

*Wolfgang Groenen*

# Towards the Needs of Third- Generation Systems: Planning the Evolution of the GSM Platform

*This paper gives an overview on the present situation and the future development of cellular mobile services based on the global system for mobile communications (GSM) in Europe and worldwide. It describes market trends and expected changes.*

*The future evolution as described in Phase 2 and 2+ of the standard will open new market segments and new customer groups for the GSM system.*

*As GSM continues its rapid growth, work on next-system generations, like the universal mobile telecommunication system (UMTS), point the way into the next millennium. The convergence of networks, applications and services will offer unprecedented mobile and personal telecommunication services to customers worldwide.*

## Cellular Markets

The success of the global system for mobile communications (GSM) can best be illustrated by the numbers of operators, subscribers, countries and networks on air (Figure 1 and Table 1).

Originally intended to be a European system, GSM is on the way to a world standard. In more than 120 countries GSM is in operation, is

being introduced or has been chosen as the standard.

Based on that success, the market forecasts show a rapid growth up to 230 million GSM subscribers until the end of the century. Worldwide subscriber figures are forecast to reach more than 500 million cellular subscribers at that time.

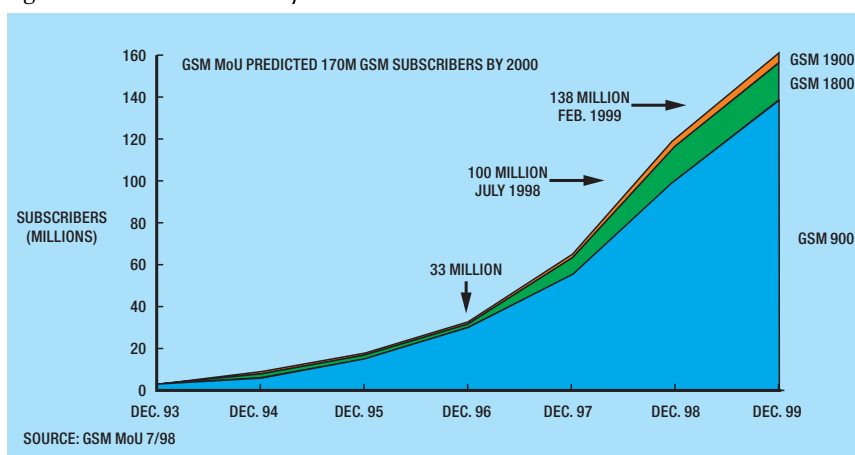
Considering the distribution of cellular subscribers by geographic region, a shift in importance can be

**Table 1 GSM Platform—Statistics of Success**

	Users	GSM MoU Members	Countries	Networks on Air
1991	Trials only	43	23	0
1995	12.5 million	156	86	117
1997	70 million	256	110	239
1999	150 million	323	129	320
2000 forecast	>230 million	>350	140–160	>350

Source: GSM MoU Association

*Figure 1—GSM subscriber forecast*



**Dipl. Ing. Wolfgang Groenen:**

Lucent Technologies Network  
Systems GmbH  
P.O. Box 3538  
D-90327 Nuremberg, Germany  
Tel: +49 911 526 2474  
Fax: +49 911 526 3500  
E-mail: wgroenen@lucent.com

expected as the European and Asia/Pacific markets will gain compared to North America (Figures 2 and 3).

**Future System Evolution**

The evolution of the GSM standard is targeted on enhancements of

- service capability,
- system performance, and
- application area.

A phased approach (known as Phases 1, 2, 2+ of the European Telecommunications Standards Institute (ETSI) standard) retains the overall compatibility of GSM.

Figure 2—Distribution of world cellular subscribers by regions

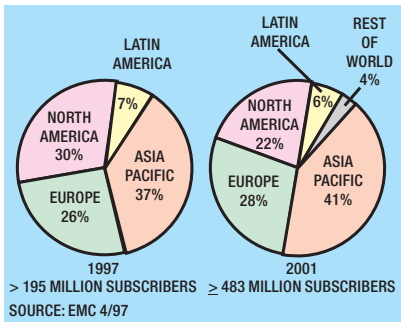
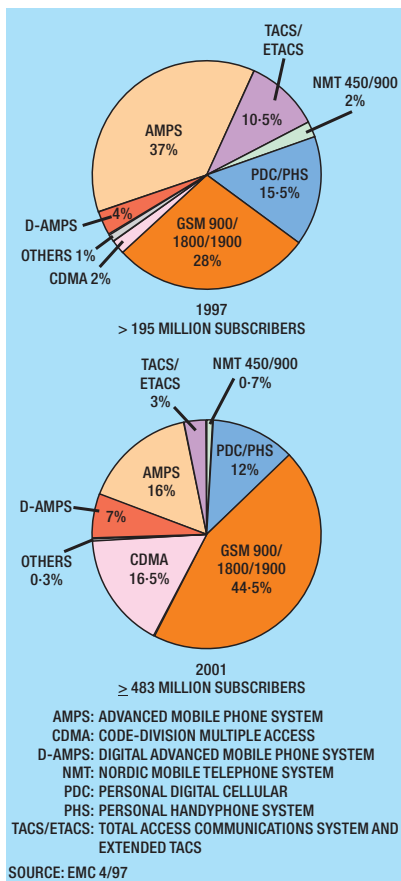


Figure 3—Distribution of world cellular subscribers by technology



The enhancements in Phase 2+ (see Figure 4) include features which will open new market segments and new customer groups, for example,

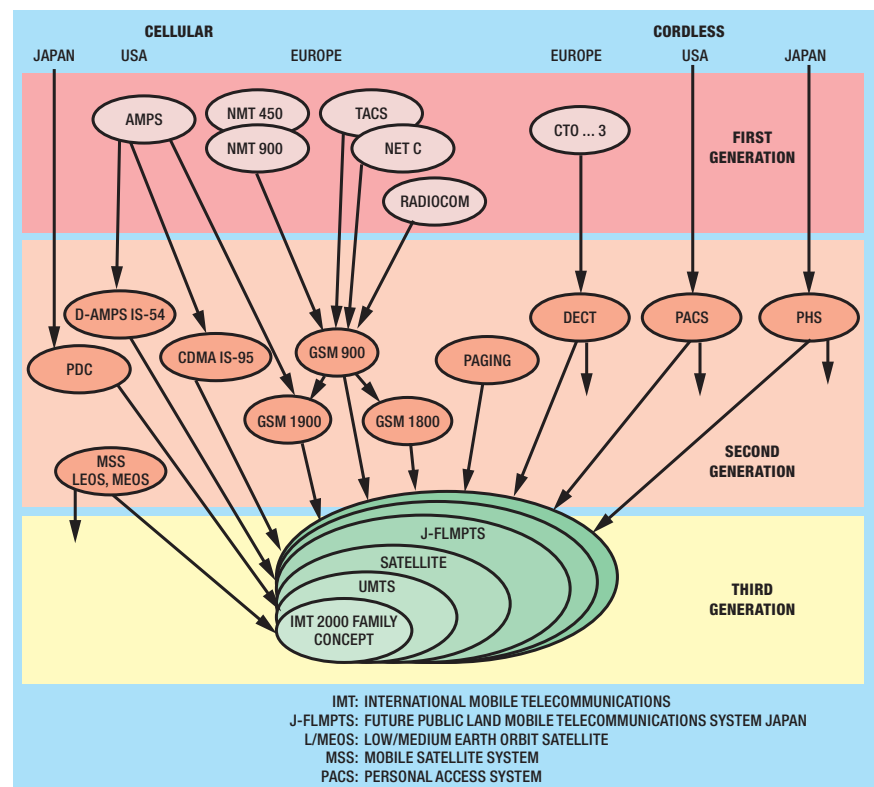
- interworking between GSM and the digital cellular system (DCS),
- interworking between GSM and the digital enhanced cordless telecommunications (DECT) system,
- wireless local loop,
- railway applications, and
- trunking, paging, and messaging services.

While personal communications network (PCN) services in countries using the GSM standard will be based on GSM 1800 as a derivative of GSM 900, the next generation of personal communication service (PCS) networks in USA will be based on both time-division multiple access (TDMA) and code-division multiple access (CDMA) standards. GSM 1900, a derivative of the GSM 900/GSM 1800 standards has a strong position in that market.

An outlook on the evolution of GSM with

- new market segments,
- new applications,
- converging of services, and
- converging of networks

Figure 5—Evolution to third-generation mobile systems



**GSM Evolution—Phase 2+**

- Intelligent network (IN) features (CAMEL—customised applications for mobile network enhanced logic)
- General packet radio system (GPRS) (packet switched data)
- 14.4 kbit/s (single time-slot)
- High-speed circuit switched data (HSCSD)
- Enhanced full-rate speech codec, multi- or variable-rate speech codec
- New supplementary services
- Dual 900/1800 operation
- DECT/GSM interworking; wireless local loop (WLL)
- Optimal routing
- UIC features (railway networks)

Figure 4

shows that GSM will retain its position as the world's leading digital cellular technology.

**Next Generation Systems**

Possible migration paths by which different mobile standards and systems could advance from the second to a third generation are shown in Figure 5.

The work towards third-generation systems in Europe, that is, the universal mobile telecommunications system (UMTS) is driven by research

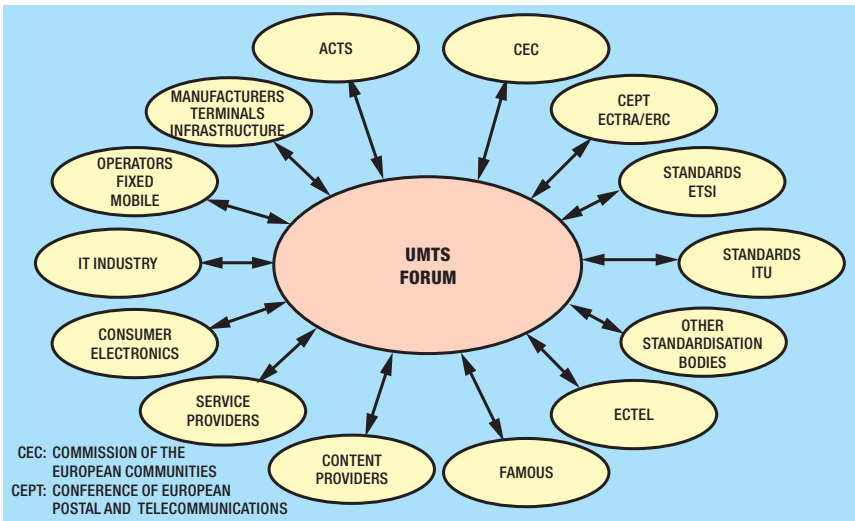


Figure 6—UMTS Forum—spheres of influence

activities in the framework of the Advanced Communications Technologies and Services (ACTS) programme and by standardisation activities in the ETSI/Special Mobile Group.

In parallel, the International Telecommunications Union (ITU) is working on a global base with its IMT 2000 concept. With the Third

Generation Partnership Project (3GPP) process in place now a global standardisation and harmonisation procedure pushes the work forward.

The European activities on UMTS have recently been refocused by the report of the “UMTS Task Force” which worked under a mandate of the European Parliament and Council<sup>1</sup>.

Figure 7—Positioning of UMTS

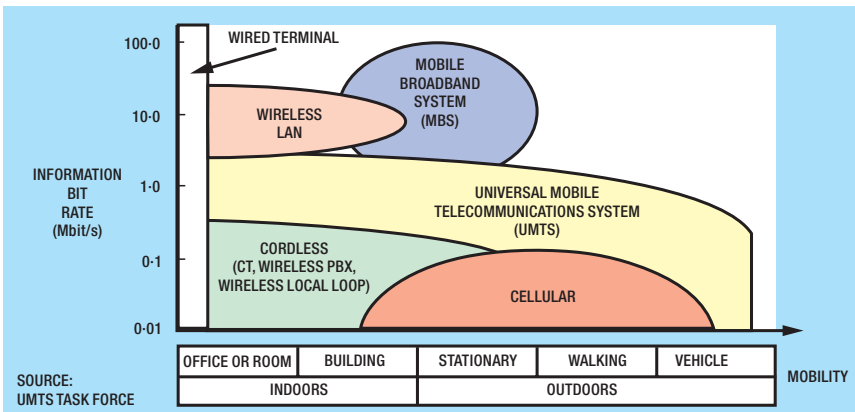
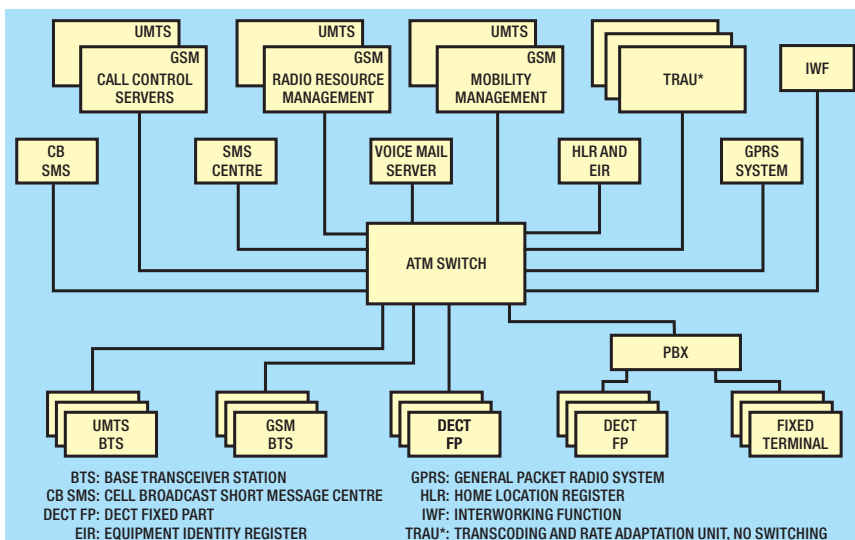


Figure 9—Multi-standard architecture



One of the recommendations was the establishment of the “UMTS Forum” as a central body charged with the elaboration of European policy towards the implementation of UMTS.

The Forum will contribute to better cooperation between all parties involved (Figure 6), taking care of regulatory aspects, frequency needs, market aspects and technology impacts. The tasks include steering the necessary evolutionary steps as well as the necessary common view on fixed and mobile networks and services (Figure 7 and Figure 8). Time schedules up to now show first installations of basic UMTS for broadband needs in 2002 and reach beyond the year 2005/2008 for full UMTS operation<sup>2</sup>.

True personal mobility in future networks can only be reached by obeying some key trends; for example,

- an evolutionary approach from second to third generation allowing a smooth introduction,
- the path from standalone to integrated solutions,
- a migration of fixed and wireless networks in a harmonised way leading to common platforms (Figure 9)<sup>3</sup>

Figure 8

**Content of UMTS Phase 1: Operation Possible in 2002**

**Services**

- **Multimedia:**
  - 144–512 kbit/s for wide area mobility
  - 2 Mbit/s for restricted mobility
- High-quality speech using low bit rates
- Advanced addressing mechanisms
- Virtual home environment for service creation and service portability
- Seamless indoor, outdoor and far outdoor
- Dual mode/band of operation of GSM/UMTS in one network
- Roaming between GSM and UMTS networks

**Terminals**

- Dual mode/band GSM/UMTS

**Access network**

- New base station system (BSS) in the UMTS/FPLMTS spectrum
- Spectrum efficient

**Core transport**

- Evolution of GSM and ISDN
- Mobile/fixed convergence elements

**Evolution in annual phases after Phase 1**

Source: Chairman ETSI SMG

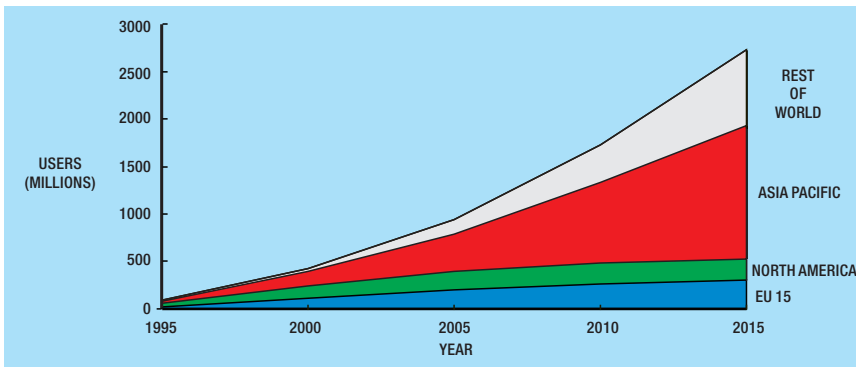


Figure 10—Mobile users worldwide

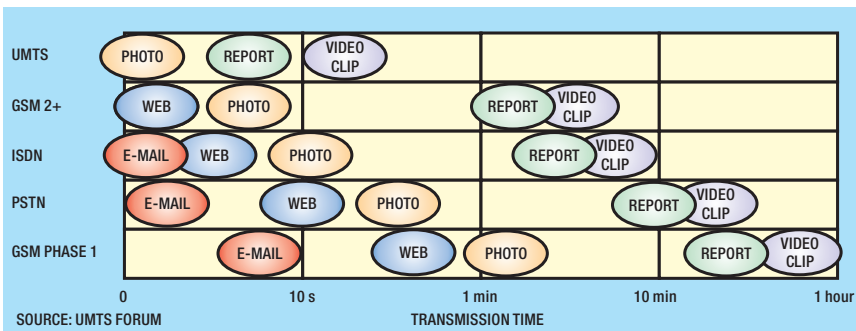


Figure 11—UMTS speed

- universal personal telecommunications (UPT) functionality, and
- convergence of networks, applications and services.

A keyword for personal seamless mobility is *convergence*; for example, convergence of:

- fixed and wireless networks and applications,
- wireline and wireless services,
- fixed and mobile numbering,
- regional and global network access,
- IT and telecommunications, and
- telecommunications and consumer electronics (mobile multimedia).

## Conclusions

Mobile communication services are among the fastest growing market segments in telecommunications. Technological evolution and international standards contribute to that success.

European mobile standards like GSM, are on the way to leading positions in additional regions of the world. Enhancements in the GSM standard enable the penetration of new market segments.

An evolutionary process towards future system generations (UMTS) will be the key for an undisturbed market growth (Figures 10 and 11).

## Biography



**Wolfgang Groenen**  
Lucent Technologies  
Network Systems  
GmbH

Wolfgang Groenen graduated with a diploma in telecommunications engineering. He has more than 20 years of experience in planning, product management and marketing of wireline and wireless telecommunications systems. He is currently the Director Industry Relations GSM and UMTS in Lucent Technologies' Wireless Network Group. For many years he has been Vice President of a section of the German Electronic Manufacturers' Association. He is the Chairman of the worldwide UMTS Forum Manufacturers' Group. He is the author of numerous publications and frequently invited as a speaker and/or chairman to international conferences.

Convergence of networks, technologies and services will be the key to a seamless mobility for the users and the key for opening mass markets in mobile communications.

## References

- 1 UMTS Task Force Report, March 1996.
- 2 UMTS Forum Report No. 8.
- 3 RICHARDS, DEREK; and JARVIS, ANDRE. Lucent Technologies. Network Architectures for Multi-Standard Multi-Band Service Provision, June 1996.