



8<sup>th</sup> ConTEL, Zagreb / Croatia - June 2005

## **3G and beyond - The Future of (Mobile) Communication**

Dr. Klaus-D. Kohrt

**SIEMENS**

- **The Market**
- **UMTS today**
- **Beyond 3G**

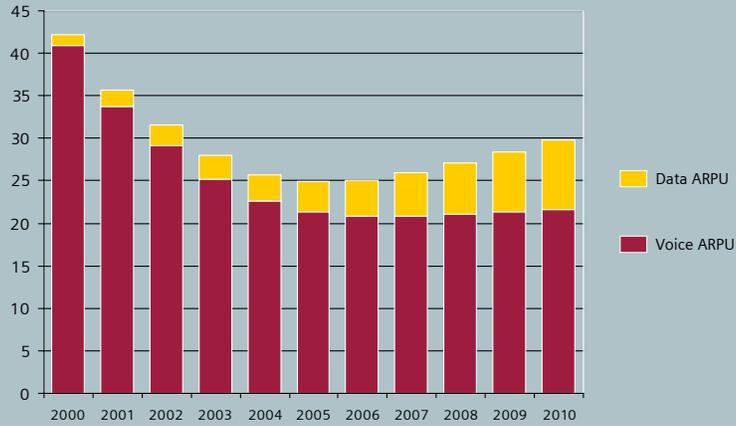
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## World ARPU Decline will bottom out in 2005 Voice ARPU continues to dominate, but data drives growth

€ per human user per month



ARPU: Average Revenue Per Human User

Source: Com MN SM Market Assessment Status: March 2005

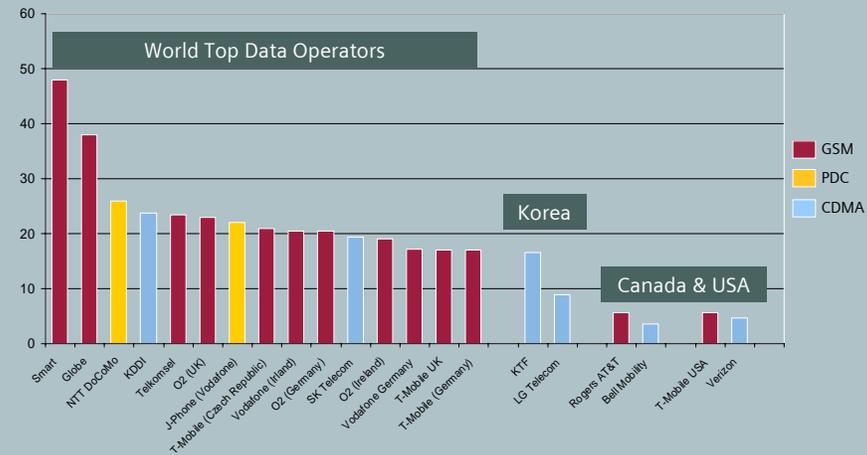
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## Mobile Data MNO Ranking 7 out of 10 are based on GSM Networks

Data ARPU % of total ARPU



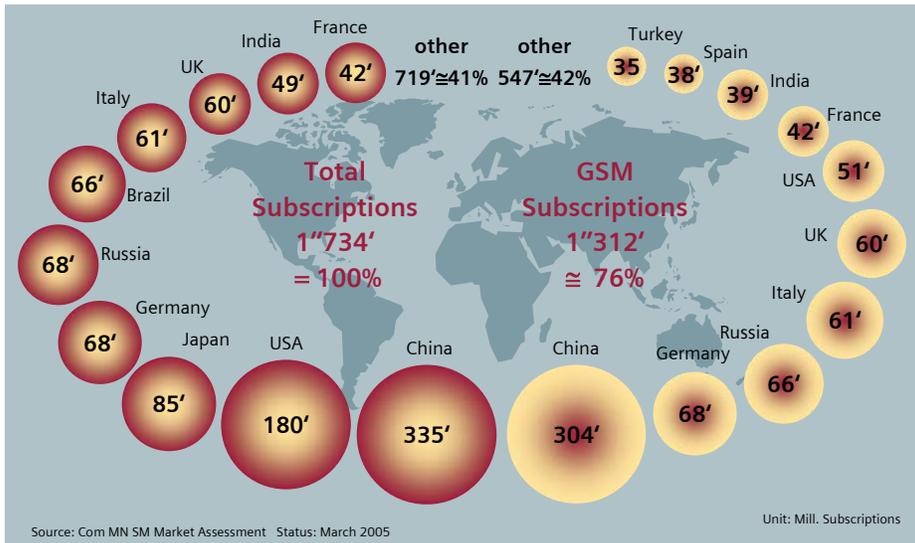
Source: EMC World Cellular Data Metrics January 2005, Com MN SM MA

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## Mobile Subscriptions at Year End 2004 Top 10 countries count for ~ 59% of world total



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## Top 10 World – YE 2004

Cingular made its way into the top league by acquiring AT&T Wireless



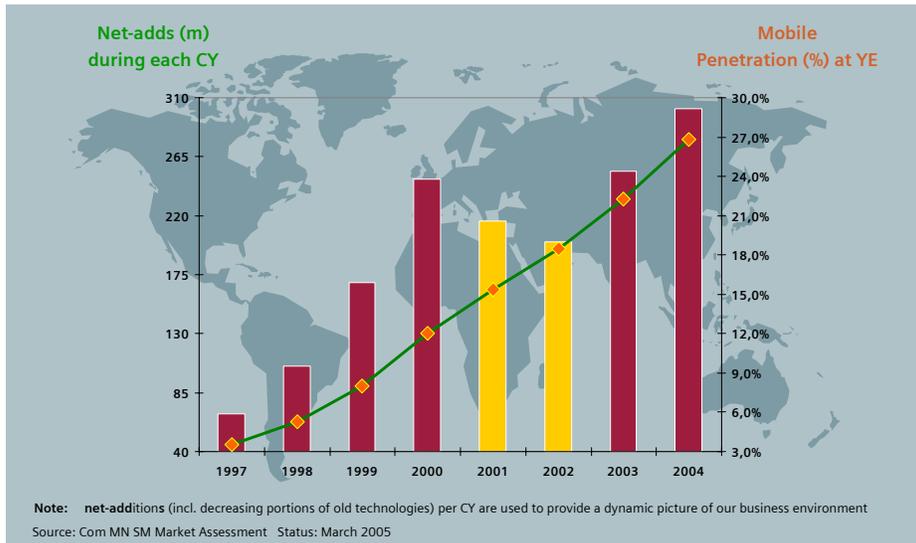
Source: Com MN SM Market Assessment Status: March 2005

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## Mobile customer (subscriptions) net-adds on the growth path again Strong showing during CY 2004 - highest growth in history

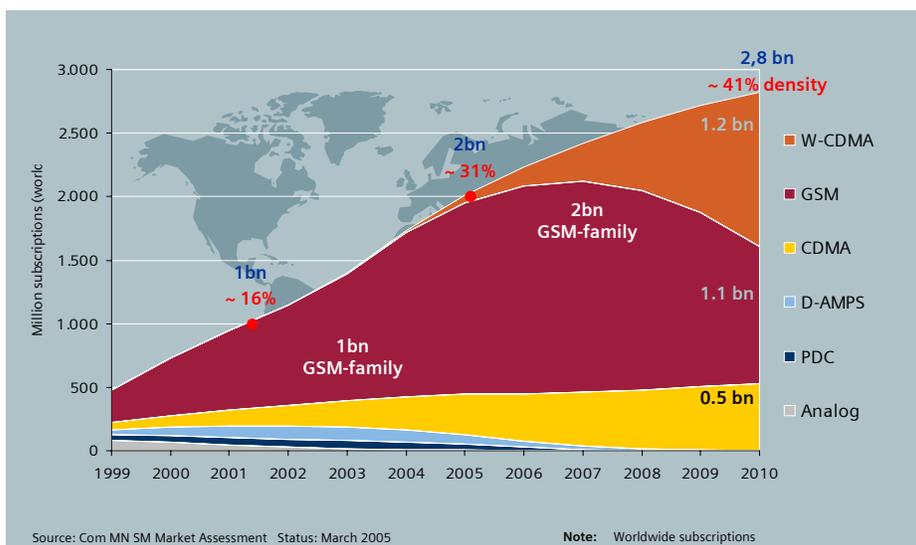


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## Worldwide Development of Subscriptions by Technology GSM family evolved into the predominant technology of choice

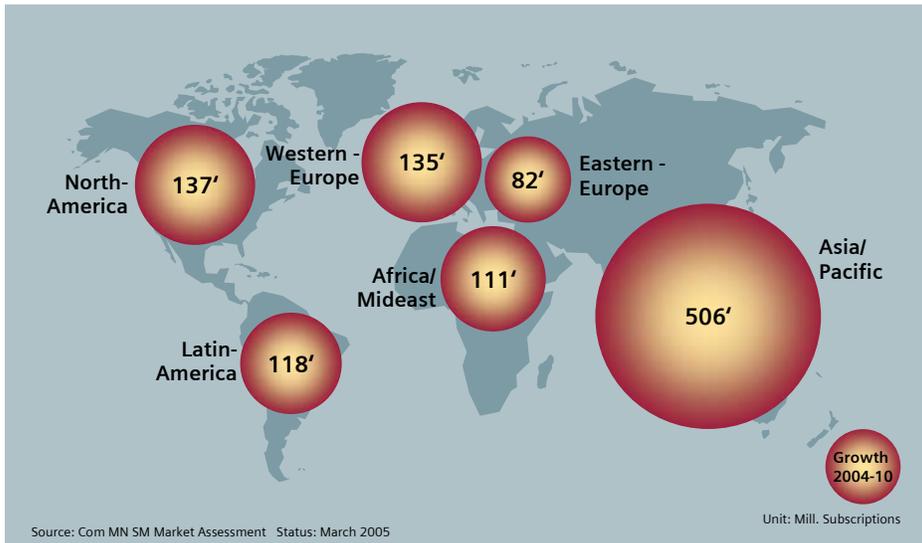


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## Future of Mobile Subscriptions until 2010 Growth in Asia almost equals all other regions

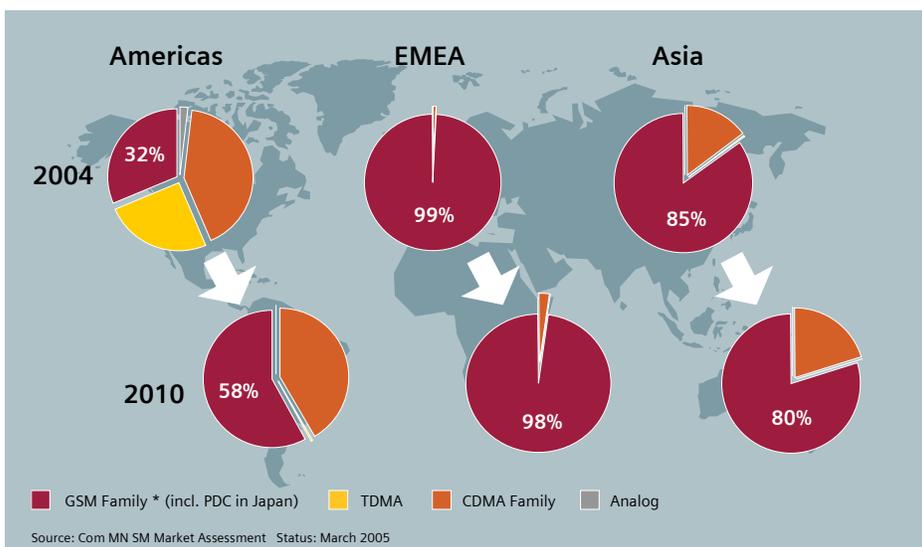


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## Mobile Subscriptions by Region & Technology GSM family continues to be the dominant technology

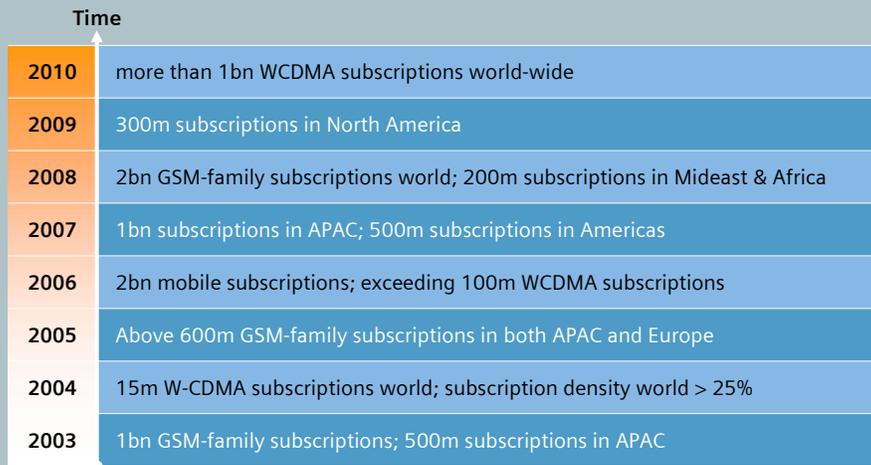


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## Let Numbers Talk Striking milestones still ahead of us



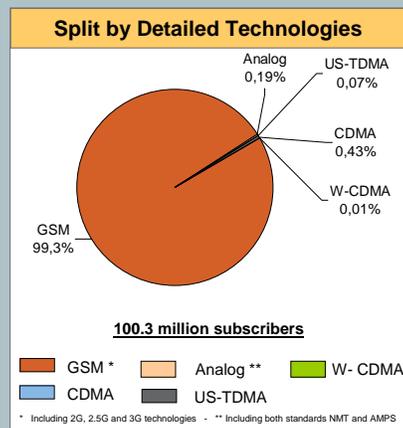
Source: Com MN SM Market Assessment Status: March 2005

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## Technology split in Eastern Europe – YE 2004 GSM is by far the dominating technological standard



Source: EMC; COM MN SM MA CA

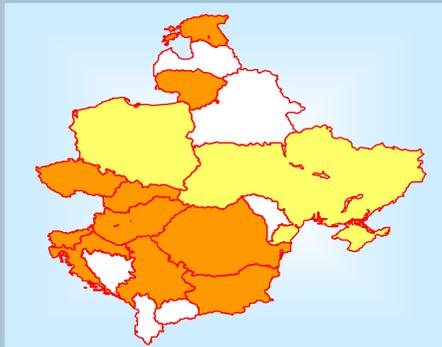
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## EGDE launches in Eastern Europe

Until now, 17 operators in 11 countries launched EDGE



### Expected Launches in 2005

Country	Operator	Launch Date
Bulgaria	BTC	n.a.
Montenegro	Promonte GSM	2H2005
Serbia	Mobtel Srbija	pilot net
Ukraine	Kyivstar GSM UMC	n.a. n.a.

Source: [www.gsacom.com](http://www.gsacom.com) 05/2005; COM MN SM MA CA

### Country Operator Launch Date

Country	Operator	Launch Date
Bulgaria	Mobiltel	03/2005
Croatia	VIPNet T-Mobile	04/2004 Q2 2004
Czech Rep.	T-Mobile Eurotel Oskar Mobil	Q4 2004 03/2005 03/2005
Estonia	EMT	06/2004
Hungary	T-Mobile Pannon	11/2003 03/2005
Lithuania	Bitė GSM	12/2003
Poland	Polkomtel PTK Centertel	Q3 2004 Q4 2004
Romania	Orange	10/2004
Serbia	Mobtel	pilot network
Slovakia	Eurotel Bratislava Orange	06/2004 01/2005
Slovenia	SiMobil	Q1 2004
Ukraine	DCC/Astelit	03/2005

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## 3G licenses – Overview of Awards and Launches

So far, only 5 MNOs launched their UMTS networks commercially

### UMTS Network Launches

Country	Operator	Launch Date	Status
Slovenia	MobilTel	04/2004	Commercial
Poland	Polkomtel	08/2004	Commercial
Croatia	VIP Net	01/2005	Commercial
Poland	PTC	04/2005	Commercial
Romania	Mobifon	05/2005	Commercial



Until today, 27 UMTS licenses in 10 countries have been awarded

### Overview of Licenses Awarded

Country	No.	Awarded	Operators
Bulgaria	1	03/2005	MobilTel
	2	04/2005	Globul, BTC
Croatia	3	12/2004	T-Mobile, VIPNet, Treca Sreca
Czech Rep.	2	12/2001	EuroTel, T-Mobile
	1	02/2005	Oskar Mobil
Estonia	3	07/2003	EMT, Tele2 Eesti, Elisa Mobile
Hungary	3	12/2004	T-Mobile, Pannon, Vodafone
Latvia	2	12/2002	LMT, Tele2
	1	04/2005	Bitė GSM
Poland	3	12/2003	PTC, PTK Centertel, Polkomtel
	1	05/2005	Netia Mobile
Romania	2	11/2004	Orange Romania, MobiFon
Slovakia	2	07/2002	Orange, Eurotel Bratislava
Slovenia	1	11/2001	SiMobil

Source: [www.gsacom.com](http://www.gsacom.com) (W-CDMA fact sheet, 05/2005); COM MN SM MA CA

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## Business Opportunities – upcoming 2G/3G licenses

Further 2G (1 GSM) and also 3G licenses are on the horizon in 2005



### Upcoming UMTS licenses in 2005/6

#### Albania:

- Sale of fixed line monopoly incl. UMTS license planned for 2005

#### Bulgaria:

- 1 license awarded to MobilTel in 03/2005
- 2 licenses awarded to Globul and BTC in 04/2005

#### Poland:

- 4th UMTS license granted to Netia Mobile (unit of fixed-line operator Netia) in 05/2005

#### Lithuania:

- Regulator plans to issue two 15-year licenses in 2005

#### Serbia/Montenegro:

- 3G licenses are expected to be issued in 2006

#### Romania:

- 3rd UMTS license planned to be awarded by YE 2005

### GSM licenses awarded in 2004

Country:	No.	Date	Operator
Armenia	1	11/2004	K-Telecom
Belarus	1	11/2004	BEST
Bulgaria	1	06/2004	BTC
Croatia	1	12/2004	Treca Sreca (Tele2)

Source: COM MN SM MA CA

### Upcoming 2G licenses in 2005/6

#### Georgia:

- Auction for CDMA license in May 2005 planned

#### Poland:

- 4th GSM license to be granted in 2005
- Tender running since Feb. 22; still no winner announced

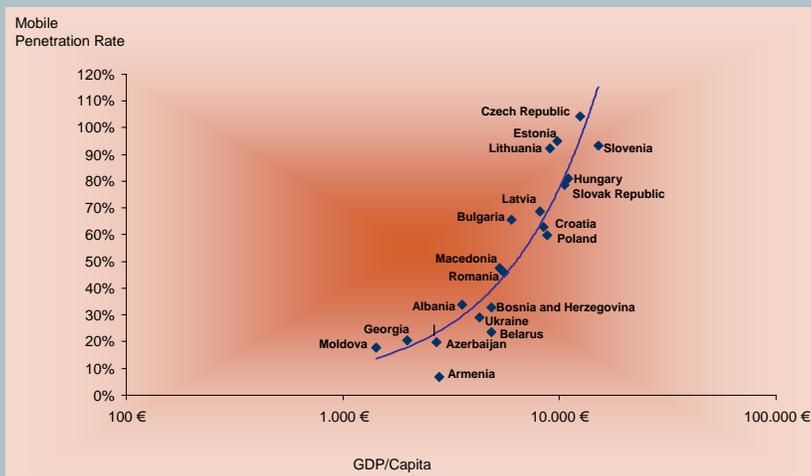
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## GDP/Capita vs. mobile penetration rates YE 2004

Czech Republic has the highest penetration with more than 100%



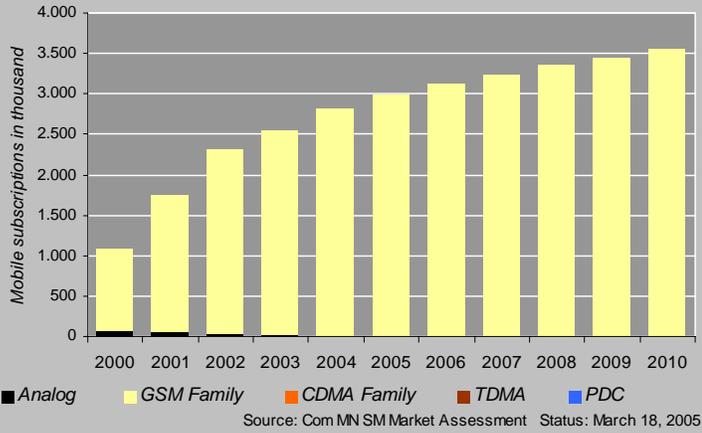
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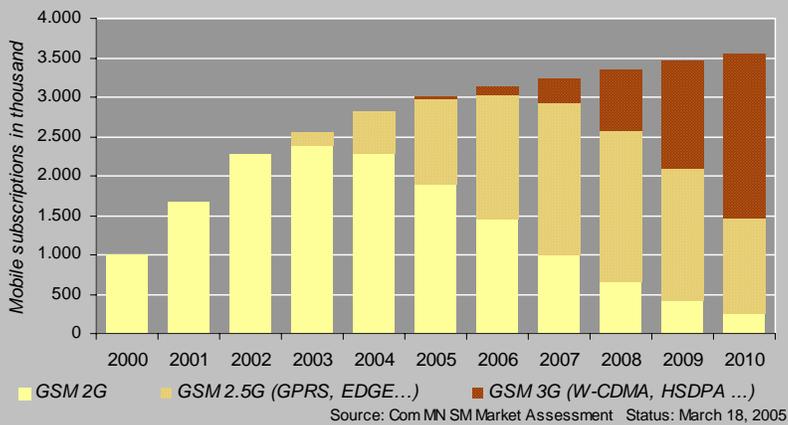
## Croatia Mobile Market – YE 2004

### Subscriptions by Main Standards



## Croatia Mobile Market – YE 2004

### GSM Family by Generations



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**Dr. Klaus-D. Kohrt**

Vice-Chairman, UMTS Forum  
[www.umts-forum.org](http://www.umts-forum.org)



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## About The UMTS Forum

### Who are we?

- An international, cross-sector industry body comprising operators, manufacturers, regulators, application developers, research organisations and IT industry players.

### Our mission...

- To promote a common vision of the development of 3G/UMTS and of its evolutions, and to ensure its worldwide commercial success.

### Our publications:

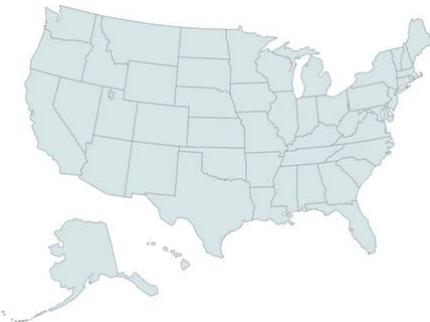
- Since 1997, more than 40 reports on Spectrum & Regulation, 3G/UMTS vision, Customer Behaviour, Market Evolution & Forecasts, Technical Studies & Implementation.  
Recent issues: Strategic Considerations for IMS – the 3G Evolution, Coverage Extension Bands for UMTS/IMT-2000 in the bands between 470-600 MHz, Magic Mobile Future 2010-2020...



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# Standardisation is key to market success

Multiple standards fragment the market and drive up the cost of interoperability



## USA:

Technological fragmentation across one nation with 5 wireless standards:

mobile penetration rate = 65.4%

Western Europe:  
Geographic fragmentation with 18+ nations and one wireless standard:  
mobile penetration rate (SIM) = 92.3%

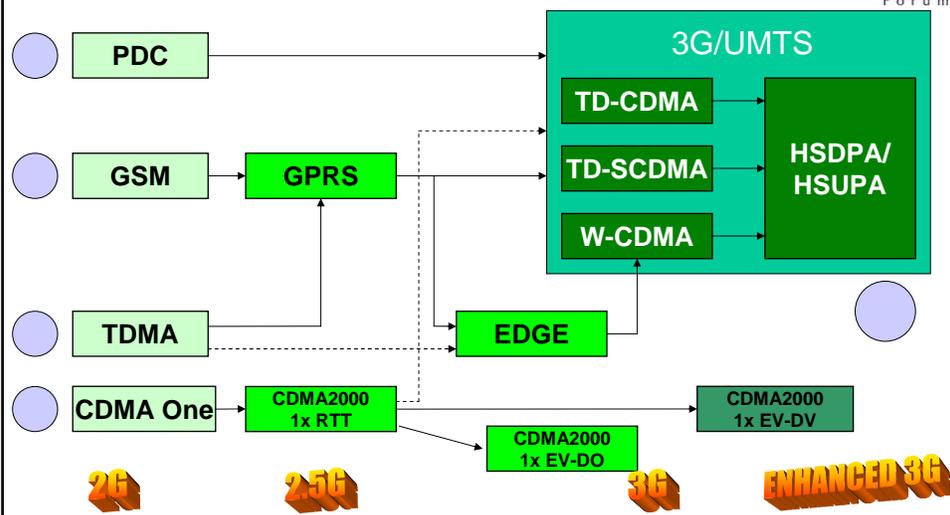


Status:  
February 2005



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# 3G Operator Evolution Options



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# 3G / UMTS Global Update



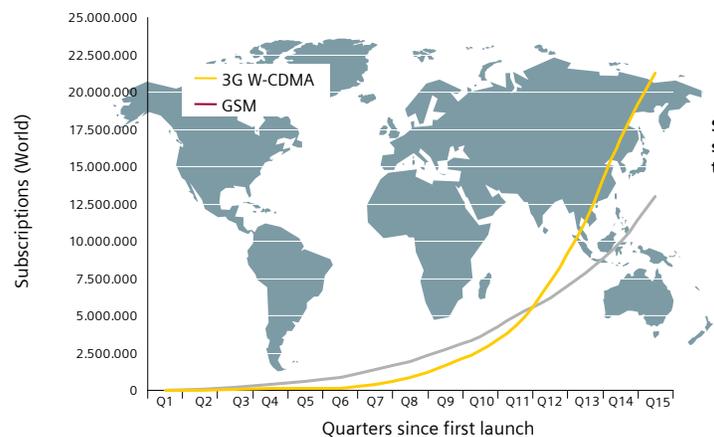
- Almost 70 networks in commercial service in 30 countries with many others in trial / pre-launch
- Over 22 million 3G/UMTS subscribers (April 2005), and growing fast
- 130+ 3G/UMTS licenses awarded in 45 countries
- WCDMA take-up faster than GSM at the same stage



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# Early GSM vs. W-CDMA Growth Comparison

## Steep W-CDMA subscriptions growth



Source: Siemens

Status: March 2005



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## 3G/UMTS Terminals



- 150+ 3G/UMTS terminals and PC cards commercially available or announced by a growing range of European, Asian and US manufacturers
- Latest models compare with 2G handsets in terms of battery life, weight and size



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## HSDPA



The next step in evolution of the 3GPP air interface

**HSDPA = true mobile broadband**, enabling a wide variety of high bandwidth multimedia services including:

- high quality streaming video;
- fast downloads of high resolution images and large files.

Compared with WCDMA, HSDPA:

1. increases throughput (2→14.4 Mbps)
2. reduces latency
3. increases data capacity up to 5x in dense urban environments (micro-cells)



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# HSDPA

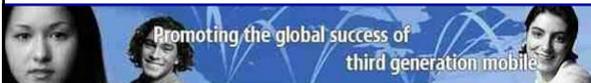
## A new paradigm for packet data



- Integrated voice on a dedicated channel (DCH)
- High Speed Data (up to 14.4 Mbps) on downlink shared channel on the same carrier (HS-DSCH) and can be deployed in both FDD & TDD modes

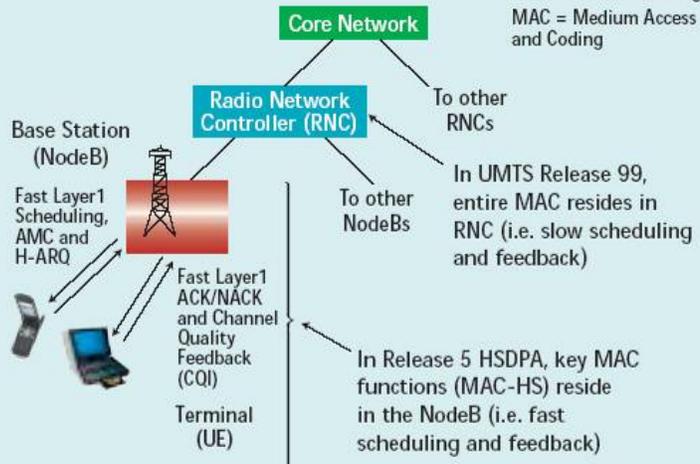
HSDPA introduces:

- Dynamic adaptive modulation & coding, multicode operation,
- Fast scheduling of packet data, fast physical layer retransmission of data packets.
- This is accomplished by incorporating many of the key scheduling & control processes at the base station – as opposed to the Radio Network Controller (RNC) – and thus closer to the air interface.



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## HSDPA System Architecture



Upgrading from Release 99 WCDMA to HSDPA is smooth since – from an air-interface perspective – HSDPA can coexist on the same RF carrier with Rel.99 WCDMA; only Node B (base station) is affected.



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## Early to market: end-to-end HSDPA solution by Siemens



### HSDPA, a UMTS extension

- With data rates to average download speeds of up to 2 to 3 MBit/sec, roughly corresponding to the fastest DSL connections today
- Ideally for 3G operators with W-CDMA license

### HSDPA by Siemens

- NodeBs (base stations) HSDPA-ready since 2002
- Smooth upgrade path from 3G W-CDMA to HSDPA
- First live demo with a PC card at 3GSM World Congress, February 2005
- HSDPA end-to-end solution available for commercial use in second half of 2005. Several operators will then go commercial with HSDPA by Siemens.



# IMS (IP Multimedia Subsystem)



- ✓ REAL TIME...
  - ✓ PERSON TO PERSON...
  - ✓ MULTIMEDIA...
  - ✓ MULTIPLE, SYNCHRONISED SERVICES
- 
- Simultaneous delivery of multiple real-time services
  - An enhanced person-to-person communication experience with interactivity and integration of services
  - A standardized solution across fixed and mobile networks
  - A cost-effective enabling technology for service differentiation and new revenue opportunities



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# IMS separates RAN, transport and control functions



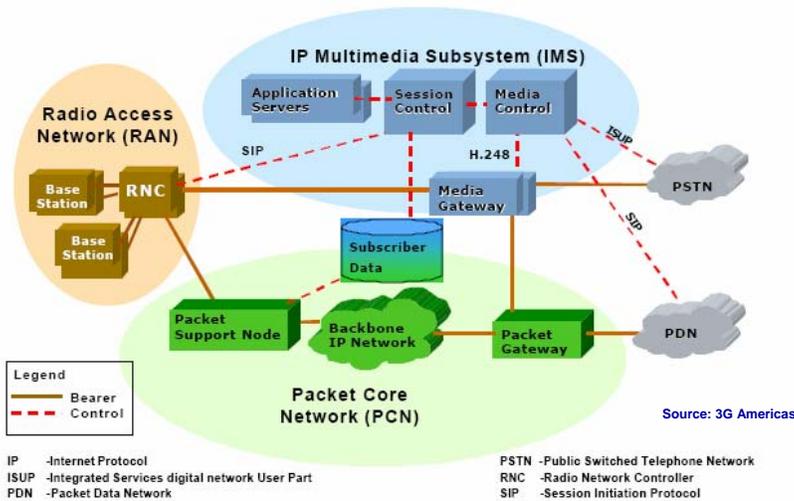
- **The Radio Access Network**  
provides the over-the-air **connection** from user equipment to core network plus low level mobility management
- **The Packet Core Network**  
provides **transport** for signaling and bearer plus high level mobility management
- **The IP-based Multimedia Subsystem IMS**  
provides **control** of applications, plus control of session and media conversion.

**With IMS, media control, session control and application control are separated as distinct entities.**



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## Upgrading to IMS



Upgrading to IMS separates radio access, transport and control elements, with the IMS handling control of applications, control of sessions, and media conversion



Promoting the global success of  
third generation mobile

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## Tomorrow... mobile broadcast (DVB-H)



- **Complementary to EDGE and 3G / UMTS, DVB-H brings “broadcast” services to handheld devices:**
  - From « one-to-one » to « one-to-many »
  - Simultaneity, speed and capacity
- **What mobile operators bring to DVB-H:**
  - True interactivity via cellular networks
  - Access to new range of customers and their mobility usage
  - Controlled content distribution to mobile users
  - Mass market distribution of UMTS / DVB-H handsets



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**For more information...**  
**[www.umts-forum.org](http://www.umts-forum.org)**



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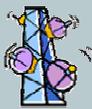
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## IEEE 802.16 - 2004 Standards Family



	Feeding	FWA	Cellular
Completed	December 2001	January 2003	June '04 / Mobility mid '05
Spectrum	10 - 66 GHz	< 11 GHz	< 6 GHz
Channel Conditions	Line of Sight Only	Non Line of Sight	Non Line of Sight
Bit Rate	32 - 134 Mbps in 28MHz channel bandwidth	Up to 75 Mbps in 20MHz channel bandwidth	Up to 15 Mbps in 5MHz channel bandwidth
Modulation	Single Carrier QPSK, 16QAM, 64QAM	OFDM 256 sub-carriers QPSK, 16QAM, 64QAM	1x Scalable OFDMA QPSK, 16QAM, 64QAM
Mobility	Fixed	Fixed	Portable Data mobility (<120 km/h)
Channel Bandwidths	20, 25 and 28 MHz	Scalable 1.5 to 20 MHz	Scalable 1,25 to 20 MHz
Typical Cell Radius	2 to 5 km	7 to 10 km Max. range 50 km	1 to 5 km

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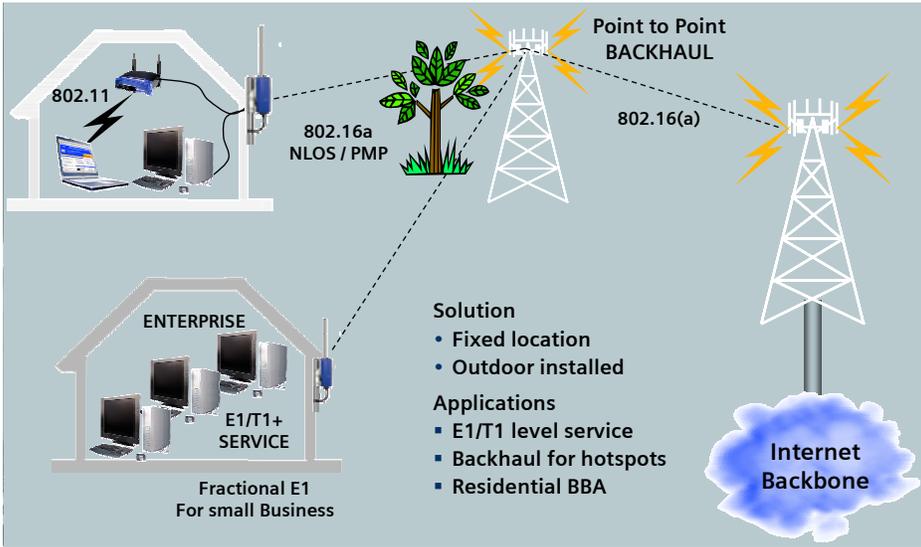
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## WiMAX Market Evolution (1)

*Fixed Outdoor starting in '05*



- Solution**
- Fixed location
  - Outdoor installed
- Applications**
- E1/T1 level service
  - Backhaul for hotspots
  - Residential BBA

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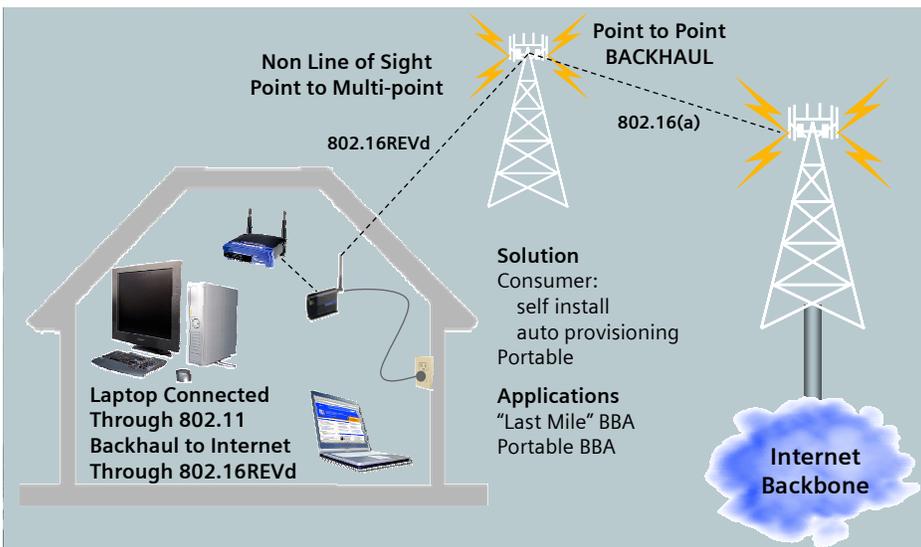
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## WiMAX Market Evolution (2)

*Consumer Indoor starting in '06*



- Solution**
- Consumer:  
 self install  
 auto provisioning  
 Portable
- Applications**
- "Last Mile" BBA  
 Portable BBA

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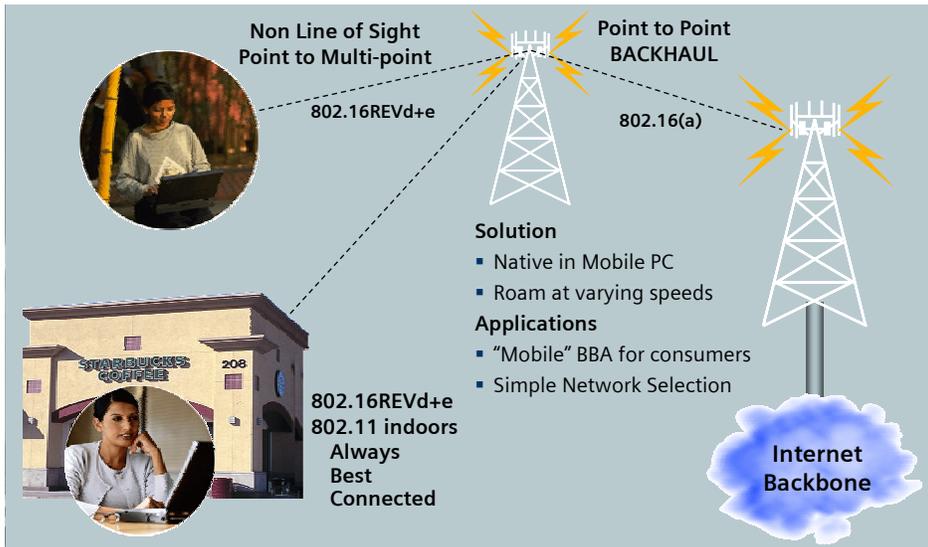
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## WiMAX Market Evolution (3)

Mobile Consumer starting in '07

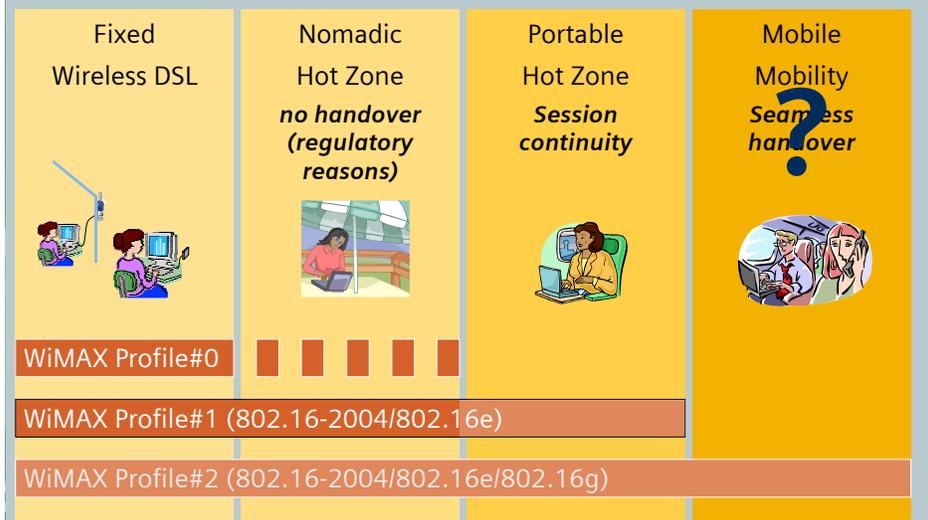


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## WiMAX Evolution

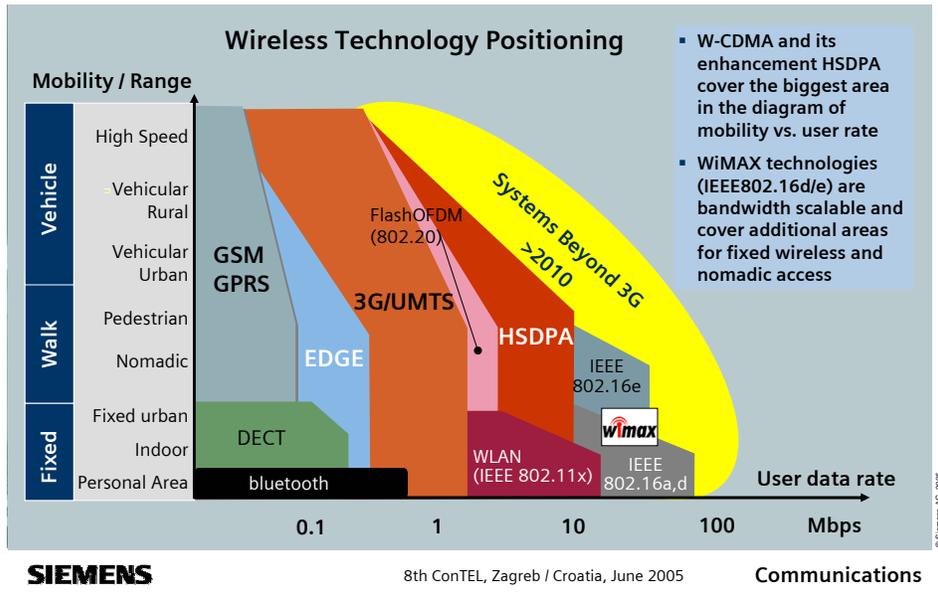


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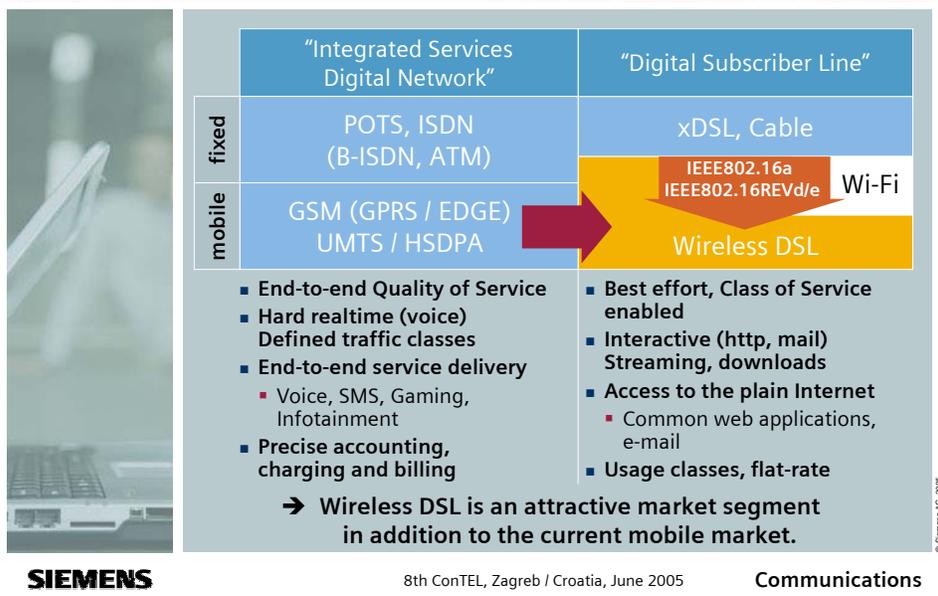
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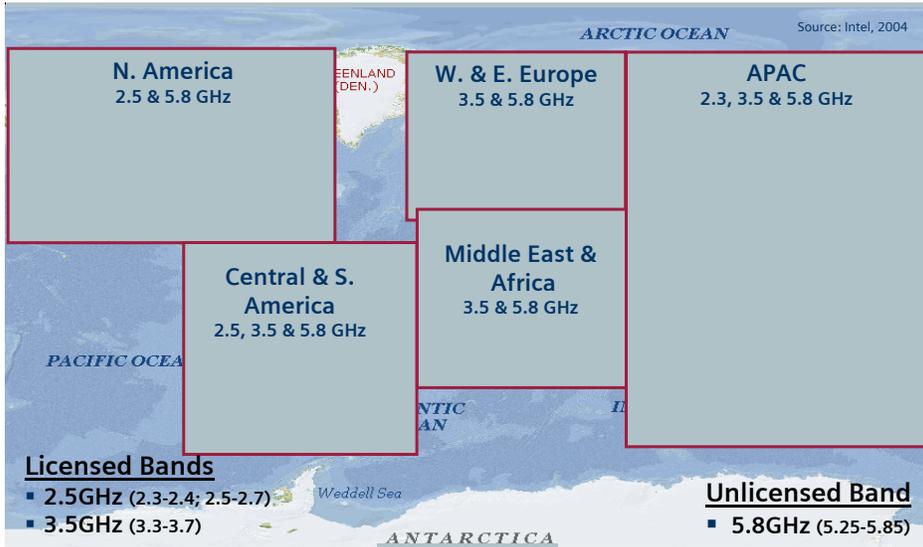
## WiMAX as standardized solution is a promising complementary technology to W-CDMA / HSDPA



## The various access technologies are addressing different telecommunication markets



## Implementing Tri-mode Radio Enabling World-Wide Client

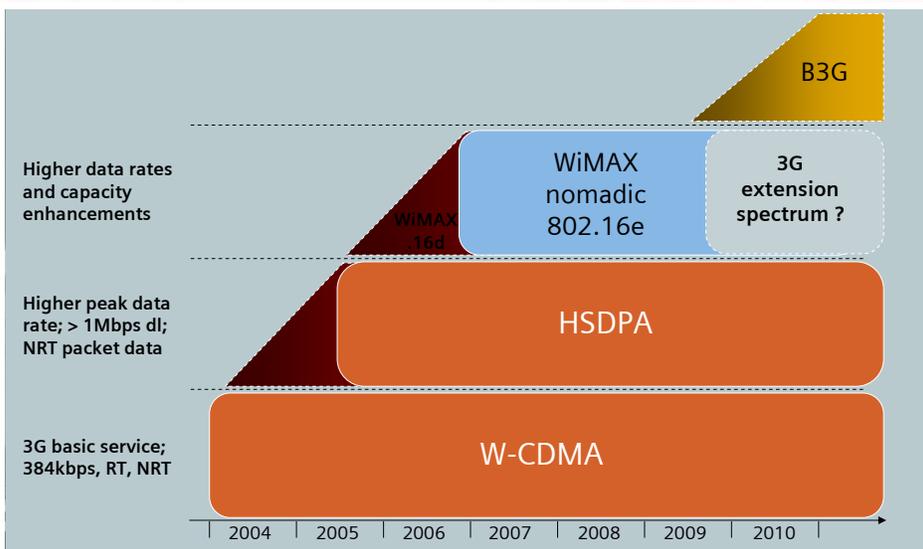


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## Peak data rate and capacity demand of a Western European Cellular Operator

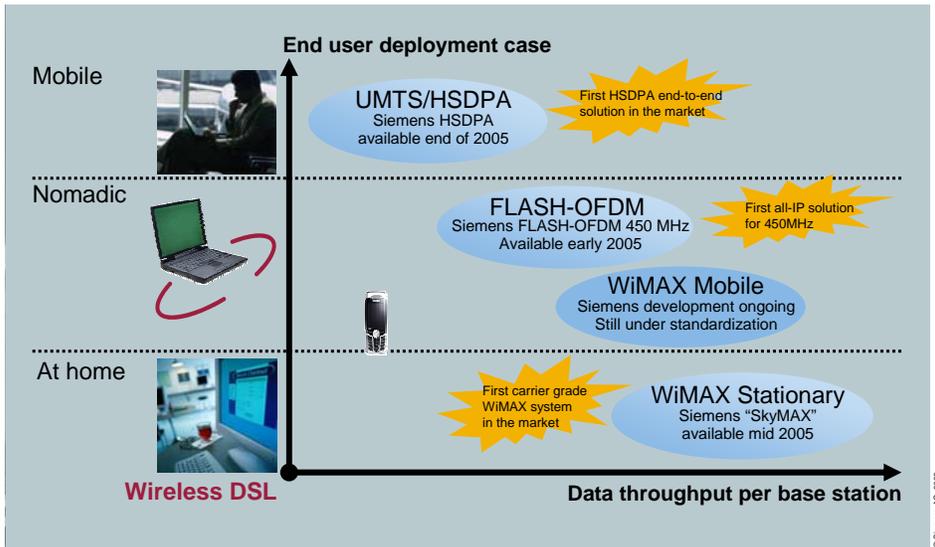


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## Siemens is worldwide leading in wireless broadband technologies



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## One of the market's first end-to-end solutions for WiMAX radio networks comes from Siemens



### ■ WiMAX

- Ideally for stationary, wireless broadband internet access
- Wireless DSL and 'nomadic' notebook use
- Wireless 'last mile' solution for fixed and mobile operators
- Ideally for rural and remote areas where the provisioning of services by cable or fiber is difficult or uneconomic

### ■ SkyMAX by Siemens

- End-to-end: SkyMAX base station and modems presented at the 3GSM Congress in February 2005
- Best-in-class in cell range
- Available in the second half of 2005

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## SkyMAX Base Station - IDU layout



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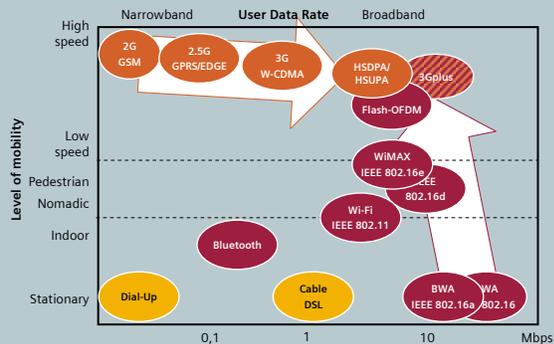
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## Trends in Mobile and Wireless Access

Several technologies move in the same direction: Mobile Broadband

Cellular technologies become more and more broadband (TDD-HCR, TDD-LCR, HSDPA)

Alternative wireless technologies become more and more mobile (WiMAX, Flash-OFDM, 802.20)



Several technologies compete for mobile Broadband:

- not all can win but several will coexist
- HSPA (HSDPA+HSUPA) is the most promising candidate

Source: Com MN SM Market Assessment Status: March 2005

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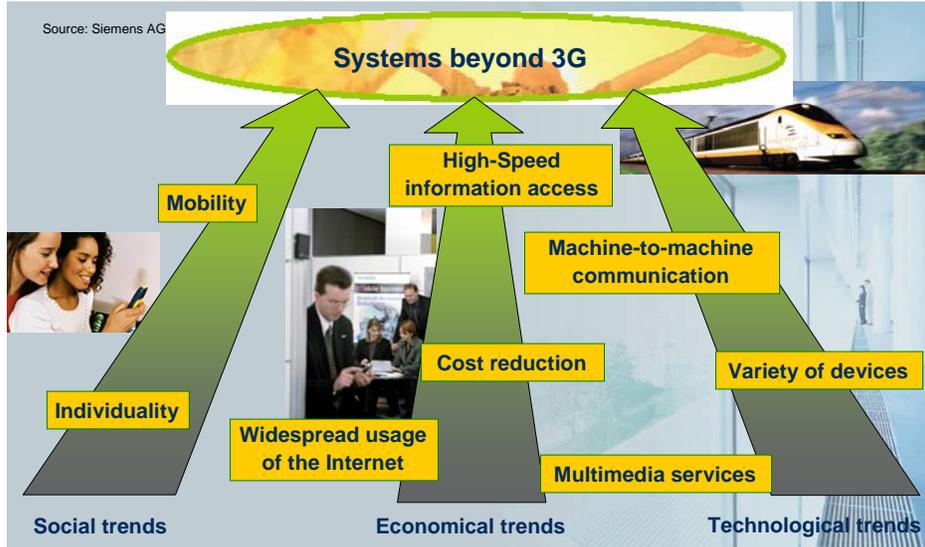
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## Trends influencing the development of mobile networks

Source: Siemens AG



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## The Future – Systems beyond IMT2000 („4G“?)

### Myths:

- (All-) IP is 4G
- OFDM is 4G
- xxx is 4G
- Let's skip 3G
- 4G is revolution
- ...

### Reality:

- 4G will be All-IP
- 4G radio will use OFDM(A)
- 4G does not exist today
- To do what instead ?
- 4G will need to co-exist
- ...

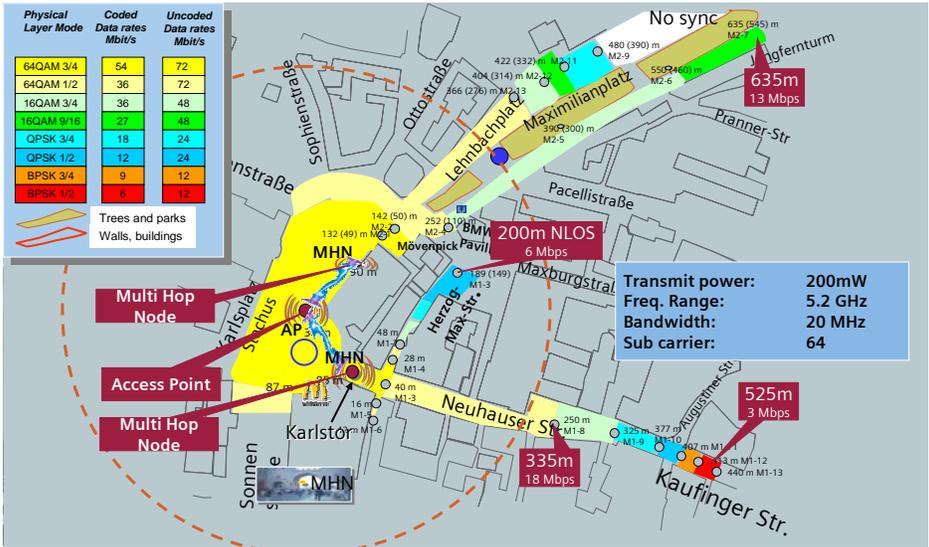


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# 20 MHz OFDM Experimental System Multihop: Stachus Munich

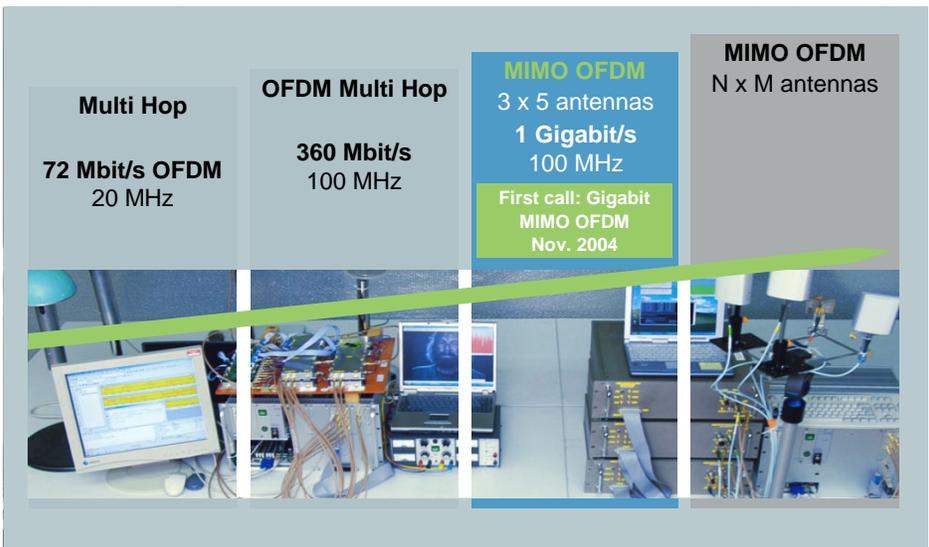


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# A glance into the Siemens labs On the way to Systems Beyond 3G

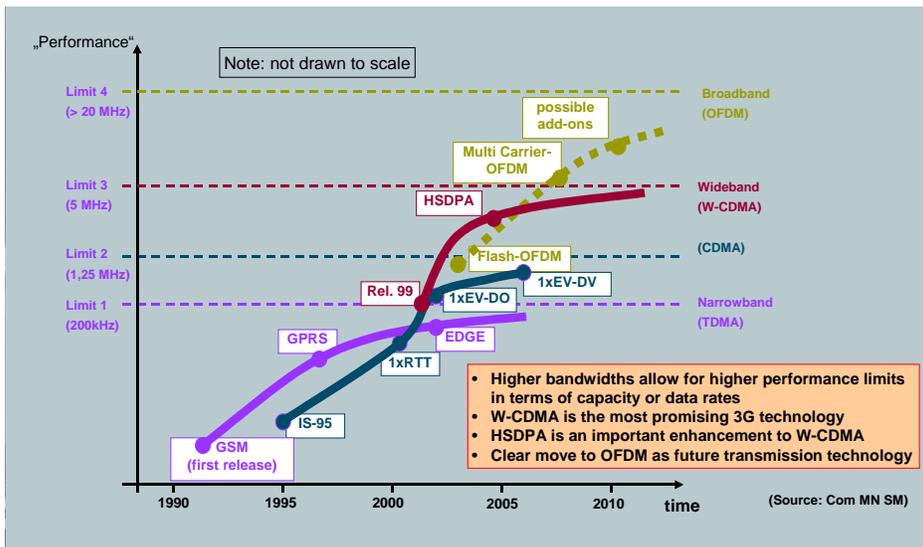


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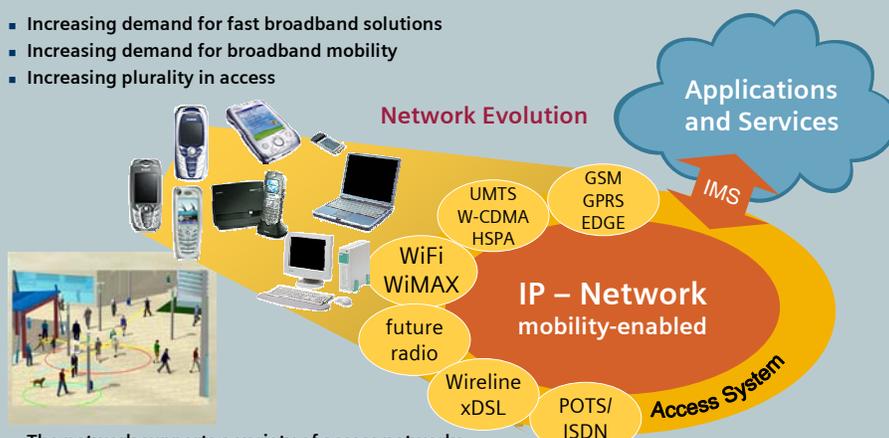
# Evolution of radio technologies



# The Network Vision – Long Term

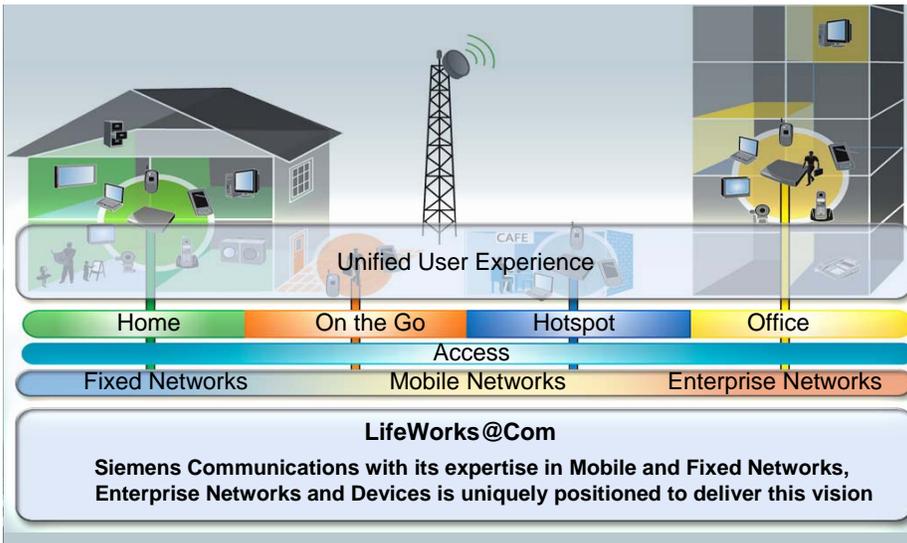
## IP as a central technology

- Increasing demand for fast broadband solutions
- Increasing demand for broadband mobility
- Increasing plurality in access



- The network supports a variety of access networks
- The majority of traffic is IP-based with increasing peer to peer and machine to machine traffic
- Opens possibilities for new radio interfaces based on improved air interfaces (OFDM) and support for multi-hop, ad hoc and self-organizing networks

## The LifeWorks@Com vision enables universal access to applications and services



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## Conclusion



- The success of Convergence & 3G is all about continually enhancing the end user experience
- IMS is the basis for convergence
  - between mobile, fixed-line and internet communication
  - and will drive access agnostic service provisioning
- Different radio technologies will complement each other
- WLAN / WiMAX and GSM / UMTS peacefully coexist
- The user will automatically be always best connected
- Network and terminal ensure seamless interoperability

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Thank you very much  
for your attention.

**SIEMENS**

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