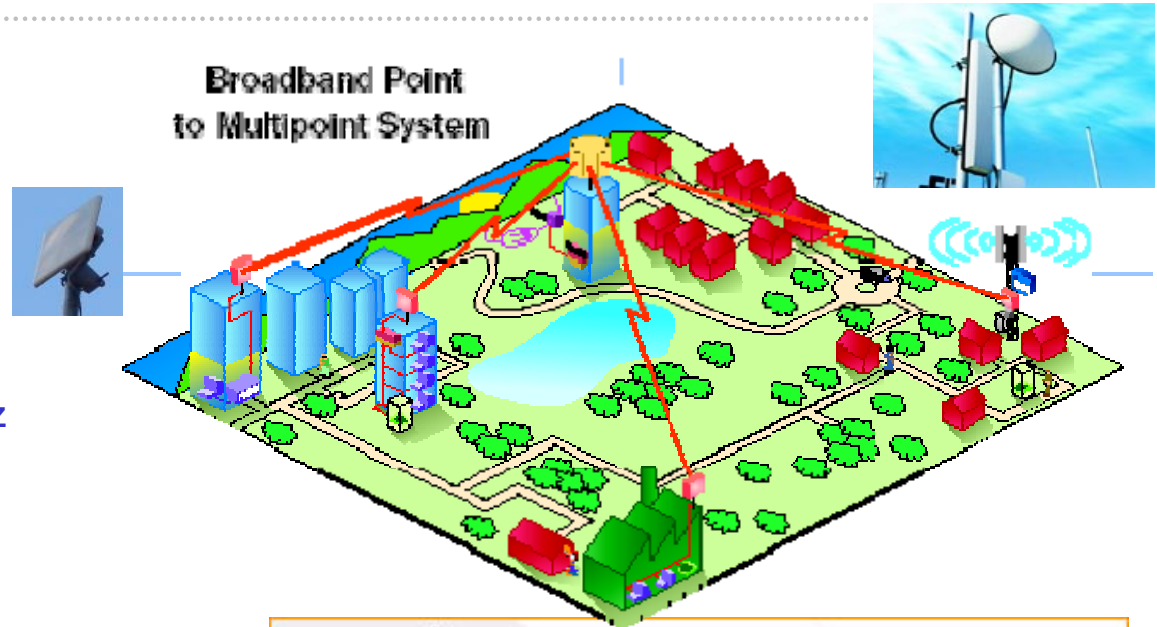
## Initiative by

- 70 member companies among which Alcatel, Airspan, Alvarion, Aperto, AT&T, BeamReach, Covad, Fujitsu, Intel, PCCW, Proxim, Redline, Siemens Mobile, SR Telecom, WiLAN, ZTE, ...

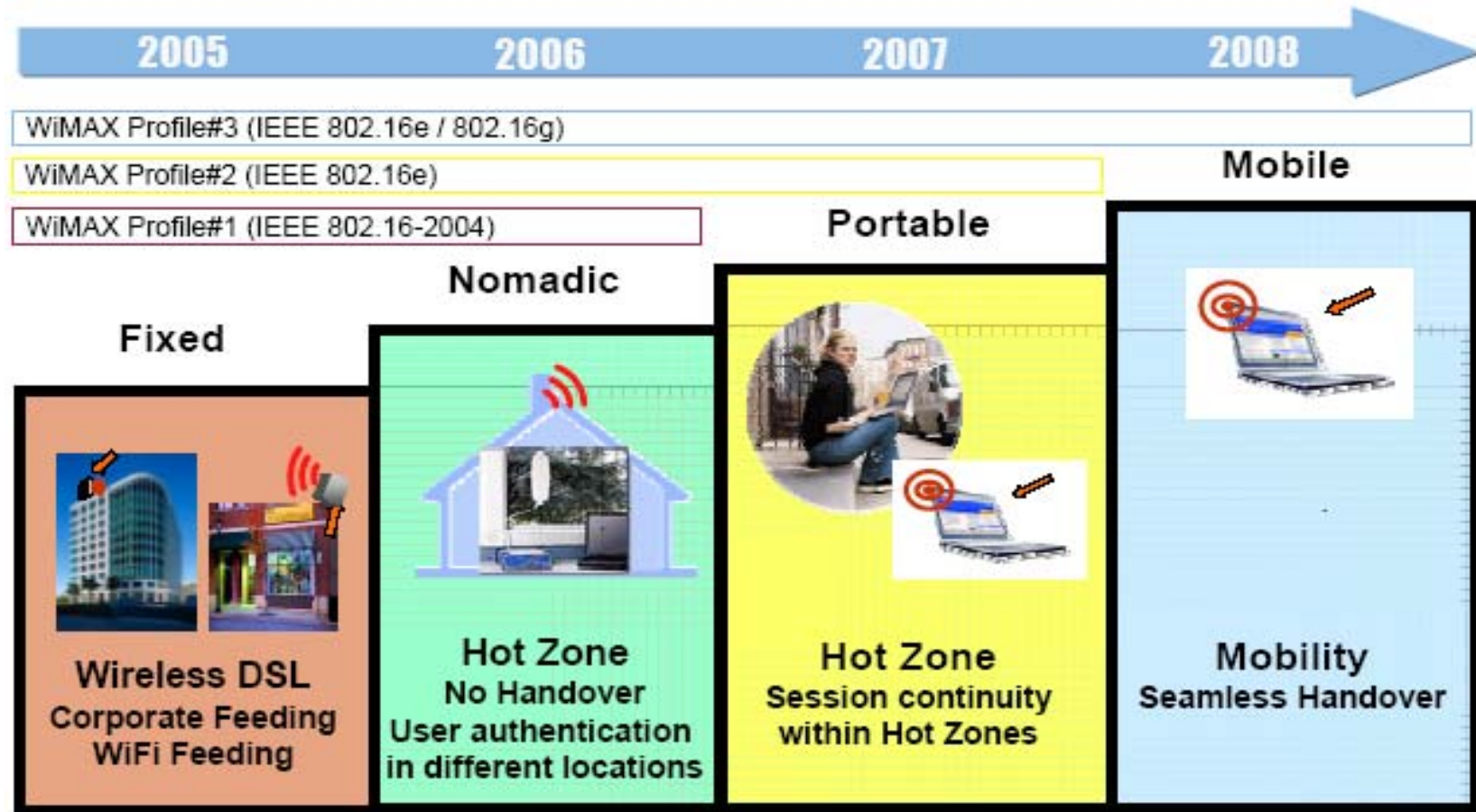


# IEEE 802.16 - WiMAX

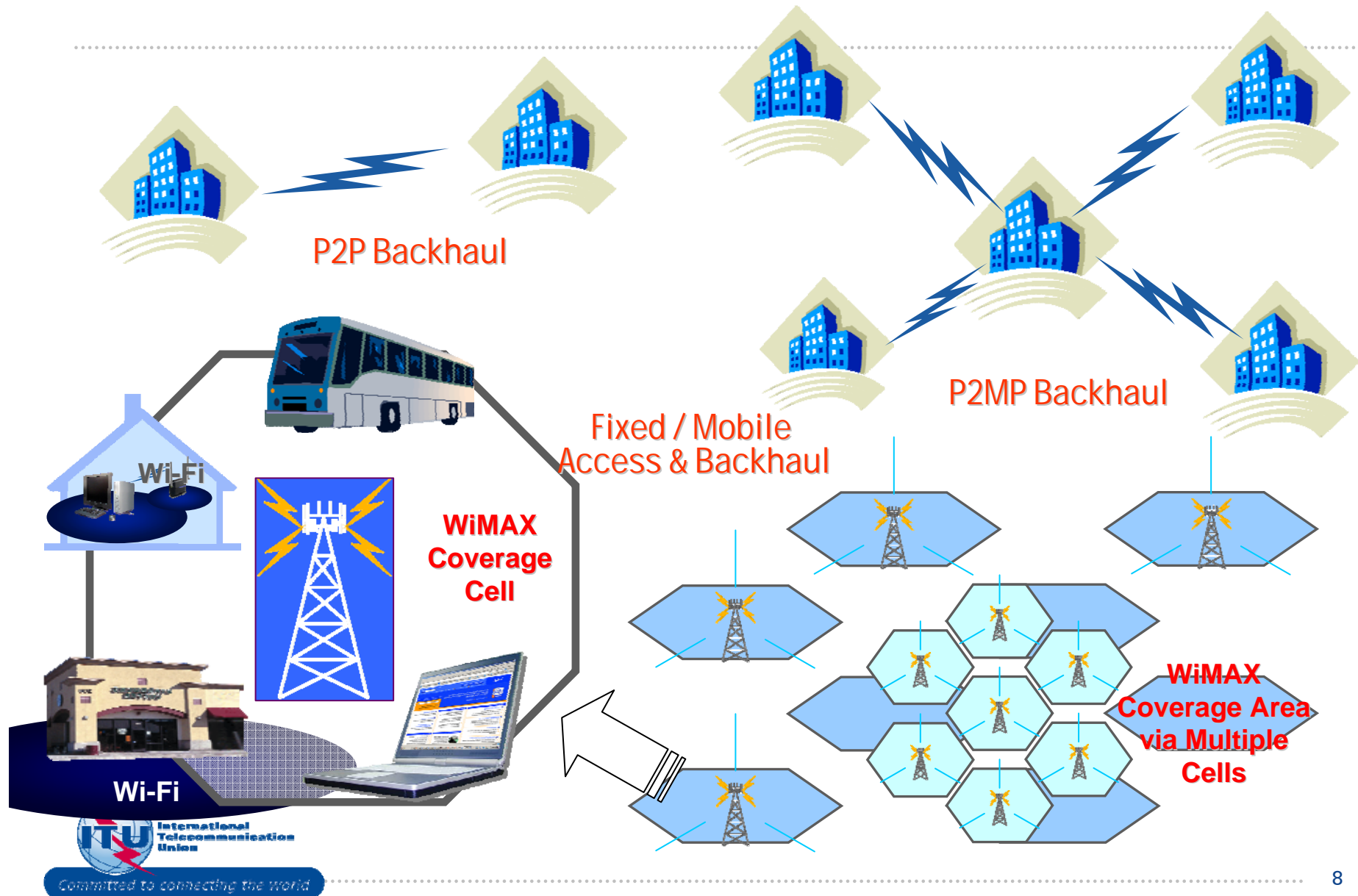
- Cable replacement (xDSL, CATV) - WDSL
- Point to Multipoint & Mesh Topologies
  - 70Mbps at 50Km (in theory)
  - 15-20Mbps at 10 Km (in practice)
- **IEEE 802.16 WMAN**
  - **WMAN, (LOS) at 10-66GHz**
  - **B(F)WA, NLOS at 2-11GHz**
  - IEEE 802.16-2004 – replaced IEEE 802.16RevD
  - IEEE 802.16e-2005 (Mobility support)
- **WiMAX Forum**: an industry-led, not-for-profit organization formed to certify and promote the compatibility and interoperability of broadband wireless products based upon the harmonized IEEE 802.16/ETSI HiperMAN standard.
  - Product Examples: Several WiMAX solutions (Chipsets, Systems, PCMCIA cards, modems, etc). Early examples: the **Rosedale** chip-set (Intel), ...



# WiMAX Evolution: Application Scenarios



# WiMAX Network Topologies





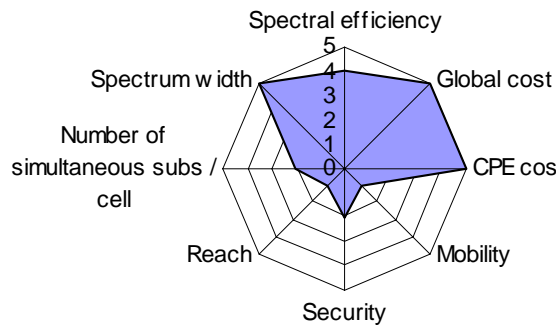
# Diverse Wireless Technologies

Standard	Family	Primary Use	Radio Tech	Downlink (Mbit/s)	Uplink (Mbit/s)	Notes
LTE	UMTS/4GSM	Mobile Internet	OFDMA/MIMO/SC-FDMA	326.4	86.4	LTE-Advanced update to offer over 1 Gbit/s speeds.
802.16e	<b>WiMAX</b>	Mobile Internet	MIMO-SOFDMA	<b>70</b>	<b>70</b>	Quoted speeds only achievable at very short ranges, more practically 10 Mbit/s at 10 km.
HIPERMAN	HIPERMAN	Mobile Internet	OFDM	56.9	56.9	
WiBro	WiBro	Mobile Internet	OFDMA	50	50	Mobile range (900 m)
iBurst	iBurst 802.20	Mobile Internet	HC-SDMA/TDD/MIMO	64	64	3–12 km
EDGE Evolution	GSM	Mobile Internet	TDMA/FDD	1.9	0.9	3GPP Release 7
UMTS W-CDMA HSDPA+HSUPA HSPA+	UMTS/3GSM	Mobile Internet	CDMA/FDD CDMA/FDD/MIMO	0.384 14.4 42	0.384 5.76 11.5	HSDPA widely deployed. Typical downlink rates today 1–2 Mbit/s, ~200 kbit/s uplink; HSPA+ downlink up to 42 Mbit/s.
UMTS-TDD	UMTS/3GSM	Mobile Internet	CDMA/TDD	16	16	Reported speeds according to IPWireless using 16QAM modulation similar to HSDPA+HSUPA
1xRTT	CDMA2000	Mobile phone	CDMA	0.144	0.144	Succeeded by EV-DO
EV-DO 1x Rev. 0 EV-DO 1x Rev.A EV-DO Rev.B	CDMA2000	Mobile Internet	CDMA/FDD	2.45 3.1 4.9xN	0.15 1.8 1.8xN	Rev B note: N is the number of 1.25 MHz chunks of spectrum used. Not yet deployed.

# WiMAX Positioning

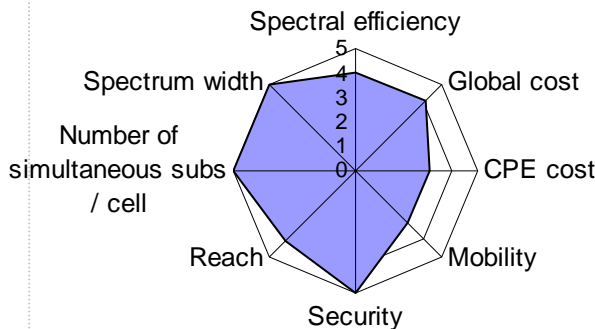
## WIFI

- Hotspot coverage “on the pause”
- Low CPE cost
- Lower security
- No guaranteed bit rate (shared pipe)



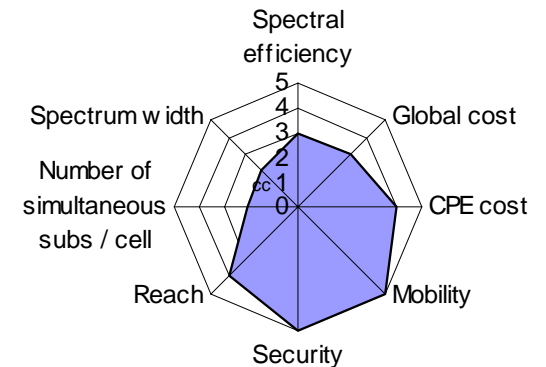
## WiMAX

- Broadband Wireless Access “on the move”
- Area coverage
- Powerful power control
- Nomadic



## UMTS & HSDPA

- Voice, data & multimedia “on the full move”
- Nationwide coverage
- Full mobility

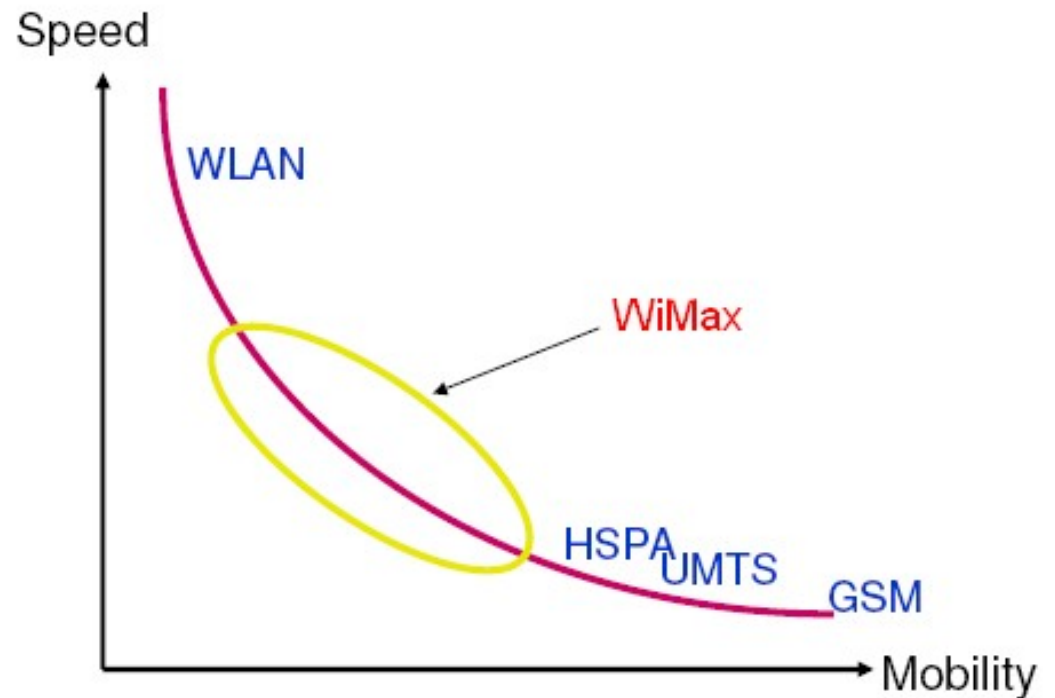


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Note: Comparative ranking with other technologies in performance per cell. Global cost per end user including spectrum fee. Source: Alcatel

# WiMAX Keyword

The keyword for WiMAX success story is **not combat** with other wired or wireless and mobile technologies, but it is **integration or internetworking** for **services provisioning over IP.**



# WiMAX cons and pros

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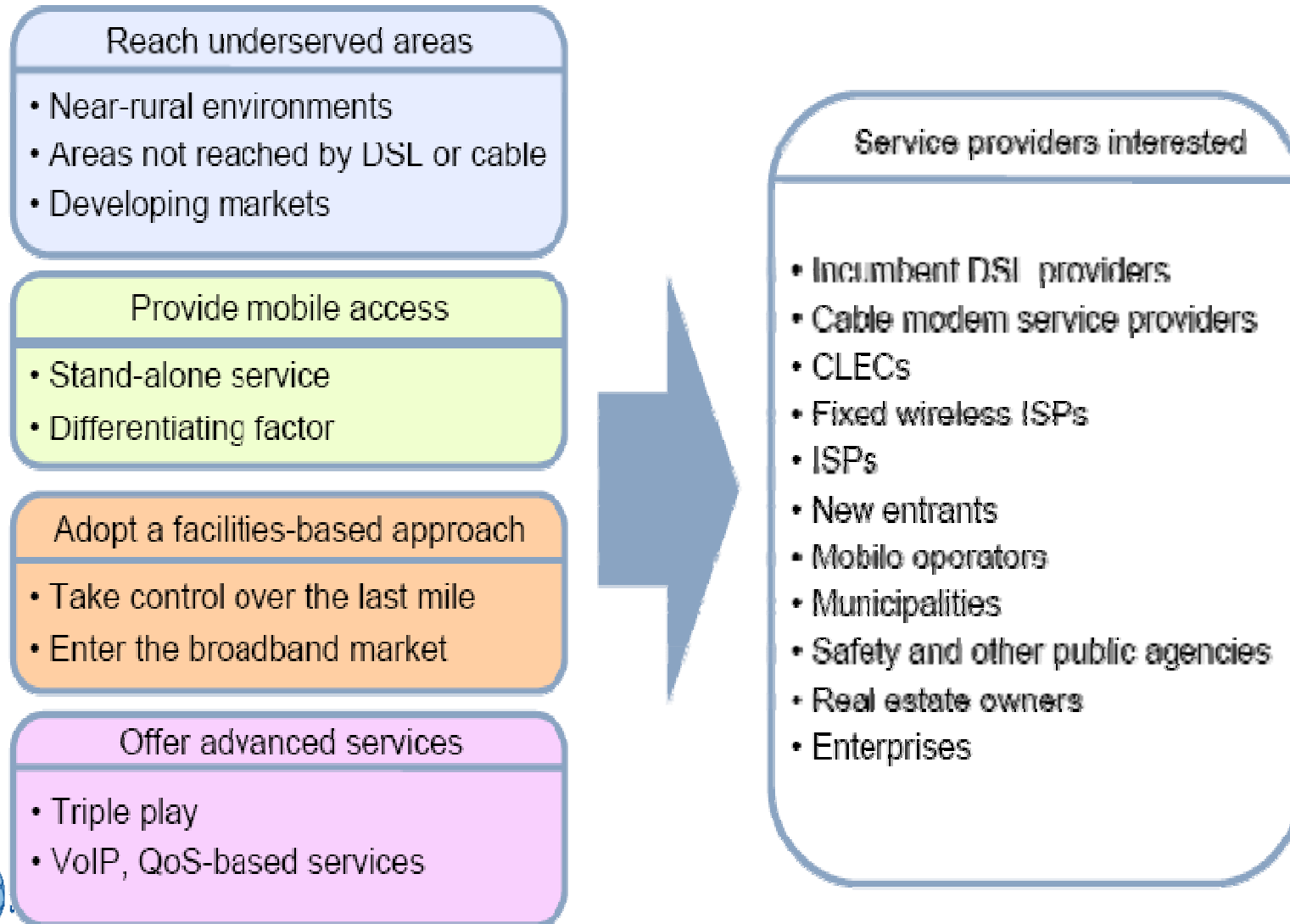
## Pros

- WiMAX has fixed version (WLL) and mobile version
- It has built-in centralized QoS support
- Offers higher bit rates than 3G mobile networks and better mobility and QoS than WLAN
- Mobile WiMAX joined ITU IMT-2000 group of 3G standards in 2007
- WiMAX is targeting attractive frequency bandwidths (e.g. 700 MHz, 2.3 GHz, 2.5 GHz)

## Cons

- Many “big” vendors from the mobile industry are not likely to go into WiMAX business near soon
- ISP market is saturated in developed countries with xDSL and cable network access to Internet (nearly 90%)
- Mobile networks are strongly going towards GSM evolution (2G, 2.5G, 3G, 3G-LTE, 4G etc.)

# What WiMAX Can Do for You?



# The Business Models

Network Model	Services	Spectrum & Standards
Metro & Government Wi-Fi Hot zones	IP Data	802.16-2004 backhaul Unlicensed 5.8
Fixed last mile only	DSL Fill-in & E1/T1 replacement: IP Data TDM Voice VoIP	802.16-2004 Licensed 2.5 & 3.5 Unlicensed 5.8
Fixed → Portable	Fixed only services + Portable IP data Portable VoIP Vertical applications	802.16e Licensed 2.5 & 3.5 802.16d backhaul
Portable & Mobile	Fixed/ Portable Services + IP Voice, data & video	802.16e Licensed 2.5 & 3.5

# Worldwide BWA/WiMAX Deployments



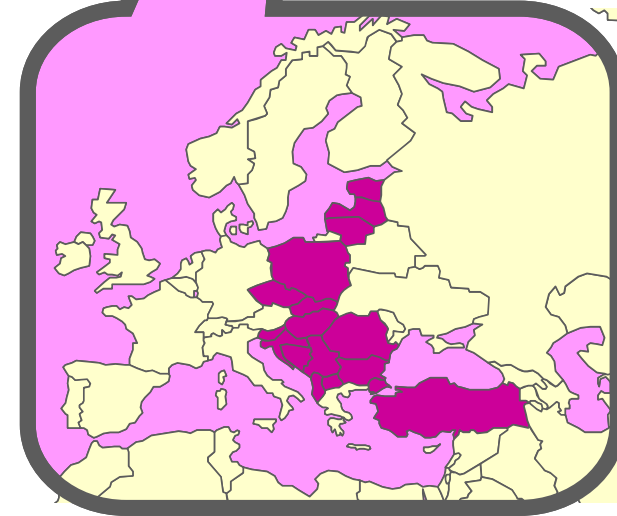
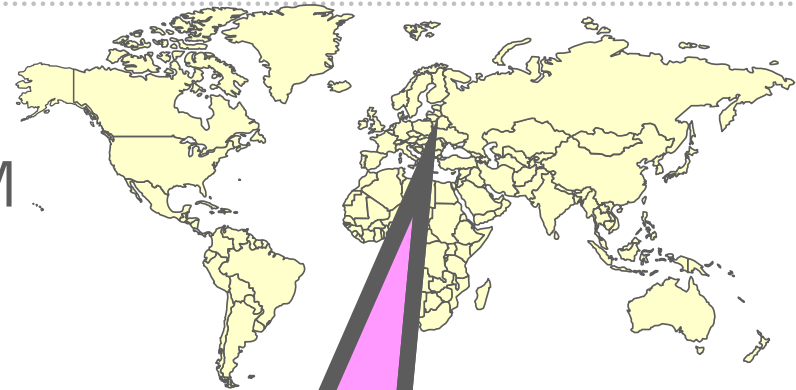
\*2.3-2.7 and 3.3-3.8GHz



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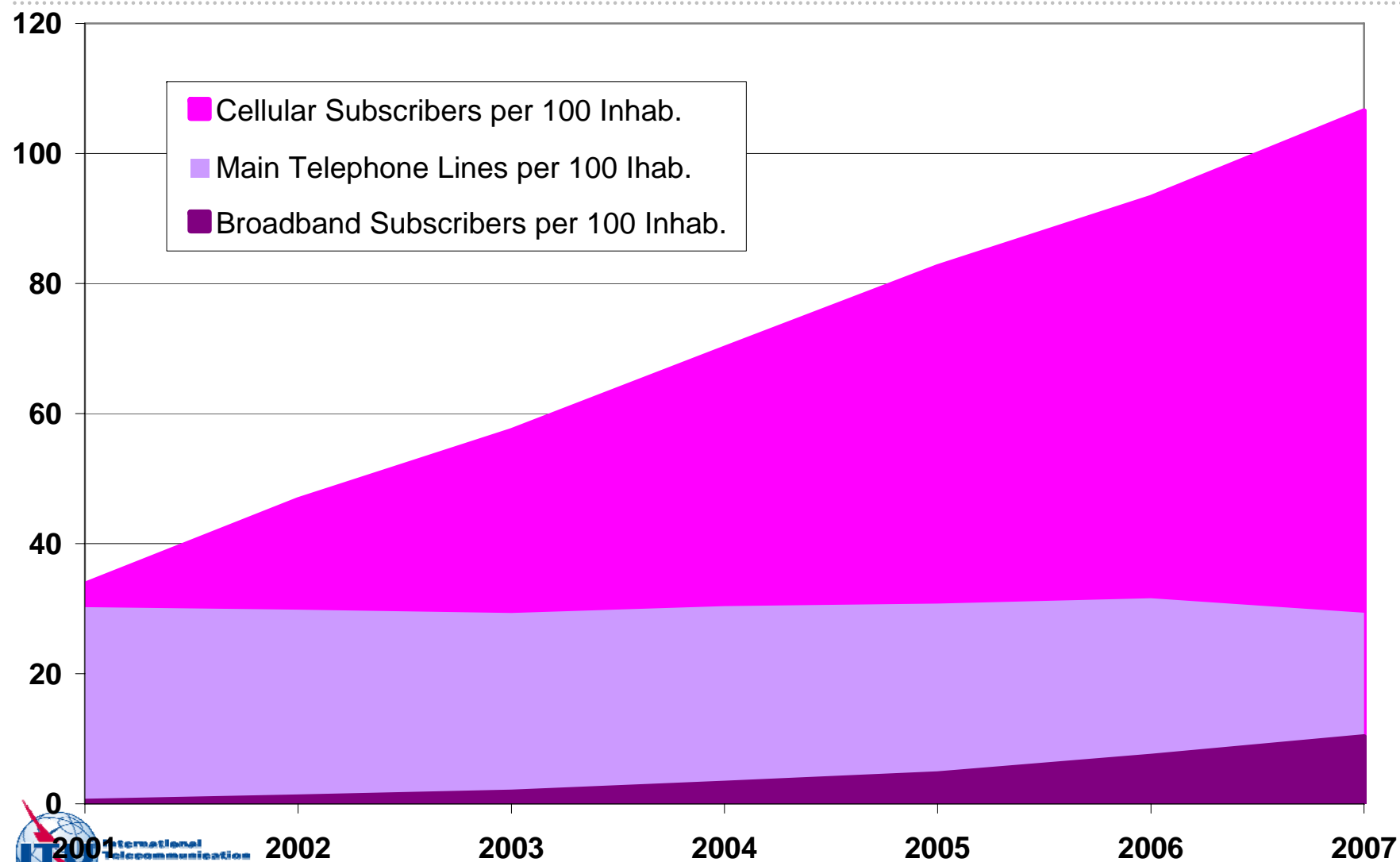
# CEE and Baltic States in Numbers 2007

- 17 countries including 10 EU members\*
- Population (total)= 125.96M
- Density= 81.68 per m<sup>2</sup>
- GDP per capita= 7578 USD
- Basic ICT Statistics
  - Total Telephone Subscr.= 155.5M
  - Fixed lines per 100= 28.7
  - Mobile per 100= 106
  - Effective teledensity= 99.41
- *Note:* Albania, Bosnia and Herzegovina, Bulgaria\*, Croatia, Czech Rep.\* , Estonia\* , Hungary\* , Latvia\* , Lithuania\* , Montenegro, Poland\* , Romania\* , Serbia, Slovak Rep.\* , Slovenia\* , TFYR Macedonia,



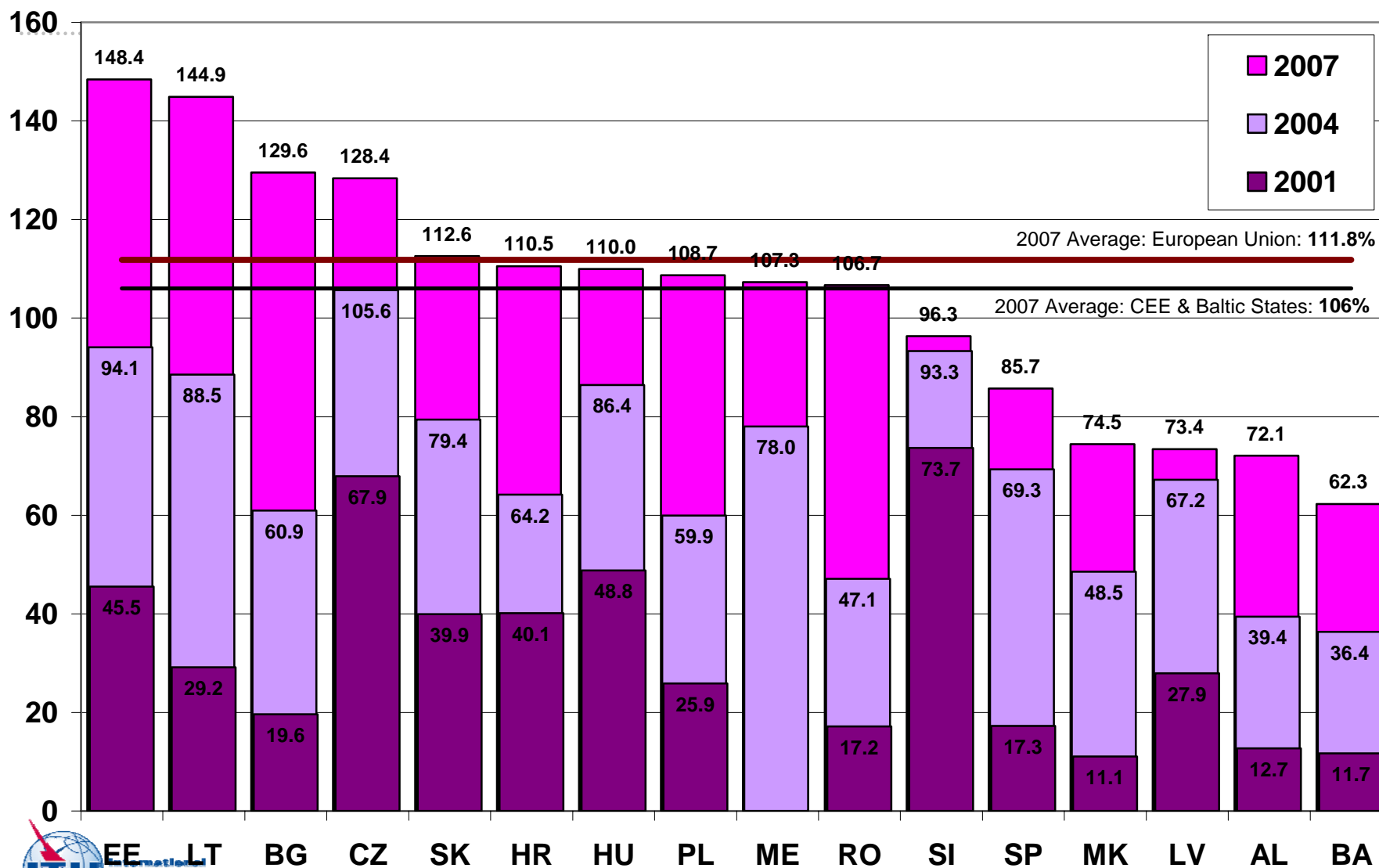


# All Communication Means per 100 Inhab. in CEE and Baltic States, 2001-2007

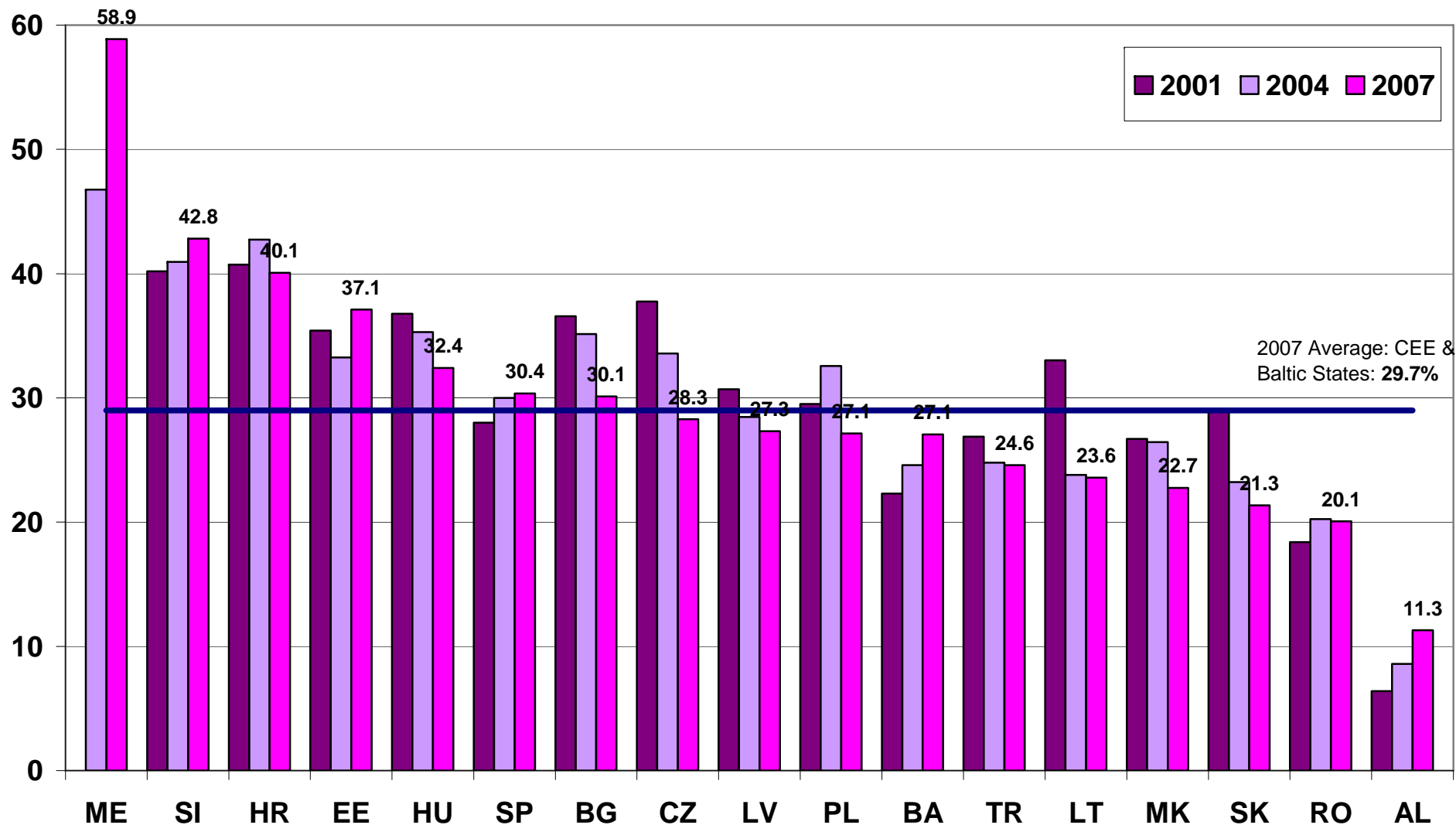


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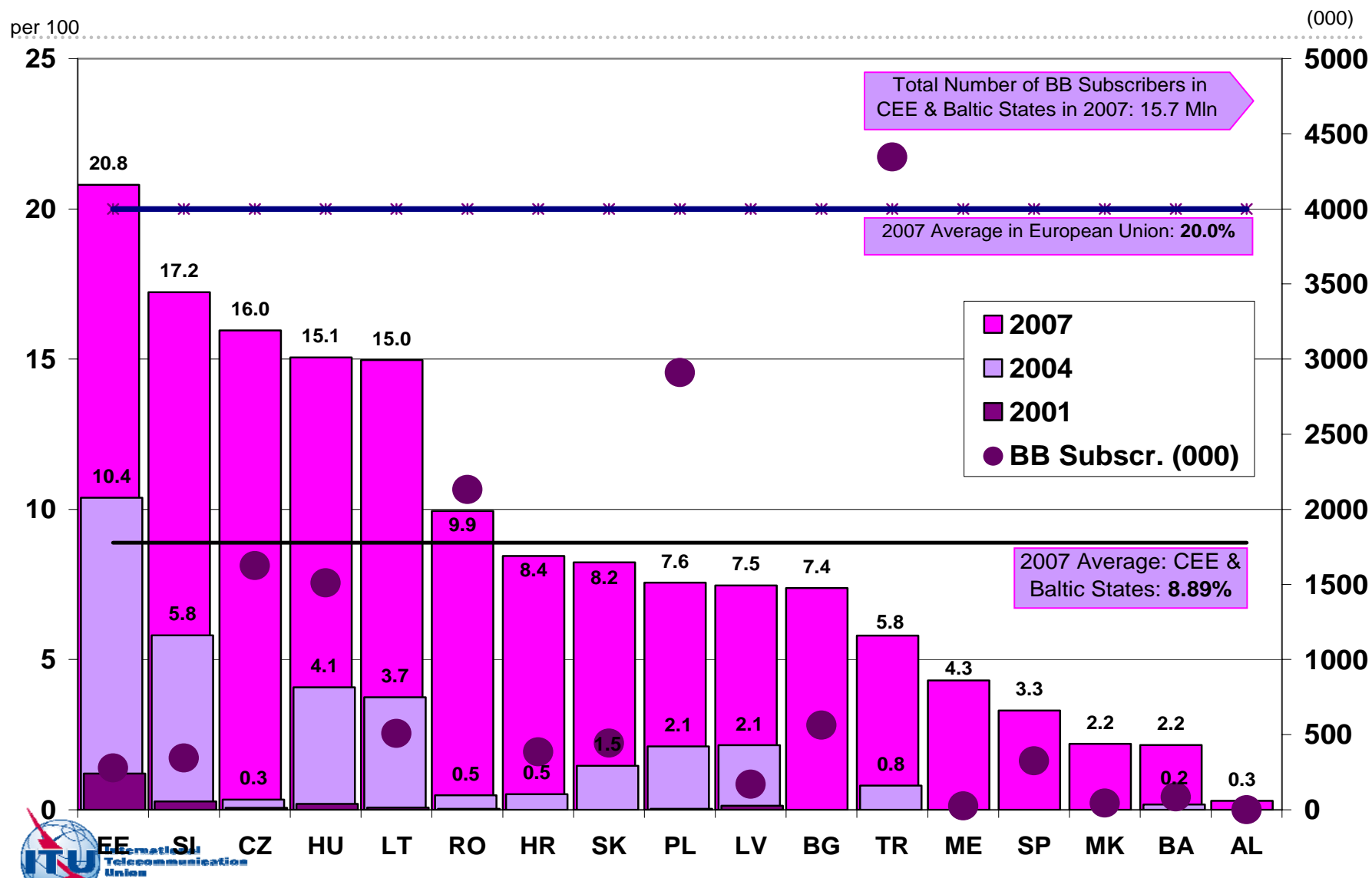
# Mobile Subscribers per 100 Inhab. in CEE and Baltic States, 2001-2007



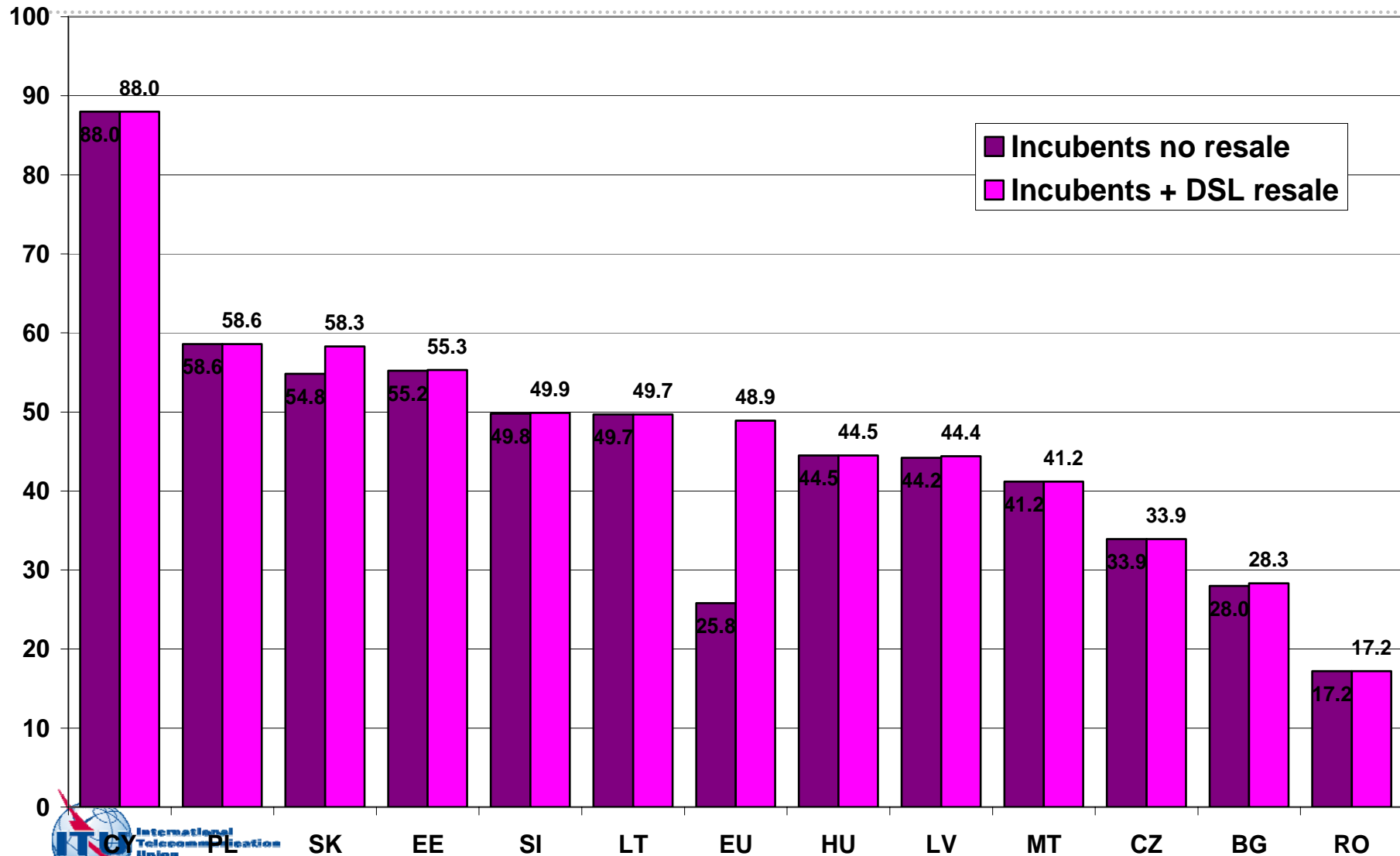
# Main Telephone Lines per 100 Inhab. in CEE and Baltic States, 2001-2004-2007



# Broadband Subscribers per 100 Inhab. & Total Subscr. in CEE and Baltic States



# Incumbent's Broadband Market Share in CEE and Baltic States, 2007



# Broadband coverage across the EU – National Coverage versus Rural Areas

	DSL rural coverage	DSL rural gap with national coverage	Cable Rural Coverage	Cable Rural Gap with National Coverage
<b>SI</b>	78.50%	9.70%	24.30%	24.80%
<b>HU</b>	77.00%	12.00%	0.00%	72.00%
<b>PL</b>	54.80%	12.30%	7.00%	11.00%
<b>LT</b>	58.00%	25.00%	2.10%	49.40%
<b>LV</b>	37.00%	35.00%	0.00%	50.00%
<b>SK</b>	29.50%	36.20%	N/A	N/A
<b>CY</b>	0.00%	69.70%	0.00%	30.00%
<b>MT</b>	0.00%	99.00%	N/R	N/R
<b>EU25</b>	71.30%	18.00%	7.40%	28.20%

# Costs Indications

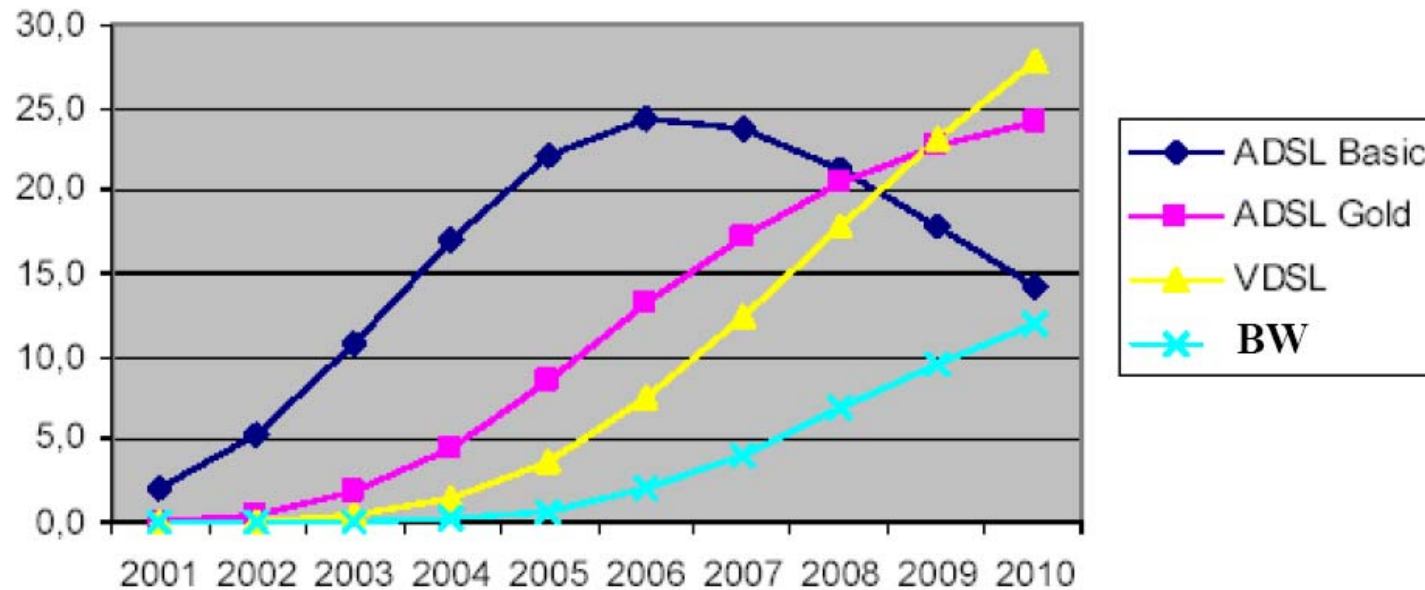
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- Base station chasis – 5 000 USD
- NPU module – 10 000 USD
- Radio module – 7 500 USD
- Power supply adaptor – 1 000 USD
- Power module – 1 000 USD
  
- Outdoor radio module (placed on roof, chimney etc.) – 3 000 USD
- Antenna (the higher placed the better it is) – 700 USD
  
- Software – 6 000 USD
- Device drivers – 2 000 USD
- Makro base station license – 2 000 USD
- CPE (receiver) licenses – 3 500 USD

➤ **Total – 41 700 USD**

# Tentative Forecasts for Broadband Access Technologies

**Broadband access penetration forecasts.  
No cable operator competition.**



*Broadband Wireless*  
This general term could refer to any of the high-speed wireless technologies currently available, such as 802.11a, 802.11b, or 802.11g for WLANs (WiFi), or the emerging 802.16 standards for WMANs (WiMAX) (source CNET)

Broadband technologies share	DSL	Cable	Fibre	WLL	Satellite	Leased lines	PLC	Other
2008 January	79.9%	15.3%	1.3%	1.1%	0.1%	0.1%	0.0%	2.2%
2007 January	80.8%	15.5%	1.1%	0.8%	0.2%	0.2%	0.0%	1.3%





# Case Studies: Poland/Netia

- Netia
  - WIMAX network coverage: 30 percent and 40 per cent of the population
  - 78 base stations
  - 12,000 WiMAX subscribers
    - Revenues
      - WiMAX ARPU: Euro 40 per month
      - ADSL (offering both voice and broadband): Euro 30 per month.
  - Total broadband subscribers: 217,000
- Change of the strategy
  - Reasons
    - Introduction of bit-stream access and local loop unbundling
    - End of 2007, Netia had nearly 100,000 broadband subscribers via TPSA's bitsteam service (the Polish altnet started to offer commercial LLU products during Q1 2008); own fixed-line network, there were 111,000 broadband subscribers by the end of 2007.
  - New focus:
    - poor service by TPSA or "insufficient coverage"
    - little scope to offer bitstream or LLU
    - Municipalities
      - It is not commercially attractive for telcos to enter cities with less than 15,000 inhabitants
      - Poland: 650 cities with less than 20,000 people each (comprising a total of around 5 million people)
      - The investment required may be subsidised by the EU by up to 80 percent
      - Additional frequencies available in the 3.5GHz, 3.6GHz and 3.8GHz frequency bands for local municipalities

# Summary

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- WiMAX is a disruptive technology
  - Full IP standard radio access system
  - High broadband rates and low latency
  - Integrated in fixed/portable terminals, or smart mobile devices
- WiMAX offers new applications critical to achieving mass market penetration rates
  - Bridging rural digital divide with wireless
  - Broadband Internet everywhere
- WiMAX Deployment is gaining worldwide momentum

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**Thank you very much for your  
attention!**

**Jaroslav K. Ponder**

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International Telecommunication Union

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