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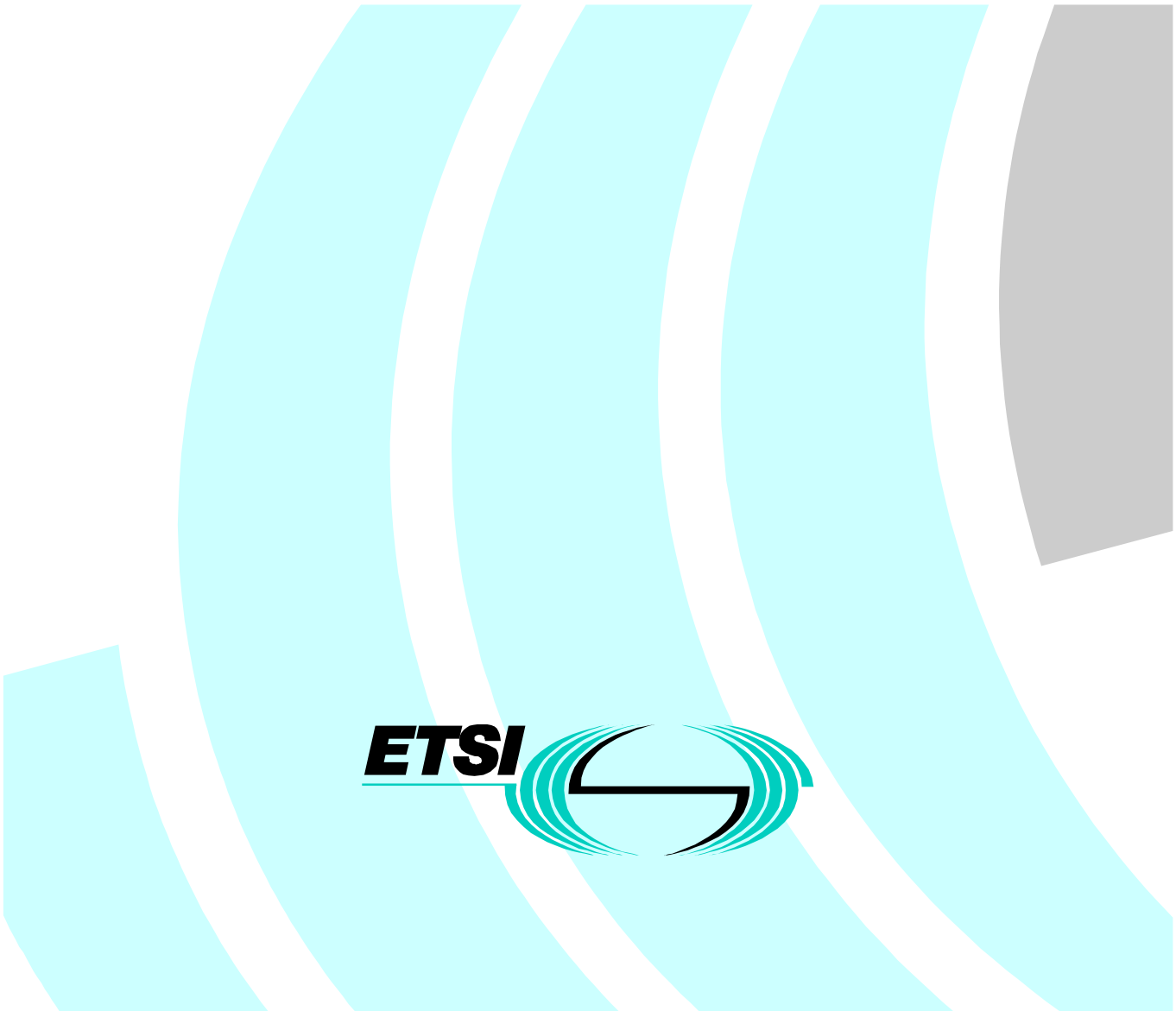
Special Report

Seamless service offering; Giving users consistent access to application/service portfolios independent of access network and core network; Companion document



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Foreword

This Special Report (SR) has been produced by the Architecture Framework Group (AFG) of the ETSI Global Multimedia Mobility Co-ordination Group (GMM CG).

Executive summary

ETSI's report "GMM - Global Multimedia Mobility - a standardization framework for multimedia mobility in the information society" was published in 1996. It addressed a very challenging goal - to provide a standardization framework for the emerging telecommunications systems, services and architectures. It encompassed a broad and diverse set of issues, not all of which were technical, nor appropriate for standardization. As a result, that study had to sift the commercial and political from the technical, then to determine what were the implications for the standardizers and others, and finally attempt to package the conclusions in a coherent, clear and helpful format.

The authors of the present document (intended as a "Companion" to the original report) faced similar challenges. The issues it addresses are equally complex. Even in the short period since the appearance of the original report technology - and the entire telecommunications business - has moved on significantly. Work is well advanced on the definition and development of "Third Generation" mobile systems, designed for multimedia use and destined to have a truly world-wide presence. In addition, the emerging strength of "The Internet" has been considerably more dramatic than could have been realistically imagined just a couple of years ago. Such matters were not taken into account in a distinctive way in the original GMM Report.

That said, the 1996 report still remains valid - it just does not go far enough. So in drafting this GMM Companion Document its authors sought to take an orthogonal view - this time from the services and the user perspective. This is considered reasonable, as much of the telecommunications business is actually based on selling services - not technology.

In fact the nature of the entire telecommunications business is changing rapidly. It is characterized, as never before, by: massive merger and acquisition activity; the creation of global alliances (currently undergoing considerable "churn"); the emergence of many new entrants, most of them without the legacy of existing infrastructures and traditional telecommunications attitudes; a strong and steady convergence of technologies; continued liberalization, underwritten by new regulatory actions; and a growing consumer orientation, especially in the mobile communication market.

The concept of Global Multimedia Mobility sits in the middle of this complex matrix and is impacted strongly by all the above characteristics. Sifting through the many issues, the authors concluded that there are three principal drivers, and the present document focuses mainly on these. Firstly it acknowledges the enormous impact of "The Internet" and the Internet Protocol (IP) on daily lives as well as on technology and network architectures. Related to this phenomenon is the more general evolution of the Information Society, with enormous value now being attached to the ability to access information, whenever and wherever needed, and predictions of massive growth in electronic commerce. Finally there is the continuing convergence between telecommunications, information technology, broadcasting and entertainment (also fuelled by the Internet), as well as convergence between technologies, and between patterns of use.

A further dimension of major significance is the huge growth in mobile communications. This report notes that not only are the numbers of mobile communications subscribers set to overtake fixed subscribers in the next few years, but that the "slow mobility" (typically walking pace) sector is growing at a very rapid pace. Moreover it is in that sector that the greatest demand for multimedia (and thus for bandwidth) can be expected.

These observations lead to a conclusion that core transport networks will be increasingly dedicated to "IP-like" traffic and will have to be designed accordingly, whilst access networks (mobile and fixed) will need to offer the bandwidth and flexibility to connect with a variety of core networks and services. At the service level, consistency of service offerings and presentation, and freedom of choice for users, are seen as being imperative (so far as they are technically feasible). Weaving all these elements together is the need for seamlessness.

The authors have concluded that the basic ideas and key messages behind the original GMM model are still valid. However, the significance of service provisioning was lost in the former model, and it was felt appropriate to revise the model slightly in order to give service provisioning the separation and visibility that it merits.

The ability to fragment networks and service structures (thanks to unifying mechanisms such as the Internet Protocol) then leads to questions about traditional telecommunications standardization. Is it still justifiable to standardize end-to-

end network architectures? The shift of emphasis towards services, mobility and seamlessness should challenge standards bodies to consider possible new opportunities (notably in the areas of terminals, services and interfaces), whilst continuing the difficult task of determining just what should and should not be standardized. ETSI in particular needs to consider future directions for its activities (there appears to be a strong case for new work on optical transport network standards, interface standards and service management, in addition to sustained effort on the Institute's high-speed access and IP-related work). Beyond the standard-writing tasks the entire strategy of ETSI's role in the telecommunications industry must be kept under constant review. Strategic alliances should continue to be forged with global and regional partners (certainly not just standards organizations) in order to maintain ETSI's contribution to world-wide telecommunications. Difficult issues such as Intellectual Property Rights and the promotion of standards must be addressed with energy, and ETSI must also strive to ensure that the services it gives to its members (in reality the creators as well as the users of ETSI standards) remain appropriate and effective.

This report attempts to address many of these issues. Most need to be worked through further; thus the value of this Companion Document and the original GMM report can only be realized when the concepts are turned into actions.

"Vision is not enough, it must be combined with venture" - Vaclav Havel

1 Scope

1.1 Objective

The authors of the present document have analysed the impact on the GMM report and specifically the GMM model in the sprit of the fast changing communication environment. The key goal was to investigate if the GMM report and its model which were widely accepted by the industry still are valid and if not, what additional views have to be considered.

The current trends in telecommunications, and the associated domains of information technology, broadcasting and entertainment, are profound and rapid. To keep its size reasonable and to avoid undue complexity, the present document can only provide an overview of those trends and their many consequences. Behind this study lies a great wealth of more detailed material. Readers wishing to explore the issues in greater depth are referred to that material.

1.2 The definition of multimedia and GMM

It may be useful to be reminded of the following definitions from the original GMM Report:

Multimedia	Information - audio, graphics, pictures, text, full motion video or animation - available as digital data types, allowing utilization of a mixture of one or more data types to be indexed, stored, retrieved and/or transmitted by wireline and/or radio network(s).
GMM	(Global Multimedia Mobility) GMM offers a standardization framework which takes account of existing and emerging systems and enables a variety of services (ranging from voice to multimedia) to become progressively available across an increasing variety of networks.

For the purposes of the present document, it is acknowledged that the end user may wish to access or communicate using voice, facsimile, data, video, music, graphics, etc., either separately or in various combinations at the same time. Furthermore, the user will generally expect networks to be transparent to whatever form and combinations of "traffic" he or she chooses to convey, both now and in the future. This report attempts to define the principal technical and non-technical issues that need to be respected if those expectations are to be satisfied.

1.3 Quo vadis

The telecommunications market is one of the fastest growing and most rapidly changing markets in the world. Concepts such as 'fixed networks' and 'mobile networks' which have been important differentiators in the 1980's and 90's will become blurred in the next generation of services and systems which are due to be introduced at the beginning of the third Millennium. There is also a very marked convergence between telecommunications and information technology (IT), most evident in the impact of the Internet and the rapid development of many types of multimedia services. "The PC" is becoming a commonplace piece of domestic furniture, teleworking is catching on, whilst forms of information that have their roots in the entertainment industry now form part of business and personal communications and are delivered to home and office - and to people on the move - using telecommunications and IT.

These trends have been particularly evident in the place of work and in the home, leading to a consequential convergence between residential and business systems. Electronic commerce has still to achieve widespread acceptance (especially in the retail sector), but even now "e-commerce" between businesses is in the multi-billion dollar range, with massive growth predicted in the next few years. Finally, the adoption of mobile telephones and other mobile devices has taken place astoundingly rapidly around the world and users expect this mobile capability (and the services that go with it) to follow them wherever they go - whether they are global travellers or just visit the local shop.

From a user perspective, one thing is very clear: telecommunications network technologies and architectures have little significance, except to the extent that they enable or constrain the availability of services and mobility. This is a major change in perception from the days when users understood that different services often meant different networks. Now, thanks to trends such as the creation of mobile telecommunications as a consumer market, users expect (as noted in the original GMM Report) individualized products and services at mass-market prices. Such has been the success of this approach that many users of mobile services use their mobile terminals in preference to the fixed network, even if their mobility requirements are minimal.

Thus the modern emphasis is on applications rather than network architectures: from the perspective of an application, the various networks are - to a large extent - simply different physical implementations of information transport between endpoints. In practice it is not quite that simple, of course. Nevertheless, core networks are basically transparent and intelligent, and therefore flexible. That really put the focus on the access networks as the variable element in information transport.

The authors of this study have analysed the original GMM report and the model presented there against a number of drivers that appear to reflect current and predicted trends. The first three in the following list were selected as having the most significant impact on GMM:

- rapidly growing importance of Internet services to the user (both residential and business);
- convergence of technology for telecommunications, data communications and consumer products (both in the private and public arenas);
- globalization of information;
- rapid growth in the number of mobile subscribers, especially among users who only require very limited mobility;
- rapidly growing interest of the mobile community for data and information services;
- competition between players using different infrastructures (CATV, railways, electricity companies, telecommunications operators, etc) driving prices rapidly downwards;
- continued shortening of technology life-cycles, resulting in dramatic reductions in the time available to amortise investment costs;
- differentiation of service offerings based on Quality of Service (QoS) and security;
- demands for genuine customer service management based on service level agreements;
- overlap between regulated and non-regulated areas of communication.

1.3.1 Rapid growth

Overall, the trends are strongly towards multimedia and mobility in all their different forms, reflected in the title of the original ETSI report - "Global Multimedia Mobility (GMM)". The telecommunications service familiar to businesses and the general public is in the process of major change. Of particular note are:

- rapid growth in information services, fuelled particularly by the Internet and "World Wide Web", is causing explosive growth in the proportion of data and mixed media traffic;
- new applications are being developed which include broadband data streams, in particular video;
- acceptance of new information services (even though these are currently limited by the low data rates that present affordable technologies provide on the copper cables connecting most households today).

Predictions for traffic and customer growth show massive increases in the coming years, notably in mobile services. For example:

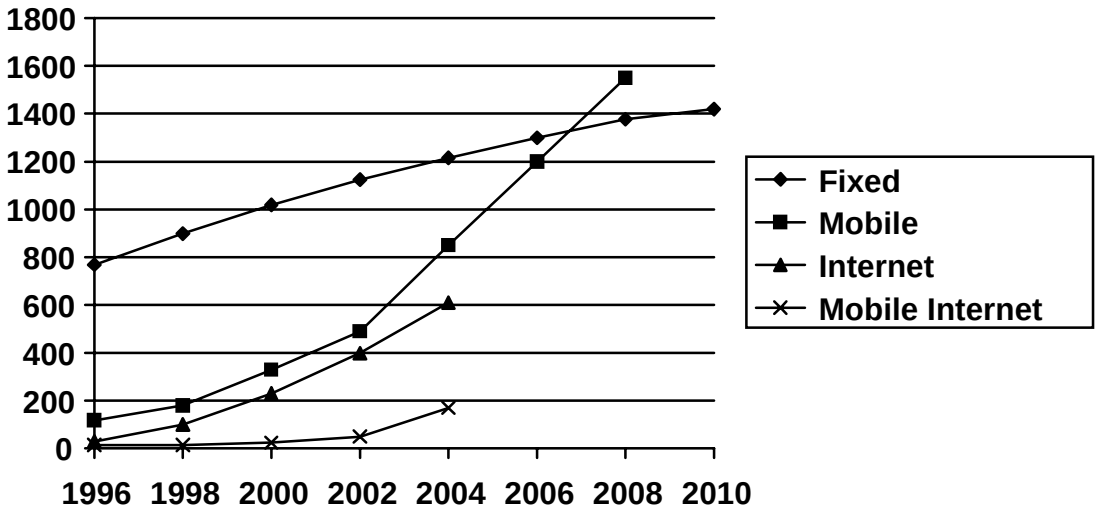


Figure 1.1: Mobile telephone and Internet growth (source: Ericsson and others)

The above chart is derived from multiple sources. Although the source figures differed somewhat the implications are quite clear: continued strong growth in mobile, Internet and mobile Internet, with an eventual "cross-over" between fixed and mobile. It should also be noted that mobile figures have been consistently underestimated!

Internet growth: The growth in the use of (and reliance upon) the Internet is an obvious trend, and correlates with the increasing value placed on the timely access to information. There will be an ever-increasing demand for Internet services from mobile and fixed users (bearing in mind also that the distinctions between "mobile" and "fixed" are disappearing).

Use of Mobile networks increasing for voice services: Rapid growth in the number of mobile subscribers is expected to continue for the foreseeable future. The main use remains voice communication, with many users opting for mobile services simply for the convenience they offer. These users may not be highly mobile but ***the ability to move and retain familiar services is proving a big attraction and 3rd Generation systems (such as UMTS) networks will bring "Mobile Internet".***

Mobile terminals are now treated as consumer products: For some poorer and developing countries it is cheaper to bypass the fixed network (which is often in a dilapidated condition) by installing wireless networks. This is especially the case for access networks whereby "instant" deployment of services becomes feasible. The immediacy of many other of the world's consumer markets leads to such expectations in the telecommunications market.

Use of Fixed networks increasing for data communications: The recent trend for increasing use of the fixed network for data (Internet) communications traffic is also expected to continue. As new transport networks are installed, or existing ones upgraded, this phenomenon ensures that their capabilities will be optimized for data communications. That suggests ***more and more optical fibre optics and packet/cell-based transport mechanisms (i.e. ATM / IP based networks)***. [During the preparation of the present document news about the creation of two major new transport networks was received (there may be others). The US energy company Enron Corporation announced plans to build a 30 000 km fibre IP network, whilst "Project Oxygen" proposed a 168 000 km global undersea fibre network. Investment on this scale is an indication of the huge value now attached to the transportation of IP-type traffic.]

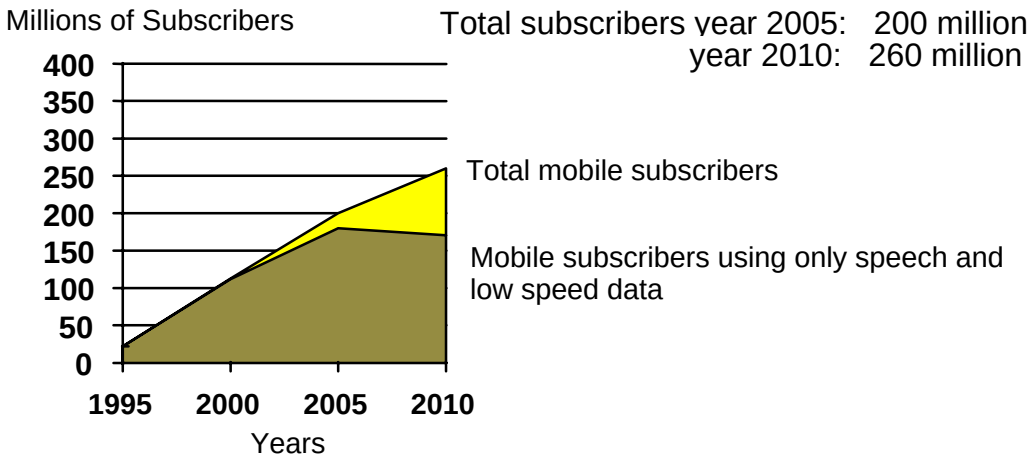


Figure 1.2: UMTS and GSM/DECT Subscriber Forecast (Private and Public) for the 15 EU member states (Source: UMTS Forum)

The above chart (which relates only to the 15 European Union countries) shows a continued and dramatic growth in the number of mobile subscribers. It predicts that, by the year 2010, around 65% of mobile subscribers will still expect to use mobile communications only for speech or low-speed data, whilst about 35% of mobile subscribers will be demanding the ability to access multimedia information via some type of high-speed data access. And although this prediction only refers to the present European Union, there is every reason to believe that the trend will be reflected world-wide.

In any case, the figures should be treated with care. "Fixed" simple voice based telephony services will move to "mobile", while the take-up and growth of the high-speed mobile data communication services will depend on the rate of introduction of 3rd Generation mobile networks and the cost of high-feature mobile user terminals (considered more as consumer communications appliances).

Although some multimedia services will be standardized arrangements of teleservices (e.g. multi-party video-conference call) the expectation is that the successful exploitation of teleworking, telemanagement, teleprocessing and similar business practices will depend on customised and dynamic multimedia communication. This demands the flexible allocation of resources (up to 2Mbit/s) with an unpredictable and probably asymmetric transmission bit-rate. That will apply for both fixed and mobile networks (as stated earlier, such a distinction between such network types is expected to disappear anyway).

A further example of rapid growth can be found in the area of electronic commerce.

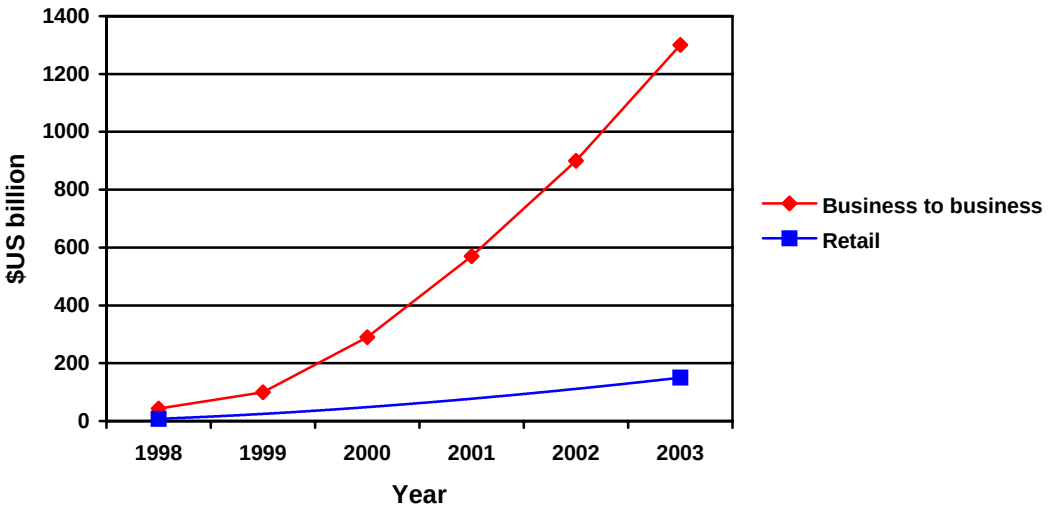


Figure 1.3: Electronic commerce predictions (US only)

Statistics from the Forrester Group (Cambridge, MA, USA) indicate that, in 1998, $43 billion business-to-business sales were conducted between American companies over the Internet. This figure is predicted to reach $1.3 trillion by the year 2003, representing 9.4% of corporate purchases in America.

Companies such as BOC Gases, Harley-Davidson Inc., and Mobil Oil Corp., already make extensive use of the Internet for business e-commerce, citing major savings in ordering costs and an almost total elimination of errors. Added benefits were claimed because of the automation of the entire ordering, shipping and stocking processes.

The business-to-business activity already outstrips the more visible retailing of consumer products, such as books, CD-ROMs, computers and the like on the Internet, and, as can be seen in the chart, will far exceed the consumer retail activity in coming years. Nevertheless, the retail sector is not insignificant.

There would appear to be important standardization issues to be considered here: for example, standards for electronic signatures and business-related secure communications in general. Within Europe - at least within the "Euro-zone" - there is a need for harmonization of security and payment systems. Studies into standardized information systems have been running for many years, in the belief that such standardization is imperative for global trading. However, this has led to question whether "standardizers" will be able to "deliver the goods". If there is no specific initiative, then proprietary solutions will prevail in the marketplace.

These observations may be interpreted as meaning:

- that telecommunications networks need to evolve to offer the capacity demanded by users of such services;
- that the networks and their supporting mechanisms provide the necessary mobility management features to allow users to roam globally whilst retaining an acceptable quality of service and, as far as possible, the same range of services and facilities as enjoyed at the user's home location;
- that application driven networking means that networks have to be designed for application support and not the other way around;
- that the administrative aspects of telecommunications, such as billing, also support mobility as well as coping with the introduction of new services and facilities;
- that government and other regulatory actions promote, rather than inhibit, the availability of such services - and the products that will use them - globally;
- and finally, that the support to the user, including the man-machine-interfaces, facilitates the deployment, use and understanding of an increasingly complex range of services, features and options.

However, perhaps the most significant message of all (at least to standardizers) is that users, industry, etc., will no longer wait years for standardized solutions if adequate proprietary ones are available now!

1.3.2 Mobility trends in users' behaviour

Lest we should develop a picture of the entire world frantically scurrying to and from, permanently linked to multimedia services, we should consider some other expectations of the multimedia market (see 35) in Bibliography):

- many more users of mobile services will emerge, but many of those users will require only very limited mobility;
- user bandwidth will increase, especially among the less mobile users;
- radio transmit power levels will decrease.

The rather surprising suggestion that the average user's mobility will decrease is due to a number of factors. For instance, it is expected that multimedia services are more likely to be used on the pause, rather than on the move. This decrease in mobility is also a continuation of a current trend, i.e. users do not move because they have mobile communications, mobile communications are appealing even to increasingly less mobile users. However, some users, such as those in vehicles, will expect to use multimedia communications with high mobility and, in the longer term, new mobile applications, such as Road Traffic Informatics, may be designed to exploit high mobility multimedia communications.

This new perspective on mobility is simply a continuation of an existing trend. When mobility first became a reality, it appealed to (and was really only available to) those users who are very mobile themselves. Increasingly however, the

benefits of mobility have reached users who are not particularly mobile. This phenomenon may be described as "slow mobility".

The following chart provides a useful illustration of different types of users and the mobility they exhibit. The "slow mobility" users are those at the lower left of the diagram, and represent a strongly growing market.

Private Mobile Radio (PMR) systems serve many of the needs of the vehicular professional users (trucks, emergency and security services, taxis, etc) at the centre of the chart.

The truly global users (towards the top right) need to be able to access services even where there is no mobile or fixed access available: *their needs may be met by satellite systems*. Such users would be prepared to pay a premium for services and would be willing to have multi-standard terminals.

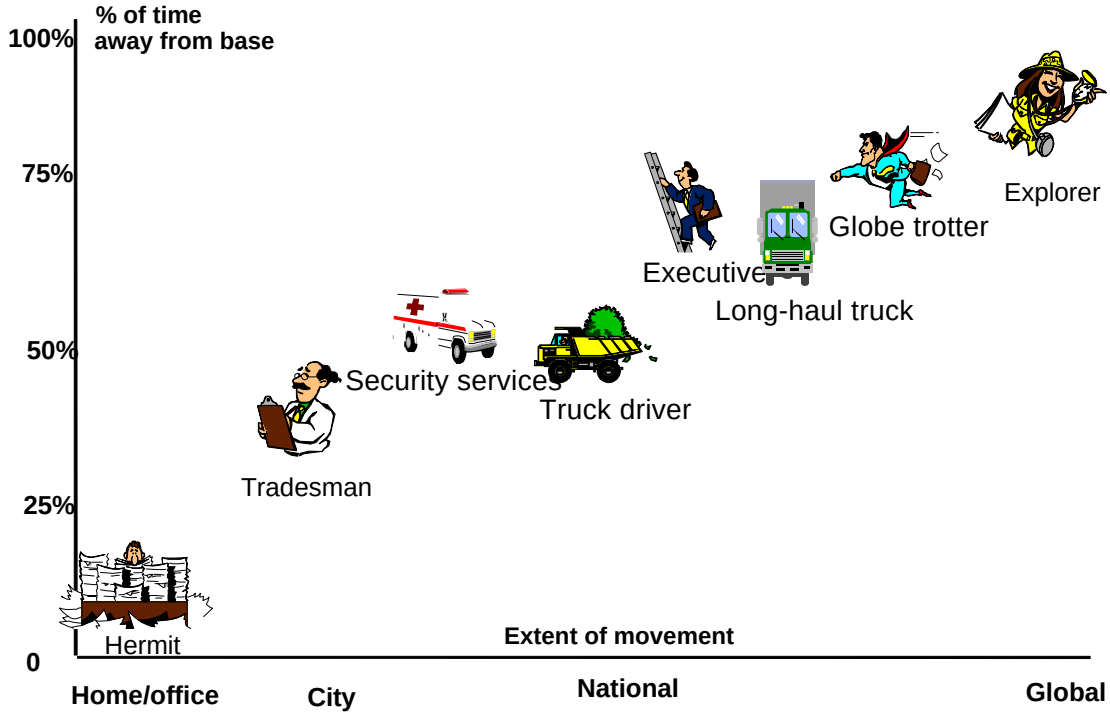


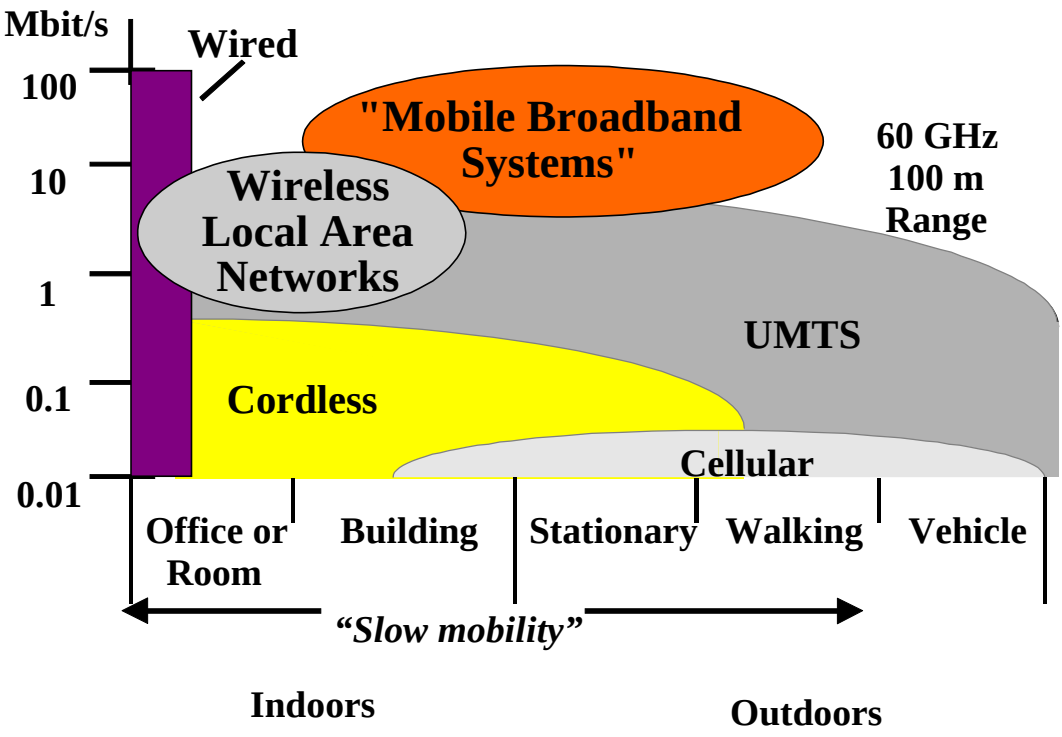
Figure 1.4: User mobility

This broad spectrum of different users implies a need for operators to offer a range of different service profiles, with different Qualities of Service and, most probably, based on a variety of technologies. Growth in the "slow mobility" sector supports a reduction in cell sizes to support higher overall traffic levels and higher bandwidth services. This in turn leads to a reduction in overall radio transmit power levels as well as reducing the power consumption of the mobile terminals.

1.3.3 Greater bandwidth but less mobile?

The above trends, over time, will result in the majority of future mobile telecommunications traffic occupying higher bandwidth and being to/from relatively immobile terminals. That is not to say that there will not still be highly mobile users. However, those users will be in the minority and their traffic will be lower bandwidth than the less mobile or stationary users using higher bandwidth services at lower radio transmit levels. Furthermore, as the use of mobile services increases, particularly the use of the higher bandwidth multi-media services, the need for efficient spectrum utilization will become particularly important. The use of pico-/micro-cells, particularly to carry traffic to/from stationary and pedestrian terminals, is an obvious way of achieving this.

The following figure illustrates the respective capabilities and typical use of several current access technologies. It will be seen that a large element of the technologies portrayed will cater for users who are either static or moving at low speeds - the "slow mobility" users.



NOTE: Figure 1.5 is illustrative only. For instance, DECT can support bit-rates of up to 2.88 Mbit/s per carrier, and HIPERLAN will provide up to 36 Mb/s at walking speeds.

Figure 1.5: Typical capabilities and use of different technologies

1.3.4 The impact of the Internet Protocol (IP)

The "information explosion" which started several years ago and continues to unfold has given most users a totally new perspective on information acquisition and use. Web technologies, software languages, and networking protocols have all contributed to a relatively inexpensive and flexible means of both obtaining and providing information of all types.

Recognizing the enormous value in "being informed", the business community has taken the lead in demanding access to information, even on the move. Applications and services based on the Internet Protocol (IP) have taken centre stage and this now means that communications networks, whatever form they take, have to be able to carry IP end-to-end.

There is a strong conviction in the telecommunications industry that:

- most of the transport capacity available in the world's telecommunications networks by the year 2003 will be occupied with IP based services;
- IP will be a universal interface for the provision of seamless access to application and service portfolios;
- Intranets and Extranets will grow faster and become even more significant than the Internet.

IP may not be the best technology but it has been widely adopted by the industry. The explosion in its popularity and its wide adoption can be attributed to the following:

1) IP is a network independent technology;
2) Customers want seamless services;
3) Customers increasingly expect to have the ability to negotiate Service Level Agreements (SLA) and differentiated Quality of Service (QoS) guarantees, and not just to be bound by a predefined, end to end network QoS. Moreover, they do not expect to pay for more capacity and service guarantees than they need;

4) IP can offer secure transactions for those who need them at a client/server level or at a network level (Security is mainly a concern for users and service providers. However, basic security is a general network provisioning issue.);

5) Packet switched networks are much more efficient than circuit switched networks for non real-time services;

6) Accessing IP networks over today’s legacy systems is relatively straightforward as these networks are totally transparent for IP services and there is no requirement for backward compatibility (at least for modest bandwidth requirements).

It can be concluded that IP has not only become a key technology at the services and application layers for multimedia service offerings, but is also gaining increasing importance for networking. IP-based packet switched technology is expected to progressively replace existing services based on today's legacy.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ITU-T Recommendation Y.100: "General overview of the Global Information Infrastructure standards development".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

3GPP	3rd Generation Partnership Project
API	Application Programming Interface
ATM	Asynchronous Transfer Mode
AU	Access Unit
B-ISDN	Broadband Integrated Services Digital Network
BSS	Broadcasting Satellite Service
CATV	Community Antenna Television
CEASD	Common ETSI Approach to Standards Development
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
COST	Co-operations projects of Scientific and Technical research
DECT	Digital Enhanced Cordless Telecommunications
DG	Directorate General (of European Commission)
DWDM	Dense Wavelength Division Multiplexing
EBU	European Broadcasting Union
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
GMM	Global Multimedia Mobility
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
HF	Human Factors
ICT	Information and Communication Technologies
IETF	Internet Engineering Task Force
IMT-2000	International Mobile Telecommunications 2000
IN	Intelligent Network
IP	Internet Protocol
IPSEC	IETF IP Security Protocol Working Group
ISBN	International Standard Book Number
ISDN	Integrated Services Digital Network
ISSS	(CEN) Information Society Standardization System
IT	Information Technology
ITU	International Telecommunication Union
ITU-T	ITU Telecommunications Standardization Sector
LAN	Local Area Network
MBS	Mobile Broadband Service

MMI	Man-Machine Interface
PC	Personal computer
PIN	Personal Identification Number
PMR	Private Mobile Radio
PSTN	Public Switched Telephone Network
PTT	Posts, Telegraphs and Telephones public operating company
QoS	Quality of Service
SMPTE	Society of Motion Picture and Television Engineers
S-PCN	Satellite Personal Communication Network
TDD	Time Division Duplex
TE	Terminal Equipment
TINA	Telecommunications Information Networking Architecture
TIPHON	Telecommunications and Internet Protocol Harmonization Over Networks
TMN	Telecommunications Management Network
TSG	Technical Specification Group
UIM	User Identity Module
UK	United Kingdom
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Terrestrial Radio Access Network
VCR	Video Cassette Recorder
VHE	Virtual Home Environment
VPN	Virtual Private Network
WAN	Wide Area Network

4 The business perspective

The telecommunications business is huge, and investments are enormous. Technical solutions have to be right, but politics, regulation, geography, culture, economics, all have a part to play in the market decision-making, and standards-oriented decision makers will do well to remember that!

Standards - only a business tool

The hard truth is that standards are only a tool for achieving business success: standardization has thus to be put in the context of business dynamics. Standardization as a business tool can help to lower the level of market "uncertainties" and lower the production and transaction costs. Within telecommunications, standardization enhances the possibilities of interconnection and interactions - needed for the complex telecommunications systems if seamless services are to be provided.

Global dimensions

Most markets in the world (not just the telecommunications market) are being increasingly dominated by a small number of large, global players, in many instances consortia of former market leaders. Economies of scale are now perceived as only being realisable in markets that have global dimensions - what place now for national, or even regional, standards? Within telecommunications, mostly at the other end of the business spectrum, new players are arriving without the 'baggage' of established network infrastructures and traditional thinking.

Within the global networked economy, corporate culture is changing rapidly towards short-term "share-holder" value - as pointed out in the original GMM report. These changes result in an environment of mega mergers so as to have a big enough presence to compete globally. Return on investment timescales are also falling rapidly: for backbone networks it used to be around 20 years, now it is down to about seven. For access networks it is now typically three years, whilst for terminals it is now zero - they are treated as consumer products and are offered at very low prices (or even given away free) in order to secure subscriptions to services.

Trade agreements at the regional and global levels (World Trade Organization, the harmonized EU market, the Trans-Atlantic Business Dialogue, the North America Free Trade Area and so on) largely remove the need for national "champions" as the means of doing trade. This in turn encourages a rationalization of the manufacturing base - it is more cost effective to have one big efficient factory then several small ones in each country.

In this environment standardization is again important: standards are essential tools for to lowering barriers to trade and allowing free flow of goods and services as enshrined in the EU directives and WTO and bilateral trade agreements.

Information is valuable

Timeliness of information is now seen as an important source of competitive advantage in all sectors. Access to data and information services (including the Internet) whilst on the move is being demanded increasingly and is leading the cultural shift towards a "web based" digital world.

This is also leading towards a "Knowledge Based" economy, where knowledge (IPRs) are leveraged to obtain competitive advantage. IPRs are becoming embedded in products and services. In many instances specific IPRs are declared too late or simply declared without any further information about licensing - this can jeopardise or waste standardization efforts. The attitude of the IPR holders can make or break particular markets.

Uneven regulation

Telecommunications remains one of the most regulated businesses in the world, although it is not the only one. Regulation is not always "negative" - it has been the means of opening up new services (and consequently new business opportunities) in many countries. However, it has to be recognized that regulation in the telecommunications sector is somewhat uneven, both from region to region as well as between different technologies. For instance, price caps currently tend to be applied only to fixed networks, not to mobile networks, creating differences in the respective commercial environments. Moreover, the regulatory environment in Europe needs harmonized standards, but competition between standards may be provoked by the World Trade Organization or arise from bilateral agreements.

The societal needs of consumers, including the aged and disabled, as well as health, safety and environmental protection, cannot be ignored. Whether by regulation or voluntary adoption, these also require standards to ensure a certain level of conformity by the market players.

The world's regulatory processes remain unclear about the need for conformance testing, type approval, certification, etc., and whether regulation or self-certification is the better solution for safety, protection, Quality of Service and so on. What is clear is that standards have an important role in these processes, however they operate.

5 Change drivers

It can be seen that there are very many factors leading to the changes that are being observed. Some are the result of technological development, others come from new opportunities to integrate previously separate services and market sectors, many are the result of major business initiatives, whilst others come from political and regulatory changes around the world.

The "Information Society" will prosper on the convergence of telecommunication, entertainment, information exchange, digital video and commercial process services. It requires the integration of audio, video and data communications with computer-based intelligence and needs the support of an intelligent, interactive, communications highway. Access to that highway must be possible wherever the user happens to be. Not all access will be mobile, but that which is must accommodate the global shift away from voice-band telecommunications towards integrated, interactive, 'broadband', multimedia communications.

A UMTS market forecast study for the EC (see 24) in Bibliography) concluded "that the development of a mass market for mobile multimedia is entirely dependent on the development of a mass market for fixed network multimedia." "It is also clear that many, if not all, of the services developed and taken up by fixed network multimedia users will be candidate services for mobile multimedia, besides those that will be developed specifically for mobile". Furthermore exposure to these fixed services "combined with increasing demands on mobility, will create expectations for delivery of these services to users wherever they are". The report suggests that by 2015 we can expect that "As far as the customer is concerned, there will be no distinction between fixed and mobile services." The least to be expected is automated adaptation of the terminal appliances to the respective network, be it fixed or mobile.

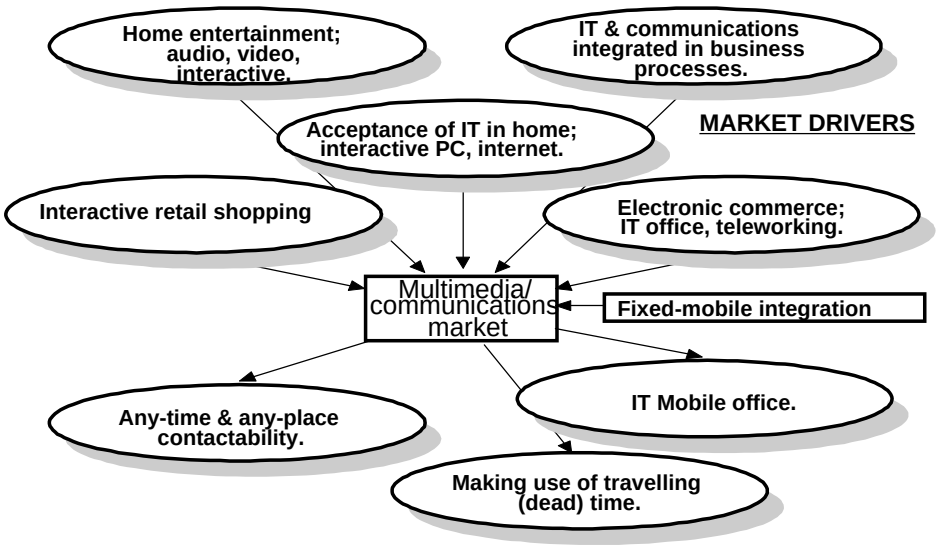


Figure 5.1: Information Society Drivers & Movers, (see 26) in Bibliography)

The above therefore proposes a scenario, shown in figure 5.1, in which the fixed network nurtures the multimedia market, adds personal mobility, and, following effective fixed-mobile integration, mobilises the full benefits of terminal mobility.

The authors of the present document believe that the above trends, influences and projections point to three principal drivers for GMM, as stated earlier:

- the rapidly growing importance of the Internet Protocol (IP) in the delivery of multimedia;
- convergence of technologies and the integration of networks and systems (fixed/mobile, business/residential, public/private, telecommunications/data communications;
- globalization of telecommunications and information services, accompanied by the customization of services.

The rest of this clause discusses the three key drivers and the (standardization-related) requirements arising from them. Additional (lesser, or not directly standards-related) issues are considered in the following clause.

5.1 Implications of the drivers for GMM

5.1.1 The impact of IP

The adoption of the Internet Protocol (IP) underlies many of the very significant changes that can now be observed in domains of telecommunications and information technology. It also impacts strongly the associated domains of broadcasting and entertainment, and is a key driver to the much-reported convergence of all four domains.

Although not the optimum solution to every requirement (IP *does* have its limitations and weaknesses - it is being asked to do things it was never designed for), IP has brought many welcome - and some less welcome - changes to communications. (It should also be noted that, in situations where radio is used, conversions between IP and radio protocols - and *vice versa* - are involved. In such cases the goal is to provide a *perceived* IP end-to-end, rather than true IP.)

5.1.2 Convergence

Convergence is occurring on many levels: the goal should be to ensure that customers receive seamless service as they use 'converged' products and as they pass from one service and/or network to another. To an extent this can be achieved by the use of common, network-independent, protocols such as IP. But there is also a need to ensure that services, features and so on also remain available to users, so far as this is feasible, as they make use of this new liberty.

Issues such as security and Quality of Service surface in such as scenario, and there may be need for a certain level of standardization and regulation in order to ensure a 'minimum set' of services and performance levels. At the same time, this is a crucial area for service providers and others to develop competitive advantage, so the amount of standardization and regulation should be restricted to the lowest possible level.

The provision of services through multiple inter-connected networks leads to three general requirements:

- Wherever practical and appropriate, the end user should have access to a consistent and coherent set of services and features across the different networks. To this end it should be possible for a user to use a single set of identities to access the same services from different networks.

- Inter-system roaming will be required to allow the users of terminals to use the services of different public and private systems without the need to have a separate subscription with each network. For roaming to take place between the different systems, features required include the availability of appropriate terminals and secure location registration, authentication, encryption and charging mechanisms. For calls in progress intra-system, and possibly inter-system, handover will be required.

- The means of network selection, and the presentation of options to the user, will need careful consideration and design. Whilst automatic selection may be appropriate in many situations, adequate and clear information will have to be provided to enable the user to select the network most appropriate to the user’s specific current circumstances.

Multimedia services, particularly IP based services, are expected to result in asymmetric traffic flows. No doubt this asymmetry will be most pronounced where higher bandwidth services are in use - and, according to the mobility trends discussed earlier, that may be mostly among the 'slow mobility' users. The degree of asymmetry and its variation with time or location, however, is not clearly identifiable as yet and the ability to handle it in as flexible a manner as possible will be important.

5.1.3 Globalization of information

Globalization of information brings an additional dimension to the convergence issues discussed above. From a user perspective those issues remain the same - access (real or apparent) to the same services and features as 'at home'. For operators and service providers, however, the matter becomes more complex with globalization. Not only are there technical aspects to be addresses: issues of a commercial and regulatory nature may also have to be accommodated (roaming agreements and the like). These non-technical aspects are considered later in the present document.

As an example of the technical challenges of globalization one may consider the Virtual Home Environment (VHE) concept of the 3rd Generation mobile systems. This is a concept of supporting mechanisms that enables customized services to be made available to the user from different networks and terminals, irrespective of geographical location

and type of network (e.g. mobile, fixed). The concept has been developed within ETSI, the ITU and other standards bodies and is expected to represent the future delivery mechanism for personal telecommunications services

The key objectives of the VHE are to support and enable:

- Customised/personalised services;
- Seamless set of services from the user's perspective;
- Global service availability;
- Common service set for all forms of access (e.g. fixed, mobile etc.);
- Common service control and data independent of type of access.

The standards required to support these objectives need to be applicable to all types of future network as well as providing a framework for the evolution of existing networks. Additionally they need to have global significance so that users can experience their services irrespective of their geographical location. This implies that all networks will need to have certain common characteristics (which may require standardizing), and that regional variants of those characteristics must be avoided.

5.1.4 The implications in more detail

5.1.4.1 Unbundling of services

Technologies such as IP support the separation (or "unbundling") of services from the transport network - a major break from traditional practices. IP is independent of the underlying network infrastructure and forms a bridge between client and server applications. Because of IP's network-independent nature, IP based services have the ability to be accessed via a wide diversity of network types, including existing networks, such as "voice networks", "data networks", "broadcast distribution networks", "radio networks", and so on.

It is not just the adoption of IP that has stimulated the extensive unbundling between services and network access technology in recent years. Developments in technology and changes in the regulatory domain have done much to stimulate competition in the access domain. The result has been greater choice and flexibility for users, including increased support for mobility. IP, although not a fundamental component of those changes, is serving as an excellent partner.

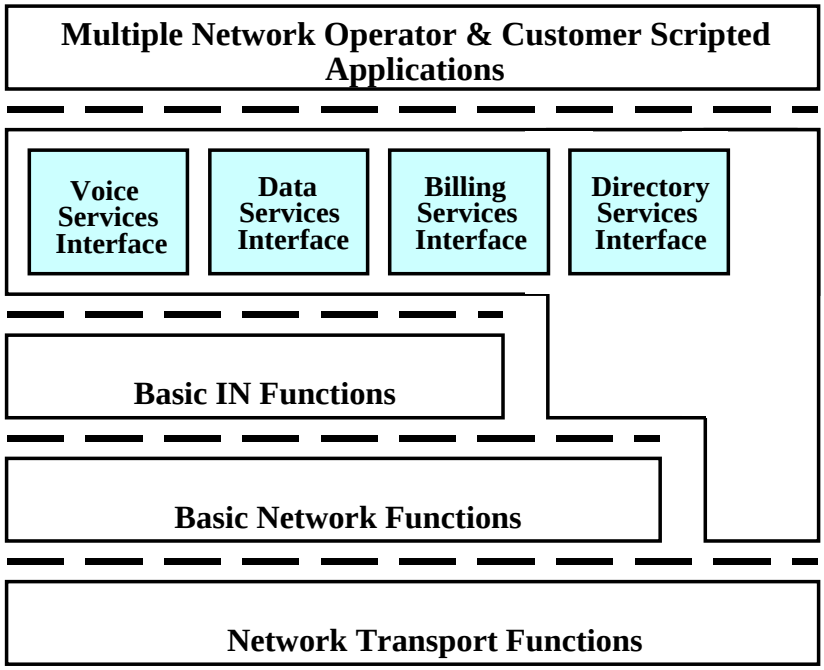
A platform model can be a helpful tool for separating technology specific issues from end-to-end service issues, which can then be standardized independently. It also helps to distinguish between those activities within the platform that need to be subject to standardization from those that are added value items (and therefore open to differentiation). Such a model may be based on IP.

This requires:

- an end-to-end protocol that will run over all network technologies (the Internet Protocol, IP, is a good example, especially for multimedia services);
- mapping between that protocol and the specific technology platform, including physical, link and network layer allocation and control of bandwidth for example.

Each technology platform then simply requires a single interface (or Application Program Interface, API) to be defined to interface with the inter-networking protocol, rather than **n** gateways for interworking with **n** existing technologies. This can be seen in figure 5.2. This model shows a number of APIs at different layers which hide the technology specific details of the layer below.

This approach allows APIs, as "vertical interfaces"), to be used to define the boundaries between functional areas, commercial domains or any level of the service architecture where a service provider might consider the positioning and implementation of a differentiated service. Equally, it allows the choice (if wished) of transport network; a choice that should, in most circumstances, be transparent to the user of the application.



Note: Dashed lines represent APIs

Source: ETSI NA8

Figure 5.2: Platform Model

The design of the public network of the future should based on a multiservice platform, independent of the service/application layer. Of course, the new network has to co-exist with existing legacy systems for as long as they remain. This combination will give users the ability to choose between different service offers (not only different services but also different Qualities of Service for the same/similar service) and decide which suits them best. A consequence of this is that the user and the competition will determine the length of time for which service can continue to be offered on today's legacy systems.

This has implications for ETSI's work programme and its choice of strategic partnerships. Standards-makers have to recognize that today's technology is moving very fast, both in the terminal area and the network area. Service and application implementations are the drivers for that development. Standards have to focus on open interfaces (such as Application Program Interfaces - APIs) for a fully-converged telecommunication environment: the primary aim should not be to protect investments in legacy systems.

It should be borne in mind that the above model indicates how protocols and interfaces *may* be unbundled, rather than what is often done in practice: manufacturers frequently prefer to keep protocols and interfaces inseparable in their software. Also it should be noted that, in existing networks, the elements identified in the model as APIs are currently network protocols, and thus tend to be network specific. However, the adoption of IP is leading the industry away from such restrictions.

5.1.4.2 Interworking

The examples of access network and core transport network types given in the original GMM model illustrate the complexity of the world's telecommunications structure. Most of the types mentioned are already operational - some have been around for many years. Given the massive investments that have been made in existing networks of all types, and the enormous capital value that still attaches to most of them, operators (and users) will wish to continue to exploit them until the end of their useful lives.

Almost all existing networks can be used as access/transport networks for IP based services. However, the range of services that can be supported varies, depending on the characteristics of each access network (multimedia video services cannot be accessed with acceptable quality via a 56kbps modem over the PSTN). This means that service characteristics have to be met by the underlying transport network. There is an interrelation between service and network characteristics, which have to fit, to guarantee a certain service quality.

The interfaces defined between domains need to be both flexible and comprehensive. In some implementations the full range of options for 'interoperability' may be provided so that all the permutations of possible equipment combinations can work together. In other cases only the options between domains that have currently been identified as required for that particular node will be provided so as to keep interworking and interoperability costs down to a more acceptable/competitive level. GMM applications and services will need to be run over a wide variety of networks between different terminals (i.e. end to end), as well as between service centres and terminals.

For GMM, interoperability means for example, UMTS terminals working with other IMT-2000 network family members, or even non-UMTS access networks. Another example could be UMTS access networks interfacing with packet switched broadband core transport networks supporting IP based services. Interoperability is an important feature of UMTS and of the IMT-2000 family where there are differences in implementation.

However in the light of a rapidly changing market using IP as basic technology interworking aspects have to be handled with care. IP based services will dominate new service offerings. To support these offerings in a cost-effective way new broadband packet switched networks will need to be built. Interworking between those networks and existing ones will have to be guaranteed for those types of services where interworking can be justified on business grounds. There is also a need for interworking between IP networks and legacy systems for services where IP is used as a substitution technology (e.g. voice calls). Interworking functions to support traditional voice-related telecommunication services are needed. Therefore standards that supports a voice gateway function between IP-based networks and legacy systems needs to be developed.

There may also be a requirement for interworking with today’s data networks based on ATM, Frame Relay, X.25 or ISDN data services. However, the basic paradigm for future networking is expected to be IP/ATM hybrid or pure IP solutions. Where existing data networks are currently not interconnected there may be no need to interconnect them to the IP networks of tomorrow.

Whilst transparency of networks and domains may be expected by users, there will inevitably be some circumstances and combinations where limitations or degradations of service arise. In such cases it may be appropriate for users to be advised in an appropriate manner, such as "You are entering Deutsche Telekom domain. Coming from France Telecom you will not be able to access […] service".

If and in which timeframe existing data networks will be phased out or remain as isolated islands for special services will be determined by the individual markets. The commitment of standardization effort is always (or should be) a matter of commercial judgement: careful scrutiny will be needed when considering the development of further for interworking/interoperability between legacy systems and new applications and services.

An example of current ETSI work directed at establishing common solutions can be seen in Project TIPHON - "Telecommunications and Internet Protocol Harmonisation Over Networks". Here, the objective is to support the market for voice communication and related voice band communication (such as facsimile) between users, within an IP environment. For instance, the work will ensure that users connected to IP-based networks can communicate with users in Switched Circuit Networks (such as PSTN/ISDN and GSM), and vice versa.

5.1.4.3 Quality of service issues

Users of telecommunications have certain expectations about the services they use. These expectations may include speed and accuracy of transmission, security, privacy, and cost. Knowledgeable users may be acquainted with the parameters of the services they employ, and may be capable of defining their requirements and determining whether they are met. Contracts, especially those with the larger business customers, may include Service Level Agreements.

Legacy networks offer one level of quality of service independent of how the network is used, and customers normally have to accept the quality the circuit switched networks can offer (PSTN, ISDN, GSM…). When there was only one basic service - telephony - there was no need for quality of service differentiation. But with the exploding IP based service market quality of service is becoming an important issue, notably in packet switched networks. Quality of service is now being regarded as a means of obtaining competitive advantage. Many users are now expecting to be able to decide individually on the quality of service that they want to have attached to a specific service even though each service is assigned a pre-selected quality level.

For many users, however, the quality of service is assumed. The vast majority of users find modern telephony systems completely adequate for their purposes - or at least have become conditioned to accept their limitations - even if they are using those systems for non-voice (e.g. low bit-rate data) traffic. That is generally because, apart from the intrinsic quality of service of the telephony system (many of which were "over-engineered" by today's standards), data applications and the like provide further safeguards, such as error checking, to minimize problems. Customers will often

accept degraded quality of service if they are compensated in some other way, such as the provision of mobility or reduced costs (for residential customers cost is usually the prime consideration, as long as the service provided is acceptable).

By contrast, users of software systems (the Internet included) quickly learn that the quality of service associated with such systems is generally low and not guaranteed. For instance, the Internet currently works on a "best effort" basis. That can be acceptable if one is browsing straightforward web sites, but it is not sufficient for "real-time" applications such as voice, music and video. This creates a dichotomy for users: on the one hand being offered greater say over network quality of service whilst on the other hand having to endure the uncertainties and inadequacies of software (weaknesses which, because of the ever-increasing complexity of software, are tending to grow rather than diminish).

There appears, therefore, to be an urgent need to address this dichotomy, in particular to identify in which ways the IP is deficient and to specify what needs to be done to move the IP world closer to the telephony situation.

5.1.4.4 Security issues

With the ubiquitous use of telecommunications systems and, often, IP for many aspects of business and personal life, security is becoming another increasingly important issue. Communications relating to electronic commerce, personal data, government issues and national security all find their way over today's networks, in which the distinction of "public" and "private" is often simply a matter of the use of different security mechanisms. This type of traffic has major importance to the world's commerce, stability and respect of personal privacy, so the matter of security is one that figures highly in the consideration of how GMM is to be achieved.

Security has to be supported in different ways depending on what type of network technology is used. In the case of IP, security is moved out to the edge of the network, or even outside the network. As users are unable to trust the IP network totally, security is also taken care of at the application/service layer.

Work is underway in the IETF's IP Security Protocol Working Group (IPSEC) to develop mechanisms to protect client protocols of IP. A security protocol in the network layer is being developed to provide cryptographic security services that will flexibly support combinations of authentication, integrity, access control, and confidentiality. One of the consequences of the GMM study could be to determine whether further actions (maybe within the telecommunications domain, and perhaps with particular reference to mobility) are needed to support the IETF efforts.

5.1.4.5 Network efficiency

Activities related to the introduction of an all-optical layer in core networks both on metropolitan and long distance level will affect the way in which future networks will be designed. From an IP perspective, putting IP directly on fibre using DWDM technology may be one the most efficient solution is in terms of network economy as the goal is to offer seamless services to the world in a cost-effective way. Such an approach would fit well with the prediction that by 2003 the majority of all network capacity will be used to support IP based services end-to-end.

Over the coming ten years or so, real-time services such as voice will need no forced network replacement. Existing legacy systems will remain as long as they are profitable and manageable to the operator. However, it seems probable that no further investments will be spent on these systems, other than to fulfil regulatory requirements, rationalization needs and interworking functions with new systems (such as to support voice over IP). Thus one can assume a gradual and steady phasing out of circuit-switched technology in favour of packet-switched technologies, which will include future generations of IP. Interactive real-time services and IP-VPN offerings in future may be supported by IP/ATM hybrid solutions.

In the past, over-provisioning was an effective, though costly, means of ensuring network quality of service. In the future over-provisioning may still be an option for new types of services may be an alternative way to go and may not be particularly costly. The conclusion that may be drawn is that the future IP environment may support all types of services based on IP using many underlying technologies and that a over-provisioned best effort service may be one of the many solutions. As far as mobility is concerned, there appears to be little difference in requirements compared to those of fixed networks.

5.1.4.6 Mobile IP

The IETF's Mobile IP Working Group is charged with the development or adoption of architectures and protocols to support mobility within the Internet. These will enable users to connect to different IP subnetworks, while always using their permanent or long-term IP address. One important advantage of IP (and hence of the Mobile IP concept) is its

independence of access technique and media (e.g., LANs, dial-up links, and wireless communication channels). It allows the user to roam between fixed and mobile networks, between private and public networks etc.

There have been suggestions for using Mobile IP for roaming between General Packet Radio System (GPRS) public land mobile networks and for using it for roaming between GSM data services and GPRS services of the same operator. For UMTS, there is an ongoing feasibility study using a standard IP backbone for UMTS, which would use a combination of GSM mobility management and Mobile IP. The GSM infrastructure concerning authentication and authorization of terminals, handling of subscriber data, charging mechanisms etc. could be reused, while the transport and mobility handling within the backbone could be handled by Mobile IP. ETSI is analyzing the usefulness of Mobile IP for GPRS as well as for UMTS. Particular areas of attention include the impact of Mobile IP on UMTS requirements concerning security, efficient use of radio resources etc. If the existing work does not satisfy such needs it will be necessary to develop dedicated protocols for the UMTS backbone, or the GSM/UMTS community will have to contribute to the work in IETF.

The IETF Mobile IP Working Group's charter indicates that, in the longer term, the group may address other types of internet mobility, such as mobile subnets (e.g., a local network within a vehicle), or mobile clusters of subnets (e.g., a collection of hosts, routers, and subnets within a large vehicle, like a ship or spacecraft, or a collection of wireless, mobile routers that provide a dynamically changing internet topology).

5.1.5 Key requirements

The need to accommodate the drivers discussed above point to the following requirements:

5.1.5.1 Requirements concerning service architectures

The approach implies that the design of future service architectures should:

- optimize requirements for future standard interfaces;
- have a standard approach for describing the interfaces;
- focus on defining what one network requires from another without imposing any internal network structure or architecture;
- allow evolution either side of an interface without requiring changes in the relationship (while realising that full implementation of certain services or features may not be possible until an updated version requiring changes has been introduced on both sides of the interface);
- accommodate current standardized or proprietary network structures as far as technically AND economically feasible: in other words standardization in this, as in other areas, must be market driven.

An important aspect of this API view of the world is that many of the APIs will be employed to create interfaces to existing telecommunications switches and systems (so-called legacy systems) that will be around for a long time to come.

5.1.5.2 Requirements concerning interworking

Seamlessness and interoperability between networks are ongoing requirements: this applies both for day-to-day operational reasons as well as for migration to new and evolving systems and networks. Interfaces need to be comprehensive and flexible, whilst the degree of interoperability and interworking may vary according to market and operational needs. This does not mean that universal platforms that can handle all types of network technologies are necessary.

For GMM a multiplicity of interworking/interoperability combinations between domains will most likely be required. Moreover, whilst IP-based services may be adequately supported by the evolving IP-based networks, for traditional telecommunications services (in particular) there is a need for gateways between the new networks and existing ones.

5.1.5.3 Requirements concerning Quality of Service

The quality of service of software systems and the associated technologies (including IP) needs to be moved closer to that expected by users of telecommunications systems. In addition, as the feasibility increases for users to select and/or

determine the telecommunications quality of service they enjoy, this freedom to choose needs to be reflected also for software and IP. Standardization actions might include identifying the ways in which IP is currently deficient and specifying solutions to those deficiencies.

5.1.5.4 Requirements concerning security

The effect of GMM of liberating access to and transfer of information brings a need for careful examination of the security issues. As far as IP is concerned it can be assumed that these matters are being addressed within the IETF. However, there would appear also to be telecommunications-related security considerations to address, including those specifically related to mobility.

6 Other issues affecting GMM

6.1 Management

Management of network and service resources, of mobility and of information content are all critical in GMM. These issues are equally applicable to fixed networks, however, and there do not appear to be separate requirements for GMM. In general, it seems that standardization of these management issues is best avoided. However, some standards may be needed to enable operators to deliver the necessary Quality of Service (QoS), and some may be needed for aspects of particular concern to the users, such as billing.

6.1.1 Network management

Today's networks are controlled and managed via gigantic management machines based on a telecommunication management network (TMN) process model. However, in reality double and triple security functions interfere with each other because of lack of interworking. Huge amounts of money have been invested in support and supervision systems, but network service providers have problems guaranteeing 100% real end to end QoS, even for leased lines. Network management and service management are still handled as separate issues that need to interoperate in a much more controlled manner.

Moving from circuit to packet switching there is no need to secure connections. Packets will flow through the network in a statistical way and arrive at their destination sooner or later, mainly depending on traffic load and transmission capacity available. Enormous investments in management, support and billing systems (which are insecure) may be avoidable if it is accepted that nowadays fibre in the core is relatively cheap and that over-provisioning - at least in some cases - may provide the answer to many of today's problems.

Up to now, the IP world has had no real management concept of its own and has tended to adopt concepts from the traditional telecommunications world. IP based packet switched networks need a new type of management concept, using a common distributed data environment in which infrastructure, networking and the customer facing parts are integrated into one common platform architecture. In such an IP-based business information environment multimedia services and mobility can be seen as integrated parts of a total concept.

6.1.2 Service management

As noted elsewhere, future architectures are likely to exhibit a clear separation between the service layer and the connectivity network layer. In the case of the service layer, three functions may be identified: service access (the user service interface), service operation (information resource, network resource and service administration) and service components (data relative to the user and his/her subscription, data relative to the service, and the content itself). The three processes of the service operation, together with service access and service data form the basis for end-to-end service management for each individual service.

There would appear to be little need for standardization of services, although standards may be needed for the mechanisms that support them. Management of network resources is a well-established activity and is frequently handled by automated processes, whilst some other aspects of service management are less well-developed, at least within the telecommunications industry. Care is needed that as the necessary tools and processes evolve, they do so in a consistent and compatible manner, perhaps aided by standardization. This is particularly significant when considering the increasing mobility of users, who may be confronted with different languages and ways of presenting various services.

6.1.3 Mobility management

There are totally different concepts for call handling in circuit switched and packet switched networks. In the circuit switched network there is a need to have mobility management in order to handle primarily mobile terminating calls. Details of such arrangements are well described in GSM specifications.

For packet switched networks the situation is different, in that the same type of mobile terminating calls do not exist. With packet networks there is always the possibility of store and forward if connection is not established (e.g. that the mobile terminal is switched off). Alternatively there is the concept of being "always connected" that can be used in a packet switched network which means that there is always a mobile originated action to connect when switched on. This

means that the mobility management is greatly simplified compared to the circuit switched case. Some of the issues are instead converted into radio resource management issues, but they are too detailed to be covered here. The matter is under consideration in 3GPP, notably its Radio Access Network TSG.

6.1.4 Content management and protection

Multimedia information (audio, image and video files stored as digital binary data) to date has accounted for only 15% of stored data, but this percentage is increasing rapidly. It is reasonably expected that the ratio will "turn around" by the year 2000 so that by then it will be the multimedia material which will account for the 85% and the record or textual files which will account for only 15%.

An illustration of the expected impact of that trend on telecommunications is that portrayed in figure 6.1, where it is predicted that data and video will represent the largest fraction of the overall telecommunications traffic (source: EC (see 25) in Bibliography).

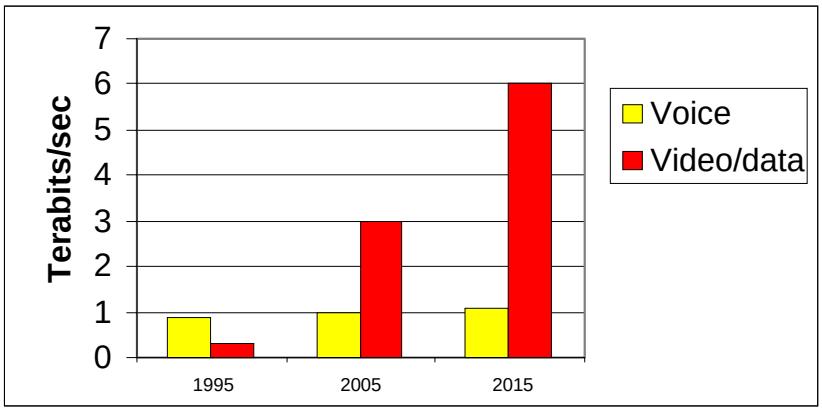


Figure 6.1: The voice - data traffic flip [Source: EC]

Much of this type of multimedia material may have high commercial value yet, by its nature, it may easily be reproduced or modified without authorization. Currently, no single simple structure exists to support the means of protecting, handling, controlling, and monitoring the use of the information content. Some present barriers to the creation, exchange and use of multimedia information products could be removed by the standardization of metadata.

Metadata refers to descriptive information or technical parameters required to transmit, charge for or add value to the essence of the material. Metadata may be carried and stored with the essence of the material or it may be separately stored in a database and transferred by file transfer or computer disk: the important point is that the essence and metadata are logically linked, not that they physically co-exist.

A well known example of metadata exists in the book publishing industry: most books have cataloguing information including a unique identifier (ISBN number) which enables them to be entered into a library catalogue with the minimum of effort.

There have been many attempts to standardize this data, but they have all failed to become universal because they addressed only the problems of one particular group of potential users. CEN/ISSS has now established a Workshop on Metadata for Multimedia Information. This workshop will focus primarily on European requirements but will liaise with similar activities in Europe and elsewhere. Its aims include the development of a model and business requirements for metadata. Within the broadcasting domain, metadata models have already been devised by the EBU and the SMPTE.

6.2 High-speed access

The provision of multimedia services to users leads to a requirement for high speed access mechanisms. Ideally these should offer flexible bandwidth, controllable by the user. Developments in technology now make it possible to provide wide bandwidth relatively cheaply at the extremities of the network (i.e. in the "local loop"). Thus to serve the market effectively, there may be justification for moving the server or cache out towards the edges of the network. This may of course have to be taken into account in the design of future network architectures.

Recognizing that, in many instances, that broadband access will be by radio, there appears to be need for today's specific GPRS protocols to be converged into a more general IP-based concept. There is scope for ETSI to do work in this area, notably to align technology and to minimize inefficiencies. Optimization for the (predicted) IP-based core networks will be a prerequisite.

Other examples of high-speed access include HIPERLAN, a major element in the work of ETSI's BRAN (Broadband Radio Access Networks) project and supported in the ETSI work on GSM and UMTS. HIPERLAN/2 provides high-speed (25 Mbit/s typical data rate) communications between portable computing devices and broadband ATM and IP networks. It is thus capable of supporting multi-media applications.

The typical operating environment is for HIPERLAN/2 is indoors but a new type of use has emerged recently: HIPERLAN/2 as a possible access network for UMTS. In this form of use HIPERLANs would be used both indoors and outdoors, in the latter case deployment being controlled by a licensed network operator.

As noted elsewhere, the trend now is to ignore any difference between mobile and non-mobile access in favour of a user or service provider perspective. Platform independent service provision maximizes the number of platforms (access networks) that can be used. Specification of a common interface between core networks and the access networks, simplifies service delivery even further. The BRAN Project is working on this basis in co-operation with ETSI's 3rd Generation mobile activities: the intention is to seek convergence between the broadband access networks and the mobile access networks such that both provide the same interface to the core network.

There will be no shortage of high speed access mechanisms as many already exist or are under development, including satellite (MMDS/MVDS, BSS and other systems), cable (copper pair, coaxial), fibre, interactive broadcast channels and so on.

6.3 Non-technical enablers and barriers

Quite apart from the diverse technical issues, there are many aspects of a non-technical nature that will influence the future of Global Multimedia Mobility. The most apparent are regulatory and commercial considerations, but there are others, notably those concerning usability and accessibility, which also have major significance. It is mainly in the latter categories that standardization can make a valid contribution.

6.3.1 Regulatory issues

The telecommunications business is one of the most regulated in the world. Even though many major steps have been taken in recent years to break up the old PTT monopolies, to introduce new industry players and stimulate new services, much regulation remains. Not all that regulation is restrictive, however. For instance, recent regulatory actions in the European Union and elsewhere have been directed at promoting roaming rights for mobile users (and suppliers), and ensuring free circulation of mobile terminals globally. In a number of countries regulation has been the means of initiating needed change.

On the other hand, use of the radio spectrum, a valuable and limited resource in great demand, requires regulation that will both ensure reasonable availability whilst minimizing the risks of misuse which could lead to harm to user privacy, safety, or even state security.

The convergence of technologies is also having an impact on the regulatory processes. In the past, telecommunications, IT, broadcasting and entertainment have each been subject to totally different regulatory and business cultures. For instance the telecommunications business is used to very strict regulation on quality of service related requirements, universal service provision and reliability, while the IT industry has often sacrificed some of these requirements for the sake of a more dynamic development. What will happen in the future when the responsibilities for various parts of the overall services become more and more distributed and invisible to the users? How will the responsibility for the content be separated from the responsibility for its distribution?

It is clear that those responsible for drafting future regulation must be fully aware of the impact of market forces. It is therefore an encouraging trend that regulators are increasingly opening the drafting processes to comments and contributions from manufacturers, operators, service providers and users.

Aspects currently under study by regulators include:

- **convergence of the telecommunications, media and information technology sectors** (see 7) and 12) in Bibliography) - a European Commission Green Paper addresses the nature of the convergence phenomenon,

focusing on the provision of services and the underlying networks over which they are carried. It also deals with the implications for both the shape and substance of regulation that may arise from convergence.

- **satellite communications** - addressing issues such as spectrum allocation and avoidance of discriminatory licensing and import restrictions (see 8) in Bibliography).

- **UMTS** - issues such as the ability to roam, not only geographically but also different public, business and residential systems and networks create a need for innovative thinking concerning regulation. Regulatory structures will also need to allow for such matters as the routing of traffic over third party networks, and the possibly different circumstances regarding licensed operators as opposed to those who use licence-exempt spectrum.

- **global circulation of terminals** - A key element in the success of third generation global communication systems is the ability for terminal equipment to circulate world-wide without any hindrance or obstacles. In this respect users of the terminals will want to carry them throughout the world and use them wherever it is possible to do so. If they are hampered from doing so by regulatory barriers, the successful development of third generation systems will be impaired. Global circulation will bring clear advantages for the user, as well as for operators and manufacturers.

6.3.2 Roaming agreements

The third generation mobile systems will enable users not only to be able to roam among countries which currently use different technologies but will also allow them to move seamlessly between multiple networks – fixed and mobile, cordless and cellular. As a result, network operators, service providers and manufacturers should benefit from increased flexibility and cost effectiveness. Users who currently cannot use their handsets when they travel to areas where other systems are in use, would greatly benefit in terms of cheaper terminals through economies of scale, reduced tariffs through increased competition, and greater functionality, operability and choice of services and equipment.

The proliferation of mobile users leads to more and more individual roaming agreements. This in turn has implications for algorithms and security keys, and further standardization action may be needed in these areas. It is expected that users will demand even greater flexibility in roaming: for example, impromptu use of a terminal in a territory of an operator with whom the user's home network has no agreement, but who will accept such use, perhaps taking payment by credit card. Further security and information handling requirements arise for such situations, and it seems probable that "electronic purse" concepts could also be applied: each of these aspects may raise a need for further standardization.

However, as operators and services proliferate, the mechanisms used to set up and manage the interworking arrangements cannot respond in a cost-effective manner. ETSI Technical Report UMTS 22.71 (see 63) in Bibliography) discusses the limitations of the current methods, and outlines a proposed solution to meet these needs in UMTS, where many more parties are required to interwork on a commercial basis.

The use of clearing houses is perceived as a practical solution for many operators. In its simplest form, it would indicate a shift from the traditional operator-to-operator type agreement process to a more advanced operator-to-clearing house type arrangement, where the latter would act as a sort of custodian for managing the roaming agreements of it clients. In the medium-to-long term, this would also point towards a more comprehensive solution for the management and maintenance of all data flows between client operators around the world.

A UK study (see 35) in Bibliography) has also noted that, in the case of public mobile networks, the problem of establishing bilateral roaming agreements between network operators is becoming unmanageable and network operators are looking for a means of automatically establishing commercial roaming agreements. If roaming between public and private systems is also to be included, then the need for automatic establishment of commercial roaming agreements will become even more important.

6.3.3 Human interface issues

Telecommunication services are used by a wide range of people to perform different tasks and in various working environments. Nevertheless there is a need for coherence of working for the same functionality and characteristics in different systems and services.

Currently there are very significant differences in the Human Interfaces relative to mobile services and products offered by different manufacturers (e.g. different procedures, same icons used with opposite meaning, etc.). This risks creating a negative impact on users about Mobile Services owing to misunderstanding and poor usability.

New technologies often present significant challenges to the users. Thoughtful design of man-machine interfaces, involving consultation with user groups (including those with special needs) can do much to ease the problems encountered by users. In turn, that can help to stimulate the adoption of the technologies and open up the markets. Nevertheless, the task is a complex one as the well-known problem that many people have of programming their VCRs still remains, in spite of many "smart" solutions devised by manufacturers (maybe the lack of a standardized man-machine interface is a factor). Yet the VCR market is brisk!

The GSM Association has described (see 36) in Bibliography) requirements for support of man-machine interface (MMI) functions in a UMTS terminal. In general, the requirements are not proposed for standardization. More detailed proposals of possibilities for addressing and numbering, especially relating to call set-up, are also dealt with. Many of the requirements are common to those of second generation systems, including GSM, but there are a number of new aspects that differentiate the two generations. In this context, these are particularly the greater specification of tool-based service capabilities rather than detailed service descriptions, and the ability for the Service Provider to determine the MMI rather than to rely entirely on that defined by the mobile station manufacturer and the specifications. The availability of dual mode GSM/UMTS terminals is assumed and the requirements of seamless operation between modes and a consistent MMI are recognized.

Users of UMTS terminals will have access to a range of services from the relatively simple to very complex. Different terminals may be produced to meet the needs of different applications, so there is reluctance in the industry to create a standardized MMI. However the GSM Association has recommended that users should be presented with a familiar MMI (as a central feature of the Virtual Home Environment) and be able to customize various aspects of the MMI to their needs. On the other hand, evolution of telecommunications MMIs (which are fast converging with computer MMIs) is very rapid at present, and it may be counter-productive to be over-prescriptive in such matters.

Apart from recognizing the needs of users in general, the industry must not forget the users with special needs. In the western world in particular, the numbers of disabled and older users continues to grow - such users already represent significant proportions of the potential markets. The European Commission (DG XIII) is encouraging European standards bodies to take due account of the needs of the elderly and disabled through a "design for all" approach (called "universal design" in the USA). A draft Standardization Mandate (see 5) in Bibliography) has been prepared, addressed at CEN, CENELEC and ETSI, which would require the standards bodies to take positive steps towards understanding and accommodating these special needs in ICT (Information and Communication Technologies) standardization.

ETSI’s Technical Committee "Human Factors" (HF) studies all aspects of the human interface with telecommunications systems and gives particular attention to accessibility of users with special needs. In this area of activity the committee has close but informal links with COST Project 219bis, which studies aspects of accessibility to telecommunications services.

7 A revised GMM model

Part of the exercise of reviewing the earlier GMM Report has included an analysis of the GMM model in the light of the developments and trends discussed in the present document. The authors' conclusion is that the basic ideas and key messages behind the GMM model are still valid. The model as it stands supports a multiservice environment and convergence aspects. However, an additional description of the model was felt to be useful to obtain common understanding.

In the GMM model the following were identified:

- The independence between the terminal equipment domain (both for fixed and mobile users).
- The multiple access domain including (both for public and private network solutions).
- The core domain supporting different kind of services networks (including network intelligence needed to support certain service offerings in the core).

Looking at the model from that perspective it even covers the FMC issue, because the model states that (for example) UTRAN must include the ability to connect to any type of feasible backbone network. In addition to these three infrastructural domains the model contains a further domain that is related to applications, content and end-user services. The horizontal arrows in the model reflect interworking protocols between the three infrastructural domains. The vertical arrows between the application services cloud and the transport network domain indicates the dependency between the implementation of an application and the services network that supports it (This could be in the form of specific FR services, specific B-ISDN services, etc.).

However, as the application service domain is expected to be increasingly dominated by Internet services (and similar) using transport mechanisms such as IP which are independent of the underlying infrastructure, this dependency will be less significant in the future. Users will not need to care about the mechanisms of the infrastructure that supports a particular service/application.

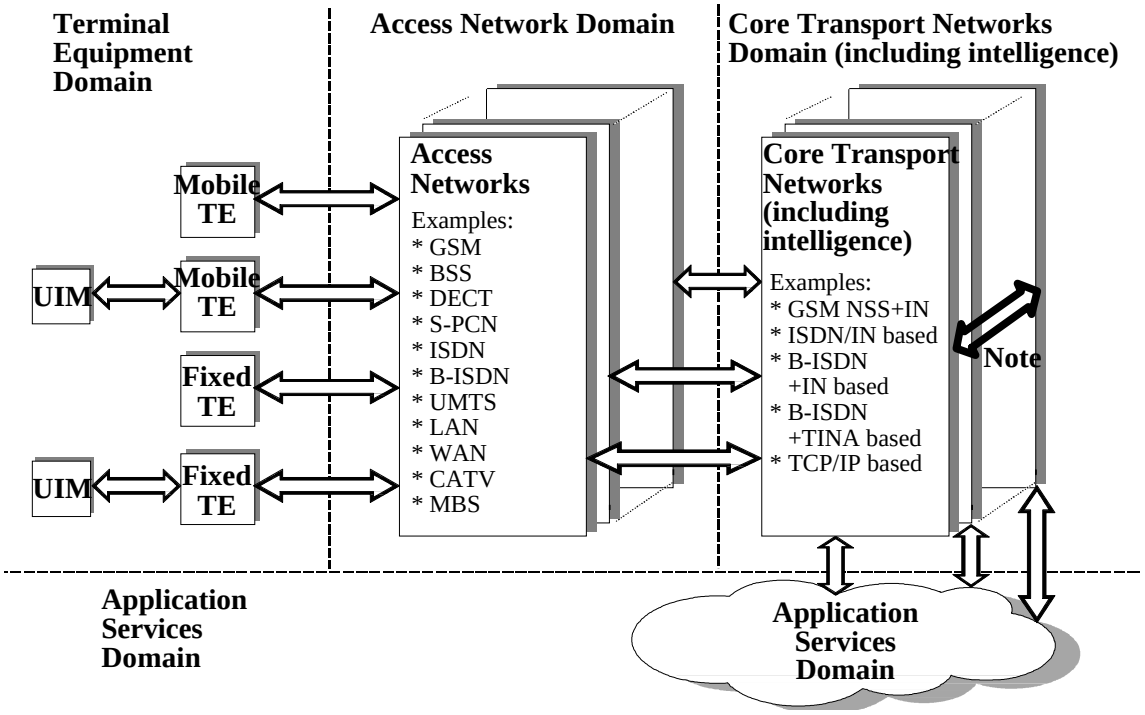


Figure 7.1: The original GMM model

NOTE: The arrow spanning the core transport network domain indicates that these networks are and will continue to be interconnected to each other. Intelligence residing in one network can and will be accessible to the intelligence residing in other networks.

As the service-provisioning domain only implicitly is imbedded in the terminal domain (a fact which is not obvious in the original model), there is a need to clarify this. To cover the service-provisioning aspect the original GMM model has to be unfolded around the core transport domain, thereby giving visibility of the role of the access networks domain in providing the connection to the "distant end" of the communication. This then facilitates the visualization of a number of traffic cases for further discussion as the initiation of a communication is not just from the left-hand side of the diagram.

The distant end may consist of services, as shown on the right of the figure, but it may equally be another user and the result *may* be a "conventional" communication, such as a telephone call. In such a case the right-most domain in the figure (shown as a Service Provisioning Domain) would be replaced by another Terminal Equipment (User) Domain, as at the left of the figure.

On the other hand (and especially taking account of the growing trend towards "information push" rather than the traditional "information pull" - an example being the Information Channels concept on the Internet), the origination of a communication may be from the right hand side of the figure. Indeed, origination could be from almost any part of the model where the necessary "intelligence" resides.

Various other scenarios can be constructed, based on this model, such as communication between two Service Provider Domains (where no conventional user may be involved).

One very important perspective is that taken by ETSI's NA6 UMTS Task Force, in which the "General UMTS Architecture" which appears in UMTS 23.01 (see 64) in Bibliography) is extended to include fixed and cordless access to public and private networks. The modified figure is provided below. Although this example is drawn from UMTS, it usefully illustrates a typical practical arrangement of the GMM model.

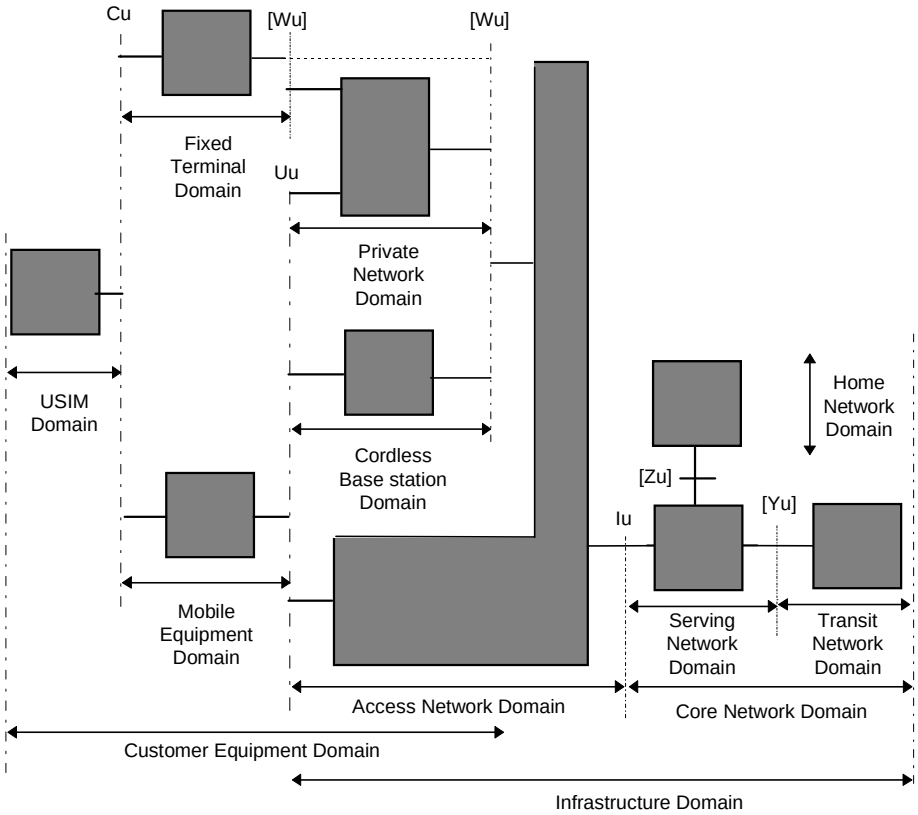


Figure 7.2: Extended general UMTS architecture proposed by ETSI NA6 UMTS Task Force

The figure follows the same convention that was used in the original figure and includes the additional domains that are included in ITU-T Recommendation Q.1701 (formerly Q.FIN) Version 4.2 - Framework for IMT-2000 Networks.

The irregular shape used for the access network is used to indicate that the part of the access network supporting the Uu interface includes UMTS radio functions, whereas, the part of the access network supporting fixed terminals, cordless base stations and private networks does not include UMTS radio functions. As a consequence of this the customer equipment and Infrastructure domains appear to overlap. However, it should be obvious that the cordless base station and private network domains belong to the customer equipment domain not the access network domain.

The second major significance of the unfolded GMM model is a clear separation of the applications and services elements from the basic connectivity components. This has been a trend in telecommunication networks to certain aspects over at least two decades. The Internet is however is the first network implementation which has fully adopted this principle.

One of the consequences of this is the connectivity part - the "network" in traditional terms - becomes transparent to the different types of information carried. Since various information types each place different requirements on the communication channel, this transparency largely eliminates the need for different types of network, thereby easing interconnectivity of services and giving the end user much greater flexibility and choice. The concept of multiservice networks that is supported by the Internet Protocol (IP) contributes to this transparency as it helps to unify many of the main interfaces within the model.

It should be noted that, in practice, the "intelligence" and the connectivity *may* still reside in the same item of equipment. The difference now is that they *need* not, and that, in a growing number of instances, each could be substituted independently as networks and applications evolve at different rates.

The decoupling of elements also allows for independent service providers (i.e. independent of the transport functions and network-based services), who need not be owners of the infrastructure. It equally allows for independent content providers.

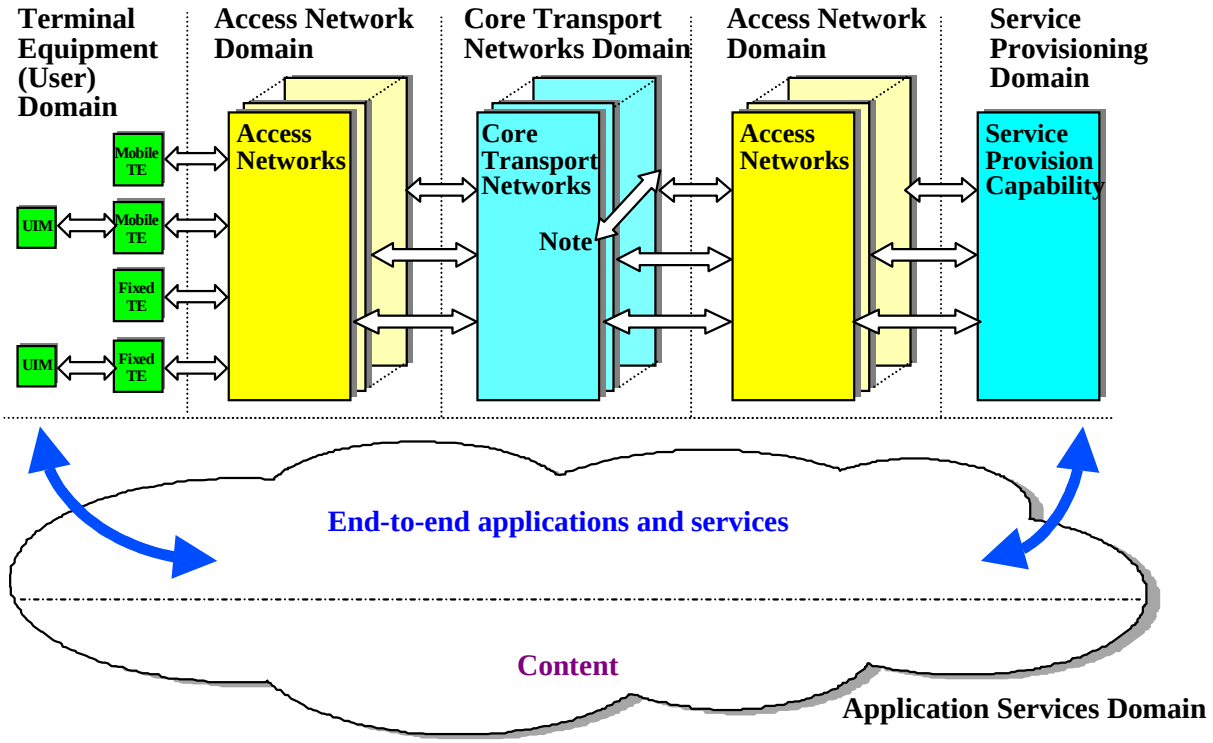


Figure 7.3: The revised GMM model

NOTE 1: As in the original GMM model, the arrow spanning the core transport network domain indicates that these networks are and will continue to be interconnected to each other. Intelligence residing in one network can and will be accessible to the intelligence residing in other networks.

NOTE 2: According to ITU-T Recommendation Y.100 [1], network management and service and transport functions, as well as Core Network supported applications and services, are internal to the Core Transport Domain and are not shown separately in the above model.

7.1 The terminal equipment domain

The discussion of the GMM model in the original GMM Report included a consideration of the terminal equipment domain. A figure similar to the following was used to illustrate the expectation that single- or multi-mode terminals would be able to be used on a variety of access networks.

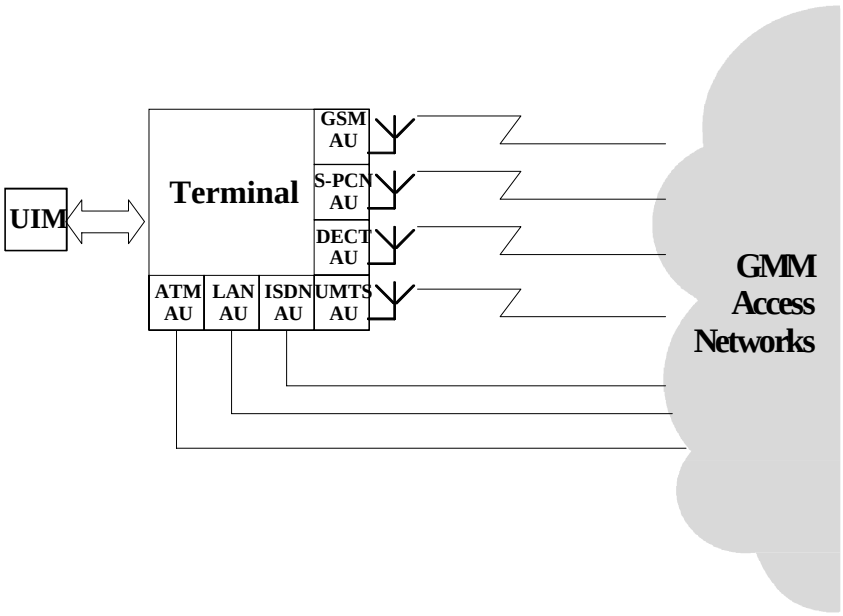


Figure 7.4: Wired and wireless access

The present studies have concluded that this view of the terminal is still valid: the market will become populated with single- or multi-mode terminals capable of accessing one or several different types of access networks. The UIM (or equivalent) identifies the user and supports personal mobility related services (and, possibly, additional functions) in the different GMM domains.

However, new issues have to be taken into consideration. The original version described the terminal as a "Multimedia PC/workstation". Experience has already established that it is now possible to have hand held mobile terminals possessing the types of functionality previously assumed to be realizable only in a desktop or laptop device.

Also, the recognition in the original report that technological developments are crucial to the production of multiple-mode terminals is being borne out in practice, with the emphasis being on treating terminals as consumer products. It thus seems probable that most multi-mode terminals will fall (or be pushed) into the category of consumer product, leaving in question certain multi-mode combinations (such as where satellite communication is included) where demand and volume will be insufficient to achieve prices that customers would be willing to pay.

In addition to such considerations, there are potential regulatory barriers to the use of mobile terminals, as discussed in subclause 4.3. These sorts of barriers - as well as commercial obstacles such the absence of roaming agreements - may affect the free circulation and global use of terminals.

Terminal design and internal functionality is an area outside normal standardization and provides a potential basis for competition between manufacturers/suppliers. Trends such as colour displays, limited web functionality (and other such limitations typically aimed at minimizing price, size, complexity, etc.), specific character sets and the like are current examples of how differentiation of products (and services) may be achieved. However, even here there may be scope for some measure of standardization, most probably outside traditional standards bodies (for instance, the GSM Association has described requirements for the support of man-machine interface functions in a UMTS terminal, although in general they are not proposed for standardization). A de facto standards war over terminal aspects is a real possibility.

This is certainly not an area in which ETSI has been significantly active in the past (apart from in certain human factors issues) but it may wish to consider whether it should be seeking a role in this possible standardization opportunity.

8 Conclusions

At present, individual services such as PSTN/ISDN, FR, ATM, GSM, IP, etc., generally require separate networks to support them. There is a need to unbundle the service/applications offered to the user from the underlying network infrastructure, in order to be able to handle the demands of an exploding market. Competition is driving the service providers to reduce costs as revenues per individual service fall. But this reduction can no longer be achieved within the framework of existing networks supporting specific service offerings. Newcomers to the telecommunications marketplace frequently come without the "baggage" of established infrastructures: moreover, their perspective - conditioned by their backgrounds outside ‘old-style’ telecommunications - is often markedly different from the traditional players. To be able to compete with new market entrants, existing players need to adopt a much more radical approach.

Service providers need to take a commitment to design a new public network based on a multiservice platform which is independent of the service/application layer, and which will stand in parallel to existing legacy systems. User choice and competition will then determine the remaining lifetime of those legacy systems.

Convergence is also demonstrating the need for "seamlessness" - the removal of traditional boundaries between fixed/mobile, private/public, business/residential. This is already happening, of course, but needs to be followed up and managed in a coherent and future-oriented fashion. The probable outcome will be modular solutions, but these have to be totally interoperable and (again) future-proof.

There is a clear role here for standardization, which also has to adapt to the fact that technology is moving incredibly fast in both the terminal and network areas, driven by service and application implementations. Standards have to focus on open interfaces (APIs) for the whole converged communication arena. For ETSI the challenge is to look into the future and focus on what the industry believes will be needed, rather than trying to perfect existing standards or preserve legacy systems.

This study concludes specifically that ETSI must address in particular the impact of IP technology and of mobility in its various forms. The members of ETSI have to decide whether and how best ETSI can contribute to this changing world. Three basic questions emerge:

1) Is there still a need for network architecture and end-to-end system specification activity?

If it is accepted that separation of services/applications from physical network structures is inevitable, and that modularity will be adopted increasingly as part of the solution, then there must be some doubt about the relevance of pursuing architectural and end-to-end standards. Surely the focus should be increasingly on interface standards and other solutions that ensure effective and flexible interworking.

2) How can such end-to-end systems be opened up to allow competition based on services rather than on tariff?

Moreover, if the future for obtaining competitive advantage lies in the service area, what standardization effort, if any, is needed - or justified - for this area? Assuming that standardization of service aspects *is* needed, can it be assumed that ETSI is the best body to perform it? If it is decided that ETSI *does* have a role, will that be alone or through strategic alliances? Does ETSI need to consider new alliances?

3) Do we really still need formal standards?

The (alleged) deficiencies of formal standardization are well known. Although ETSI has made remarkable progress in accelerating its processes and ensuring its products are "fit for the market", perceptions of slowness and lack of timeliness in standardization still remain. Further attention may be necessary to ensure that ETSI retains it position at the front of the field, producing standards that consistently meet the needs of the market.

9 Recommendations

ETSI's role is not restricted to writing standards. The Institute is here to serve the telecommunications industry (manufacturers, equipment suppliers, operators and service providers), users, administrations and regulators. Many facets of that responsibility will be served by solutions other than standards - strategic relationships, information services, expert advice and so on.

In considering GMM it is important that this fact is not forgotten. Consequently the GMM studies have concluded that various "non-standards-writing" issues need to be addressed in parallel with specific standards-oriented actions. These issues relate to matters of a (mostly) non-technical nature, such as continued efforts by ETSI to establish strategic partnerships, effective marketing standards and the Institute's other "products" (including its expertise and services), and careful attention to the standards-making processes.

9.1 Standards-writing issues

The following are areas in which the GMM studies have concluded ETSI must take and maintain a leading role. Some are already very much part of ETSI's work programme, but most still need to be integrated into the programme and given appropriate status.

API	- API-based architectures
Core transport	- totally-optical core networks
Access	- high-speed access for copper, fibre & radio
Radio access	- compliant with the GMM framework - BRAN activity should continue
IP-based work	- TIPHON - Mobile-IP, IP services, security
Core network	- separation of switching and service platform - move from circuit to packet / cell
Service	- QoS, management of services, customization of services (VHE)

The authors of this report are convinced that these activities are essential if ETSI is to continue to have a valid role in the GMM domain and meet the future needs of industry and users. That in turn generates the expectation that the Institute's members "buy in" to this vision and make the necessary commitment: the studies on GMM will have been largely wasted if that is not the case.

A number of key issues are embodied in the above table:

- application networking, and therefore Application Programming Interface (API)-based architectures will assume growing importance in the further development of communications;
- in future there will be no distinction between fixed and mobile multi-media services;
- mobility in connection with multi-media services will be independent of the type of access;
- IP is a key technology for multimedia;
- new market entrants generally use only packet switched technology to support IP based services;
- services offered by legacy systems are under attack from similar services which employ IP technology;
- the telecommunications industry is turning away from circuit switched technology;
- users want to be able to chose the Quality of Service levels on line based on service usage;
- over-provisioning may become an alternative to Quality of Service differentiation;
- IP end-to-end will be used and in case of using a radio access (where over-provisioning is not suitable) techniques need to be developed that offer at least "perceived IP en-to-end";

- the number of interworking cases that really need to be standardized has to be chosen with care. Initiatives such as TIPHON must be strongly supported;
- standardization of services and user interfaces should be the minimum necessary. To the extent that standardization of these aspects *is* required, ETSI should consider what part it may play - in other words, to determine whether ETSI is the appropriate body to deal with such matters. There may, for example, be scope for involvement in the area of terminal standards, even if just to provide a federating function for the other interested parties. ETSI should support standardization of all optical core networks both at the metropolitan and national levels;
- whilst allowing for diversification of service offerings (for reasons of competition and user choice, among others) some degree of consistency needs to be maintained, and that may require standardization action. Due account should be taken of the fact that users, particularly those who are mobile, will increasingly encounter different languages and forms of presentation of service offerings;
- finally, ETSI should:
  - continue to be active in the standardization of high speed access for copper, fibre and radio based access techniques as they are needed for real time multimedia applications;
  - undertake studies on the use of Mobile IP in connection with multimedia service offerings;
  - ensure that its work on VHE retains the essential purposes of the concept (a common, global, network-independent, framework for service delivery and control for all types of future networks, supported by future network standards) and promote those requirements at the ITU, in fora and other relevant bodies; and
  - develop refined management concepts which will support interoperability between network, service, content and protection management for multimedia and packet switched networks supporting IP based services.

9.2 Non-standards-writing issues

Many of the conclusions of the GMM study relate to matters that are not directly concerned with standards-writing as such. They are nevertheless at least as important as the technical issues. It is therefore proposed that ETSI:

- continues to pursue strategic alliances;
  - in particular with partners such as the ITU and IETF to develop API based architectures and security solutions to support multimedia services and transport;
- makes continued efforts to maintain the delicate balance associated with "depth of standardization";
- studies ways of easing the task of accommodating the IPR interests of members and others;
- intensifies its efforts to ensure that customers (notably ETSI members) are supported in their own ambitions for standards that serve their purposes (concern was expressed during the studies that care for ETSI members, including especially those who take office in ETSI Technical Bodies, had deteriorated in recent years and was showing little sign of improving);
- continues to pursue the marketing of standards as a matter of vital importance; and
- undertakes a review of the existing ETSI Technical Organization to assess its suitability for future needs, particularly in relation to work on architectural issues.

9.3 The GMM model

It is the recommendation of the authors that the "refined GMM model" replace the original model as the basis of the standardization framework for Global Multimedia Mobility for the immediate future. ETSI should support this model as an important input to the 3GPP work and to promote this revised view of GMM world-wide.

ETSI's commitment to the 3rd Generation mobile standardization programme should include work items which cover the service, system, network, radio and protocol aspects related to the integration of residential and business systems.

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