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## **UMTS broadband mobile technology is a reality – Confounding many expectations**

Stefan Heng

Deutsche Bank Research

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# UMTS broadband mobile technology rolled out

Confounding many expectations

June 13, 2006



**UMTS already proving its market viability.** In Europe some 60 commercial 3G networks have already been rolled out. 3G technology is being used by 47 million subscribers worldwide, and their number is rising fast. 3G penetration in Western Europe will grow to more than 60% by 2010. At the moment this strong growth is primarily being driven from the supply side by the telecommunications companies (telcos). If a sufficiently large number of attractive broadband services develop, demand will become the driving factor by the end of the decade.

**The take-up of UMTS differs sharply from one country to the next.** Italy and the UK will boast the highest 3G penetration rates in 2010, while Belgium and Greece will have the lowest. Germany and France will rank just below the Western European average. The large differences are due not only to market-related factors (e.g. country-specific disposition towards mobile telephony, special mobile service offerings, varying levels of network coverage) and diverse marketing strategies, but also political intervention that distorts the market.

**UMTS symbolises the transition from pure voice telephony to a multi-faceted choice of mobile services.** At present, the slow acceptance of mobile services is a particularly big risk for telcos and their investments. As mobile telephony continues to develop, both the potential attacks on the security of data transfers and the possibility that electromagnetic waves may be harmful to human health will pose additional challenges for the business models.

**Besides ringtones and online games, video clips as well as data and information services will soon face market testing.** The spread of these new services can only go hand in hand with the proliferation of high-performance handsets and broadband infrastructure.

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**Author**  
Stefan Heng  
+49 69 910-31774  
stefan.heng@db.com

**Editor**  
Antje Stobbe

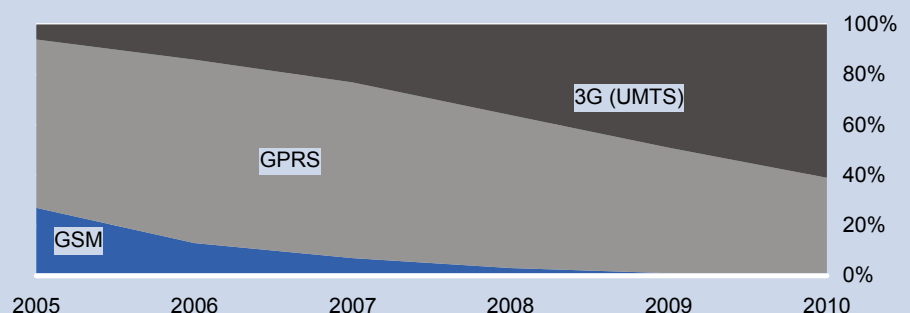
**Technical Assistant**  
Martina Ebling

Deutsche Bank Research  
Frankfurt am Main  
Germany  
**Internet:** www.dbresearch.com  
**E-mail:** marketing.dbr@db.com  
**Fax:** +49 69 910-31877

**Managing Director**  
Norbert Walter

## End of the line for GSM

Mobile handsets by technology, Western Europe, %



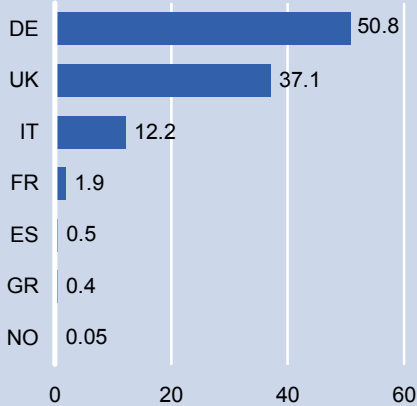
Source: Forrester Research Inc., 2005



*The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it. (Mark Weiser, American computer scientist)*

### High costs for UMTS bandwidth in DE and UK

UMTS licence revenue, EUR bn



Source: Reg TP, 2000

1

As a symbol of the “new economy”, the third generation (3G) in mobile telephony, aka Universal Mobile Telecommunication System (UMTS), was an emotionally charged issue from the very start. The hype-induced expectation that 3G would rapidly prove a sweeping commercial success was reflected particularly clearly in the auctions for 3G frequencies in Germany and the UK. These auctions drew sums of EUR 50 bn and EUR 37 bn into the coffers of the respective countries (chart 1). However, the overblown expectations of the “new economy” were dashed very soon after the turn of the millennium. The fact that two licence holders handed back their licences before 3G even got off the ground in Germany – leaving aside the patently evident inhouse difficulties each company faced – has generally been seen as symbolic of the failure of an entire technology. However, the reality is more complex. For despite this emotionally conducted debate on 3G the crash of the “new economy” should by no means lead us to the conclusion that 3G is a hopeless case.

### Telecommunications undergoing fundamental change

The telecommunications industry is undergoing fundamental changes. Two major trends emanate from the roots of traditional telecommunications business. The first big trend revolves around the fact that the telecommunications companies (telcos) now define their business as more than voice telephony. Telecommunications is turning into multi-play business, covering not only voice telephony but also data telephony and radio and television.<sup>1</sup>

The second big trend is that mobile telephony is becoming more and more important in relation to fixed-line telephony. In all the industrial countries except the US, the number of mobile phone subscribers is already higher than the number of fixed-line subscribers (chart 2). The mobile phone is no longer merely an add-on but is increasingly functioning as a replacement for a fixed line.

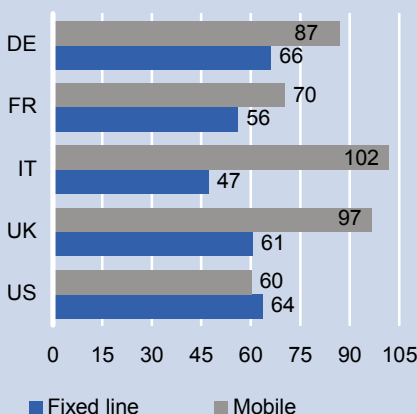
Societal trends – especially the trend towards individuality and mobility – are driving the shift away from fixed-line to mobile communication. The trend towards greater mobility is benefiting from advances in mobile transmission technologies, especially the leap from the voice-based second generation (2G) to the data-based third generation (3G). The second generation includes GSM and its successor GPRS, the third generation UMTS, WLAN, HSDPA, HSUPA, DMB, FuTURE, DVB-H and Bluetooth. In the foreseeable future technological advances such as WIMAX and UWB will become marketable commodities (see Glossary, chart 3).

### Fixed-line operators facing new competition

The spread of broadband mobile telephony at the expense of fixed-line telephony is also eroding the dominance of the incumbents who used to hold a monopoly in fixed-line business. The hard dividing lines between fixed-line and mobile applications are softening; the markets are converging. This means that the technical advances in

### Telecom goes mobile

Fixed-line and mobile subscriptions per 100 inhabitants, 2004



Source: DB Research, 2005

2

<sup>1</sup> See Just, Tobias and Antje Stobbe (2006). IT, telecoms & New Media: The dawn of technological convergence. E-economics No. 56. Frankfurt a.M.

**Glossary**

Asymmetric Digital Subscriber Line	ADSL
Digital Multimedia Broadcasting	DMB
Digital Video Broadcasting for Handhelds	DVB-H
Future Technologies for Universal Radio Environment	FuTURE
General Packet Radio Service	GPRS
Global System for Mobile Communication	GSM
High Speed Downlink Packet Access	HSDPA
High Speed Uplink Packet Access	HSUPA
Ultra Wide Band	UWB
Universal Mobile Telecommunication System	UMTS
Voice over Internet Protocol	VoIP
Wireless Local Area Network	WLAN
Worldwide Interoperability for Microwave Access	WIMAX

Source: DB Research, 2006

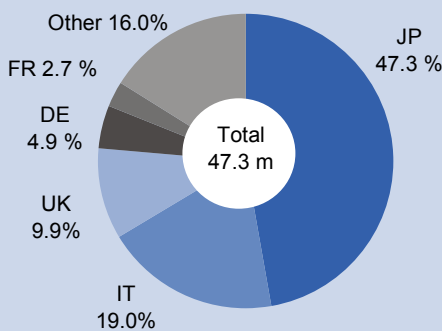
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**Hybrid business models are the key**

**Potential application field: broadcasting**

**Big in Japan**

3G users at end-2005, %



Year-end figures. Source: Bitkom, 2006

4

mobile telephony are also raising the intensity of competition in the fixed-line market.

**After the hype: UMTS keeps on going**

Following the emotionally charged public debate some telcos are reluctant to use the term UMTS as an integral part of their advertising campaigns. Nevertheless, the business decisions taken lately indicate the potential of broadband mobile communication. For instance, players entering the market are moving aggressively to acquire vacant UMTS frequencies. The longstanding owners of licences are also investing in their 3G networks following the “new economy” hype. In the meantime total investment has exceeded EUR 100 bn. At the same time as rolling out their UMTS networks the telcos are also working on hybrid business models that combine not only a variety of wireless broadband technologies (such as WLAN, DVB-H, DMB, FuTURE) but also fixed broadband technologies (like Asymmetric Digital Subscriber Line, ADSL) and thus paving the way for the attractive business area of modern data telephony.<sup>2</sup>

**UMTS will be an enabler for transmission technologies**

At times, UMTS and WLAN are described as competing technologies. Advocates of this theory praise the advantages of WLAN in broadband data communication for nomadic users. The transmission speed of WLAN is indeed up to 1,000 times greater than that in analogue fixed-line networks and comparable to the widespread ADSL (fixed-line) technology. A negative point for WLAN is the small cell size, which only allows unbroken data transmission within a maximum radius of 500 m. This is where UMTS comes back into the picture. The big telcos are working on offers that combine the advantages of WLAN with those of UMTS.

Apart from WLAN, digital radio and television are also regarded as being rivals to UMTS. Advocates of DVB-H, DMB and FuTURE point to their low investment costs in comparison with UMTS. The technical challenges to setting up nationwide networks and the low number of transmittable broadcasting channels are ignored in this respect. Given these challenges, the telcos are seeking to find integrative strategies with multiband devices for UMTS and digital broadcasting.

The examples of WLAN, DVB-H and DMB show that the existence of UMTS is essential for the development of modern transmission technologies. Hybrid business models that combine the advantages of diverse transmission technologies will shape the path of the telecommunications sector in the near future.

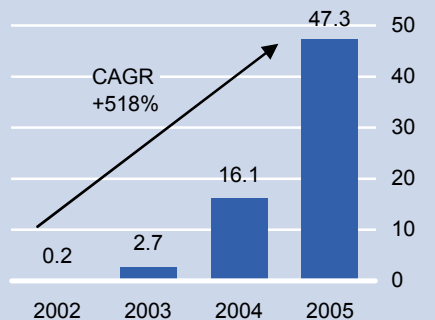
**3G nothing more than a flop?**

More than 80 commercial 3G networks have already been rolled out in some 40 countries around the world. In Europe alone there are about 60 UMTS networks. Nearly three-quarters of the planned frequency blocks are thus already in commercial use (chart 6). The telcos are getting ready for UMTS to dominate the mobile communication market by 2010. One in 40 mobile subscribers currently uses 3G technology. This amounts to 47.3 million users worldwide – with 22.4 m in Japan, 9 m in Italy, 4.7 m in the UK and 2.3 m in Germany (chart 4).

<sup>2</sup> See Heng, Stefan (2005). Broadband: Europe needs more than DSL. E-economics No. 54. Frankfurt a.M.

### User numbers quintupling each year on average

3G users worldwide, million



Year-end figures. Source: Bitkom, 2006

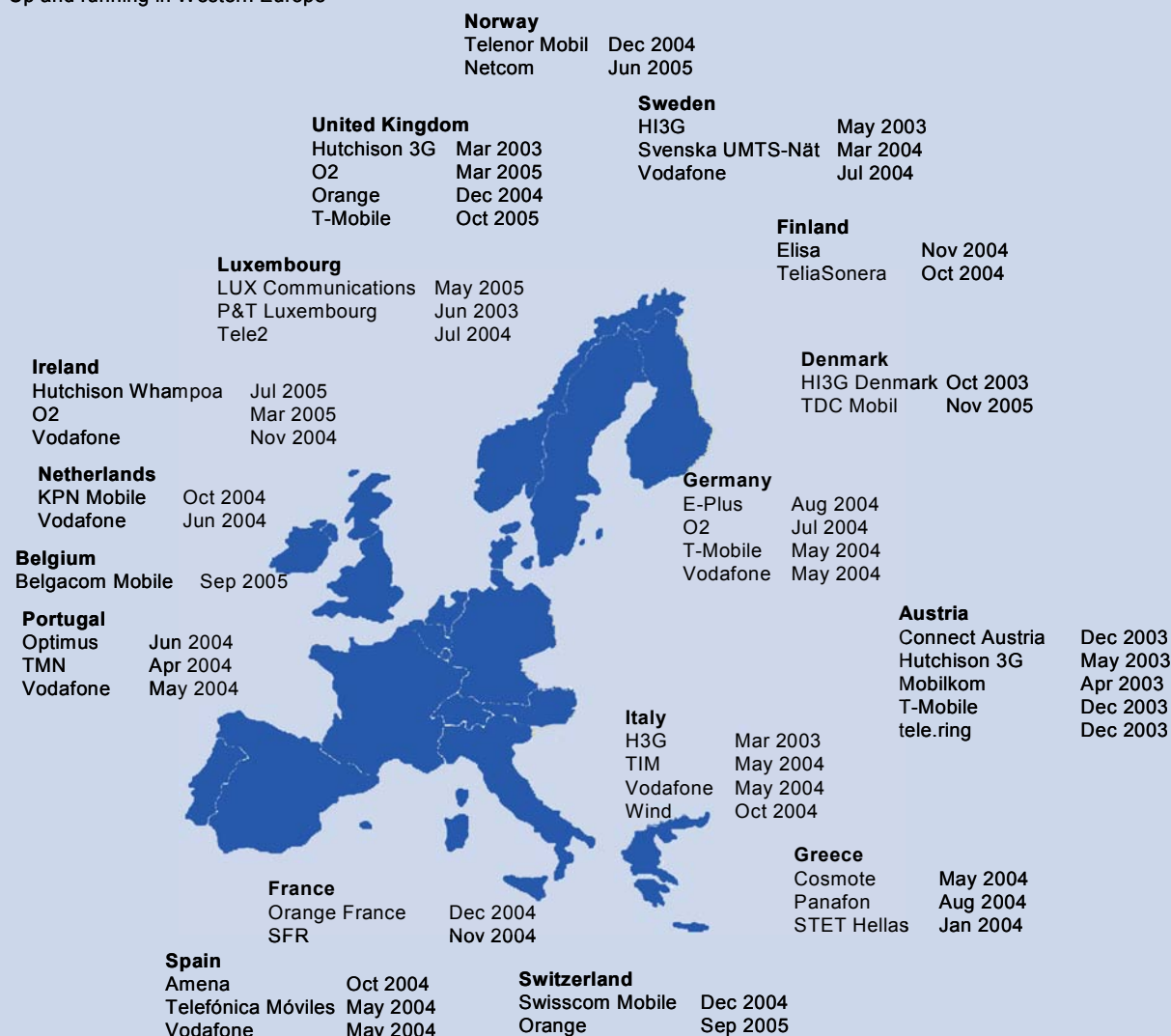
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The number of 3G customers is rising very fast, at present being driven primarily from the supply side by the telcos. Between end-2002 and end-2005 the average growth rate worldwide was more than 500% p.a. (chart 5). Handset makers are aiming to be in a position to sell 100 million UMTS-enabled handsets worldwide by the end of 2006. In Q4 2005 alone the number increased by nearly 9 million. In Western Europe, one-third of the 12.4 million new mobile contracts signed in Q4 2005 was for 3G technology.

3G penetration in Western Europe will have grown from 6% in 2005 to more than 60% by 2010. Nevertheless, there will be wide variations between 3G take-up levels from country to country. Italy (72%) and the UK (68%) will boast the highest penetration rates in 2010, while Greece (47%) and Belgium (46%) will have the lowest. Germany (58%) and France (57%) will find themselves just below the Western European average of 61% (chart 7).

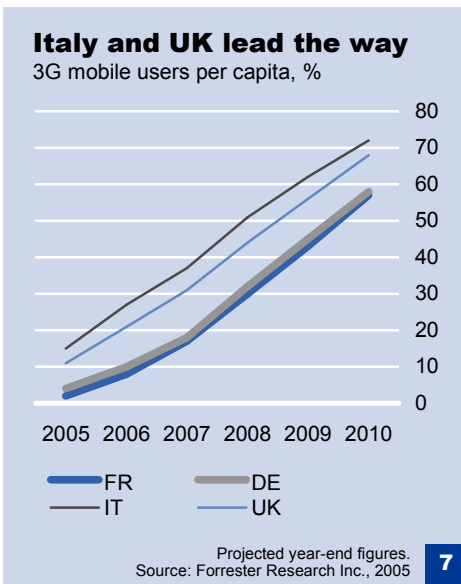
### 3G networks rolled out long ago

Up and running in Western Europe



Source: Informa Telecoms & Media, 2006

6



**Warning to watch out for mobile push services**

**Consumers worry about potential health risks**

The differences in penetration rates between countries are due not only to market-related factors (e.g. overall country-specific disposition towards mobile telephony, special mobile information and entertainment service offerings, and varying degrees of network coverage) and marketing strategies, but also to political intervention that distorts the market. For example, Belgian mobile operators are prohibited from bundling handsets and services. In Finland no network operator may have more than 35% of the population as subscribers to its 3G network. These examples bear witness to the complexity of finding a sustainable solution. Given the continuing dominance of the incumbents it is very hard to strike a balance between effecting the rollout of new technologies and promoting competition.

**Data privacy and health risks: Debate on various aspects far from over**

Besides the topic of high market concentration public debate on modern mobile telephony focuses increasingly on protecting the integrity of information exchanges and the health risk posed by electromagnetic waves. In their public relations work the telcos seem to have neglected these two aspects so far. This will probably change fundamentally in the coming years as mobile telephony continues to develop.

**Confidentiality of information: Not only private individuals could eavesdrop**

Hackers are already exploiting security gaps in mobile technology today. They usually aim to tap into mailboxes or to use telephone services at someone else's expense. Germany's Federal Office for Information Security (BSI) warns "security-sensitive areas of public administration and companies vulnerable to espionage" to watch out for e-mail traffic with mobile push services. This warning is based partly on the fact that the market leader for mobile e-mail services channels global data volume via one single computer centre. Since the government authorities responsible for this key computer centre demand access to the database on the basis of a very generous interpretation of the relevant conditions (partly "for the good of the domestic economy"), this business model proves to be particularly problematic for private information. Given these shortcomings, system operators targeting management communication functions, in particular, will increasingly have to place greater emphasis on the security of data transfers offered.

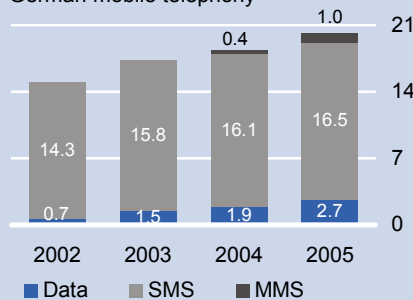
**Health risk of electromagnetic waves: Communication of risk is the key**

Not only potential attacks on the security of data transfers but also the possibility that electromagnetic waves may be harmful to human health represent challenges for the telcos. Scientific researchers (e.g. INTERPHONE, a WHO project; the Reflex Project being conducted by Germany's VERUM foundation; and the TNO Project in the Netherlands) have investigated the effects of electromagnetic waves on the human organism for a long time. Up to now it has been established that both the energy and the frequency of the radio wave play a role in the potential danger. But, beyond that, the results of the different research projects do not point in any clear direction.

The scientific community has so far mainly concentrated on potential health risks linked with the absorption of electromagnetic waves and the related warming of body tissue. Maximum limits have been set

### Text messaging (SMS) drives turnover in Germany

Data services as % of total turnover in German mobile telephony



Source: VATM, 2005

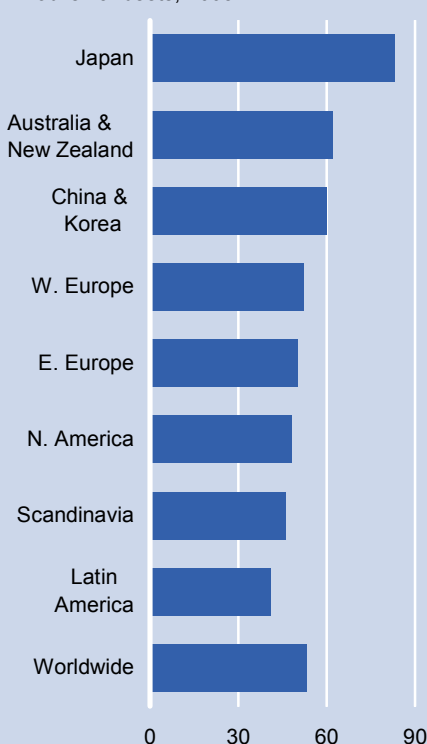
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### Japan calls the (digital) tune

Japan is the most advanced market for mobile digital music sales. The Japanese share of total revenues comes to 96% (Q1 to Q3 2005 revenues: USD 211 million). There the telcos combine innovative marketing concepts with attractive payment models (e.g. sale of packages of video, music, ringtone and online information or subscription to a music programme). Ringtones still constitute the bulk of this business.

### Japan the leader in mobile multimedia handsets

Multimedia-enabled devices as % of all mobile handsets, 2005



Source: AT Kearney, 2005

9

for the specific absorption rate (SAR) of non-ionising electromagnetic waves. These limits are usually geared to the recommendations of the independent International Commission on Non-Ionizing Radiation Protection (ICNIRP). But since no long-term results are available in this field of research there are fears that the electromagnetic waves used in mobile telephony might in the long run also be harmful below the limits recommended by the ICNIRP.

Given these conditions it is up to the telcos to improve how they communicate the existing risk. To ensure that consumers do not overreact, the potential health risks posed by mobile telephony and the measures taken by the telcos to minimise such risk should be detailed to the public at large. In many countries there is an instrument anchored in law known as mediation – i.e. an independent third party would be selected to mediate between the telcos and concerned consumers before any legal action were taken. This could prove to be an effective way to shore up mobile telephony activities going forward.<sup>3</sup>

### Foster a service culture

Leaving aside the growing issues of data protection and health risks, the biggest challenge currently facing the 3G business models is the lack of attractive broadband services. Although network operators and handset manufacturers are also cooperating with prominent suppliers of digital content, these projects are isolated highlights. So far, they have not signalled any consistent strategy for conquering the mass market. In public, network operators often claim that they are mere technological enablers and not in a position to speed up the development of innovative services themselves.

### Multimedia providers cast admiring glances eastwards

In the German data telephony business the text message is the only success story that stands out to date. Text messages generate nearly 17% of all German mobile telephony revenues, which represents over 80% of all mobile data service revenues combined (chart 8). In other parts of the world data services have already progressed far beyond the simple text message (see box). This is confirmed by comparing the percentages of mobile handsets that are multimedia devices on an international basis. Western Europe ranks only at the international average in multimedia devices (chart 9). The German share is some 30 percentage points lower than in Japan. All the same, hope is beginning to spread in the Western European market for multimedia mobile applications. The optimism of content providers is based on the findings of commercial market research institutes which estimate that 270 million Western Europeans, or 90% of Western European mobile subscribers, already use handsets that can handle more than simple voice applications on the GSM network. By 2010 nearly every handset is then essentially to be data enabled. The number of Western European users will thus rise 20% to about 325 million (chart 10).

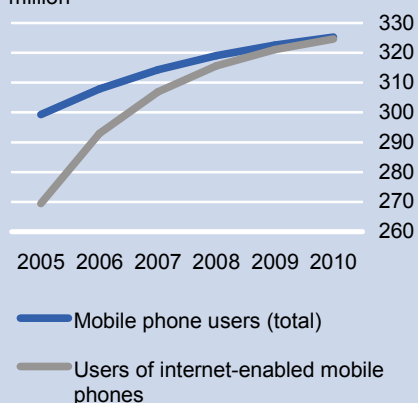
Just a few years ago the telcos still assumed that traditional voice telephony would generate 80% of 3G business. Given the telcos' enormous investment costs, the models have in the meantime developed towards data-based business with digital content – mainly games, information services, music and video clips. However, the fact that customers are currently showing limited

<sup>3</sup> See Berger, Sabine et al. (2005): Mediation bei der Standortsuche von Mobilfunkanlagen. Multimedia und Recht (MMR), Heft 7, Munich, pp. 25-27.



**Mobile internet on the advance**

Number of users in Western Europe, million

Projected year-end figures.  
Source: Forrester Research Inc., 2005

10

**Away from stationary IT via broadband****Mobile office not ready to materialise yet****Upgrading of UMTS to HSDPA is a logical step**

willingness to pay for digital content is a challenge. In the content available up until now private users have all too often failed to identify the actual value added that they would consider worth paying for. Sports information might entice subscribers to use broadband mobile services. The providers of mobile information services – from text to video clips – are banking on the football World Cup in 2006 to get the ball rolling.

**Mobile VoIP on the rise also in Germany**

The pressure on Germany's telcos to make a success of broadband mobile communication with attractive services is patently evident. Thanks in particular to the fact that internet telephony (Voice over Internet Protocol, VoIP)<sup>4</sup> has been hailed by some as the next big thing, many a line of defence of the traditional telcos is currently crumbling.

**Mobile broadband: *Cui bono?***

Business users should benefit more than private users from the advantages of broadband technology. Data communication in everyday business life is still largely based on IT terminal devices that are stationary. Desktop PCs or notebooks usually log into corporate networks via fixed access lines. The high transmission rates of broadband mobile communication now make it possible for advanced mobile applications, such as order planning or invoicing, to conquer the market. Field staff, in particular, is keen to see the advent of mobile broadband. Calculations indicate that staff working in the field could save up to about one hour of effective working time per day via broadband services.

All the same, the vision of the mobile office still faces a number of hurdles which are much more complex than the issue of transmission technology. For example, the integration of mobile solutions into existing IT structures often proves difficult owing to the varying system-related demands of makers of user devices, network equipment and software. Desktop applications that have been expanded even slightly may not necessarily transmit to portable terminals. Cooperation between economic agents at all stages of the value chain is required. Given the issues still outstanding, the vision of the mobile office is unlikely to materialise before the end of this decade.

**HSDPA data turbo up and running**

The telcos are driving the expansion of mobile internet. In the role of the traditional technological enabler the European telcos in particular have so far described their mandate as being merely to offer bandwidth. With the 3G networks now installed in many places the network operators are pushing ahead for the HSDPA upgrade. The migration from UMTS to HSDPA is already becoming tangible. HSDPA is already being used by commercial subscribers on the Isle of Man and in Austria. In Germany, too, network operators and handset manufacturers are starting to market their new projects. The manufacturers say they want to place their new handsets in the market by 2007 at the latest.

The HSDPA network will offer a download speed of 7.2 Mbit/s. With this speed the mobile network nearly matches the performance of the broadband fixed network. Potential users can already test

<sup>4</sup> See Heng, Stefan (2005). Internet telephony: media darling still a far cry from the mass market Deutsche Bank Research. Talking point. Frankfurt a.M.

### Using a UTM5 handset as a modem

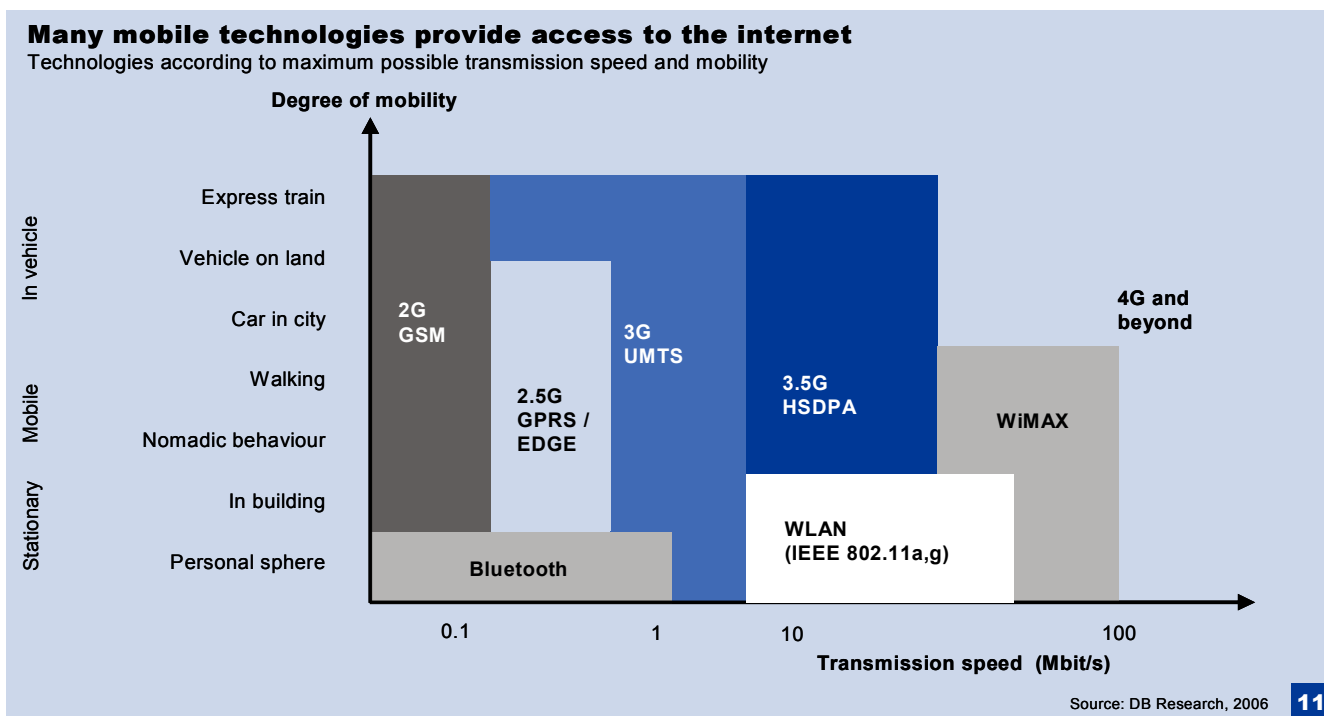
HSDPA at several locations as an alternative gateway to the internet. The aim is to familiarise subscribers with the new ways of using the 3G handset as a modem for broadband services for PCs and laptops. The network operators call this step from UMTS to HSDPA a logical progression. Since HSDPA is predominantly a software-based development, the upgrade from UMTS to HSDPA is a matter of only modest capital expenditure.

### HSDPA approaching its limits

#### Pros and cons will be decided in practice

The HSDPA pilot projects reveal the shortcomings of the technology, too. On the application side, HSDPA is particularly suited to surfing, e-mail and the downloading of video and music files. Video telephony and other applications that require heavy uploading highlight HSDPA's limitations.<sup>5</sup>

Besides the uploading aspect, HSDPA also displays weaknesses in actual bandwidth. The maximum prospective transmission rate can only seldom be reached in practice owing to various factors inherent in the technology. For one, the rate declines rapidly as a function of the distance to the centre of the network cell. Instead of 1.8 Mbit/s only 250 kbit/s can be transmitted at the edge of a cell. For another, HSDPA is a "shared technology". The shared aspect is that all users access the entire spectrum of bandwidth offered. The transmission rate falls rapidly if a large number of users within one cell call up large data packets simultaneously.



### Telcos are familiar with Schumpeter's "creative destruction"

Since telecommunications infrastructure declines rapidly in value, the telcos have basically always been compelled to innovate. And

<sup>5</sup> Applications requiring heavy uploading are based on HSUPA. HSUPA is a transmission technology closely related to HSDPA that allows upload rates of up to 2 Mbit/s.

the upgrade from UMTS to HSDPA will not solve all the challenges faced by mobile communication. Within ten years new wireless technologies such as UWB and WIMAX will have become marketable entities. With transmission rates of up to 500 Mbit/s and an average cell diameter of up to 50 km these advanced technologies will then crowd HSDPA out of the market, too. The process of “creative destruction” postulated by Schumpeter will not stop at the current round of innovative communication technologies, from UMTS to WIMAX, either (chart 11).

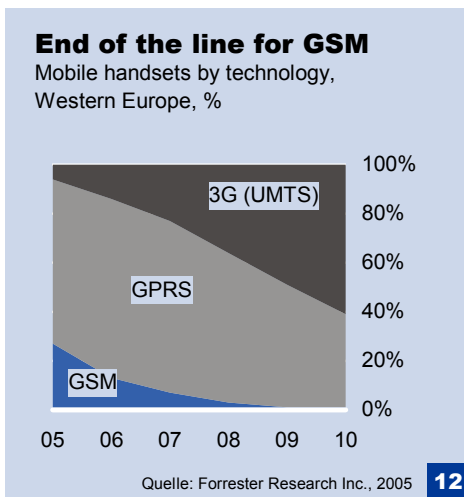
### Conclusion: 3G advancing softly and slowly, with no bells or whistles

The telcos are preparing for the fact that 3G will assume a greater role in mobile communication as it grows in importance. More than 80 commercial 3G networks have already been rolled out around the world. The technology is used by 47 million subscribers, and their number is rising fast. 3G penetration in Western Europe is set to grow to more than 60% by 2010 (chart 12). However, the individual countries show very different degrees of acceptance. Italy and the UK will boast the highest penetration rates, while Belgium and Greece will have the lowest. Germany and France will land just below the Western European average. The large differences are due not only to market-related factors and marketing strategies, but also to political intervention that distorts the market.

Currently, the biggest challenge facing 3G business activity is in offering attractive broadband services. High-performance handsets and broadband infrastructure will pave the way for new services. New services will in turn boost demand for broadband infrastructure. Up to now, ringtones and games have been predominant in mobile business. But with greater bandwidth other more sophisticated applications such as video clips and data and information services will soon have to prove their market viability. As mobile telephony continues to develop, both the potential attacks on the security of data transfers and the possibility that electromagnetic waves may be harmful to human health will also call into question the outlook for the telcos' business models.

In conclusion, it can be said that 3G symbolises the move away from pure voice telephony to a multi-faceted selection of mobile services. Contrary to the negative public perception 3G has become reality in Western Europe. The 3G networks have been rolled out, the 3G business is getting going and content providers, handset makers and telcos are collaborating on 3G-based supplementary offerings. Despite all criticism, 3G is here to stay!

Stefan Heng (+49 69 910-31774, stefan.heng@db.com)



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