UMTS Forum

The UMTS Third Generation Market - Structuring the Service Revenues Opportunities

INCLUDING WORLDWIDE AND REGIONAL FORECASTS FOR CUSTOMISED INFOTAINMENT, MOBILE INTRANET/EXTRANET ACCESS, AND MULTIMEDIA MESSAGING SERVICE

REPORT NO 9

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Report from the UMTS Forum

The UMTS Third Generation Market – Structuring the Service Revenues Opportunities

Including Worldwide and Regional Forecasts for Customised Infotainment, Mobile Intranet/Extranet Access, and Multimedia Messaging Service

UMTS Forum, September 2000

This report has been produced by the UMTS Forum, an association of telecommunications operators, manufacturers and regulators who are active both in Europe and other parts of the world and who share the vision of UMTS (Universal Mobile Telecommunications System). UMTS is a modular concept which takes full regard of the trend of convergence of existing and future information networks, devices and services, and the potential synergies that can be derived from such convergence. UMTS will move mobile communications forward from where we are today into the Information Society of third generation (3G) services, and will deliver speech, data, pictures, graphics, video communication and other wideband information direct to people on the move.

A key objective of this report is to study worldwide service forecasts for 3G mobile networks as well as present a framework for future market studies and forecasts. The study was carried out by the consulting company Telecompetition, Inc. under the guidance of and with contributions from the Market Aspects Group (MAG) of the UMTS Forum.

This study was funded by the UMTS Forum, and the additional sponsorship of the following organisations to this work is gratefully acknowledged

- British Telecommunications PLC
- GSA – Global Mobile Suppliers Association
- Lucent Technologies Inc.
- Nokia Mobile Phones
- Nortel Networks
- Vodafone Group PLC

Revenue data is reported in current US dollars. Totals may not always add up due to rounding. Unless otherwise credited, the source of all diagrams and exhibits is Telecompetition, Inc.

This report - the ninth published by the Forum to date - follows on from other outputs which have dealt with: a regulatory framework and spectrum aspects for UMTS (Report #1), technical aspects (#2), impact of licence cost levels (#3), licensing conditions (#4), minimum spectrum requirements (#5), UMTS/IMT-2000 spectrum (#6), extensions to core band spectrum (#7), and the future market for mobile multimedia services, as well as mobile voice and data services.(#8).

Many statements in this report represent the views of the original author, Telecompetition, Inc., and have not been subject to formal approval in the UMTS Forum. However, the main conclusions and key findings in the report are supported by all operators and manufacturers of the UMTS Forum. The National Administrations that are members of the Forum have actively supported the development of the report. However, the views and conclusions expressed in this report do not necessarily represent the views of the National Administrations. Therefore the Administrations cannot be bound by the detailed recommendations contained in the report.

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TABLE OF CONTENTS

LIST OF FIGURES

List of Tables

Selected Industry Views[1]

[1] Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

1. Executive Summary

The next decade will see the emergence of 3G networks to fully realise mobile multimedia services. Enabling anytime, anyplace connectivity to the Internet is just one of the opportunities for 3G networks. 3G brings more than just mobility to the Internet. The major market opportunity builds on the unique characteristics of mobile to provide group messaging, location-based services, personalised information, and entertainment experiences. Many new 3G services will not be Internet-based—they will be truly unique mobility services.

Data will increasingly dominate the traffic flows. Pent-up latent demand for mobile data services will jump start 3G networks since there are more and more mobile users—over a quarter of a million *every single day*. By 2005, more data than voice will flow over mobile networks. This is an amazing statistic considering that mobile cellular networks today are almost exclusively voice.

Mobile subscribers will benefit from the always-on characteristic of 3G. Successful 3G services providers will navigate around the discontinuities that this new always-on mobile data environment creates. Many data services are possible and services providers with experience in marketing and billing bundled services will have an advantage.

This study highlights four areas of change for services providers[2]:

- Business Models
- Industry Structure
- Revenue Models
- Market Strategy

This report presents a compelling framework for categorising and studying the majority of near-term 3G services. This framework, introduced in Section 2.5, is the basis for the structure of the analysis and forecasts. The data services are subdivided into content connectivity and mobility, then further subdivided to create the following six services:

- Customised Infotainment
- Multimedia Messaging Service
- Mobile Intranet/Extranet Access
- Mobile Internet Access
- Location-based Services
- Rich Voice

Service diagrams and business models are then added to the framework to provide a complete picture.

[2]The term “services providers” is introduced to indicate the changed role of the mobile operator in the 3G world.

This study presents worldwide forecasts for 3G services that are consistent with the EU15 multimedia subscriber forecasts published in Report 8 from the UMTS Forum. Existing forecasts of worldwide mobile subscribers and 3G substitution rates are used to determine the growth of 3G subscribers worldwide until 2010. Adoption rates are then applied to the 3G subscribers to determine worldwide service subscriptions.

These 3G service subscriptions are then allocated amongst 195 countries world-wide according to country-level demographics, existing mobile penetration rates, anticipated 3G commercialisation schedules and other economic and regulatory factors. At the service and country level the forecast subscription numbers are also determined by propensity-to-buy considerations and population projections by age, occupation and industry. Addition of average pricing assumptions then allows service revenues to be forecast at a country level. The resulting country-level subscription numbers are the target market for the six 3G service categories introduced in this report.

Plausible pricing and adoption assumptions based on current pricing of analogous services existing today have been used throughout this study. This approach establishes an average price level for services based on known willingness to pay. It does not presume a pricing structure and so allows services providers flexibility in managing capacity.

The result is a conservative forecast that gives 3G services providers a benchmark from which to develop future marketing strategies. The forecasts demonstrate that significant revenue flows are realistically achievable from 3G services.

Three of the six 3G services are forecast in this report. Significant market potential exists for 3G services, although successful players may include only a select few in their product portfolio. The three forecasted services (Customised Infotainment, Mobile Intranet/Extranet Access, and Multimedia Messaging Service) were chosen because they encompass a variety of target markets and business models.

These service forecasts predict a Compound Annual Growth Rate (CAGR) of over 100 per cent growth during the forecast period, with total revenues for the three forecasted services of over $164B[3] by 2010. This partial forecast is impressive when compared to current worldwide totals for ALL mobile cellular service of about $270B.[4]

Many high-potential 3G markets will be launched by 2004, with Japan, Finland, Spain and the UK leading the way in 2001. Regional differences highlighted in the study will dictate the rate of growth in each region. Both

[3] All financial data in this report are presented in nominal US dollars.

[4] Telecompetition Inc. estimate based on average worldwide ARPU (Average Revenue per User) of $35 per month per subscriber.

geographic regions and economic regions are presented. Critical factors for success will be international roaming capabilities, device availability, and network deployment costs.

While this study only addresses 2000-2010 and the mere infancy of 3G, high growth is expected beyond 2010. At that time, developing countries will accelerate deployment of 3G to realise the potential for accelerating national development and closing the information gap with the developed world. The potential number of new subscriptions is staggering with over six billion people on the planet and the opportunity for multiple service subscriptions per person. The advent of company-wide corporate services also holds promise. Historically, mobile service for business has always been sold on an individual basis. This will change with the advent of Mobile Intranet/Extranet Access and other 3G services. 3G services provider shareholder value promises to be enhanced by these developments—if the barriers and challenges identified in this report are addressed successfully.

Some key implications and conclusions of this study are listed below. Details of the discussion can be found in the report where these key messages are highlighted.

- The continued use of mobile penetration rates and Average Revenue per User (ARPU) as performance indicators for the future 3G environment has to be questioned
- The importance of local content in the mobile portal environment cannot be overstated. Content should be appropriate to the local culture and in the local language
- Realistic positioning of the “mobile Internet” should be a priority for 3G services providers
- Mobile portals are an additional opportunity for mobile services providers
- Service portability between services providers will be necessary for location-based services to be offered globally
- The market expectations of Internet users tomorrow will be much higher than their expectations today
- Positioning 3G as the “mobile Internet” sends the wrong message to the market and paints an incomplete picture of 3G service potential
- Of the three services forecasted in this report, Customised Infotainment is forecast to produce the highest revenues during 2000-2010 primarily due to its low cost and mass market appeal
- 3G represents a significant revenue opportunity for services providers, infrastructure and device manufacturers, applications developers, content providers, etc.
- Asia Pacific and Europe will dominate other geographic regions during 2000-2010
- The US will continue to lag in the 3G market due to its lack of 3G spectrum and fragmented approach to the market

- Mobile services providers must effectively manage a sophisticated portfolio of services and target segments, continually developing new services, improve existing ones, and targeting high-value customers
- The UMTS Forum strongly recommends that deployment of 3G networks in developing countries occurs sooner rather than later to meet ITU objectives
- Today there are four device types that will evolve into a multi-purpose 3G Multimedia Device in 2005. Each of these four devices will also continue to be available resulting in five device types by 2005.
- Wide coverage for data services is a particularly important requirement in the marketplace that will be intolerant of any significant service degradation suffered when moving out of 3G coverage.

Section 2 follows and develops the study framework and puts it into an industry perspective. Section 3 explores the industry dynamics that drive revenue and subscription forecasts. Section 4 details each of the services and provides a framework-consistent diagram for each of the six. Section 5 contains details about the forecast assumptions and inputs as well as the forecasts themselves. Finally, Sections 6 and 7 provides key technology and business issues affecting 3G service demand. Conclusions regarding the framework and future potential are discussed in the final section. Appendices provide further forecast methodology and country-level detail.

2. Establishing the Framework

The mission of the UMTS Forum is to enable the global mass market and to develop the vision and strategy for a market-driven, co-ordinated introduction of future mobile multimedia services. Earlier work by the UMTS Forum studied the total size of the market for mobile multimedia services.[5] This present study builds on these results to explore the 3G mobile market in more detail, addressing the key questions of what services could be deployed and what revenues might be expected.

2.1 Study Methodology

There are many issues and some uncertainties regarding 3G. The UMTS Forum has not attempted to re-evaluate all the issues. This has been done many times by a number of well-respected research companies. The objective of this study is to add clarity to thinking by identifying and analysing those issues critical to developing market demand, and quantifying the opportunities in light of that analysis. This has been accomplished by creating analytical frameworks for evaluating services, applications, business models and device types, and by using a structured, rigorous methodology for quantifying opportunity into regional service forecasts.

The forecast approach is a conservative one, using realistic adoption rates and price points. The end result is a snapshot of three high-potential services with achievable 3G services provider revenue streams. The study did not attempt to quantify revenue for players other than mobile services providers, to forecast all possible services, or to recommend specific pricing strategies. The study considers demand served via 3G technologies, including satellite technology that may be used to serve remote or rural areas.

This study has used several recent secondary research reports on the subject of 3G markets as a starting point, with the goal being to produce an updated market assessment for a market that is rapidly changing. Telecompetition using its proprietary ATIVA Research Tools® developed the forecast contained later in this report. In addition, key industry experts were interviewed to validate hypotheses and share their perspective and vision. As part of the process, Telecompetition developed a number of country-level inputs including worldwide forecasts, propensity-to-buy and GeoGain™ (country weighting) scores.

Early in this study, the UMTS Forum identified a number of hypotheses about 3G that have been proposed by various sources. These hypotheses do not represent the pre-defined views of the UMTS Forum. They are a distillation of some important issues that have been raised or firm statements that have been published in the various secondary research reports.

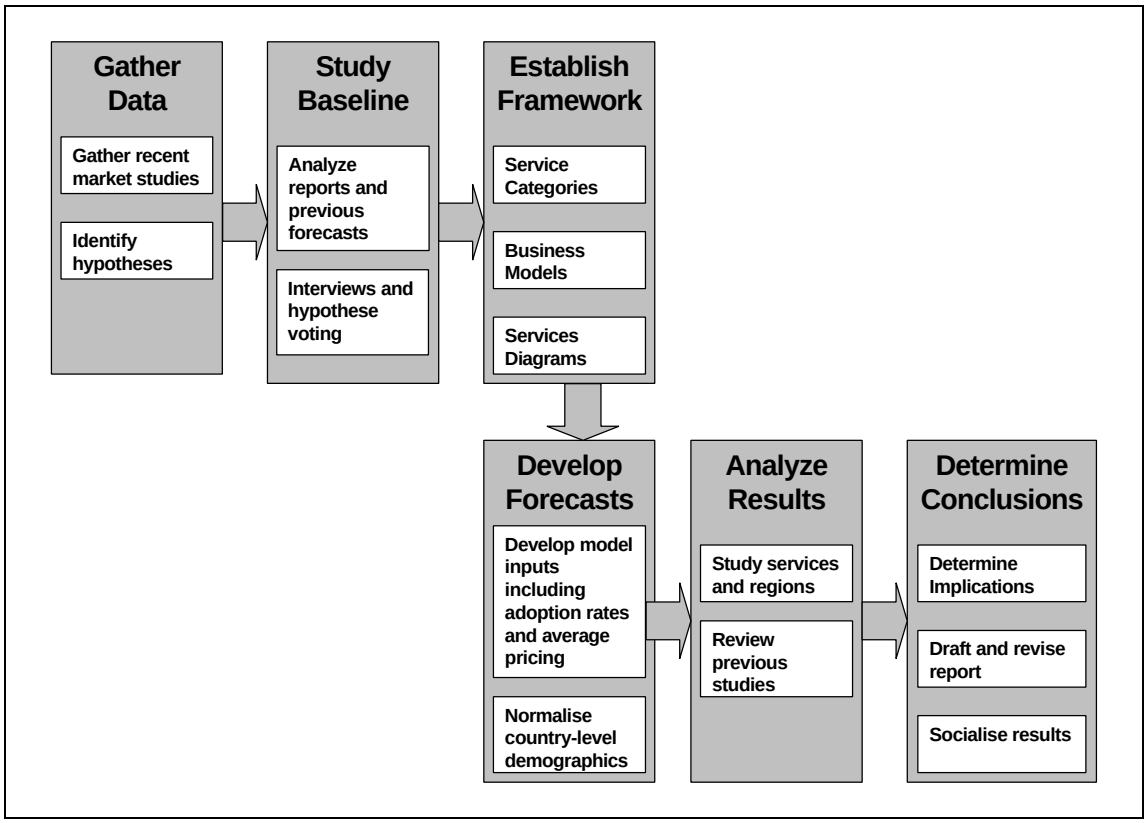
These hypotheses were presented to vendor and services provider contacts

[5] UMTS Forum Reports 1, 2 and 8.

within the industry, UMTS Forum members, and to individuals interviewed in connection with the study. Recipients were asked whether they strongly agreed, agreed, had no opinion, disagreed or strongly disagreed with each hypothesis. A total of 58 responses were accumulated. The tabulated responses for a selection of these hypotheses are shown as "Industry Views" and have been used to illustrate specific points throughout this report.

The responses to the hypotheses represent an industry perspective on the issues. They do not always agree with the market perspective on which this study is based. Figure 1 summarises the study methodology.

Figure 1. UMTS Forum Report #9 study methodology.

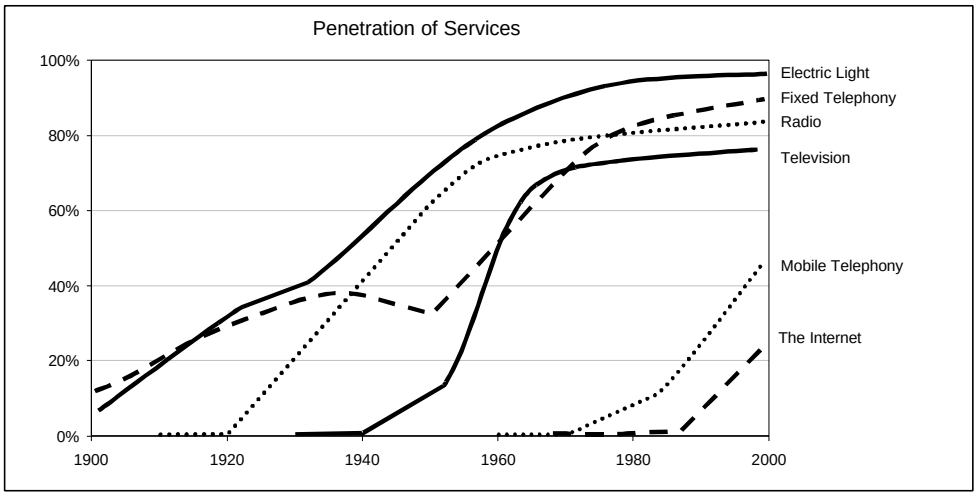


Source: Telecompetition Inc., July 2000.

Most previous forecasts of 3G subscribers and revenues have been built around technological criteria. Subscriber number and revenue forecasts have been grouped into categories according to the data rates required, or other essentially technical criteria such as the degree of asymmetry involved in data delivery.

This study takes a different approach, acknowledging the fact that market growth is driven by services rather than by technology. As Figure 2 illustrates, market growth has only just begun in both the mobile and Internet worlds.

Figure 2. Penetration of services in US households.



Source: US Bureau of Census, 1996.

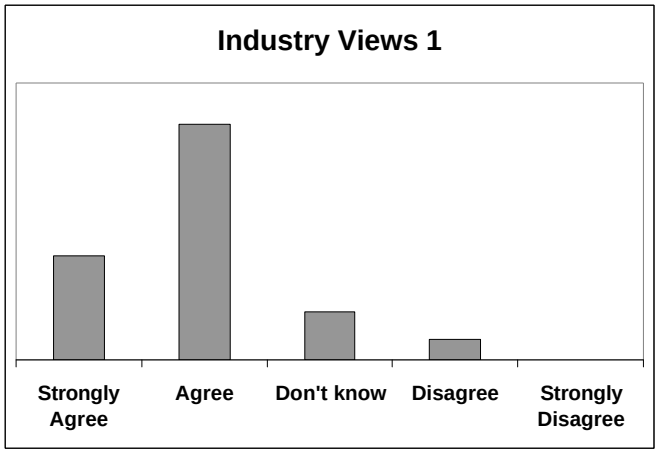
Mobile telephony already has a clear lead over the Internet in terms of penetration. As of August 2000, there are over 570 million mobile users worldwide compared with some 200 million users of the Internet.[6] It should come as no surprise to learn that the number of mobile devices capable of accessing the Internet will soon outnumber the quantity of Internet-capable Personal Computers (PCs).

Both mobile and Internet penetrations are now on the exponential portion of the classic "S" demand curve illustrated in Figure 2. But this does not necessarily mean that "mobile Internet," a frequently used description of 3G services, will automatically experience the same exponential growth rate. Nevertheless, most forecasts of 3G subscribers and revenues simply assume a dramatic uptake of mobile Internet services. This is more a statement of faith than a reflection of reality. 3G service revenues will only materialise if 3G networks deliver compelling services that satisfy subscriber needs. Adding mobility to the Internet is a necessary but not a sufficient condition for success.

Not everybody agrees with this proposition. There is a belief within the industry that the introduction of the mobile Internet will accelerate the already rapid growth of both mobile and Internet services (Industry Views 1). Note that the consequence of such an accelerated pace is that Internet adoption in developed countries from the combination of wireline and mobile access would approach 100 per cent by the year 2010.

[6] Sources: Dain Rauscher Wessels, and Telecompetition Inc., 2000.

Industry Views 1. The mobile Internet will greatly accelerate the adoption rates of both mobile and Internet services—even beyond the high growth rates currently seen.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

The Internet was in existence for about three decades before it entered the current phase of mass-market acceptance. The trigger was the introduction of interfaces such as Mosaic and the World Wide Web that transformed the Internet into a user-friendly environment. The PC was merely a cheap alternative to mini-computers until the introduction of mass-market applications such as spreadsheets and word processing. Mobile was a limited alternative to fixed telecommunication services until national coverage could be guaranteed, and has only become a true mass-market commodity with the introduction of prepaid services.

The success of 3G will not just come from the mere combination of two existing successful phenomena—mobility and the Internet. The real success of 3G will result from the creation of new service capabilities that genuinely fulfil a market need. Meeting market demand is not just a question of technological capability and service functionality. Creating and meeting market demand requires services and devices to be priced at acceptable levels. This requires economies of scale to be present. The ability to benefit from economies of scale is one of the strongest market drivers for 3G services. Universal Terrestrial Radio Access (UTRA) now includes both the Direct Sequence and Time Code components of IMT-2000 and so embeds both the FDD access mode previously known as W-CDMA as well as the TDD modes previously known as TD-CDMA and TD-SCDMA. UTRA is now applicable to the major markets of Europe, China, South Korea and Japan. UMTS promises significant economies of scale.[7]

[7] Study Group 11 of the ITU Telecommunication Standardisation Sector agreed five radio interface standards for the terrestrial component of IMT-2000. These are:

- IMT-DS Direct Sequence (UMTS Terrestrial Radio Access - Frequency Division Duplex (UTRA-FDD), Wideband CDMA (W-CDMA) or UMTS-FDD) using paired spectrum

- IMT-MC Multi-Carrier (cdma2000 3X) using paired spectrum

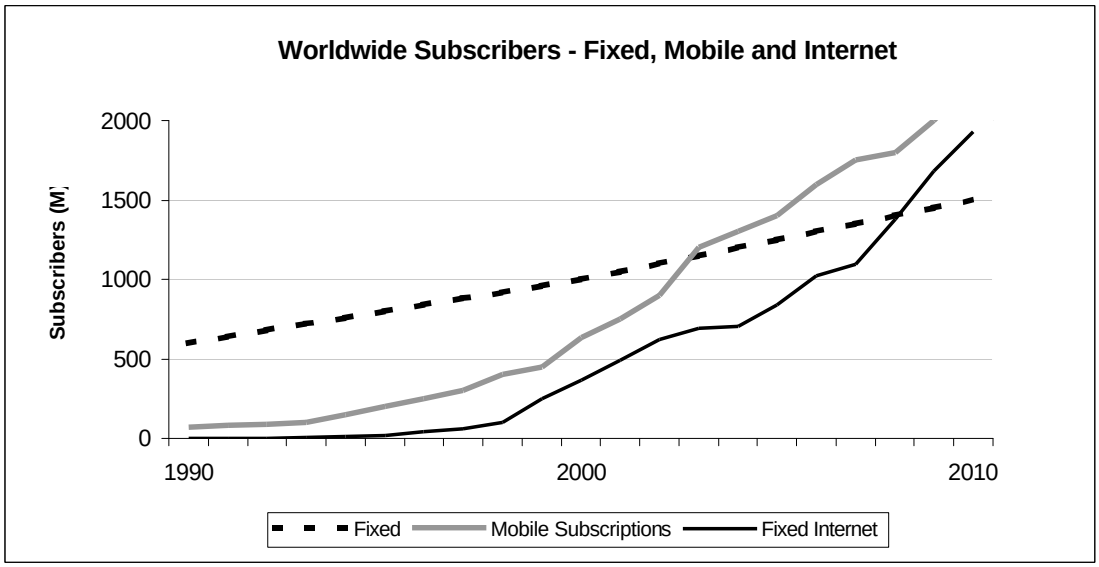
- IMT-TC Time Code (UTRA-TDD (Time Division Duplex) and TD-SCDMA (exact specification still to be finalised)) using unpaired spectrum

This study examines the service capabilities that UMTS can provide from a market perspective. It identifies six service categories that encompass much of the revenue potential from 3G services that can be envisaged today. It concludes that 3G is much more than the addition of mobility to the Internet. 3G has a successful future in its own right.

2.2 Mobile and Internet Growth

The statistics paint a relentless picture. Internet users are growing by over half a million per day.[8] A quarter of a million people around the globe are signing up for mobile cellular service *every single day*.[9] Mobile cellular is on target to reach one billion subscribers worldwide by 2002-2003. It will have taken cellular over 10 years to reach the billion mark compared with 130 years for the fixed networks (Figure 3).

Figure 3. Worldwide subscribers to fixed, mobile, and fixed Internet networks.[10]



Sources: ITU[11], World Telecommunications Development Report 1999 with Telecompetition Inc., July 2000.

The International Telecommunication Union's (ITU) World Telecommunications Development Report 1999 predicted that there would be more mobile than fixed subscribers worldwide by 2007. More recent industry estimates (July 2000) suggest a crossover point as early as 2002. Whatever

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- IMT-SC Single Carrier (UWC-136 (US TDMA)) using paired spectrum

- IMT-FT Frequency Time (Digital Enhanced Cordless Telecommunications (DECT)) using both paired and unpaired spectrum

[8] Dain Rauscher Wessels, 2000.

[9] ITU, World Telecommunications Development Report 1999.

[10] Subscribers refer to the number of people using the service. Mobile subscriptions refer to the number of services used.

[11] International Telecommunication Union.

the reality will be, this discrepancy illustrates the fact that forecasts of mobile penetration rates increase inexorably with time. Past forecasts have almost always significantly underestimated actual figures. Forecasting mobile growth has often been more of an art than a science.

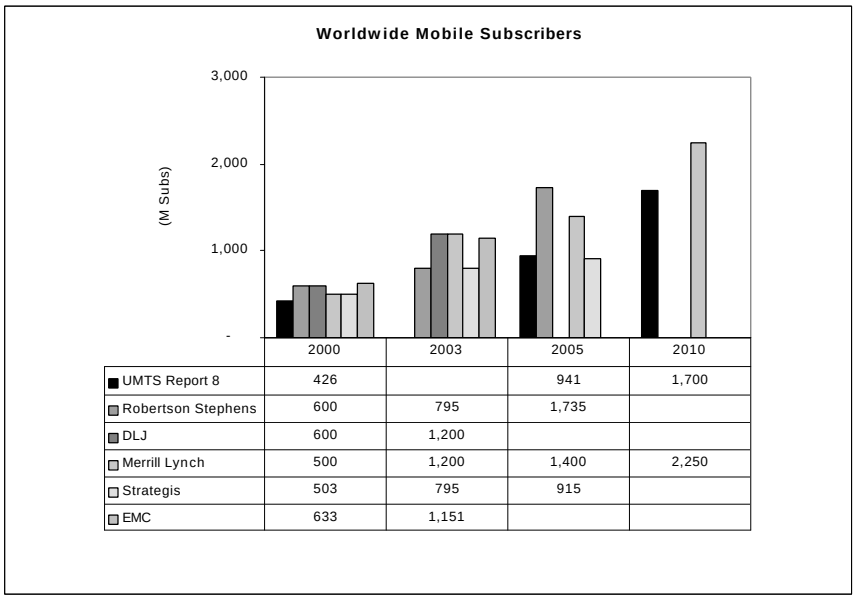
The continued use of mobile penetration rates and ARPU as performance indicators for the future 3G environment has to be questioned. Mobile penetration rates have been a reliable measure of success for mobile markets in the past and have been considered a reasonable indicator of revenues. This may not be the case in the 3G environment that will have characteristics closer to the Internet than to the traditional mobile world. The Internet community has also been using subscriber numbers as a virility symbol but is now learning that high subscriber numbers without an underlying revenue stream does not guarantee a sustainable long-term business.

"Internet winners are not those who got there first– they are those who have the best content"

Phil Laven, Technical Director, European Broadcasting Union

There is no lack of information and analysis on the mobile data opportunity. Worldwide forecasts for mobile cellular subscribers, for example, are abundant and often vastly different. Definitions and methodology vary; and due to the great uncertainty in the market, most analysts do not attempt to forecast beyond five years. Telecompetition analysed over two dozen research and analyst reports, sifted through large amounts of data, and distilled the information down to quantifiable items that impact market demand. In developing the underlying forecast for this report, Telecompetition considered the data shown in Figures 4 and 5 to arrive at headline figures.

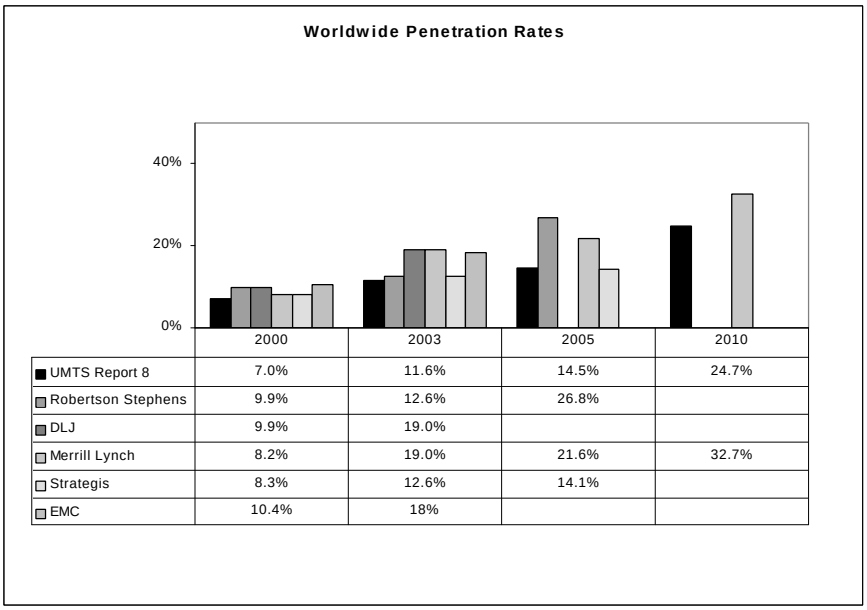
Figure 4. Worldwide mobile cellular subscriber forecasts – all services and all technologies.[12]



	2000	2003	2005	2010
UMTS Report 8	426		941	1,700
Robertson Stephens	600	795	1,735	
DLJ	600	1,200		
Merrill Lynch	500	1,200	1,400	2,250
Strategis	503	795	915	
EMC	633	1,151		

Sources: Merrill Lynch, June 2000; Strategis, 1999; DLJ, May 2000; EMC, July 2000; UMTS Forum, 1997; Robertson Stephens, June 2000; Telecompetition Inc., July 2000.

Figure 5. Worldwide penetration – all mobile cellular services.



	2000	2003	2005	2010
UMTS Report 8	7.0%	11.6%	14.5%	24.7%
Robertson Stephens	9.9%	12.6%	26.8%	
DLJ	9.9%	19.0%		
Merrill Lynch	8.2%	19.0%	21.6%	32.7%
Strategis	8.3%	12.6%	14.1%	
EMC	10.4%	18%		

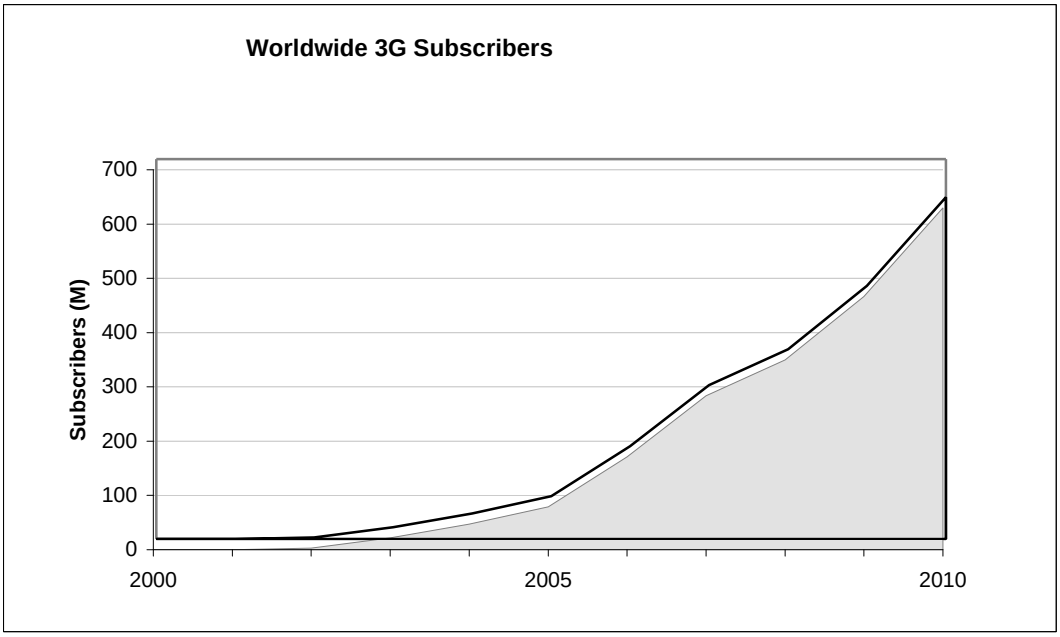
Sources: Merrill Lynch, June 2000; Strategis, 1999; DLJ, May 2000; EMC, July 2000; UMTS Forum, 1997; Robertson Stephens, June 2000; Telecompetition Inc., July 2000.

As the UMTS Forum forecast is now over two years old and is now recognised as too conservative, Telecompetition chose to adopt a higher

[12] Strategis, UMTS Forum, DLJ, Merrill Lynch, and Robertson Stephens end-of-year (EOY) 1999 forecasts do not reflect the most recent 2Q2000 results from EMC of 572.8M subs as of June 2000. Strategis estimate of worldwide subscribers derived from the sum of selected country level forecasts and dedoes not include all countries.

forecast for worldwide mobile cellular subscribers, which exceeds 30 per cent worldwide penetration by 2010 (closely following Merrill Lynch estimates). With over 50 per cent of the world population residing in "low income" countries, a 30 per cent penetration level translates into a 60+ per cent penetration level in developed countries and therefore, a reasonable estimate. In addition, estimates were made of the substitution rate of 3G over other mobile technologies. Telecompetition reviewed research by other industry experts[13], estimated country-level commercialisation dates, considered operator execution issues and financial limitations, and developed the 28 per cent 3G "share" of mobile subscribers by 2010 as shown in Figure 6. On a worldwide basis, adoption of 3G is slow in the first few years due to the time required to complete licensing and network buildout. However, in the developed countries, adoption is much faster, with Western Europe, for example, accounting for over 60% of the worldwide 3G subscribers in 2003.

Figure 6. Total worldwide 3G subscribers.



Source: Telecompetition analysis and review of secondary research including Strategis, Herschel Shosteck, Merrill Lynch, Robertson Stephens, August 2000.

2.3 The UMTS Concept

The original vision for 3G, as exemplified by the ITU's FPLMTS[14] concept, envisaged the provision of tightly integrated voice and high data rate services to a hand-held wireless terminal device. 3G was to be a global standard, facilitating international roaming. It was essentially a market-driven approach, conceived before the implementation of second-generation (2G) networks.

[13] Research reviewed included Strategis, Herschel Shosteck, Merrill Lynch, Robertson Stephens and others.

[14] The International Telecommunication Union's Future Public Land Mobile Telecommunications Systems (FPLMTS) concept has since been renamed IMT-2000.

Now that 2G networks have been deployed for nearly a decade, the concept of 3G has had to be modified.

The success of 2G expanded the cellular market beyond all expectations. And the success of the Global System for Mobile communications (GSM) fundamentally altered the characteristics of that market. GSM developed into a near-global system, providing widespread international roaming between all continents, and delivering both voice and data services to a hand-held terminal. Within the large North American market, GSM was challenged by alternative 2G technologies in the form of Time Division Multiple Access (TDMA) (IS-136) and cdmaOne (IS-95). Japan introduced its own 2G standard, Personal Digital Cellular (PDC), as well as cdmaOne. Operators throughout the world invested heavily in 2G technologies to satisfy market demand. Regional mobile cellular markets developed in different ways (Table 1).

Table 1. Regional differences in mobile cellular markets.

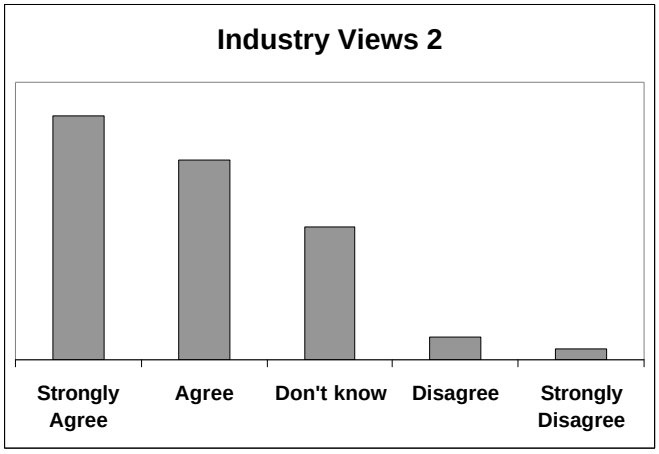
	Europe	Asia Pacific	US
Standards	One digital standard (GSM)	Three + digital standards	Three + digital standards
Coverage	Excellent	Good	Fair
Calling Party Pays	100%	High	None
Wireline Service	Metered	Metered Business desks share one phone	Flat rate
SMS[15]	Available for many years	Available for many years	Not widely used

Source: Telecompetition Inc., September 2000.

Introducing 3G into this environment required a change of focus. The need to protect existing investments in different 2G technologies has shifted the drive toward a single global standard. When you add the significant event of the emergence of the Internet, the additional capabilities of 3G became more focused on the provision of high data rates to deliver multimedia services. The emergence of the Internet as a mass-market content resource had justified the need for such high data rate capabilities and has since shifted the emphasis to packet-switched, Internet Protocol (IP)-based core networks. There is general acceptance within the industry that 3G core networks will eventually be all-IP based (Industry Views 2).

[15] SMS = Short Message Service

Industry Views 2. 3G core networks will be all-IP based by 2010.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

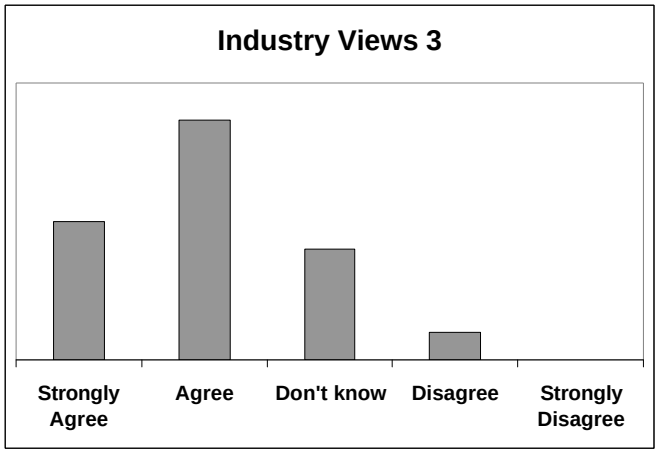
The solution was the introduction of the IMT-2000 family of systems concept for 3G. One consequence of that solution is that a single global standard does not exist yet. However, the UMTS Forum believes that progress of technology, operational deployments, and market requirements will continue toward convergence. Another consequence – important when considering market perspectives – is that 3G now means different things in different parts of the world.

In Europe, 3G refers to the UMTS technology members of the IMT-2000 family, derived from GSM and deployed on new spectrum. There is a strong focus within the UMTS community on international roaming capabilities and the potential benefits of the economies of scale that result from a common standard deployed across many nations. The same UMTS technology members will be used in South Korea, China, Japan and most of the Asian region.

In the US, 3G refers to derivatives of existing 2G technologies, deployed largely on occupied spectrum. 3G in the US focuses more on high data rates; international roaming capabilities are not a significant concern. The US has lagged behind other world regions in the deployment of 2G digital cellular.[16] Industry opinion is that it will continue to lag behind in the deployment of 3G (Industry Views 3). In Japan and South Korea, 3G means an opportunity to join the worldwide opportunity.

[16] The majority of cellular subscribers in the US are still on analogue systems.

Industry Views 3. The US will continue to lag behind European/Asian markets in 3G deployment.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

This situation reflects differences in culture and in the approach to standardisation. The large domestic market of the US celebrates diversity. The US approach is to let the market determine which standards succeed. Much of the rest of the world takes the opposite approach, seeing standards as a way of creating markets. The success of GSM is a consequence of this approach. In this approach, the choice of the standard and underlying technology is itself the result of a competitive process.

The opposite approaches to standardisation will actually converge in the 3G environment following WRC-2000 in Istanbul where spectrum was identified to enable 3G to deliver multimedia services. The results of WRC-2000 have opened up more potential markets for 3G. Where IMT-2000 is accepted, market forces will determine when the spectrum is released and what 3G technology will be deployed.

However, the market for 3G is radically different from that for earlier generations of cellular which owe their success to the addition of mobility to voice communications. The market now takes mobility for granted. Simply adding mobility to data communications will no longer command a sufficient premium to justify the introduction of 3G.

3G will have to satisfy market expectations. Those market expectations are determined by developments in the fixed Internet world that is now delivering high-speed access to content. Both the access and the content are perceived by consumers to be low, or even zero, cost. Market expectations for 3G today are for affordable multimedia communications to hand-held and portable devices–delivering the *same functionality* as can be achieved in the fixed environment a*nd at similar price levels*. Providing such functionality at a price acceptable to the market can only be achieved through technologies with a sufficient global reach to achieve significant economies of scale.

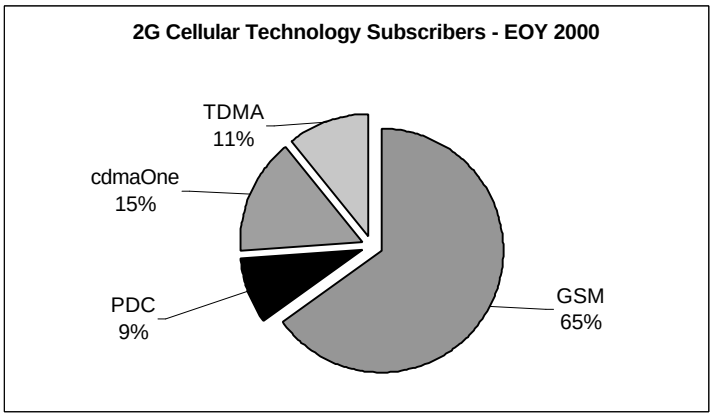
The history of cellular illustrates that market success is determined more by the availability of terminals than by the provision of network resources.

Terminal manufacturers face a multiplicity of choice in a multi-mode environment and naturally focus their resources on developing products for what they perceive to be the largest potential markets. Economies of scale rule supreme in cellular terminal manufacturing which is rapidly becoming a consumer electronics environment.

Without massive economies of scale, technologies will not be able to survive in the 3G environment. Intermediate or regionally based systems will become, in the words of Herschel Shosteck Associates, "orphan technologies."[17] This applies not only to 3G technology candidates but also to some of the interim technologies being introduced on the road to 3G.

In 2G technologies, GSM currently has 65 per cent of the world market (Figure 7). Japan has decided that its PDC 2G technology will not be evolved to 3G but will be replaced by the UMTS/IMT-2000 technologies. The TDMA and GSM communities are working on harmonisation procedures in the approach to 3G. The 15 per cent of the world market currently using cdmaOne technology, mainly located in the US and South Korea, have a transition path to the IMT-MC member of the IMT-2000 family, but are limited to existing spectrum.

Figure 7. 2G cellular technology statistics – EOY 2000 estimate.



Source: EMC, August 2000.

Assuming that deployed 3G technologies will follow migration paths from 2G, it is clear that UMTS will enjoy significant economies of scale worldwide. In the US, GSM is close to achieving a national footprint that should eventually ensure roaming capability with UMTS services providers worldwide using multi-band rather than multi-mode handsets—a much more attractive proposition for terminal manufacturers.[18]

[17] Herschel Shosteck Associates, Third Generation Wireless (3G): Why, When and How It Will Happen, November 1999.

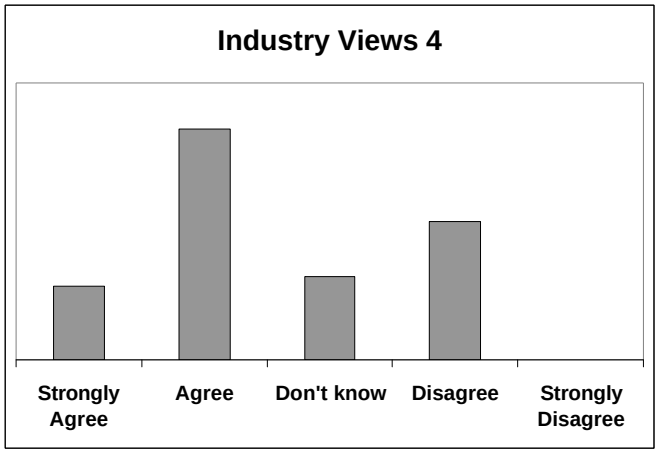
[18] Multi-mode solutions such as GSM/DECT and intermediate technologies such as HSCSD (High Speed Circuit Switched Data) have been deployed by operators, but suitable terminals have failed to materialise in volume.

With a potential market size of less than 20 per cent, cdma2000 has been forecasted to become a "semi-orphan technology, gradually falling behind IMT-2000/UMTS."[19]

The same may not be true for the low chip rate TD-SCDMA (Chinese proposal for the TDD mode). The possibility of implementing IMT-TC rather than IMT-DS technology in the vast rural areas of China would immediately give this option sufficient economies of scale to be economically interesting.

There is a belief in the industry that 3G will play a role in meeting the communication needs of developing countries, helping to narrow the digital divide surrounding access to the Internet that increasingly separates the developed from the developing world (Industry Views 4).

Industry Views 4. The communication needs of developing countries will provide a significant source of 3G growth and revenue over the next 10 years.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

There is evidence that narrowing the digital divide will occur through the implementation of 3G networks in developing countries. In general, mobile communications is seen as very important for developing countries to build up economic activity. This study, however, has not forecasted significant deployment of 3G networks in developing countries between now and 2010. This is in line with the conservative approach to market forecasting adopted in this study. **However, the UMTS Forum strongly recommends that deployment of 3G networks in developing countries does in fact occur sooner rather than later to meet ITU objectives**. Actual forecasts can be found in Section 5.

2.4 Market Perceptions

Japan has been forcing the time scale for the early implementation of 3G for a variety of political and economic reasons. Japan is unique in the cellular

[19] Herschel Shosteck Associates, Third Generation Wireless (3G): Why, When and How It Will Happen, November 1999.

world because it does not intend to migrate its existing 2G technology to 3G, although it is faced with 2G capacity constraints. Even roaming between PDC and 3G is discouraged—there will be no dual-mode handsets.

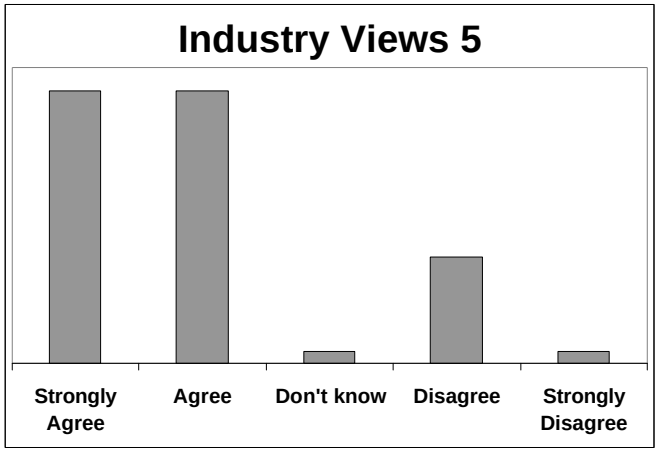
Heavily subsidised Nippon Telephone & Telegraph (NTT) DoCoMo's i-mode has become a mass-market success, providing "high speed Internet access from mobile phones." It is considered by many to have out-staged WAP. "Accessing the Internet via the current WAP phones has proved a disappointment for many, due to slow connections and limited content."[20]

The fact that i-mode is neither high speed nor provides Internet access does not matter to the market. It is successful because it is a branded, easy-to-use service with rich content. It is perceived to be high speed because it is packet-based, allowing fast connection times.

WAP has not waited for General Packet Radio Service (GPRS) packet-based networks but has been released on current circuit switched networks in the GSM world. It is therefore now perceived as a clunky, slow service. It is, in fact, a branded technology—not a service. WAP users on different networks have access to different content. The consequence is that "WAP services" are now perceived in the marketplace to have limited content.

Neither i-mode nor WAP are fully-fledged 3G solutions. This is, of course, accepted throughout the mobile industry (Industry Views 5).

Industry Views 5. WAP is only an intermediate solution. Longer-term mobile users will demand full HTML[21]/Web-browsing capability.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

But the market has a different perception. The distinction between long-term and short-term solutions is understood by the supply side but is not appreciated by the demand side of the market. Promising too much too soon

[20] Financial Times, 13 July 2000.

[21] HTML = Hypertext Markup Language.

can have serious adverse effects on eventual market development.

Market perceptions are not based on the reality of the technology. But market perceptions ultimately determine the success of the technology. Market perceptions and service branding matter a great deal.

The market perceives i-mode to be an extension of mobile telephony into the data-based Internet environment. i-mode offers additional functionality and is viewed positively.

By contrast, some services providers are now marketing WAP as enabling mobile phones to surf the Internet. The promise here is entirely different. Adding mobility to computing and the Internet raises entirely different expectations. Internet surfers are not willing to compromise on reduced functionality. WAP, therefore, comes as a disappointment, even though it is intended to be "telephony plus" rather than "computer minus."

Both i-mode and WAP are examples of one approach to the market—the approach of extending mobile terminals into the data and computing environments. This approach is targeted at the "moving" mobile (rather than the portable) environment and seems to be favoured by European manufacturers.

The alternative approach is to extend computers to become communication devices—an approach more favoured by US manufacturers. This approach is targeted more at the portable than at the mobile environment.

Both approaches will co-exist for some considerable time. In the short term, this could lead to some polarisation in market perceptions of 3G between the US and the rest of the world. The US will tend to market 3G as adding mobility to computing devices. The rest of the world will tend to market 3G as adding computing and data functionality to mobile devices.

Both are already positioning 3G as the mobile Internet. Both will therefore run the risk of not satisfying the market. Fixed Internet technology is developing much faster than mobile technology. **The market expectations of Internet users tomorrow will be much higher than their expectations today.**

Device manufacturers have an even harder task. Evolving from an established technology base may impose more constraints than benefits. Willingness to change could well be the key to the development of the successful 3G multimedia terminal devices of the future. A prediction present since the beginning of the cellular market may now be realised. The centre of gravity for terminal devices will shift toward Japanese consumer electronics manufacturers—at least for the near term.

Market perceptions have a greater influence on commercial success than technological realities. This should be borne in mind when considering 3G services and applications.

2.5 Study Framework

Numerous articles, reports and documents are available that discuss 3G mobile services and applications. Yet, in all this literature, we have found no clear definition of the two terms. The labels "service" and "application" often seem to be interchangeable—even within the same document. A concept such as m-commerce will be classified as a service in one report and an application in the next. The terminology serves to confuse rather than clarify.

2.5.1 Services and Applications

We would like to introduce a clear distinction between services and applications.

Services are the portfolio of choices offered by services providers to a user.
Services are entities that services providers may choose to charge for separately. They will be a prime differentiator between services providers in the 3G environment. Users are likely to select their preferred 3G services providers based on the options available in that product portfolio. Different users will choose different service options. They may elect to subscribe to a personalised mobile portal offering banking facilities. They may later decide to add unified messaging. Such service options will affect the user's bill.

Applications are service enablers—deployed by services providers, manufacturers or users.
Applications are invisible to the user. They do not appear on a user's bill. A banking service, for example, would require a secure transaction application to be implemented by the services provider. A unified messaging service would require voice recognition and text-to-speech applications deployed on the network or in the terminal device. Individual applications will often be enablers for a wide range of services.

Under these definitions, m-commerce will most commonly be an application rather than a service. More strictly, it will be the combination of a large number of applications (e.g., security, certification, transaction recording and interchange, application execution environments, etc.) that an services provider deploys to enable a range of services.

This study will adhere rigorously to the distinction between services and applications defined above. Services are entities that mobile networks deliver from the user's perspective. Applications are entities that enable the delivery

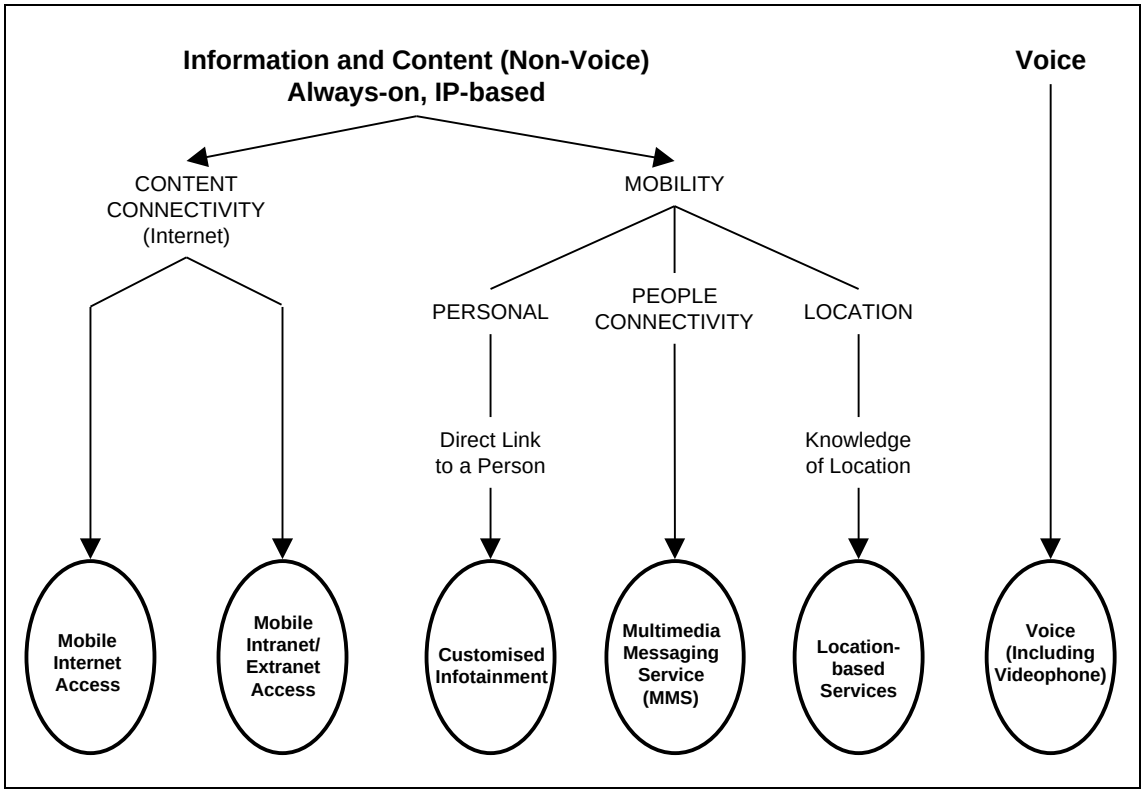
of services over mobile networks. Applications are usually sourced from third-party suppliers but may also be created by mobile services providers. Some applications could be sold by services providers into the corporate market creating a separate revenue stream, or the application cost could be bundled within the service charges.

But the main market demand is for services, not applications. Defining the universe of services used to be trivial. A simple distinction between voice services and data services was often sufficient. In the 3G world, defining a unique set of distinct categories of services is a difficult task. These difficulties reflect the wealth of opportunity opened up by 3G. They are a cause for celebration, not despair.

2.5.2 Service Categories

This study identifies six service categories that we believe represent the majority of the demand for 3G services over the next five years. The six service categories are defined determinedly from a user perspective and are intended to reflect the perception of the market. Technological distinctions have been deliberately ignored in the service definitions.[22] There is a compelling logic behind the six service categories that are illustrated in Figure 8.

Figure 8. 3G services framework.



Source: Telecompetition Inc., September 2000.

[22] Technology constraints have, of course, been taken into account in the service demand forecasts.

Rather than the voice-centric environment that has dominated the mobile world to date, 3G will be an always-on data environment. Enabling anytime, any place connectivity to content on the Internet will clearly be an important role for 3G. Users will be able to add mobility to their fixed Internet experience giving rise to what could be termed "untethered desktop" services—***Mobile Internet Access*** for the residential market segment and ***Mobile Intranet/Extranet Access*** for the business segment.

Mobile Internet Access	A 3G service that offers mobile access to full fixed ISP[23] services with near-wireline transmission quality and functionality. Includes full Web access to the Internet as well as file transfer, electronic mail (e-mail), and streaming video/audio.

Mobile Intranet/ Extranet Access	A business 3G service that provides secure mobile access to corporate Local Area Networks (LANs) and Virtual Private Networks (VPNs).

But mobility is not the only benefit provided by cellular networks. Mobile cellular networks have two distinctive features that distinguish them from the fixed networks. The mobile terminal is associated with a person rather than a place, and the network knows the current location of that terminal. These are powerful features, particularly in the multimedia environment of 3G.

Association of a terminal with a person allows the provision of a whole range of Internet-based content services tailored to the needs of the user and delivered through mobile portals. NTT DoCoMo's i-mode service is an early indicator of the potential of such ***Customised Infotainment*** services. These services based on mobile portals are a major opportunity for 3G services providers. Mobile portals encourage loyalty through the ability to personalise the selection of available content and commerce capabilities.

Customised Infotainment	A consumer 3G service that provides device-independent access to personalised content anywhere, anytime via structured-access mechanisms based on mobile portals.

Association of a terminal with a person also creates the opportunity for messaging services amongst closed user groups or specific communities of interest. The dramatic growth in short message service (SMS) traffic in GSM networks illustrates the demand for such messaging capabilities. The always-on characteristic of 3G networks will enable instant messaging capability, and the high data rates available will add image and video capability to create a ***Multimedia Messaging Service***.

[23] ISP = Internet Service Provider.

Multimedia Messaging Service	A consumer 3G service, that offers real-time, multimedia messaging with always-on capabilities allowing the provision of instant messaging. Targeted at closed user groups that can be services provider- or user-defined.

Knowledge of the current location of a mobile terminal (which may be associated with a person or a machine) is already generating a rich portfolio of ***Location-Based Services***. Again, the combination of always-on connectivity and multimedia capability available with 3G adds a new dimension to this service category. Location technology not only enables specific Location-based Services but also enhances other service offerings such as Customised Infotainment and will be a major driver for the creation of new applications.

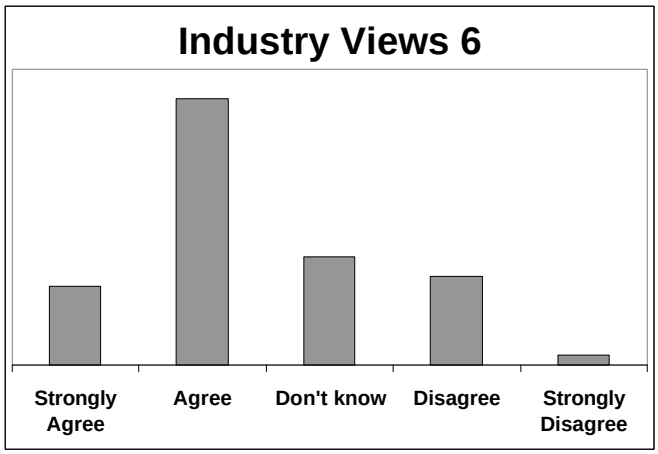
Location-Based Services	A business and consumer 3G service, that enables users or machines to find other people, vehicles, resources, services or machines. It also enables others to find users, as well as enabling users to identify their own location via terminal or vehicle identification.

Voice will inevitably continue to be an important service offering in the 3G environment. High data rates will allow the addition of videophone capabilities to traditional voice services. The IP environment of 3G will allow the delivery of multimedia communications within the ***Rich Voice*** service.

Rich Voice	A 3G service that is real-time and two-way. It provides advanced voice capabilities (such as Voice over IP (VoIP), voice-activated net access, and Web-initiated voice calls), while still offering traditional mobile voice features (such as operator services, directory assistance and roaming). As the service matures, it will include mobile videophone and multimedia communications.

Note that high data rates, real-time and machine-to-machine communications could be a component of all six service-categories. There is a some doubt within the industry that high data rates will be a major factor driving demand for 3G services (Industry Views 6).

Industry Views 6. Applications below 384 kbit/s will dominate demand for 3G for the next 10 years.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

Inevitably the boundaries between these service categories are somewhat artificial, and there is considerable overlap between the categories. Whether an individual service offering falls into one category or another could be the source of protracted (and ultimately fruitless) debate.

The service category definitions provide a framework for analysis of market demand and discussion of industry trends. They encapsulate the essential differences between the mobile and fixed environments—differences that create enormous opportunities. They incorporate the major learnings that have already emerged from the introduction of data services in the 2G environment.

The framework cannot, of course, include radically new service categories that have yet to be invented or implemented. Such developments will inevitably occur and will only further expand the market opportunity for 3G services.

A summary of the six service-categories indicating the market segments analysed is presented in Table 2. Detailed market forecasts have been made for three of these services: Mobile Intranet/Extranet Access, Customised Infotainment and Multimedia Messaging Service.

Table 2. Services that represent the majority of the near-term 3G demand.

Service Name	Service Description	Market Segment Analysed
Mobile Internet Access	A 3G service that offers mobile access to full fixed ISP services with near-wireline transmission quality and functionality. Includes full Web access to the Internet as well as file transfer, e-mail, and streaming video/audio.	Consumer
Mobile Intranet/Extranet Access	A business 3G service that provides secure mobile access to corporate Local Area Networks (LANs) and Virtual Private Networks (VPNs).	Business
Customised Infotainment	A consumer 3G service that provides device-independent access to personalised content anywhere, anytime via structured-access mechanisms based on mobile portals.	Consumer
Multimedia Messaging Service	A consumer 3G service, that offers real-time, multimedia messaging with always-on capabilities allowing the provision of instant messaging. Targeted at closed user groups that can be services provider- or user-defined.	Consumer
Location-based Services	A business and consumer 3G service that enables users to find other people, vehicles, or machines. It also enables others to find users, as well as enabling users to identify their own location via terminal or vehicle identification.	Consumer and Business
Rich Voice (Voice, Video, and Multimedia Communications)	A 3G service that is real-time and two-way. It provides advanced voice capabilities (such as Voice over IP (VoIP), voice-activated net access, and Web-initiated voice calls), while still offering traditional mobile voice features (such as operator services, directory assistance and roaming). As the service matures, it will include mobile videophone and multimedia communications.	Consumer and Business

Sources: UMTS Forum and Telecompetition Inc. research, June 2000.

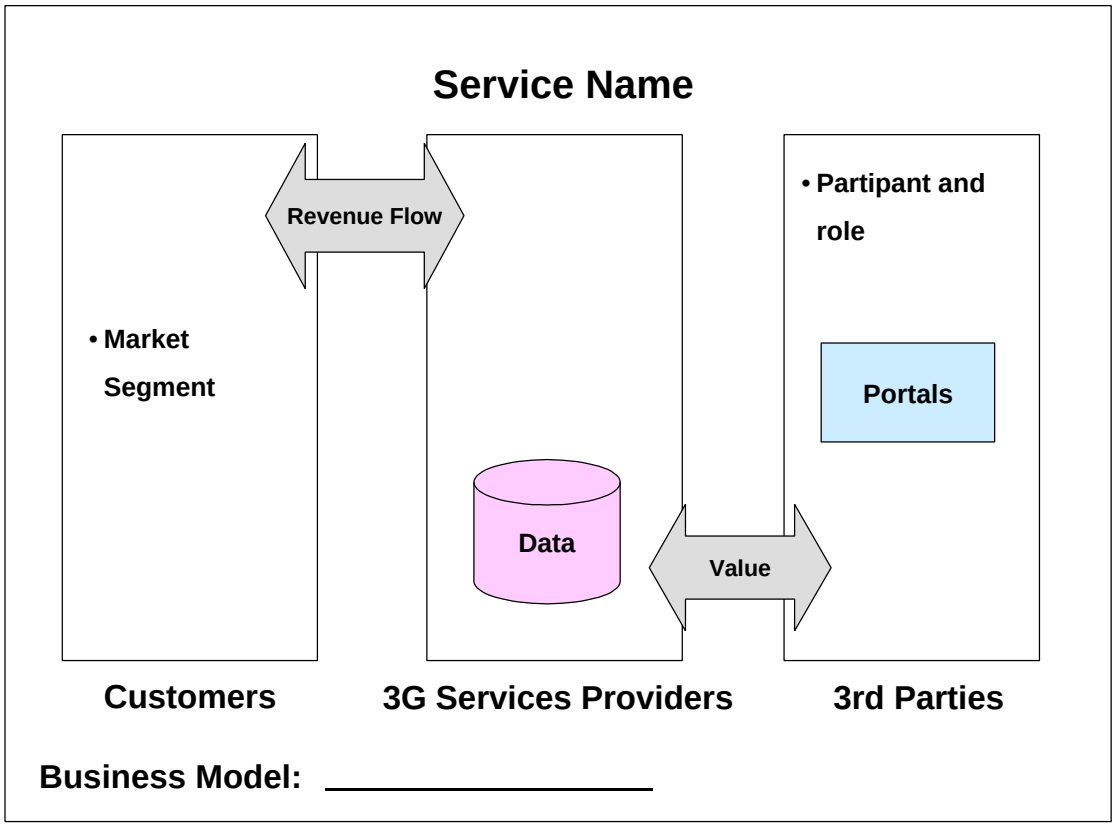
2.5.3 Service Diagrams

For each service category described in the framework, a service diagram(s) can be developed to better understand the business relationships involved in service delivery. The following can be found in the service diagrams show in Section 4:

- What market segment is addressed
- Who controls key data such as portals, subscriber profiles, location data, etc.
- Type of participants and the value they provide
- Illustrative revenue flows
- Business model

Figure 9 shows the service diagram template.

Figure 9. Service diagram template.



Source: UMTS Forum and Telecompetition Inc., July 2000.

The service diagrams are meant as tools for continued analysis and are not intended to be complete. For example, only the consumer segment for Multimedia Messaging Service is illustrated in Section 4, even though this service can be offered to a business segment.

2.5.4 Mapping Services to Business Models

The UMTS Forum has analysed market and industry dynamics and created the following business-model and market-segment frameworks.

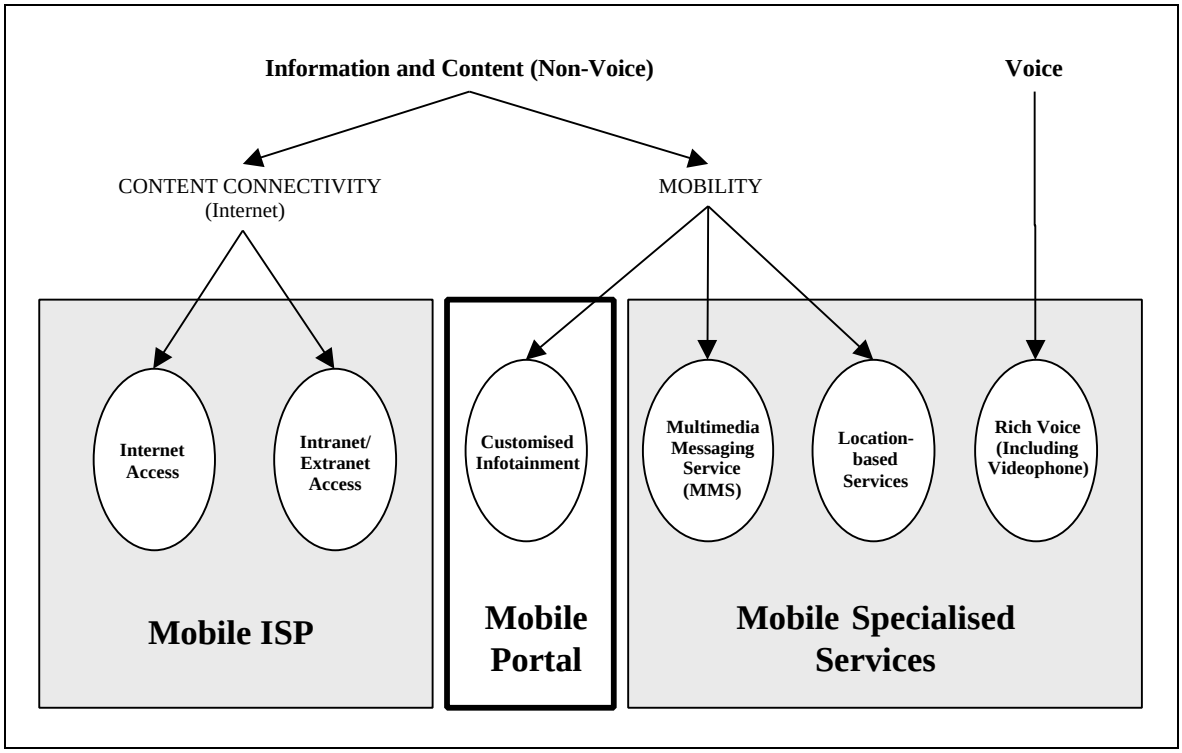
There are three probable business models for mobile services providers that will evolve with 3G mobility. The business model determines what revenue streams the mobile services provider will retain from either its partners or the subscribers.

- The **Mobile ISP** services provider provides ISP services only, with ISP subscription and airtime revenues.
- The **Mobile Portal** services provider provides a mobile portal, which includes access to selected (partner) content as well as access. Revenue sources in this model include subscription, airtime, transaction fees and advertising.
- With **Mobile Specialised Services**, the mobile services provider provides a specialised service capability for a service-set targeted to a specific market. Revenue sources include airtime, subscription and messaging

fees.

In offering the six service categories identified in this study, the mobile services provider will use different business models as shown in Figure 10.

Figure 10. Business model framework and relationship of business models to services.[24]



Source: Telecompetition Inc., September 2000.

There are three major segments of 3G mobile subscribers that correspond to these business models. While in the real world, these three segments are not truly distinct; modelling them separately provides a cleaner picture of the market potential.

- The Internet-centric segment derives from the existing fixed Internet base and will be more likely to subscribe to a mobile computing service which provides similar functionality to that currently available from the fixed Internet. Requirements include full multimedia Internet capability and devices capable of running commonly available software applications. For modelling purposes, it was assumed that mobile services providers would provide this segment with ISP services only (i.e., that these subscribers would continue to use their fixed Internet portal even when mobile).
- The mobility-centric section derives from a mobile telephony base. Worldwide mobile subscribers will adopt "data" capability and will be less likely (initially) to demand full Internet/Web-browsing capability and full

[24] Examples include Multimedia Messaging Service targeted at teenagers and various types of location-based services.

software applications. In this segment, it was assumed that mobile services providers would provide mobile portal or specialised service functionality.

- The third segment derives from new types of services that are neither Internet nor mobile telephony-based. These services fulfil specific user needs for mobility and content, and are typically targeted at smaller segments with specific demographic profiles. Examples include Multimedia Messaging Service targeted at teenagers and various types of location-based services.

2.6 3G Devices

It is difficult to determine precisely how 3G devices will evolve. For certain, their evolutionary path will be the key to when certain 3G services will be available for introduction. However, there are many obstacles that appear to be lined up for 3G-device development.

Device manufacturers want narrow product lines to maintain cost levels as they are squeezed by suppliers and customers. 3G services providers want special consideration with demands for customised or subsidised devices in order to differentiate from competitors. The meeting point will probably be in the choices of keypads, screens, video cameras, colour and device accessories that individual 3G services providers and/or subscribers are willing to pay for. For as long as phones and computing devices have been made, there has been a natural conflict between users and services providers (who want many more choices and features), and manufacturers (who typically seek a narrow product line that allows reasonable profit margins based on lower design and production costs).

Something that will come with the availability of 3G devices is risk sharing between manufacturers and services providers. Revenue sharing will be based on the success of the total service, including the device. This is happening partially because 3G devices will be critical for product introduction. Also, they will be extremely difficult to design and build, and complex dual-mode handsets are likely to be the first device deployed.

In talking with market leaders, it is clear that functions that device makers will automatically have to include in 3G devices are: voice communications; smaller and clearer colour screens; lighter weights; longer battery life; more computing power; and a variety of input choices such as keypads, pens, touch pads, and speech recognition. All the above will be found in a mobile device capable of being held in your hands (Table 3).

Table 3. 3G device categories and characteristics.

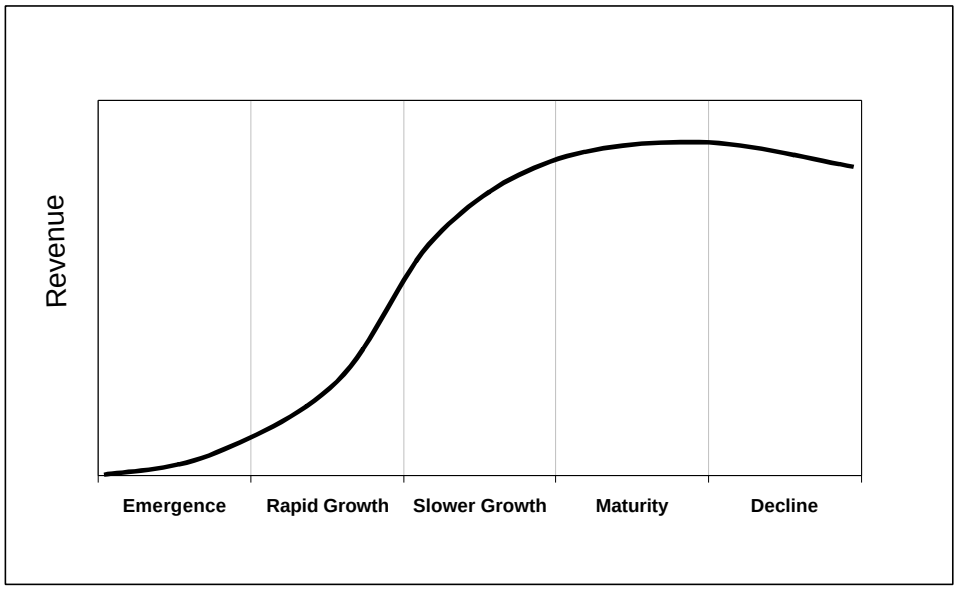
Device Type / Features	Smartphone/ WAP Phone	Personal Digital Assistant	3G Laptop	3G Web Tablet	3G Multimedia Device (Videophone Plus)
Input	Touchpad, keypad	Keypad, pen, voice	Keypad, voice	Keypad, touchpad, pen	Keypad, pen, touchpad, voice
Form Factor	Slightly larger than mobile phone	Small, thin	Becoming smaller, lighter	Magazine-size, (148mmx210mm), lightweight	Larger than Smartphone with keypad smartly built in; camera unobtrusive, video screen small but clear
Power	Low	Low	Medium	Low (always-on)	Medium
Screen	Full colour	Small, flat, full colour	Full colour, high resolution	Full colour, flat panel	Full colour, small, clear, collapsible screen
Graphics	Basic, limited	Yes, (2001)	Yes	Yes	Yes
Video	Some animation	Yes	Yes	No	Yes
Voice	Yes	Yes	Yes	No	Yes
Availability	2000-2005	2000-2006	2004	2004	2005-2010

Source: Telecompetition Inc., August 2000.

2.6.1 Five 3G Device Types

The UMTS Forum has chosen five 3G device types that will fill the study period of 2000 to 2010 with functionality that will enable the six 3G services. These 3G devices will overlap at times, succeed each other in some instances, and decline and evolve in most cases. Each will have its own product lifecycle in accordance with a standard product-lifecycle demand curve such as that illustrated in Figure 11.

Figure 11. Typical product lifecycle demand curve for a 3G device.



Source: Telecompetition Inc., September 2000.

There will be a consolidation in devices as manufacturers seek to meet customer needs while controlling costs. Smartphones and Personal Digital Assistants (PDAs) will become talkative PDAs by 2002. 3G Laptops and 3G Web Tablets, while keeping their separate identities, will both be handheld Internet devices, hitting the high and low end of 3G users. Like all of the 3G devices noted in Figure 12, the 3G Web Tablet will have a product lifecycle of its own through 2010. As innovative technology and customer demand cause the accumulation of all new device capabilities, the 3G Multimedia Device or 3G Personal Companion will become the sought after all-in-one mobile Internet tool for the middle of the decade. Others have predicted that by 2010, there will be a single wireless gadget that will meet all needs.

Smartphones/WAP Phones – These early devices provide content and Web browsing. They use standard and new operating systems and protocols (like Pocket PC and WAP), and will soon synchronise with other devices (like desktops and mobile phones). As WAP becomes popular and takes advantage of the high data rates and always on capability that GPRS will provide, these devices will naturally evolve into some of the first 3G devices at the even higher 3G data rates. The Smartphone will evolve to a Talkative PDA by 2002.

Personal Digital Assistant (Talkative PDA) – Although there is still room for coverage and quality improvements, today you can purchase a PDA that also has mobile voice communications (e.g., radio modems for GSM, OmniSky). Besides their calendars, address books and other organising features, PDAs are thin and lightweight, have colour screens, and are quickly gaining computer strength due to low power chip designs, screen miniaturisation and evolving operating systems (such as Palm Operating System (OS) and EPOC). As they grow in computing capability while maintaining their hand-held form factor, they will continue to distinguish themselves from 3G laptops as less expensive, less powerful solutions. Examples are numerous with

Palm, Casio, HP and others leading the pack.

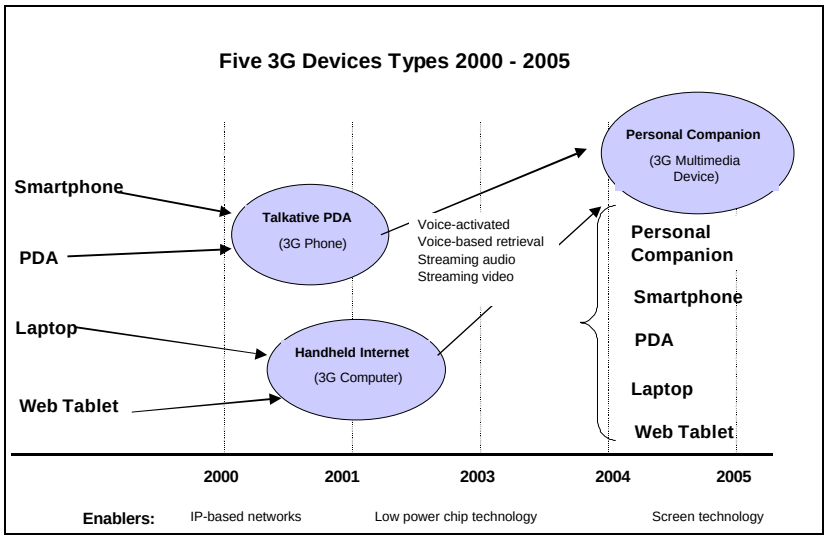
3G Laptop (Handheld Internet) – Laptops today have modems and Personal Computer Memory Card International Association (PCMCIA) cards that enable wireless communications. They continue to get smaller, lighter and with more powerful computing. Operating systems include Windows, Windows CE and Linux. With the bandwidth 3G will offer, these powerful, portable computers will thrive with the custom graphics, two-way video, and large file transfers of tomorrow.

3G Web Tablet (Handheld Internet) – Emerging in 2000 with Qubit and others supplying "Wireless Web Tablets," these devices offer portable Internet access by plugging into power and access at home, and gaining limited mobility via a short wireless connection. As low cost, lightweight, thin Internet appliances the size of magazines, these devices offer e-mail, robust Internet access and Web browsing. Eventually (estimated 2004), they will gain both full mobile access and synchronisation with other devices via more powerful 3G spectrum.

3G Multimedia Device (Personal Companion) – Today's slow connections based on low bandwidth cause "jerky" video images. Even compression techniques cannot overcome the need for speed and capacity. 3G will answer this problem in the mobile world. There are many visions of the ultimate 3G device with some saying it will evolve from phones, others from computers. Since there will be different 3G services addressing specific user needs, all of the above devices will develop from both worlds. However, there will be a need for an all-powerful device that does quality VoIP, full Internet access, and two-way video—in a hand-held form factor.

Figure 12 shows how four device types today will evolve into a multi-purpose 3G Multimedia Device in 2005. Each of the four devices will continue to be available resulting in five device types by 2005.

Figure 12. 3G device evolution 2000-2005.



Source: Telecompetition Inc., September 2000.

Table 4 shows device availability and how each of the five devices maps to current service definitions. In other words, this table does not consider 2005 capabilities of these devices.

Table 4. Service availability by device types based on current device definitions.

Business Model	Mobile ISP		Mobile Portal	Mobile Specialised Services		
Service	Mobile Internet Access	Mobile Intranet/ Extranet Access	Customised Infotainment	Multimedia Messaging Service	Location-Based Services	Rich Voice
Smartphone	◑	◑	◑	◑	●	●
PDA	◑	◑	◑	◑	●	○
Laptop	●	●	●	●	◑	●
Web Tablet	●	◑	◑	●	○	◑
3G Multimedia Device	●	●	●	●	●	●

Legend: ● High Availability ◑ Limited Availability ○ Unavailable

Source: Telecompetition Inc., September 2000.

2.7 Summary

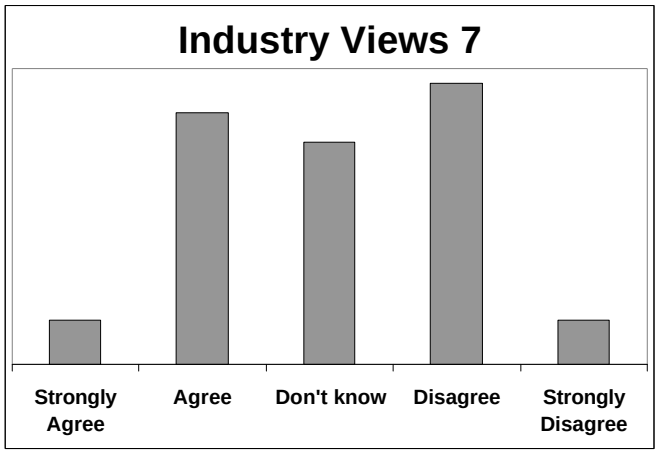
This section has introduced the framework used in this report. This framework consists of service definitions, service diagrams and business models that together enable a consistent analysis of service potential. In addition, this section has set the scene for the analysis and forecasts in the rest of this report by studying earlier forecasts, regional variations, market perceptions and device issues.

3. Market Dynamics

The enormous size of the market opportunity in mobile Internet has attracted new players from the media, financial services, entertainment, consumer electronics, fixed ISPs, as well as new 3G/mobile licensees and incumbent mobile operators.

Early predictions that content and media providers would dominate the bidding for new entrant 3G licences appear to be rather wide of the mark. Content and media providers are forming strategic partnerships with mobile services providers, but their appetite for investment is far more constrained. There is no clear balance of opinion within the industry as to which players will be dominant in the 3G market (Industry Views 7).

Industry Views 7. By the year 2005, the 3G market will be controlled by players in the Internet and content/media space.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

The goal of many 3G services providers is to own as much of the subscriber's disposable income within the value chain as possible. Billing plus partnerships (content, ISP, etc.) equal ownership of the subscriber. Not surprisingly, many other players have the same objective. End-users can expect to be targeted by multiple players from both ends of the value chain.

Analyst opinions are also polarised as to who will own the customer in this new environment. The argument for the mobile services provider centres on their large subscriber base, billing systems, availability of location information, and the huge investment required to enter 3G. On the other hand, fixed Internet providers have already established partnerships with content and media providers and are, therefore, years ahead of mobile services providers in executing market leverage in those partnerships. A summary of the strengths and weaknesses of mobile and fixed Internet operators follows (Table 5).

Table 5. Strengths and weaknesses of mobile and fixed Internet operators.

	Mobile Services provider	Fixed Internet Operator
Continuity of End-user Relationship	●	◑
Billing System	●	○
Cost of Access Device (Phone vs. PC)	●	○
Location-based	●	○
Application Simplicity	●	○
Security	●	◑
Battery Life	○	◑
Content and Commerce Relationships	○	●
Network Infrastructure	●	○
Corporate Customer Support	○	●
B2B Transactions Enabled	○	●

Legend: ● **Strong** ◑ **Moderate** ○ **Weak**

Sources: Merrill Lynch, June 2000; Dain Rauscher Wessels, May 2000 with Telecompetition Inc. analysis, September 2000.

3.1 Industry Structure – Fixed Internet

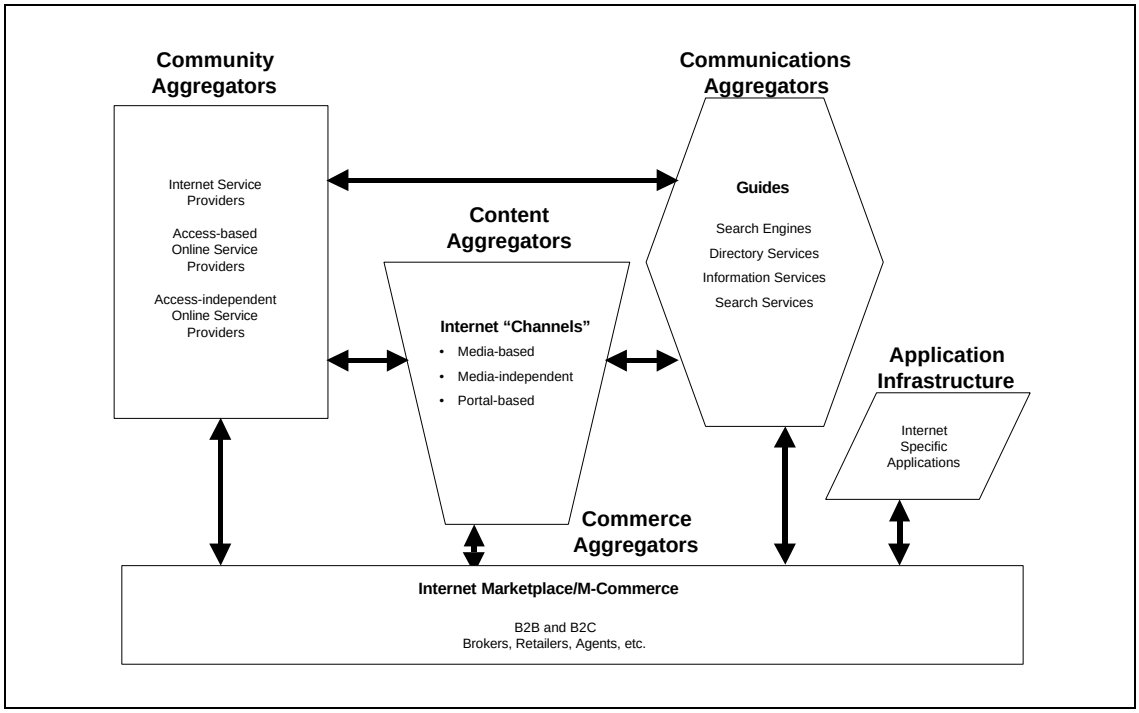
To become mobile Internet services providers, voice mobile operators will be moving into what is currently the fixed Internet space, and striking partnerships with players with revenue models designed for the fixed Internet. It is therefore useful to understand the structure and dynamics of the fixed Internet industry.

The fixed Internet industry includes multiple and complex relationships between providers of content, services, applications, and networks. Figure 13 illustrates these components and categorises them into five major categories: Community Aggregators (ISPs and Online Service Providers (OSPs)).[25] Content Aggregators, Commerce Aggregators, Communications Aggregators (Digital Guides), and Application Infrastructure. Together, these sectors enable new distribution channels for the delivery of goods and services. As demonstrated in Figure 14, Content Aggregators have the smallest share (13 per cent) of the market opportunity. Commerce Aggregators dominate with 56 per cent of the total market opportunity. Community Aggregators (the most likely space for mobile services providers to enter) collectively capture

[25] ISPs (e.g., PSINet) provide access only; OSPs (e.g., AOL) provide content and access.

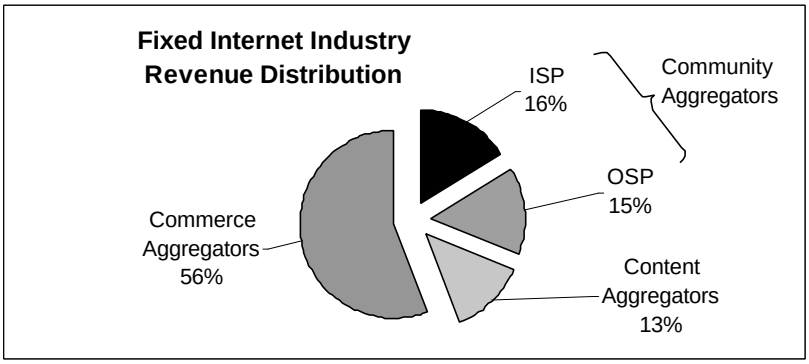
31 per cent of the market opportunity.

Figure 13. Historic structure of the fixed Internet industry.



Source: Dain Rauscher, "The Digital Revolution: Emergence of the Fourth Channel," 1999.

Figure 14. Revenue share – fixed Internet industry.



Source: Dain Rauscher with Telecompetition analysis, 1999.

3.2 Industry Structure – Mobile Services

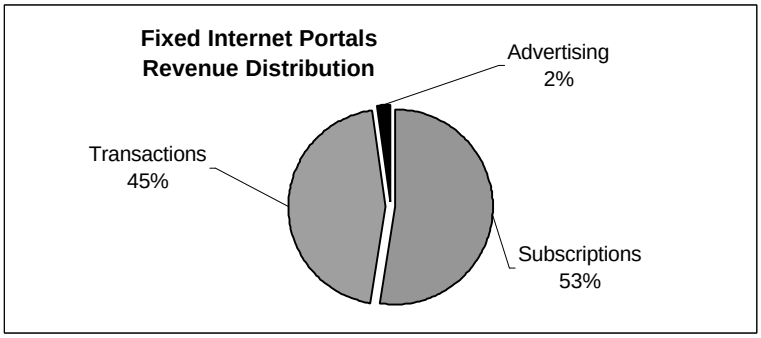
A similar industry structure can be envisaged for the provision of Internet-based services in the mobile 3G environment. Mobile services providers will either play the role of ISPs (providing Mobile Internet Access services with subscription fees) or access-based OSPs (providing Customised Infotainment services through a mobile portal, including access to selected content aggregators/partners).

For this report, the UMTS Forum developed industry and corresponding revenue models for the mobile Internet that are consistent with the fixed

Internet structure, but also account for the unique capabilities offered by the mobile services provider.

For example, in the fixed Internet industry, the most complex revenue structure can be found in the Internet Portal[26] where subscriptions and transactions comprise over 90 per cent of the total revenue, and advertising only two per cent. In comparison, ISPs receive only subscription revenue and virtually no advertising revenue at all.

Figure 15. Fixed Internet portals revenue structure.

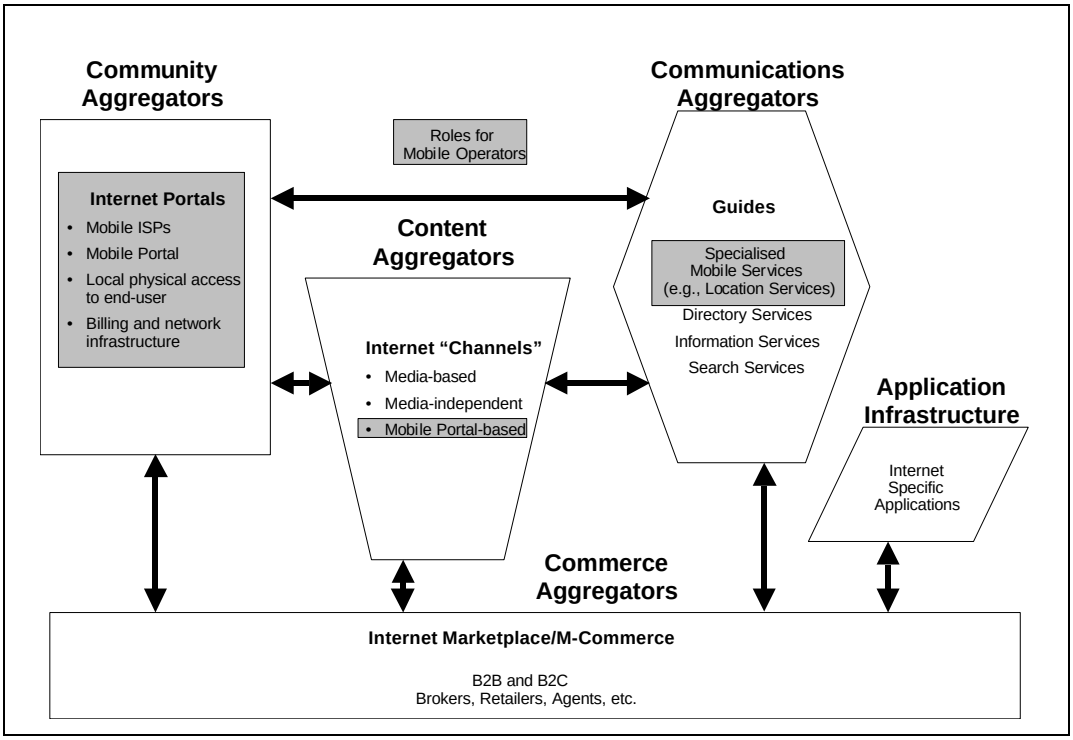


Source: Dain Rauscher Wessels with Telecompetition analysis, July 2000.

The UMTS Forum used the structure and revenue distribution of the fixed Internet industry as a baseline in developing business models for mobile Internet services providers. Figure 16 illustrates the functional elements of such a mobile Internet value chain. Mobile services providers have the strategic choice of participating in one or all of these areas.

[26] Also referred to as an "access-based OSP," with AOL as the primary example.

Figure 16. Roles for mobile services providers in the Internet value chain.



Source: Dain Rauscher with Telecompetition Inc. analysis, January 1999.

3.3 User Needs

To understand the potential target consumer and business segments for mobile data services, it is useful to look at characteristics and trends of existing fixed Internet users. While demographic characteristics vary widely between countries, the US (with the highest overall number of fixed Internet users) can serve as a directional guide to understanding end-user needs.

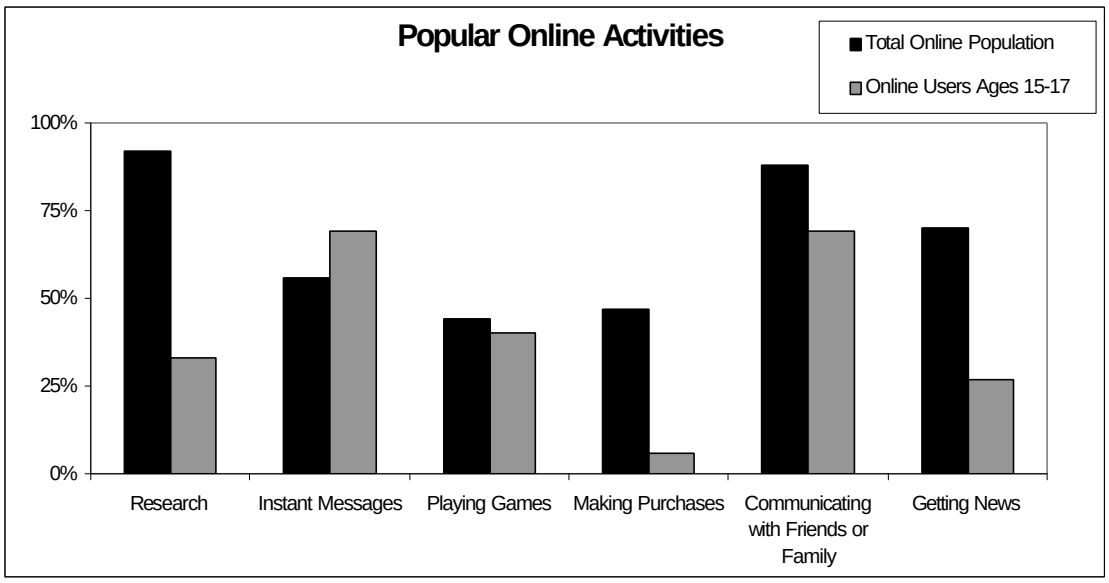
According to a US study by America Online (AOL), on-line consumers are still more affluent and more educated than the population at large. But they are becoming more mainstream, attracting older, moderate income and slightly less-educated consumers. Some important findings from the study are:

- All ages consider communicating with friends and relatives to be one of the most important activities
- In 1999, 60 per cent of online users were between the ages of 25 and 49
- The longer people are online, the more activities they engage in, with e-commerce as the fastest growing online activity
- Online usage is becoming a central part of family life, with 66 per cent preferring computer Internet connection to television or telephone communications
- The teenage market (ages 15-17 years) represents an important segment with higher penetration levels and an influential role in bringing their parents "online"
  - The youth segment has some distinctly different preferences for online activities than the total online population

– The youth segment in particular expresses a broad interest in new online technologies

Figure 17 and Table 6 compare popular online activities of 15-17 year olds to the total online population.

Figure 17. Most popular online activities by fixed Internet users – youth segment.



Source: AOL, "The American Online/Roper Starch Cyberstudy," November 1999.

Table 6. 17-year-olds expressing interest in new online activities.

Exchanging Photos	78%
Live Video Conference	70%
Downloading Music	76%
Watching Video Clip	63%

Source: AOL, "The American Online/Roper Starch Cyberstudy," November 1999.

Using fixed Internet preferences as inputs, Table 7 summarises the anticipated needs and requirements of users of 3G mobile services.

Table 7. User profiles and needs by service.

Business Model	Mobile ISP		Mobile Portal	Mobile Specialised Services		
Service	**Mobile Internet Access**	**Mobile Intranet/ Extranet Access**	**Customised Infotainment**	**Multimedia Messaging Service**	**Location-based Services**	**Rich Voice**
Profile/ Demographics	Traditionally work-at-home professionals; expanding to include families and all age groups	Mobile professionals in sales, marketing, administration; increasingly distribution and logistics management	Youth and young adults up to middle age	Youth: those growing up on the Internet and young adults	Varies by service	Traditionally older and more affluent, but increasingly younger and lower income population
Needs	Anywhere, anytime access to information needed	Higher productivity and greater information access to mobile workers	Need to access specific types of information (e.g., financial, recreation)	Community of interest; maintain social contact	Specific location-based information on demand	Voice access anytime and anywhere
Most Popular Activities	News, e-mail, research, purchases, games		Games, news, communicating, purchases	Instant messages, communicating	Purchases	Communicating

Source: Telecompetition Inc. analysis, July 2000.

3.4 Price Trends

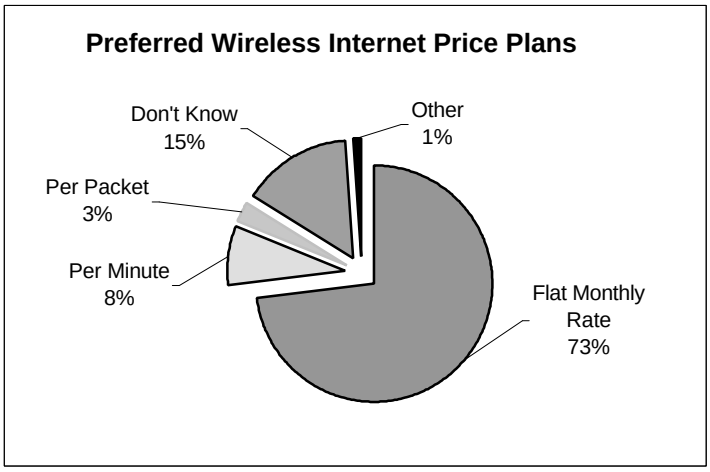
Existing price trends in both the fixed and mobile industries are an indication of user preference in price structure. It can be expected, therefore, that user expectations for pricing will be extended into the mobile data/mobile Internet services as well. While user expectations cannot always be reconciled with mobile services provider requirements to price and manage limited spectrum, user preferences need to be accommodated as much as possible when establishing pricing. Significant trends that mobile services providers need to consider include the following.

- A demonstrated user preference for flat rate and "flatter rate" services. For example:
  - Mobile pricing structures are shifting from high usage-sensitive pricing to lower unit pricing with a higher subscription fee (one which includes the first 100 or so minutes).
  - In the US, unlimited (flat-rate) Internet access is common.
- Declining price for bandwidth.
  - In fixed data services, price per Mbit/s is rapidly falling. Business users quickly substitute usage sensitive (e.g., packet-based Asynchronous Transfer Mode (ATM), Frame Relay) data services with flat rate (e.g., leased line) services when economic crossover is reached.
  - As wireless access is substituted for wireline access, mobile-per-minute prices approach parity with wireline pricing for both voice and data.
- The advent of "free" fixed Internet access.

– This is driving up subscriber numbers and turning access from a gross profit for ISPs into a marketing cost. Adoption of broadband access is expected to reduce the negative impact to ISPs, but not enough to turn access alone into a sustainable business.[27]

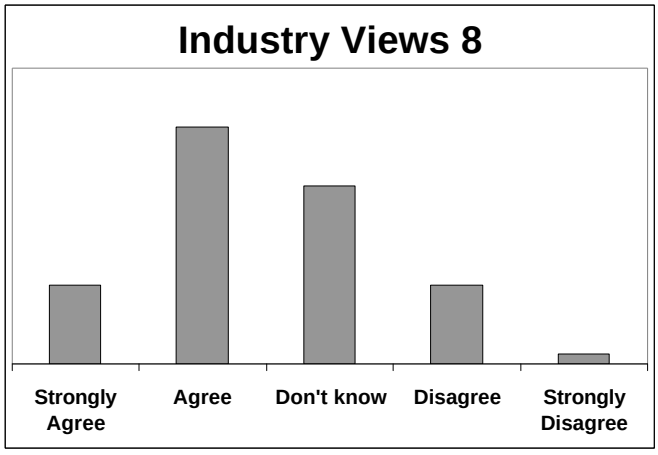
A direct analogy with the fixed Internet world would indicate that usage-sensitive pricing in 3G would rapidly be replaced by flat-rate plans. Market expectations for services offering "Mobile Internet Access" will certainly be for pricing packages similar to those in the fixed Internet world. Consumer surveys indicate a strong preference for flat-rate pricing (Figure 18), and there is some support within the mobile industry for such developments (Industry Views 8).

Figure 18. Consumer preference for flat-rate price plans.



Source: Cahner's InStat Group, as quoted in Dain Rauscher Wessels, May 2000.

Industry Views 8. Usage sensitive pricing (packets or minutes of use) will migrate to flat rate plans by 2010.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum

[27] UBS Warburg, "European ISP/portals," June 2000.

3.5 Revenue Models for Services

A great deal of uncertainty exists regarding the business models to be adopted by the new industry and therefore, the pricing structure of specific services to be offered. It should be expected that no one revenue model will dominate, but rather a variety of service-specific business and revenue models would exist. In keeping with the business model and service frameworks introduced earlier, revenue structures for the six services were defined as shown in Table 8.

Table 8. Revenue sources by service.

Business Model	Mobile ISP		Mobile Portal	Mobile Specialised Services		
Service	**Mobile Internet Access**	**Mobile Intranet/ Extranet Access**	**Customised Infotainment**	**Multimedia Messaging Service**	**Location-based Services**	**Rich Voice**
Airtime	✓	✓	✓		✓	✓
Message				✓		
Subscription	✓	✓	✓	✓	✓	
Advertising			✓			
Transaction			✓			

Source: Telecompetition Inc., September 2000.

Mobile services providers will prefer to bill for airtime, subscription and most transaction revenues to protect the relationship with their subscribers. But unlike traditional voice and SMS services, the new data services involve third-party information and content providers who will expect a share of the revenue generated.

Revenue sharing has been a feature of fixed networks for many years where intelligent networks have been used to deliver premium rate services in which the caller is charged a higher than normal rate to receive specific content. The subscriber is billed by the network services provider who retains a proportion of the revenue to cover transport and administrative costs and passes the balance to the content provider.

Fixed network operators providing premium rate services, essentially offer a billing mechanism that significantly lowers the market entry barriers for information and content providers. The number of small content providers in premium rate markets can be very large, enabling a wealth of service offerings for subscribers.

Such revenue sharing arrangements with a large number (over 8,000 unofficial sites) of content providers are an important component of NTT DoCoMo's i-mode service, enabling a rich variety of content to be offered to i-mode subscribers.

The premium rate industry in the fixed network environment is one of the few

examples of partnerships between network services providers and content providers. It is also one of the few examples of content provision in telecommunications—and content provision will be at the heart of many 3G services.

Some lessons can be drawn from the evolution of the fixed-network premium-rate services market that could be relevant to the 3G mobile environment.

- Content providers rarely pay network operators to deliver their services. Content providers expect a revenue share.
- Competition between network operators to attract content providers soon becomes fierce. Competition focuses on attractive revenue-share arrangements for content providers, reducing the margins for network operators.
- Content providers exhibit little loyalty to network operators.
- Network operators are often the targets of bad publicity resulting from inappropriate or addictive content.
- The responsibility for handling customer complaints is often unclear. Some countries have imposed additional regulatory and consumer protection measures for content-based services.

3.6 Implications

As mobile services providers embark on new mobile data services and markets, they can expect more and different business relationships with customers and partners. Customers will expect services that meet their individual preferences at price points and quality similar to what they receive from fixed service providers. Partners will not be satisfied with a supplier relationship, but instead will expect to share in revenue opportunities. Players from all areas of the value chain will vie for “ownership” of the customer relationship. Mobile services providers will have many new revenue opportunities, but in some targeted segments or services, they will be relegated to the role of access provider only. Brand equity will become a significant factor in establishing relationships with customers that can be leveraged in negotiating partnerships with content providers.

3G services providers can best maintain their strong market position by leveraging those capabilities unique to mobility including location information, billing mechanisms and their existing customer base.

Table 9 illustrates some of the shifts required. The most significant is the overall adjustment from a static, defined industry role and customer relationship to one that is constantly evolving and requires service-specific marketing.

Table 9. Structural shifts in the mobile industry.

	Mobile Services provider	New Structure
Industry Role	One role – network provider	Multiple roles – mobile portal, mobile ISP, and communication infrastructure provider
Price and Product	Simple price structure: airtime One product – voice	Complex, service-specific price structures: subscriptions, messages, advertising, airtime, transactions
Partnerships	Vertical integration of network infrastructure and device distribution	Strategic partnerships to emulate end-to-end integration

Source: Telecompetition Inc., September 2000.

3.7 Summary

This section has reviewed many of the industry dynamics and trends that impact the service forecasts. These include the dynamics of the fixed and mobile Internet environments, business and revenue models, and pricing trends. Section 4 next describes the six services in the study framework. That is followed by the demand forecasts in Section 5.

4. Services Analysis

This section includes a detailed description of the six services driving the 3G market. A market segment description, as well as timing regarding the introduction of each service is discussed. Each service description includes a service diagram in the study framework introduced in Section 2. The first three of these services are then forecasted in Section 5. The forecasted services were selected to include one service from each business model and services representing both consumer and business market segments. Other services may be forecasted in future reports.

4.1 Service #1 – Mobile Intranet/Extranet Access (Business)[28]

The high growth of intranet and extranet deployment along with the increasing trend for teleworking is creating a workforce that expects the same access to desktop applications, messaging, and information retrieval whether in the office, travelling in a car, working from home or visiting a customer location. Intranet and Internet traffic from corporate employees outside the office is beginning to exceed traffic inside the office.

Mobile services providers can profit from this opportunity by developing a business enterprise Mobile Intranet/Extranet Access service. The Mobile Intranet/Extranet Access service is more than just a mobile port in a laptop or a WAP gateway into corporate databases. It is a package of capabilities that includes, as a minimum, mobile access to desktop applications (e-mail, contact lists, spreadsheets, corporate management systems, etc.), Internet access and mobile access to the intranet and/or extranet portals. While, in many ways, Mobile Intranet/Extranet Access is the business parallel to the consumer Mobile Internet Access service described later in this section, it requires more sophisticated interfaces to the enterprise portals and some significant shifts in marketing strategies. The availability of 3G “broadband” mobile service only addresses one piece of a very complex Information Technology (IT) enterprise problem.

Target segments for mobile workers include professionals (especially sales and marketing) in communication-intensive industries such as finance, transportation and insurance. In a recent survey by Forrester Research of 50 Fortune 1000 companies, half said that their companies intended to buy mobile technology over the next two years,[29] with sales and marketing at the core of this decision. Other frequently cited industries included utility, transport, healthcare, and public safety. Corporate applications include job despatch, remote working, collaborative working, remote order entry/stock check, inventory, supply chains, procurement, vehicle positioning, e-mail and customer service.

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[28] Mobile Intranet/Extranet Access is one of the three services included in the Telecompetition market demand forecast.

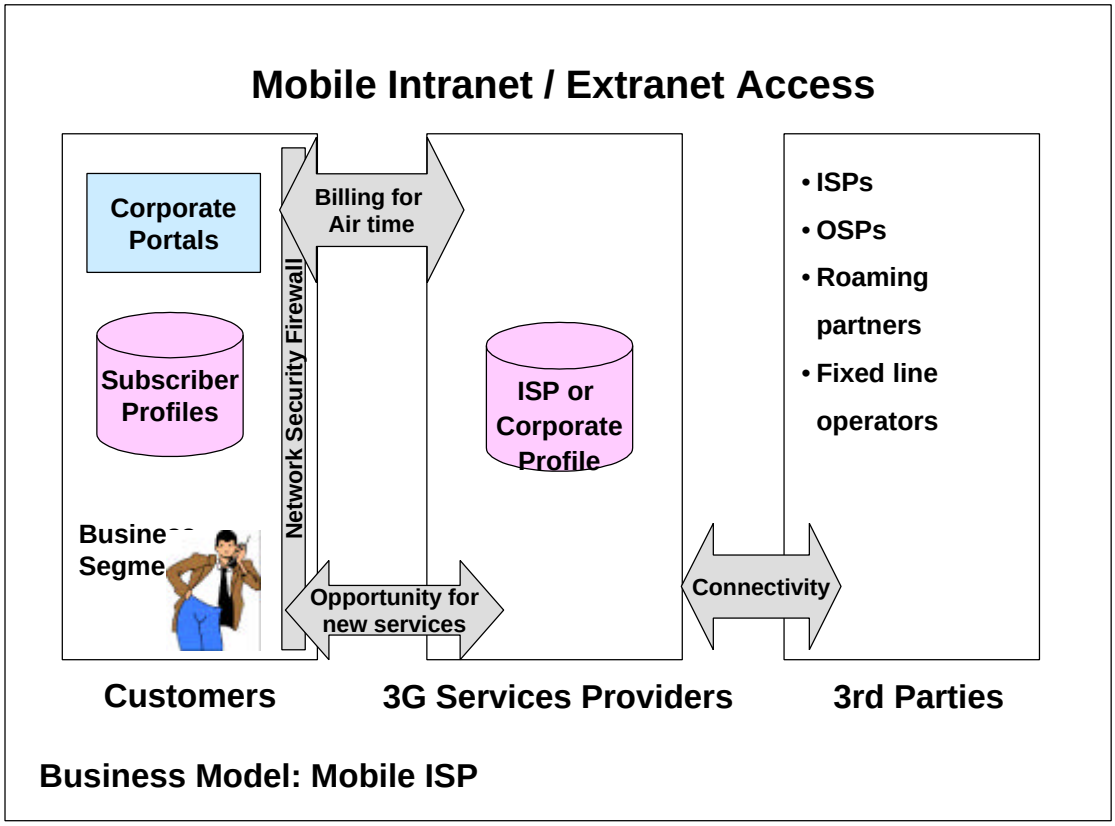
[29] Merrill Lynch, “Wireless Internet,” 5 June 2000, page 32.

Mobile services providers can gain access to additional revenue streams with the Mobile Intranet/Extranet Access service. In addition to levying service charges, services providers also have the opportunity to provide specialised services into the corporate environment (e.g., location data and services provided back through the corporate firewall).

Corporate customers can bring very large numbers of subscribers to a 3G services provider and so, have the potential of significantly increasing shareholder value.

Figure 19 illustrates the possible business relationships amongst 3G services providers, customers, and third parties for Mobile Intranet/Extranet Access.

Figure 19. Illustrative business relationships for Mobile Intranet/Extranet Access.



Source: The UMTS Forum and Telecompetition Inc., September 2000.

The challenges for mobile services providers are similar to those facing traditional wireline voice telcos in making the transition from a voice-centric network to a data-centric one:

- Lack of general Information Technology (IT) and IP/Internet technical expertise throughout the organisation from sales to service technicians
- Enterprise requirement for very high end-to-end network reliability to support mission critical applications
- A usage-sensitive price structure that is not suitable or cost effective in enterprise use

- Lack of experience in marketing and sales to IT departments and multi-location enterprises

4.1.1 Enabling and Inhibiting Factors

The acknowledged demand for Mobile Intranet/Extranet Access is present in both mobile and portable scenarios. It encompasses mobile workers whose job demands anytime, anywhere access to messages and information as well as management travelling outside the office.

Mobile Intranet/Extranet Access would be inhibited by a lack of low cost terminals, unresolved security issues, and lack of network devices that enable full Web browsing.

Security concerns are paramount in the corporate intranet/extranet environment. Mobile services providers will have to convince enterprise customers that appropriate security systems are in place to prevent unauthorised access to intranets and to enable secure transactions over extranets. Quality of service guarantees and the provision of bandwidth-on-demand will be important requirements for many enterprises.

Mobile services providers have limited skills and experience in dealing with large corporate clients. They are often lacking in data communication capabilities and are unfamiliar with the corporate data communication world. Corporate data communication departments have little or no understanding of the wireless environment. These factors may severely limit the early take-up of mobile intranet services but will be less of a factor for mobile extranet services which are targeted more at the enterprise's customers than its employees.

Mobile Internet Access will need to be an optional component of this service offering. Some enterprises may wish to offer some of their employees Mobile Internet Access, others will not.

Flat rate pricing will be an attractive but difficult to implement option for Mobile Intranet Access. Many enterprises will demand service level agreements that are proving difficult to implement in packet-based networks. Billing systems that can cope with packet data and also produce output tailored to individual corporate requirements are not yet available.

International roaming capability will be particularly attractive for many potential clients of Mobile Intranet/Extranet Access services. Roaming capability requires robust service portability to be in place and significantly complicates the provision of service level guarantees. Roaming between different services providers may prevent the introduction of flat pricing and customised billing in many circumstances, presenting a major opportunity to services providers with a presence or close partnerships in many countries.

4.1.2 Implications

The Mobile Intranet/Extranet Access service can capture large numbers of subscribers and has significant potential to enhance shareholder value.

The needs of multinationals for international roaming in many Mobile Intranet/Extranet Access service offerings will give a significant advantage to services providers with a regional or global presence.

Many mobile services providers will have to strengthen their data communication capability and expertise if they are to succeed in the enterprise market. Most will need to develop strategic partnerships with systems integrators in order to provide acceptable enterprise solutions. Until billing systems with the required sophistication and functionality are available, the potential of the enterprise sector for mobile services providers will not be realised.

4.2 Service #2 – Customised Infotainment (Consumer)[30]

This consumer 3G service provides access to personalised content anywhere, anytime via structured-access mechanisms based on mobile portals that are easily accessed and manipulated by end-users. True personalisation allows users to control their access to content regardless of device or protocol used. Users want to make and change menus, add or drop content items, and generally pay for content on a per-use basis.

The mobile portal is the mechanism for delivering content-rich mobile services. Mobile portals provide billing, controlled access to content, and support services to the mobile end-user. They can be supplied independently or by the mobile services providers themselves. Mobile services providers need to control the mobile portal to preserve ownership of subscribers, grow revenues beyond voice-only services, and prevent subscriber churn. The larger mobile services providers can create their own mobile bureaux and arrange strategic alliances with content providers. Smaller services providers will fill in gaps through alliances. Services providers can become content or commerce providers in their own right, increasing their share of retained revenue.

Strategic alliances with major content or commerce providers can enhance the attractiveness of an services provider's mobile portal for the end-user. But major content providers with brand recognition will seek to maximise their market share and are unlikely to entertain long-term exclusive relationships. They will also seek to retain a significant percentage of revenue.[31]

Mobile services providers can enrich the content portfolio offered to their subscribers by providing hosting facilities to a range of smaller content providers through revenue sharing arrangements. In such arrangements the mobile services provider provides both access to their subscriber base and a billing mechanism, significantly lowering the market-entry barriers for content providers.

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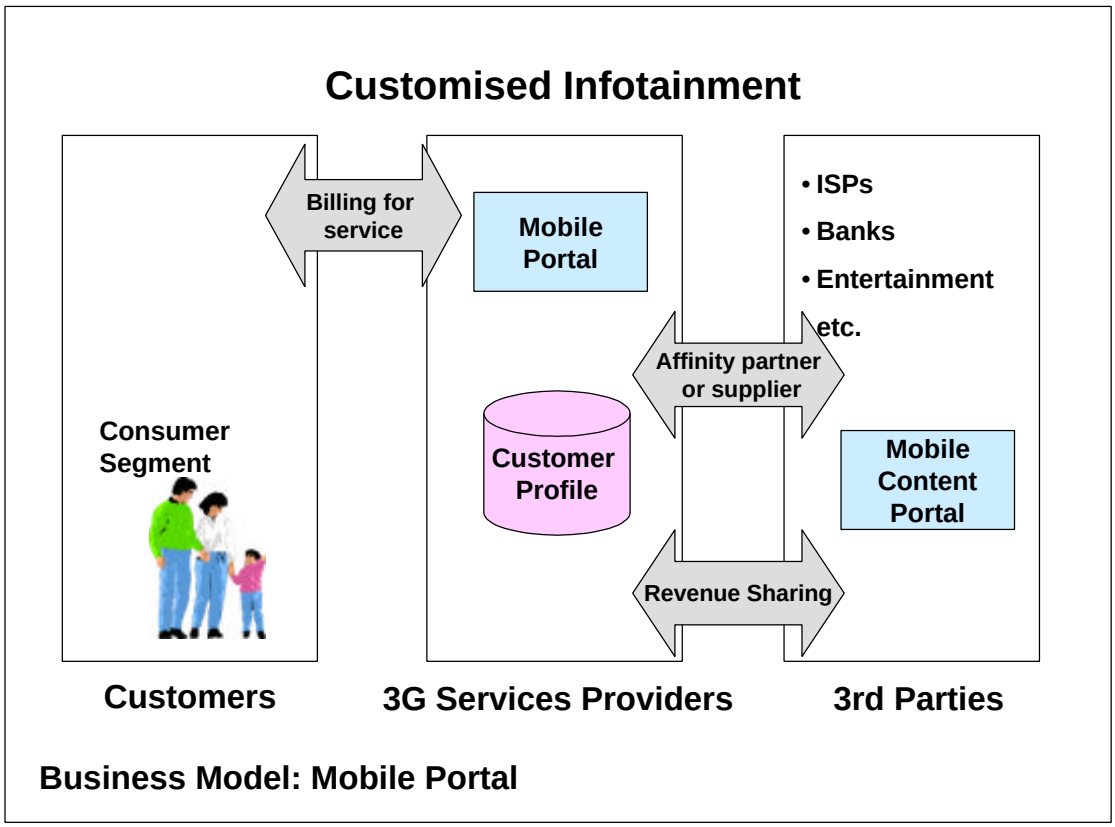
[30] Customised Infotainment is one of the three services included in the Telecompetition market demand forecast.

[31] Telecompetition's forecasts refer to revenue retained by the services providers.

Two characteristics of mobile portals illustrate the central importance of Customised Infotainment services to services providers: **Mobile portals are specific to the mobile environment and are an additional opportunity for mobile services providers**.

Figure 20 illustrates the possible business relationships amongst 3G services providers, customers and third parties for Customised Infotainment.

Figure 20. Illustrative business relationships for Customised Infotainment.

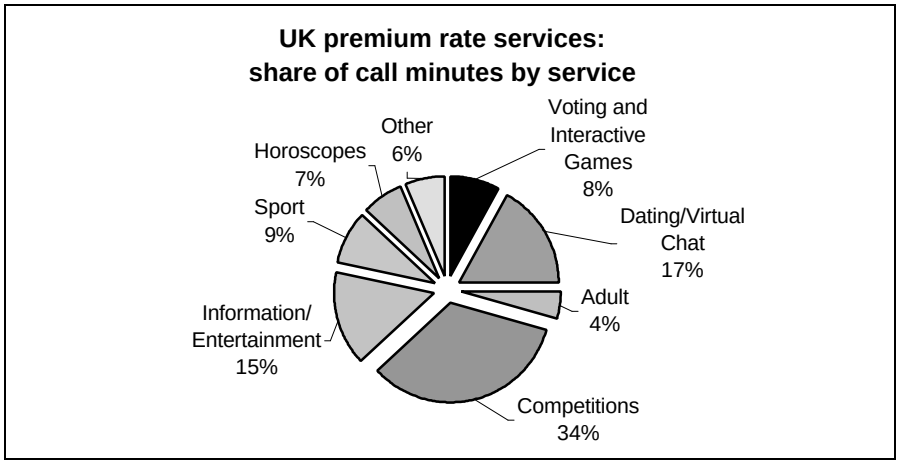


Sources: The UMTS Forum and Telecompetition Inc., September 2000.

The importance of local content in the mobile portal environment cannot be overstated. The vast majority of content currently available on the Internet is in the English language and is strongly US-biased. Customised Infotainment services in most countries cannot rely on content already available on the Internet; they have to deliver relevant content appropriate to the local culture and in the local language.

Entertainment services such as fortune telling (horoscopes) and games are the most popular category of i-mode services. This closely parallels the experience of premium rate services in fixed networks where traffic patterns are remarkably similar in most countries. Premium rate services on fixed networks represent the best model available for predicting the types of service that will be popular on mobile portals (Figure 21).

Figure 21. UK premium-rate services: share of call minutes by service type.



Source: ICSTIS.[32]

An early example of a mobile portal is Zed from the mobile operator Sonera in Finland. Launched in October 1999 on an SMS platform, Zed had 700,000 regular users a month in Finland in August 2000, roughly a third of its GSM subscriber base. A third of these active users have used the Zed Web site to personalise their services. Zed services are now available in SMS and WAP environments and will be upgraded to encompass GPRS and UMTS technologies. Significant enhancements to mobile portal services can be expected once 3G technologies become available; mobile portals are currently in the very early stages of the development cycle.

Sonera has sold Zed into markets outside Finland. Zed services will soon be launched by operators in Germany, the Philippines, Singapore, Turkey, the UK and the US. The services currently offered through Zed are summarised in Table 10. These services add mobile transaction-based billing to Sonera's considerable experience of providing premium-rate services in the fixed network. They offer mobile users personalised services that include location, profile and time-based services with global and local content.

[32] Stuart Sharrock, "UK Premium Rate Market Survey" report for ICSTIS, April 1999.

Table 10. Services currently offered through the Zed mobile portal.

Examples of Zed Services	
Information Services	Zed delivers informative and entertaining content. News, jokes, horoscopes, weather forecasts and sports scores can be delivered to a mobile phone on a regular basis. Another popular service is the facility to check the balance of mobile phone bills.
Entertainment Services	Accessories are services that give "personality" to mobile phones. For example, users can choose favourite pop songs as handset ringing tones as well as choosing new caller group icons.
Mobile Commerce	Zed enables users to purchase products over mobile phones. In Finland, goods can be ordered, paid for and delivered using Zed. The cost of the transaction is charged to the user's mobile phone bill.
Mobile Chatting	Similar to Internet chat rooms, Zed offers mobile chatting. Information about the user is entered into a database held centrally by Zed. Zed then puts mobile chat users in touch with other users who have similar interests. The user's identity remains anonymous when exchanging messages with "mobile friends."
Zed Finder	Zed Finder has access to a directory of 300 million telephone numbers covering Finland, Austria, Belgium, Denmark, France, Switzerland, the UK and shortly to cover the US. The service enables users to search for contacts within all listed countries. The reverse search, which allows users to find the name and address of a caller from their number, is available in Finland, France, Switzerland, and will soon be available in the US. Selected Zed Finder services using a mobile phone have been available in Finland for nearly two years.
Zed Travel	Zed Travel allows users to access accurate information on particular flights to be sent directly to the mobile phone, therefore minimising the amount of time wasted at airports. If any relevant delays and/or terminal changes occur, Zed Travel sends real-time updates. A pilot scheme is presently in operation in Finland.

Source: Sonera Zed, September 2000.

4.2.1 Enabling and Inhibiting Factors

From a market perspective the major enablers for Customised Infotainment include:

- WAP and GPRS will ready the market, creating subscribers eager for even more robust 3G services
- Mobile operators have significant subscriber bases
- There is a wide abundance of content providers from which to choose

Mobile portals represent an services provider's best opportunity for retaining market share. The combination of personalisation with rich content will enhance stickiness. But regulators are already opposing attempts to

implement “walled gardens,” insisting that subscribers must not be locked in to a tied portal.

Consumers will expect to be able to roam internationally with their personalised mobile portals just as they roam today with voice services. Ability to implement service portability will be a major competitive advantage for services providers.

Specific market factors, which could affect the success of Customised Infotainment services in markets outside Japan, include:

- Due to the more fragmented markets, European and US mobile services providers do not have as great an ability to control the design of infotainment devices
- If 3G services providers are late to market, other providers and/or technologies may gain early market position.
- Mobile data services have been already positioned in the market as mobile Internet, attracting a fixed Internet proficient subscriber base that has experienced disappointment in its first use of the service

4.2.2 Implications

The provision of Customised Infotainment services through a mobile portal is a viable business model. In addition to partnership arrangements with major content and media providers, possibly used to strengthen market presence through branding, mobile services providers can act as “service bureaux.” Service bureaux offer a billing mechanism to a broad community of smaller third-party content providers who deliver content services in exchange for a share in revenue.

A properly positioned mobile service does not have to replicate the fixed Internet in order to be successful. However,

- Like the fixed Internet, well-chosen content and well-managed business partnerships with content providers are critical for success
- Skilful marketing and well-designed service bundles are essential
- Service bundles must be targeted to the local market
- Mass market success requires mass market pricing
- Customised Infotainment can be marketed to users who are not currently fixed Internet subscribers
- Customised Infotainment is best marketed as an enhanced mobile service rather than an Internet service

Personalised portals can only be effectively deployed in a mobile environment where the terminal device is uniquely associated with the user. Combined with the ability to personalise terminal devices through Subscriber Identity Module (SIM) card functionality, mobile terminals can be transformed into transaction appliances rather than just communication and Internet access devices.

4.3 Service #3 – Multimedia Messaging Service (Consumer)[33]

Traditional fixed and mobile communication systems provide the ability to communicate primarily by voice. 3G adds an interacting and a doing dimension to mobile by allowing communications by text, graphics, images, audio and video.

The power of textual communications at the touch of a button – or the click of a mouse – is exemplified by the phenomenal success of e-mail. Few people write letters anymore and even voice telephony and fax are declining, as e-mail becomes the dominant communication mechanism.

Electronic mail has traditionally been regarded as a store-and-forward system but is increasingly being used as a near-real-time communication mechanism. It should now really be called e-messaging. The value of e-mail in a "real-time" mode is illustrated by the popularity of America Online's Instant Messaging Service that has eight million average daily users of its Communications Community[34].

E-mail also adds functionality not easily achievable with voice – the ability for users to set up groups or communities of interest and circulate messages or information to the entire group, at the single click of a button.

But in the fixed world, the group addresses do not uniquely define the target audience at all times. The mobile world is different; addresses refer to individuals not places. Translating the ability to do group messaging into the mobile environment is immensely powerful. The unanticipated explosion in the use of GSM's SMS by user communities such as teenager clubs is a demonstration of that power. Sending text messages over mobile combines the advantages of both the real-time and store-and-forward worlds; adding multimedia capability to this mix produces the ultimate messaging system. Ease of use is enhanced by the provision of menus of standard messages and graphics, removing the need for users to create message content.

- The Multimedia Messaging Service is a 3G service, offering real-time, multimedia messaging capabilities with easily created distribution lists. Always-on capabilities allow the provision of instant messaging. By providing a standard service development and deployment environment for application developers and business partners, plus high bandwidth for message transmission, 3G's Multimedia Messaging Service will cause a dramatic increase in the already hot demand for mobile messaging.

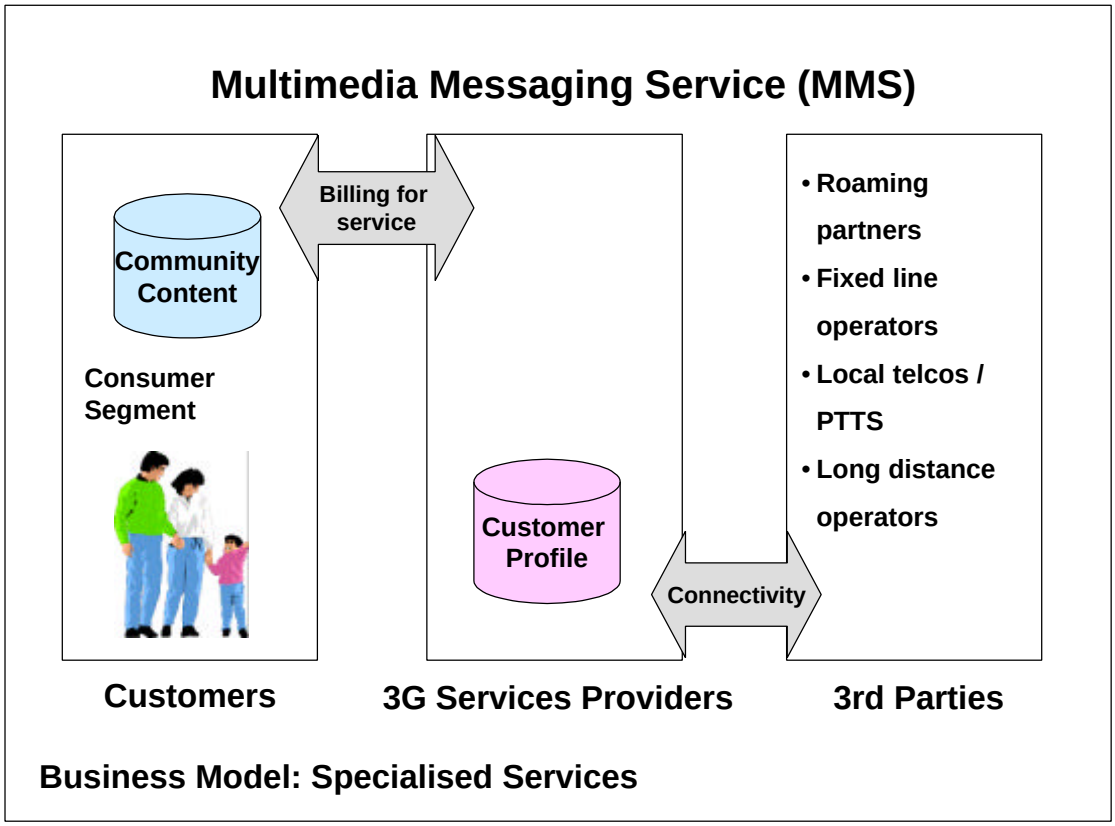
Figure 22 illustrates the possible business relationships amongst 3G services providers, customers, and third parties for Multimedia Messaging Service. Note that Multimedia Messaging Service is only modelled for the consumer

[33] Multimedia Messaging Service is one of the three services included in the Telecompetition market demand forecast.

[34] Per AOL, August 2000.

segment in this report. Future work can and should be done to forecast the potential for the business market.

Figure 22. Illustrative business relationships for Multimedia Messaging Service.



Sources: The UMTS Forum and Telecompetition Inc., September 2000.

Two early adopter mobile data markets, Japan and Finland, have found "instant messaging" using SMS to dominate mobile data usage.[35] This is consistent with a study conducted by AOL and others that found "communicating with friends and relatives" as the most popular activity for on-line users. Sonera's SMS service in Finland is especially popular with teenagers who frequently chat or swap quick messages amongst friends.

Sonera has reported remarkable growth in its SMS offer. Over 60 per cent of its 2.1 million users have used the service. In 1999, the number of messages per user grew to 21 per month, an increase of 58 per cent in one year. In the Philippines, where SMS has been "free," users average over 100 SMS messages per month. In Japan, "instant messaging" is one of the most popular activities on i-mode. Clearly this type of service with the addition of multimedia capability for pictures, music clips and other multimedia files could prove popular for future 3G subscribers.

Price structures vary significantly illustrating the number of pricing models that could be adopted. SMS service prices range from the "free" SMS service in the Philippines to Sonera's very complex pricing that ranges from

[35] Robertson Stephens, "Wireless Data – the New Economics," 5 June 2000, page 9.

approximately $0.15 to $0.80 per message, depending on the type of content and whether it is a standing order or a “one-off.”

Basic text messaging over mobile will rapidly become a commodity service. The primary advantage to the mobile services provider is that this service will generate “stickiness” and reduce churn. It could become an immensely powerful loyalty generator if mobile services providers can persuade the younger generation to set up their first “e-mail account” on a mobile network. The most important factor preventing subscribers changing their ISPs in the fixed world is the need to change their e-mail address.

Adding multimedia functionality and unified messaging capabilities to basic mobile text messaging will create a service with perceived added value that can command a premium.

4.3.1 Enabling and Inhibiting Factors

SMS has been very successful after a slow start. During May 2000, over 500 million text messages were recorded in the UK, a ten-fold increase over May 1999. Globally, an estimated eight billion text messages were sent during May 2000.[36] Logica recently forecast that within three years, ”mobile telecom operators will be sending 100 billion short messages per month.” As with most successful service technologies, the migration path to more sophisticated services is there for Multimedia Messaging Service with the success of SMS.

Perhaps the most important aspect of the Multimedia Messaging Service will be the user interface. Ease of use will be the determining characteristic of such services from the consumer perspective.

Multimedia Messaging Service creates the ability to push content to specific subscriber groups. Combine this with a customer profile database and knowledge of a subscriber’s location, and you have the ultimate marketing tool. Such marketing exercises have already been used to great effect in the GSM SMS environment. They have to be used with caution. Information valuable to a subscriber at their particular place and time is welcomed—inappropriate marketing messages are not. Mobile services providers not only benefit from increased traffic but can also strengthen corporate customer relationships by identifying appropriate marketing opportunities and messages in their coverage area. Such "push" opportunities will not be acceptable to users in countries that have not implemented Calling Party Pays.

4.3.2 Implications

Multimedia messaging should be one of the first services offered on newly deployed 3G networks as it has a proven demand in the market and an established price structure. Migrating users from SMS to Multimedia

[36] Mobile Data Association, July 2000.

Messaging Service (perhaps initially with just enhanced graphics) should prove a relatively easy task. Subscriber and usage growth in Multimedia Messaging Service could be inhibited, however, if there were a lack of low cost devices that can adequately display multimedia images or video clips. Demand for Multimedia Messaging Service should accelerate rapidly once these capabilities are in place around 2004.

The enhancement of the GSM short message service with icons and animated graphics is already preparing users for the introduction of Multimedia Messaging Service. Issues that need to be addressed include the desirability of standardisation of graphics and messages, interoperability between messaging systems and mechanisms for handling non-delivery of messages.

4.4 Service #4 – Mobile Internet Access (Consumer)

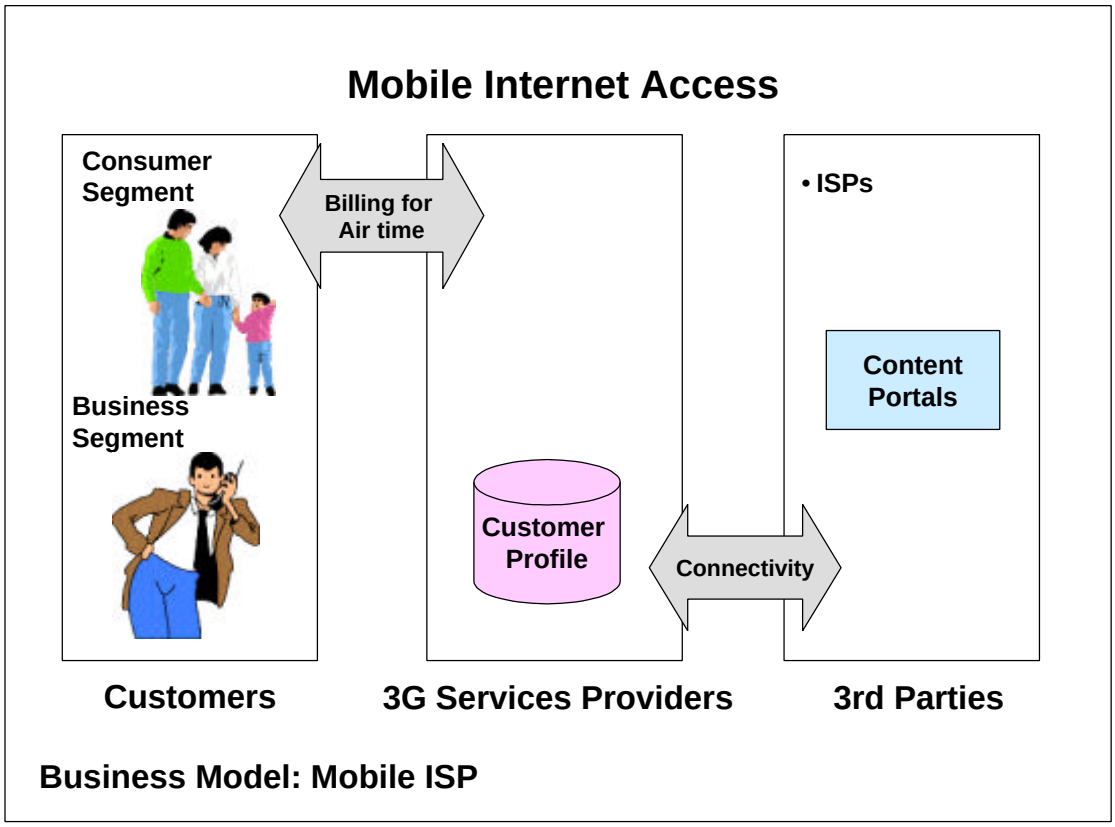
The Mobile Internet Access service offers full fixed ISP services with near-wireline transmission quality and functionality to mobile users. It provides full Web access to the Internet and includes capabilities such as file transfer, e-mail and streaming audio.

The Mobile Internet Access service essentially extends the consumer's fixed Internet experience into the mobile environment, providing an alternative access mechanism into existing content. Mobile access to existing e-mail accounts with fixed ISPs is predicted by many analysts to be the major initial driver for such a service.

When offering Mobile Internet Access, 3G services providers function as a mobile ISP for consumer or business customers. In addition to enabling mobile Web browsing, they provide their customers access to fixed line operators and affinity partners.

Figure 23 illustrates the possible business relationships amongst 3G services providers, customers and third parties for Mobile Internet Access.

Figure 23. Illustrative business relationships for Mobile Internet Access.



Sources: The UMTS Forum and Telecompetition Inc., September 2000.

The prime target market for Mobile Internet Access is the existing customer base of fixed Internet users.

Existing and established demand for the addition of mobility to the fixed Internet experience means that customers will expect 3G services providers to deliver Mobile Internet Access service. It will need to be an early member of a 3G services provider's service portfolio.

4.4.1 Enabling and Inhibiting Factors

Mobile Internet Access targets a substantial and growing customer base of fixed Internet users who already have relationships with fixed ISPs. The Internet itself provides the ultimate source of rich content.

But fixed Internet users are increasingly expecting access to be provided at minimal or even zero cost. There is no evidence to suggest that a significant number of users would be prepared to pay a substantial premium simply for mobile access to the Internet.

"The public will not pay for access costs if they are multiples of current mobile costs."

Phil Laven, Technical Director, European Broadcasting Union

Mobile access to the Internet today cannot compete with fixed access because of the limitations of current mobile devices and access bandwidth. Advances in low-power chipsets, screen technology, browsers and operating systems will remove some of those limitations over time, but acceptable Web browsing in a mobile environment will only become possible with the advent of "handheld Internet" devices around 2005.

Few fixed Internet users will be prepared to accept a reduced quality Internet experience in a portable or even a mobile environment. The Internet is already evolving rapidly with increasing use of sound, multimedia and plug-ins and with the advent of peer-to-peer networking. The Internet in 2005 could be very different from the Internet today. Mobile devices will need to handle all current and future functionality to deliver the full Internet experience. Otherwise they will not be acceptable to the user.

"People will demand the full Internet experience on a PC desktop today. The technology to do this is just arriving."

David Ditzel, CEO, Transmeta Corporation

The initial inability to replicate the full Internet experience created by fixed broadband access to the desktop will inhibit mobile Internet access subscriptions until after 2004. This is due more to lack of mobile devices that mimic the PC desktop than to lack of network capability.

In some countries, user expectations have already been set by the publicity surrounding the introduction of WAP functionality. WAP cannot deliver full Web browsing in a mobile environment, but many consumers now believe that it represents the best that mobile can offer. Managing and correcting these user expectations has to be a priority for 3G services providers. **Realistic positioning of the mobile Internet should be a priority for the 3G community**.

4.4.2 Implications

A frequent prediction is that there will be more mobile devices accessing the Internet than PCs by 2004. Few people disagree with this proposition. Most people agree that the popularity of wireless Internet access will even accelerate the growth of the Internet itself. But there is an important distinction to be made here between broadband wireless access, or wireless devices in a local area network, and mobile devices in the wide area network. The emphasis on "mobile Web browsing" within the US community reflects

the US perspective of 3G as a high data-rate wireless system. Mobile Web browsing is envisaged mainly in a cordless or personal area network environment rather than in a truly mobile environment.

Mobile Internet Access, in any environment, is unlikely ever to dominate Internet usage. Wireline access with high bandwidth will always be an important feature of the Internet. 3G will replace some high-speed access, but will never be a complete substitute.

Simple Mobile Internet Access will not drive the overall development of the Internet. But user addiction to e-mail and Web sites is a powerful driver for mobility, and 3G services providers who do not provide Mobile Internet Access service may well find themselves at a competitive disadvantage. The service will enhance customer loyalty and shareholder value, but, just as in the fixed environment, an ISP service alone is unlikely to be a sustainable business model in the long term.

4.5 Service #5 –Location-based Services (Combined Consumer and Business)

Location-based Services are business and consumer 3G services that enable users or machines to find other people or machines, and/or enable others to find users, as well as enabling users to identify their own location. Key characteristics of Location-based Services are the provision of localised content–available globally through service portability functionality.

Location-based Services include any mobile voice or data service enhanced with the added value of location information, maintained in a customer database by the mobile services provider. This could include information such as local weather reports, news, hotel and restaurant information, traffic and travel reports, navigational services, telematics[37], and mobile commerce. Location information is a truly unique capability that the 3G mobile services provider can provide both to Internet and non-Internet information sources such as mobile portals, voice emergency services, SMS, and others. With location capability, the mobile services provider can offer a sense of where the user is at any point in time relative to where he may want to go. Location-based Services offer end-users the added value of getting information they want when they want it, rather than the banner push so prevalent on the fixed Internet. For retailers, fulfilment issues are less of a problem as a pre-qualified buyer is led into the store. Location-based Services increase the availability and value of local content.

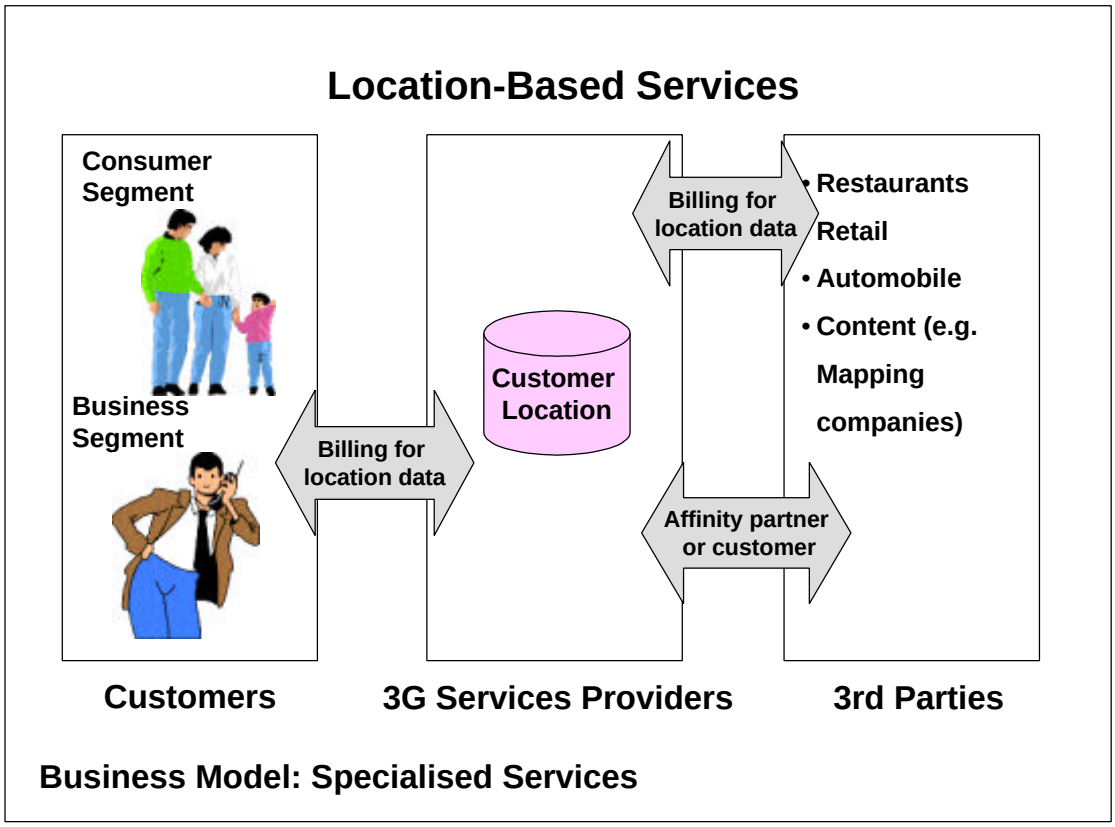
Location-based Services should be viewed as an infrastructure element of a personalised content package. As such, it is likely that much of the mobile services provider revenue will come through the business relationship with the content provider and not directly with the end-user. In other words, the end-

[37] Telematics: A wireless communication system designed for the collection and dissemination of data. Applications include vehicle-based electronic systems, vehicle tracking and positioning, online navigation and information services and emergency assistance.

user may not be billed directly by the mobile services provider for this functionality. The mobile services provider will also benefit from the increased traffic on the network.

Figure 24 illustrates the possible business relationships amongst 3G services providers, customers and third parties for Location-based Services.

Figure 24. Illustrative business relationships for Location-based Services.



Sources: The UMTS Forum and Telecompetition Inc., September 2000.

Examples of the many innovative uses of Location-based Services that have been proposed are:

- "Clicks and Mortar" – allows mobile subscribers to request information on a particular business close to their current location. The service could be offered "free" to the subscriber, charging the retailers a referral or transaction fee.
- "Instant Couponing" – matches a subscriber location, predefined preferences and retailers' promotions to send the subscriber an instant coupon.
- "Product-Price Comparison" – allows the customer to compare prices of similar goods offered by competing retailers.
    - Machine-to-machine telematics applications are expected to be a major component of Location-based Services. The Strategis Group estimates that 11 million vehicles will be enabled with cellular by the end of 2004. Some German and Japanese vehicle manufacturers have stated their intent to

> equip all their future cars with IP addresses. Polls of consumers have indicated significant interest in telematics services with very little difference in consumer interest between demographic groups. Consistently 40-50 per cent of consumers show interest in location services.[38] Presumably, most of these are already mobile users. These mobile users have indicated an interest in emergency roadside assistance and traffic and navigation information, but most users in the US market are not willing to pay more than $5 per month for that capability.

Location capability is a functional component of many services. Location information and services generated by a mobile services provider could be offered to commercial partners (such as other fixed or mobile services providers) or to corporate clients, creating an opportunity for licensing revenue.[39]

4.5.1 Enabling and Inhibiting Factors

End-user acceptance of telematics and other location services will depend upon skilled packaging of the service with desirable content and a user acceptable pricing structure. Some potential inhibiting factors for telematic services are:[40]

- Hardware Obsolescence – While mobile phone device upgrades are inexpensive and convenient, a hardware upgrade in a vehicle could be costly in terms of both service cost, vehicle obsolescence and inconvenience for owners as it requires vehicles to spend time "in the shop." This problem comes with the bundling of hardware intended to last decades (automobiles) with services and technologies changing at Internet speed.
- Lack of Common Standards – Most auto part suppliers cannot afford to replicate information technology and underlying platforms.
- Consumer Preferences – Telematics service subscribers may want to keep their current cellular provider when they purchase a vehicle from a different manufacturer. Conversely, consumers may want to keep their telematics service, but upgrade the mobile hardware.
- Network Coverage – Telematics service subscribers will expect ubiquitous network coverage, particularly for emergency and roadside assistance services.

On the other hand, mobile services providers can offer some advantages:

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[38] Dain Rauscher Wessels, "Telematics – Play Ball," 3 April 2000, page 16.

[39] Subject to privacy protection rules.

[40] Dain Rauscher Wessels, "Telematics – Play Ball," 3 April 2000 and Telecompetition Inc. analysis, August 2000.

- With Location-based Services, mobile providers can provide an inexpensive mobile device both inside and outside the car that provides the information desired and is not embedded in the automobile design. This eliminates the concerns over vehicle obsolescence and economies of scale.

Many context-specific location services have been suggested. For example, restaurants could promote special offers to out-of-town visitors walking past their premises. Considerable customer opposition to such "push" services can be anticipated.

Location-based Services are inherently local but not necessarily local to the user at any given time. Localised services for hotel, restaurant or taxi reservations will be required by users at both the beginning and the end of journeys. Service roaming agreements between operators are essential to the provision of really compelling Location-based Services.

Service portability between operators will be necessary for Location-based Services to be offered globally. Billing and tariffing issues within a roaming environment will need careful attention.

4.5.2 Implications

In-vehicle devices are likely to focus only on telematics services. Consumers would prefer to have infotainment and mobile commerce applications delivered via a portable device rather than one installed in the vehicle.

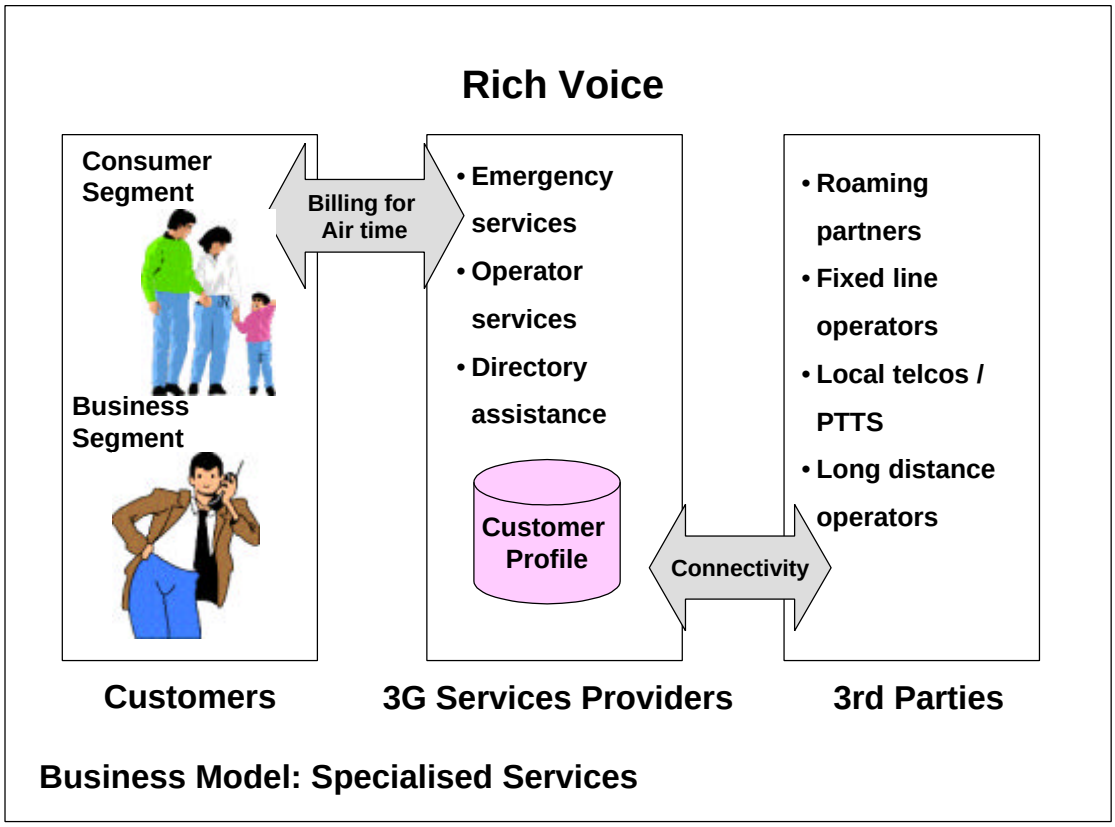
- 3G operators are uniquely positioned to offer Location-based Services in a data-intensive environment
- 3G operators need to be aware that it may become necessary to disclose location information to third parties
- User privacy concerns regarding personal location data will need to be addressed
- Location-based Services can be a wholesale or retail service. Revenue potential is high for the wholesale relationship

4.6 Service #6 – Rich Voice (Combined Consumer and Business)

The 3G Rich Voice service is a real-time, two-way service for businesses and consumers that provides advanced voice capabilities such as concurrent voice and data services using VoIP, voice-activated net access, and Web-initiated voice calls, while still offering traditional mobile voice features like operator services, directory assistance and roaming. Possibly circuit-switched initially, 3G Rich Voice will quickly evolve to a packet-based, IP-oriented service to enable new applications.

Figure 25 illustrates the possible business relationships amongst 3G services providers, customers and third parties for Rich Voice.

Figure 25. Illustrative business relationships for Rich Voice.



Sources: The UMTS Forum and Telecompetition Inc., September 2000.

Originally, mobile voice services were status symbols and were expensive, appealing primarily to affluent individuals or corporate-sponsored business users. Today, with lower prices on service and devices, more competition, greater geographic coverage and the advent of prepaid services, cellular has truly become a mass-market service appealing to all ages, income levels, industries and occupations.[41] Targeting future cellular markets has become a question of not who to market to, but under what lifestyle situations and conditions. The battle for market share becomes one for total voice minutes per subscriber—from any source.

2G mobile networks are increasingly capturing voice minutes of use from the fixed networks. The trend toward commodity tariffing on mobile networks will accelerate this substitution effect and could lead to a significant increase in mobile voice traffic. According to current industry opinion, over half of the current voice traffic on fixed networks will have shifted to mobile networks by 2010.

Some long-established GSM 900 networks in Europe are now experiencing capacity problems during peak traffic periods. Many of the newer GSM 1800 networks are expected to hit the same problems over the next two to three years. Capacity for voice traffic has undoubtedly been a factor for many

[41] For example, in the U.K., penetration rates have reached 50% (Financial Times, July 5, 2000.)

established European 2G-network operators bidding for new 3G spectrum.

The need for more mobile capacity refers to both voice and data. But separating voice from data makes little sense from a market perspective. Voice is an essential component in many "data-oriented" services. Voice communications, speech recognition and options such as Web-initiated voice calls and voice-activated Web access are increasingly being added as options in the fixed Internet world.

For all but a few niche applications, offering mobile services without a voice communication capability would be regarded in the marketplace as a retrograde step.

Mobile videophone is a natural evolution of today's voice services and is regarded by some as a major driver for 3G. Such high-tech services will certainly be expected as part of the 3G offering by the early-adopter segment of the market, although the eventual level of demand for mobile videophone services is at present uncertain.

4.6.1 Enabling and Inhibiting Factors

The lack of Calling Party Pays (CPP) billing in some countries such as the US continues to inhibit voice traffic on mobile networks although this has been partly compensated by the introduction of "flat rate" and other incentive service options. In most countries, capturing voice minutes of use from the fixed networks will be a major driver and revenue generator for 3G services providers.

However, all mobile cellular operators should anticipate a continuing decline in per-minute voice revenues as they inexorably approach the commodity pricing levels now becoming apparent on the fixed networks.

The ability to offer VoIP services on 3G networks represents a major potential market opportunity for 3G services providers. Incumbent fixed network operators with legacy circuit switched networks are unable to offer combined voice and data services suitable for collaborative working. Such services are fast becoming available from emergent fixed network operators with multi-service packet-switched networks.

Although 3G core networks will probably include a circuit-switched component initially, rapid migration to a single multi-service packet-switched network is essential to enable 3G services providers to offer a compelling Rich Voice service. Delaying 3G core network standards to accommodate high quality circuit-switched voice will probably hurt the industry. Implementing VoIP with different Quality of Service (QoS) levels supported by differential tariffing would enable 3G services providers to compete effectively with the emerging IP-based fixed networks. In this scenario market expectations work in favour of mobile services providers—less than toll-quality voice has become accepted in the mobile environment.

Data-only services will be acceptable in some niche markets but non-voice

services alone are unlikely to generate sufficient revenue to support the costs of establishing a 3G network. For Rich Voice services to be effective, service portability and interoperability between network services providers is essential. This will require inter-working QoS parameters to be developed to support connectivity between networks.

4.7 Conclusions

This section has portrayed the 3G market in terms of six service categories:

- Mobile Internet Access
- Mobile Intranet/Extranet Access
- Customised Infotainment
- Multimedia Messaging Service
- Location-based Services
- Rich Voice

The first two service categories in this framework can be described as "untethering the desktop." They effectively add mobility to the fixed Internet experience.

But the full potential of 3G derives from the unique characteristics of the mobile multimedia environment rather than just adding mobility to the Internet. The association of a terminal address with a person rather than a place opens up the possibility of personalised services and multimedia communications services encompassed by the Customised Infotainment and Multimedia Messaging Service categories. And knowledge of terminal location embedded in the access network gives rise to a rich portfolio of Location-based Services.

These service categories are not mutually exclusive. Most service offerings from services providers will include a package of services from across the different categories. The advantage of the service categorisation introduced in this study is that it provides a logical framework for assessing market demand and forecasting realistic service revenues.

Examining the market from the service perspective leads to some conclusions and observations listed below.

- "Mobile Internet" subscribers will want to have the same functionality on a mobile device that they currently have on their laptops. They will be unwilling to sacrifice computing capability or Internet access functionality when mobile.
- Computer-based device manufacturers are designing terminals that view voice as secondary, and computing and Internet as primary requirements.
- Mobile access is unlikely ever to dominate Internet usage. Wireline access with high bandwidth will remain an important feature of the Internet. Requirements for broadband Internet access are becoming increasingly significant and cannot be satisfied by 3G mobile.

- Current fixed Internet subscribers will expect 3G services providers to offer a full Internet experience.
- **Services providers offering Mobile Internet Access should benchmark their services against the evolved fixed Internet.**
- 3G services providers might consider adopting different marketing strategies when marketing to non-fixed Internet users. For example, they might not want to position the service as a mobile Internet service.
- **Positioning 3G as the mobile Internet sends the wrong message to the market.**
- 3G services providers can create significant revenue through narrowly focused, targeted services such as the Multimedia Messaging Service.
- Customised Infotainment services offered through personalised mobile portals owned by mobile services providers are a major market opportunity.
- Location-based Services represent a unique differentiator for mobile services providers.
- Service bundling should not be confused with technology integration. Non-voice services can be effectively “bundled” with voice service from a subscriber perspective (e.g., one bill, one device), but not implemented on the same network.
- While voice can be a desirable element of any service bundle, it does not need to be provisioned over the 3G network.
- The provisioning of VoIP should be a priority for 3G core network standardisation.
- The value of wholesale revenue opportunities should not be overlooked.

5. 3G Market Demand Forecasts

The demand forecast uses a most likely scenario based upon the body of secondary research, expert option and team analysis, using realistic price and adoption assumptions. The intent is to demonstrate likely subscription numbers and revenues given what is know today. The result is a conservative forecast that gives mobile services providers a benchmark from which to develop future marketing strategies. Forecasts for services have been derived using Telecompetition's ATIVA Research Tools®, a proprietary system that calculates country-level market size in four dimensions—time, product, segment and geography. There are two major steps in the process.

First, the following inputs were developed for incorporation into the forecast calculations:

- Industry dynamics and business models
- Worldwide 3G market size from 2000 to 2010
- Service-level propensity-to-buy scores by age, occupation and industry
- Country-level GeoGain™ scores (weighting factors) for each service that include commercialisation schedules and other significant economic and regulatory factors
- Worldwide country-level population projections by age, occupation and industry (for 195 countries)[42]

Second, these inputs are incorporated in ATIVA Research Tools® for calculation of country and regional forecasts. ATIVA Research Tools® is further described in the Appendix.

Section 5.1 describes how inputs were developed. Section 5.2 describes various aspects of ARPU. Sections 5.3 and 5.4 contain the service and revenue forecasts. All revenues are in nominal US dollars.

5.1 Forecast Assumptions and Inputs

In developing the demand forecasts described in later sections of this report, it was assumed that the 3G mobile industry would follow much of the business models and revenue structure of the fixed industry. Key assumptions follow:

- Different services would be offered under different business models, as described earlier. Therefore, the revenue sources for each service would also differ. For example, the Mobile Intranet/Extranet Access service uses a mobile ISP business model and would consist of subscription and airtime/access revenues only. Customised Infotainment offered through a

[42] Telecompetition has developed comprehensive worldwide population and demographic databases using well-known sources such as International Labour Organisation (ILO), US Census Bureau International Database, Rand McNally and other country-specific statistical sources. Other market factors can be considered, such as income. Uniform international demographic data for income is not currently available.

mobile portal would consist of subscription, transaction, advertising and airtime/access revenues.

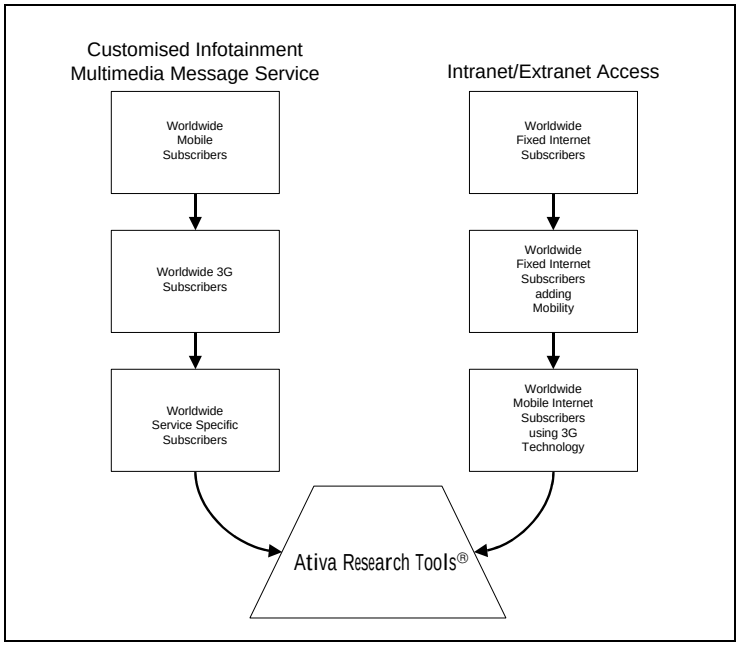
- The future market position and business relationships between fixed Internet ISPs/OSPs and mobile portals is highly uncertain. It is clear that both have strengths and are capable of capturing significant market share. Therefore, for modelling purposes, it was assumed that by 2010, market share is equally divided.
- Finally, the potential that exists for new mobile data services is not limited to the Internet. Services such as Rich Voice, Multimedia Messaging Service, and Location-based Services can be offered on non-Internet platforms and new devices.

5.1.1 Worldwide Market Size – Subscriber and Subscription Inputs

When moving from a voice-centric to a data-centric environment, a distinction needs to be made between subscribers and subscriptions. The term "subscribers" refers to the number of people, while the term "subscriptions" refer to the number of services they use. In this report, the sum of the service subscriptions forecasted will exceed the total number of 3G subscribers, since some subscribers will have more than one service subscription. (For example, a 3G subscriber could have both Customised Infotainment and Multimedia Messaging Service.)

Worldwide service subscriptions were calculated using a top-down approach and a series of adoption curves ("S" curves) against most likely worldwide-mobile or Internet-subscriber penetration levels. To develop these adoption curves, historic substitution rates of similar products, current penetration levels, recent growth and technology constraints were analysed. Near-actual 2000 and most likely 2010 penetration-levels were derived, with exponential ramp-up estimated between those two points. Figure 26 illustrates the proprietary forecast methodology used:

Figure 26. Calculation of worldwide subscription levels for forecasted services.



Source: Telecompetition Inc., 2000.

5.1.2 Worldwide Market Size – Service Revenue Inputs

The revenue forecasts in this report are for **mobile services providers retained revenues** only. They **do not** include the market revenue that will be attributed to other players such as content providers, device manufacturers and m-commerce partners. Therefore, many forecasts by other analysts in areas such as m-commerce may appear to indicate much larger numbers than displayed in this report. A major objective of this report has been to sift through the available data and identify realistic revenues that mobile services providers can truly expect to obtain. In all steps of the analysis, plausible prices and numbers have been used that reflect a likely, achievable revenue flow. This is a more conservative approach than may be taken by other analysts.

For example, in the absence of generally available results from market trials to test price points for 3G services, revenue estimates were developed using current pricing of analogous services that meet similar needs and are targeted to similar markets. The underlying assumption in this approach is that users will be willing to pay at least as much for 3G services as they currently pay for a current mobile or fixed version of the capability. This approach establishes an average **price level** for services based on known willingness to pay. It does not presume a **price structure**, and so still allows for a usage-sensitive pricing scheme that would enable services providers to manage capacity by charging more bandwidth intensive users higher prices than lighter users.

It was assumed that users will compare fixed and mobile service pricing and will make rational choices that will financially optimise their mix of mobile and fixed communication services. Therefore, it is appropriate to use fixed service prices as analogies in some cases. Service price points and usage levels

were estimated using analogies as shown in Table 11.

Table 11. Analogies used for price assumptions.

Service	Analogies	Year 2000 [43] Monthly Prices Per Subscription
Customised Infotainment (Mobile Portal)	i-mode	$20
Multimedia Messaging Service (MMS)	SMS	$8.40
Mobile Intranet/Extranet Access	Fixed Internet access (xDSL[44]) and subscription fees	$82 – ISP Subscription and Access/Airtime

Source: Telecompetition Inc. analysis, July 2000.

Revenue sources for each forecasted service were based on the three business models described earlier. For example, the Customised Infotainment (Mobile Portal) service includes revenue from airtime, subscription fees, transaction fees and advertising, while the Mobile Intranet/Extranet Access service only includes airtime and subscription fees. Multimedia Messaging Service includes revenue from message charges and subscription fees.

Keeping price trends and business models in mind, the following price assumptions were made in the service forecasts.

- Worldwide average prices for digital services will drop an average 16 per cent per year for a total decline of 80 per cent by 2010.
- The worldwide average price per message for Multimedia Messaging Service will drop from $0.12 to $0.035 by 2010. A premium will be still charged for higher-value multimedia messages.
- Worldwide average subscription prices for Mobile Intranet/Extranet Access will decline an average 10.5 per cent per year, for a total decline of 70 per cent by 2010.
- Broadband access prices will drop an average 13 per cent per year for a total decline of 80 per cent by 2010. As a result, businesses will pay no more for Mobile Intranet/Extranet Access than they currently pay for broadband access (i.e., xDSL) to remote locations. Subscription prices for Customised Infotainment will increase initially, then drop slightly over the forecast period. Increased transactions will maintain the relatively flat price trend.

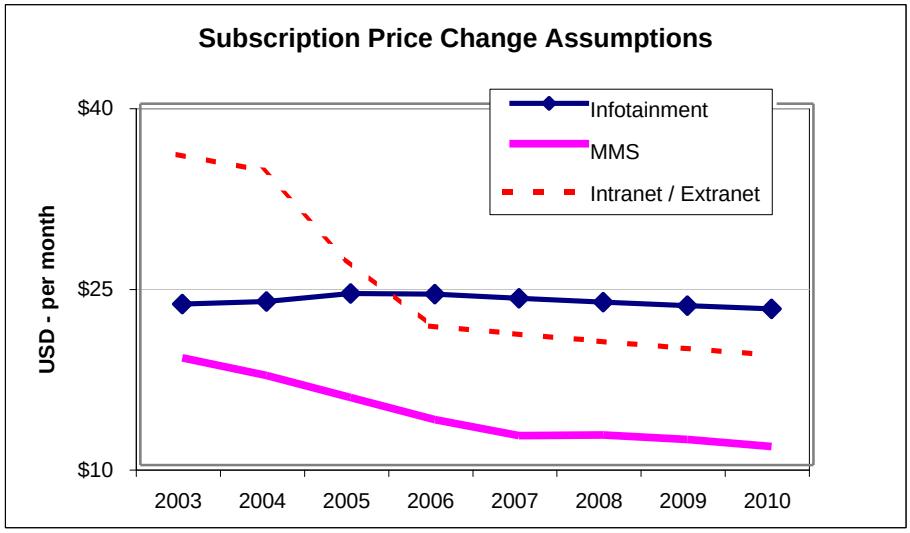
Using the above assumptions, the existing price analogies and other service-

[43] These estimates were made after review of a number of secondary research sources including Merrill Lynch, Durlacher, ARC, Robertson Stephens, Dain Rauscher Wessels, Strategis, Herschel Shosteck and others.

[44] DSL = Digital Subscriber Line.

specific assumptions, the average revenue-per-service subscription was calculated over the forecast period as shown in Figure 27.[45] All revenues were calculated using nominal (year 2000) US dollars.

Figure 27. Telecompetition forecast – service price assumptions.



Source: Telecompetition Inc. analysis, July 2000.

5.1.3 Service Level Propensity-to-Buy

Telecompetition® propensity-to-buy scores are relative scores that weight population in each country by age, occupation and industry for each service forecast.[46] These scores are used by ATIVA Research Tools® to calculate the individual country-level portion of the worldwide market for each service. Service-level propensity-to-buy scores were developed through analysis of available primary and secondary market research from reputable sources.[47] General propensity-to-buy assumptions are shown in Table 12.

[45] The steep price decline shown for the Mobile Intranet/Extranet Access service is a result of rapidly declining prices for broadband business Internet. Due to increased competition and the need to maintain mass-market price levels, average subscription revenues for Customised Infotainment and Multimedia Messaging Service increase for the first few years, then decline and flatten out over the later years in the forecast.

[46] As worldwide population data by income level is not available for all countries, propensity-to-buy by income is not considered in international forecasts.

[47] Sources reviewed include analysis by AOL, Personal Communications Industry Association (PCIA), Cellular Telecommunications Industry Association (CTIA) and various financial analyst reports.

Table 12. Propensity-to-buy assumptions by service.

Service	Propensity-to-Buy
Customised Infotainment (Mobile Portal)	Weighted to young adults up to middle age
Multimedia Messaging Service (MMS)	Weighted to teenage and young adult population
Mobile Intranet/Extranet Access	Weighted to communications-intensive industries and professional occupations

Source: Telecompetition Inc. analysis, July 2000.

5.1.4 GeoGain ä Scores

Telecompetition GeoGain™ scores are another weighting factor that allows ATIVA Research Tools® to consider other country-specific infrastructure, technology or social/cultural factors. GeoGain scores were developed for each service and country using estimated commercialisation start dates for 3G services and a relative score of service adoption potential[48] (derived from teledensity, Cable Television (CATV) penetration, PC penetration[49], Gross Domestic Product (GDP) growth and mobile penetration levels).

5.2 Voice and Data ARPU

Average Revenue per User (ARPU) is the traditional way to measure mobile market success. In the single service voice world, ARPU is derived by dividing total revenue by total mobile subscribers. ARPU is an adequate measure in this environment where everybody takes the same service, and where subscribers and subscriptions are the same. However, in the 3G world of various services and service bundles, multiple business models and revenue sharing, ARPU is not a meaningful measure. It does not enable services providers to measure subscriber profitability or success of individual services. Incremental revenue per subscription or subscriber becomes a more useful metric.

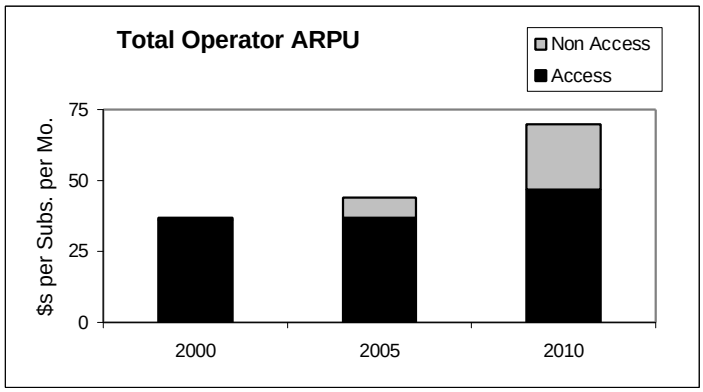
Generally speaking, most analysts agree that mobile data services will increase ARPU and thus reverse the current declining trend for voice-only service. For example, Merrill Lynch forecasts a 2010 total ARPU of $66 for Western Europe, almost half of which will come from mobile data services. According to Merrill Lynch[50], airtime/access for both voice and data services will continue to dominate revenue. However, non-access revenues (primarily data) will increase from less than 1 per cent to 25 per cent of revenues by 2010 (Figure 28).

[48] Sources analysed for penetration levels were CIA World Factbook, ITU Yearbook of Statistics, and ITU STARS database.

[49] PC penetration was used as a substitute for Internet usage, due to sparse availability of data on Internet penetration.

[50] Merrill Lynch, "Wireless Internet – More than Voice: The Opportunity and Issues," 5 June 2000.

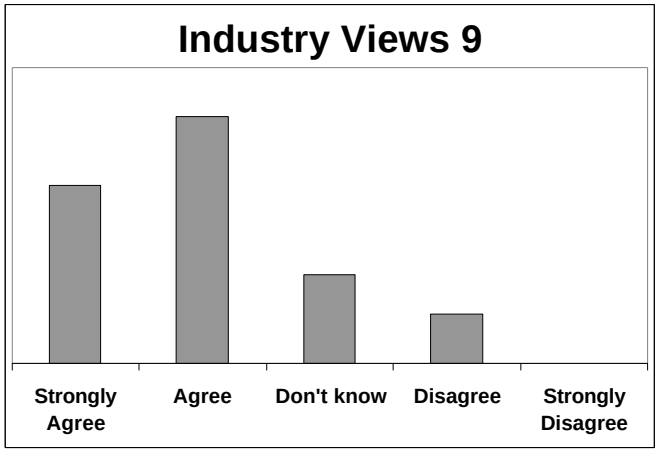
Figure 28. Forecasted European ARPU by access and non-access revenues.[51]



Source: Merrill Lynch, June 2000.

Whatever the future value of ARPU as a measure of market success, there is a strong belief in the industry that 3G services will increase ARPU (Industry Views 9).

Industry Views 9. 3G services will increase average revenue per user.



Industry views come from various analyst reports and informal industry surveys. They do not necessarily represent the views of the UMTS Forum.

This study has not modelled revenue forecasts for all foreseeable 3G services. The incremental impact of the total revenue from just the three forecasted services over the entire worldwide mobile subscriber base is shown in Figure 29A. By 2010, the three forecasted services collectively contribute additional revenue of $6 per month per worldwide mobile subscriber, or $22 per month per 3G subscriber (Figure 29B).

[51] Non-access ARPU includes value-added voice and data services. Access includes airtime generated from voice and data services.

Figure 29A and B. Incremental revenue impact of new service revenue on worldwide and 3G ARPU (three forecasted services only).

ARPU and 3G – an explanation.

Traditionally, ARPU is calculated by dividing total revenue by total subscribers. This can be calculated on either a worldwide basis or for individual services providers to compare revenue changes. When there is basically one product (i.e., voice) and only one subscription per subscriber, this makes sense. ARPU illustrates the net effect of declining prices and increasing usage for voice services.

In a 3G world, however, not all mobile subscribers will purchase 3G services and not all 3G subscribers will purchase the same mix or number of 3G services. ARPU for any one 3G service will only reflect the net effect of declining price over an increasing subscriber base. A more meaningful measurement for 3G services is incremental revenue.

Figures 29A and B illustrate the complexity in trying to apply traditional ARPU measurements to 3G services.

Figure 29A shows the $164B revenue (in 2010) for the three forecasted 3G services adds an average incremental revenue of $6 per month, when spread over the entire worldwide mobile base of 2.25B subscribers. If one assumes a 2010 traditional voice ARPU of around $25, this is an increase of 25 per cent.

Figure 29B shows that the $164B revenue (in 2010) for the three forecasted 3G services, when spread over the 3G base of 630M subscribers, adds additional incremental average revenue of $22. The declining curve over the forecast period reflects declining prices for all data services including mobile 3G services. This should be expected in a growing market that is approaching critical mass.

Figure 29B also illustrates that, since prices will typically decline, **services providers must effectively manage a sophisticated portfolio of services and target segments, continually developing new services, improve existing ones, and targeting high-value customers.**

Figure 29A

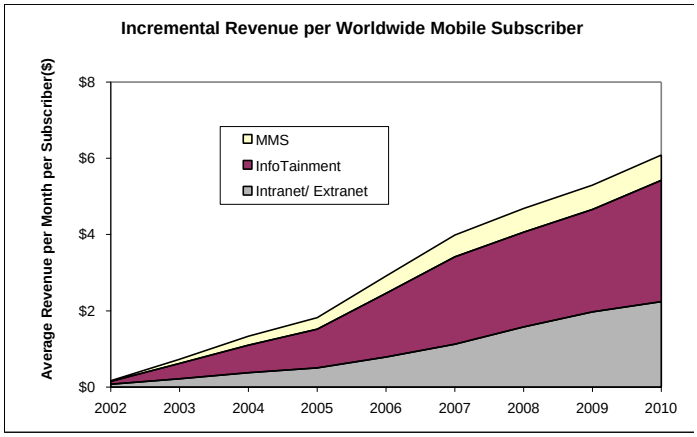
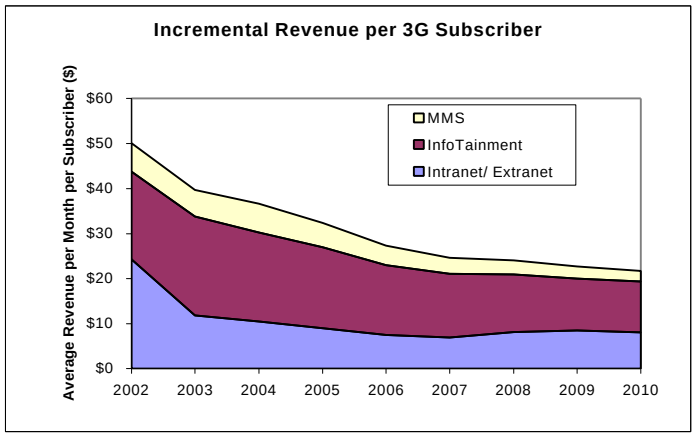


Figure 29B



Source: Telecompetition analysis, July 2000

5.3 Worldwide Demand by Region for Selected Services – 2001-2010

Of the six service categories shown in the service and application framework (Figure 8), three services have been forecast at regional and country levels. These three services are representative of the three types of business models:

- Customised Infotainment (Mobile Portal)
- Multimedia Messaging Service (Mobile Specialised Services)
- Mobile Intranet/Extranet Access (Mobile ISP)

Worldwide subscribers are expected to grow dramatically, especially during 2005-2010. The CAGR for each service for the five-year period, 2005-2010 is

shown in Table 13.

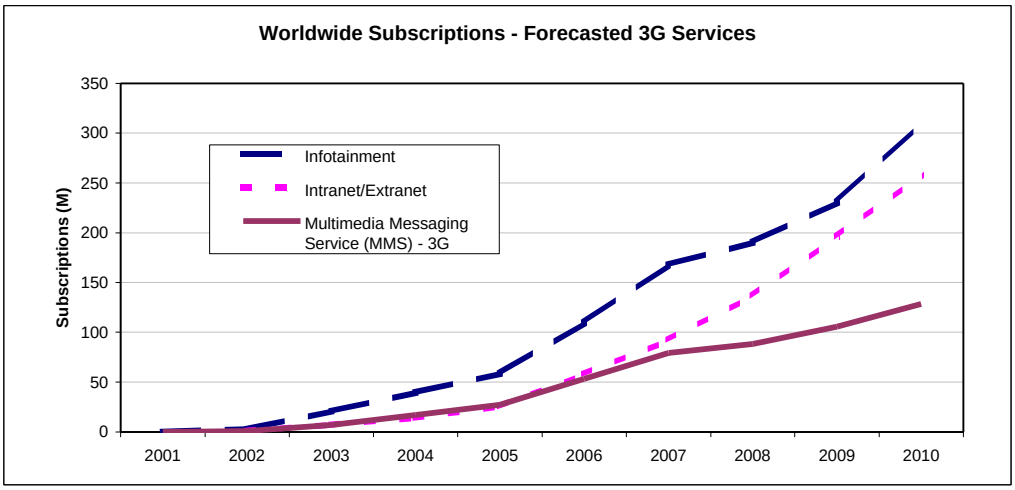
Table 13. Compound annual growth rates for forecasted services for 2005-2010.

Service	CAGR
Customised Infotainment (Mobile Portal)	23.2%
Multimedia Messaging Service (MMS)	19.4%
Mobile Intranet/Extranet Access	34.8%

Source: Telecompetition Inc., July 2000

Figures 30-31 and Table 14 summarise the worldwide and regional demand for the three services targeted in this market study.

Figure 30. Worldwide market demand for the three forecasted services over time.



Source: Telecompetition Inc., July 2000.

Note that since these are service level forecasts, subscribers may have more than one service subscription and the total service subscriptions may, and indeed will often exceed, the total market estimated in this study. Customised Infotainment subscriptions will exceed both Mobile Intranet/Extranet Access and Multimedia Messaging Service during the forecast horizon.

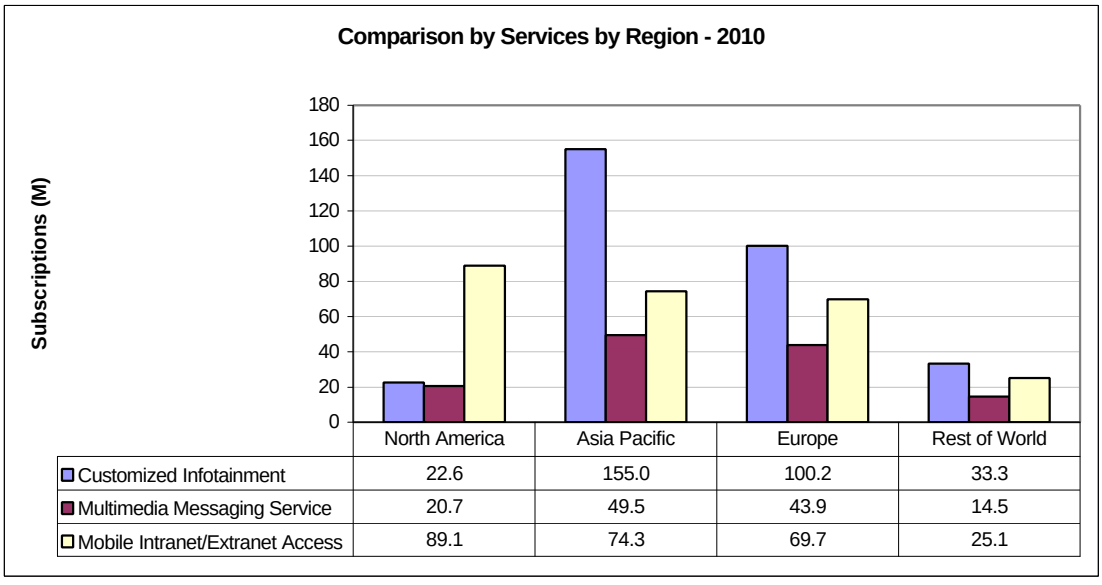
Table 14. Worldwide 3G services by subscriptions and revenues for 2001-2010 (three forecasted services only).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Subscriptions (M)										
Customised Infotainment	0.0	2.6	20.7	39.7	58.5	109.8	168.2	190.1	230.4	311.1
Mobile Intranet/Extranet Access	0.1	1.2	7.2	14.2	25.8	58.1	92.4	137.1	196.3	258.2
Multimedia Messaging Service	0.0	1.0	6.9	17.2	27.3	53.1	79.4	88.2	105.8	128.5
Revenues ($B)										
Customised Infotainment	0.0	0.7	5.8	11.2	17.0	31.9	48.1	53.7	64.3	85.8
Mobile Intranet/Extranet Access	0.0	0.9	3.1	5.9	8.5	15.3	23.6	34.1	47.4	60.7
Multimedia Messaging Service	0.0	0.2	1.6	3.6	5.1	8.8	11.8	13.2	15.4	17.8
Total Revenue	**0.0**	**1.8**	**10.5**	**20.7**	**30.6**	**56.0**	**83.5**	**101.0**	**127.1**	**164.3**

Source: Telecompetition Inc., July 2000.

It is useful to see how the different services develop in each region. Figure 31 shows the forecasted service mix for each region in 2010.

Figure 31. Regional market demand for the forecasted three services by subscriptions.



Source: Telecompetition Inc., July 2000.

5.3.1 Mobile Intranet/Extranet Access

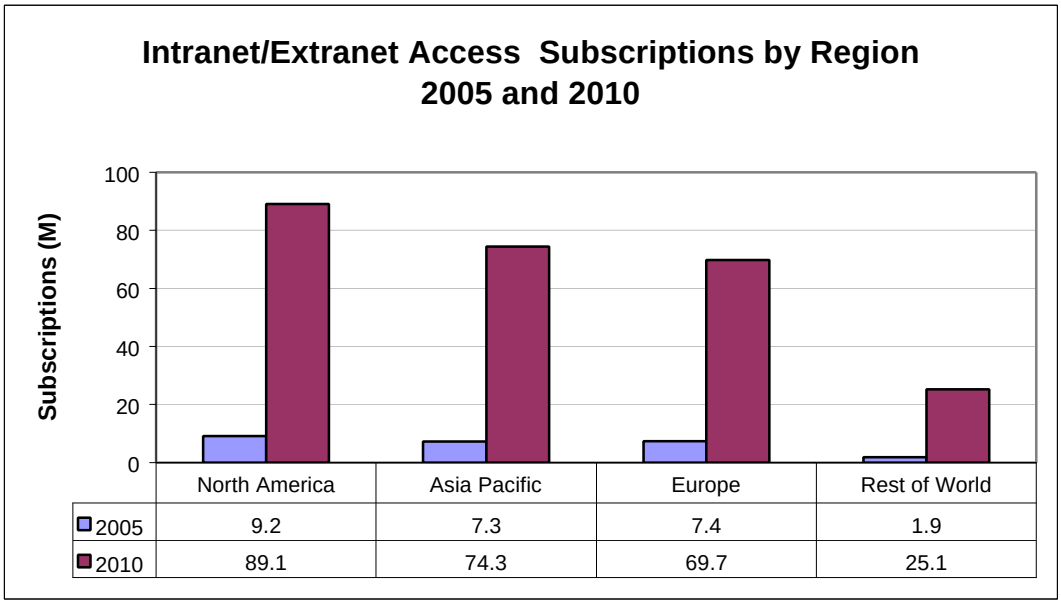
Mobile access to a business Intranet or Extranet is viewed as a widespread service used in combination with Internet and e-mail by nearly all mobile, "remote access" professionals. Therefore, it was assumed that by 2010, approximately 40 per cent of the worldwide 3G mobile subscribers will use

Mobile Intranet/Extranet Access. As the service is targeted mainly for fixed business Internet subscribers who wish to add "mobility," it is assumed that the service adoption will be slow until full multimedia/Web browsing with comparable quality and speed of fixed Internet becomes available in the 2004–2005 timeframe. The security issues and the general complexity of the customer base will cause Mobile Intranet/Extranet Access service to lag consumer services by one year, delaying any significant commercial availability until 2002.

The revenue forecast is built upon a combination of subscription fees and airtime access. The forecast assumes that businesses will be willing to pay no more for airtime access than they currently pay for broadband remote access (i.e., DSL) and that an Internet subscription fee will also be applied. Over the forecast period, prices for airtime access decline by 70 per cent and Internet subscription fees decline by 80 per cent. This decline takes into account general industry trends for declining price per Mbit/s, discounts for negotiated contracts with businesses, and for the possibility that the mobile services provider could sell this service "wholesale" to the business ISP or system integrator. Average monthly revenue per Mobile Intranet/Extranet Access subscription declines from $65 in 2000 to $20 by 2010.

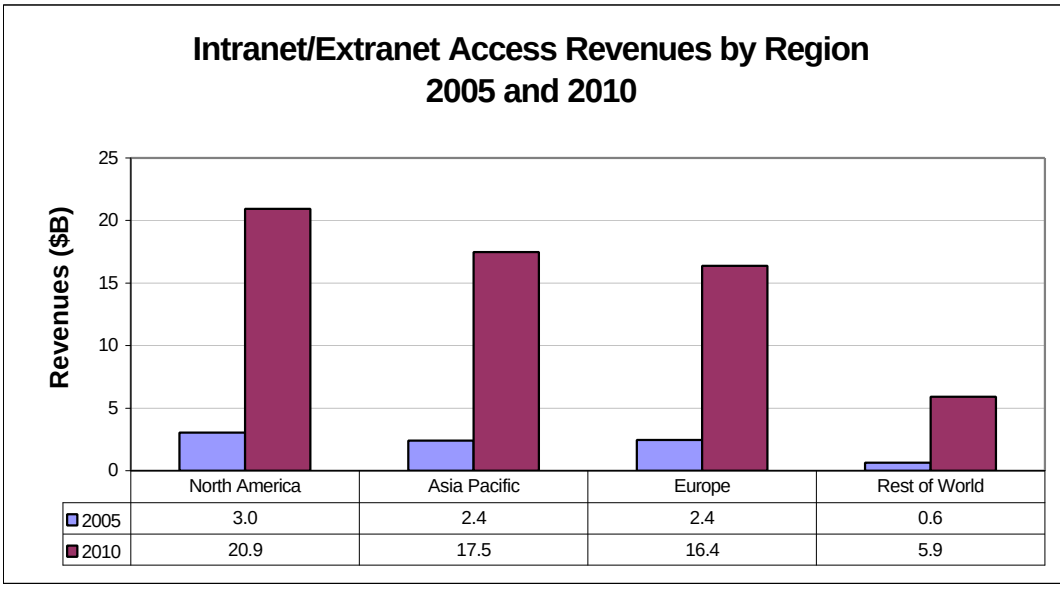
Figures 32 and 33 show forecast subscriptions and revenues by region.

Figure 32. Worldwide Mobile Intranet/Extranet Access subscriptions by region in 2005 and 2010.



Source: Telecompetition Inc., July 2000.

Figure 33. Mobile Intranet/Extranet Access revenues by region in 2005 and 2010.



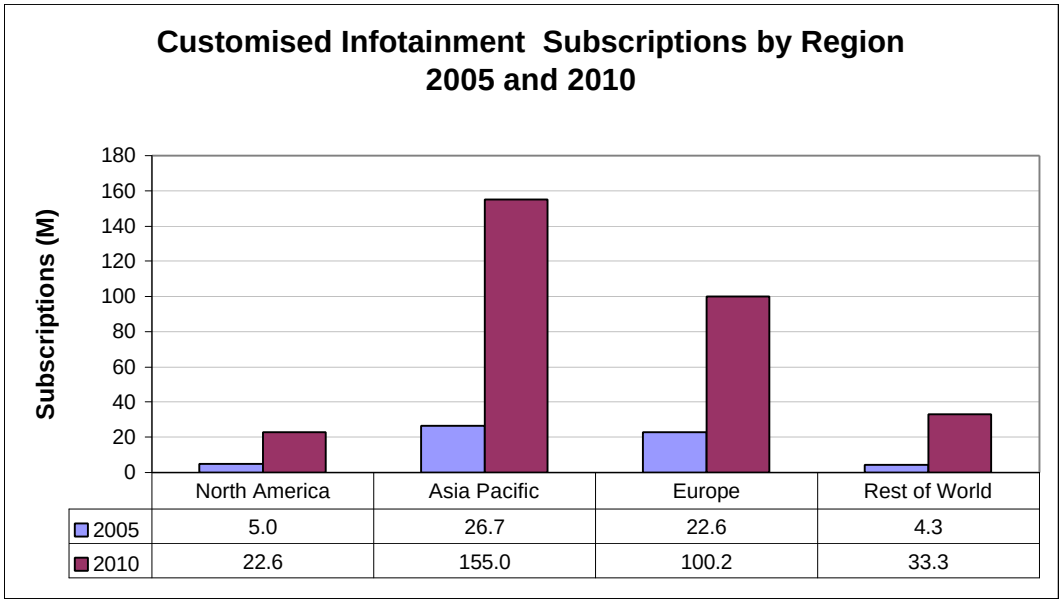
Source: Telecompetition Inc., July 2000.

5.3.2 Customised Infotainment

The demand forecast assumes Customised Infotainment is offered through a mobile portal. The Customised Infotainment revenue forecast includes subscription, airtime, advertising, and transaction fees. Prices for subscriptions drop almost 50 per cent over the ten-year horizon, while advertising fees remain constant. Transaction and airtime fees per subscription increase 46 per cent due to increased use of the service. Average total revenue per subscription for Customised Infotainment rises from $20 in 2000 to $23 in 2010.

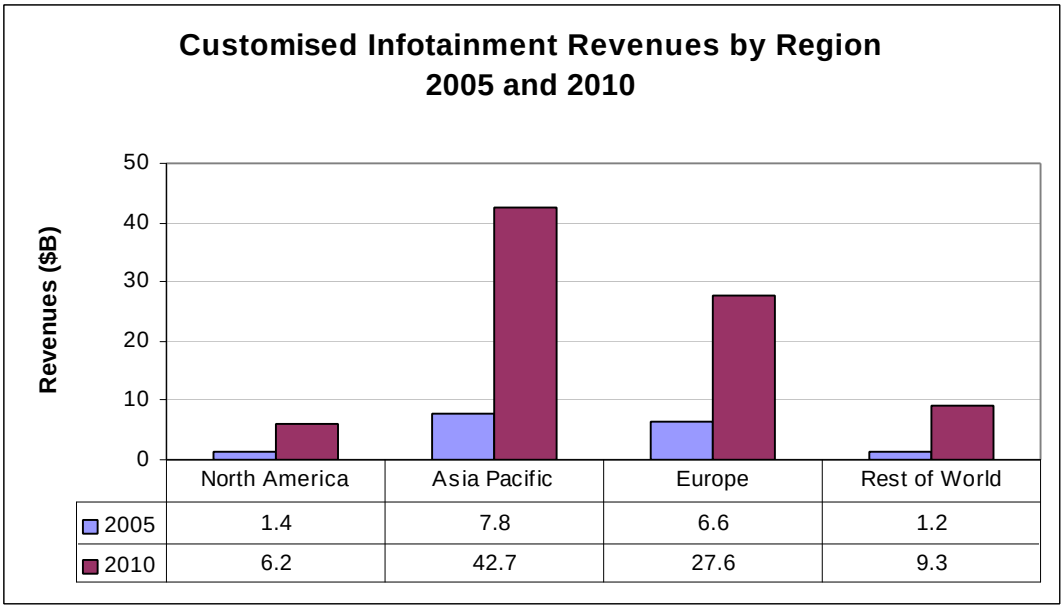
The forecast does not include subscription revenues from fixed Internet consumers who “extend” their capability to include mobile access. This would be included in the Mobile Internet Access service.

Figure 34. Customised Infotainment subscriptions by region in 2005 and 2010.



Source: Telecompetition Inc., July 2000.

Figure 35. Customised Infotainment revenues by region in 2005 and 2010.



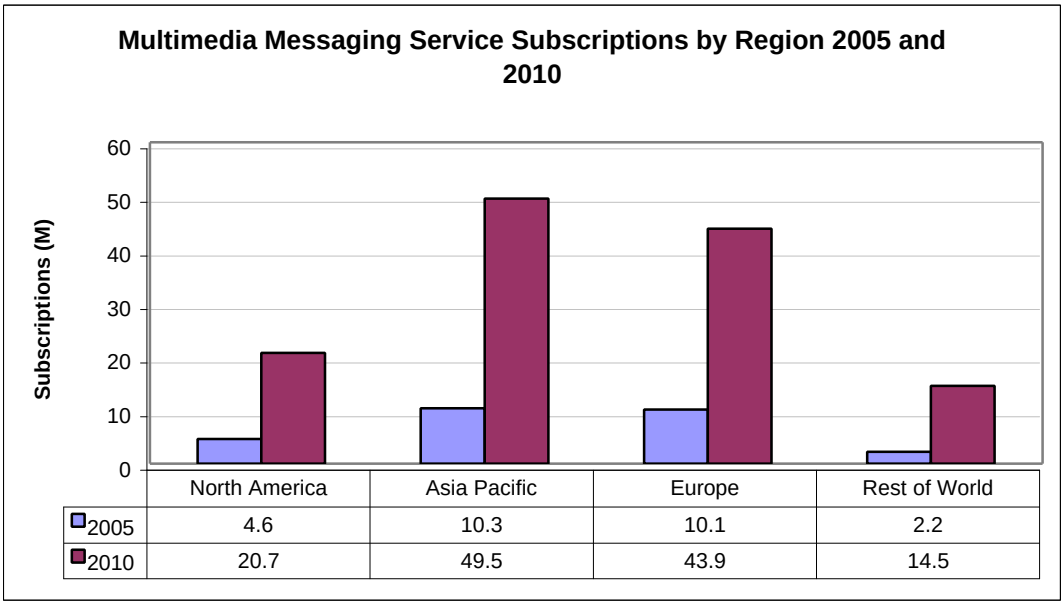
Source: Telecompetition Inc., July 2000.

5.3.3 Multimedia Messaging Service

The forecast for Multimedia Messaging Service is restricted to a specific market segment—young consumers. The demand forecast for Multimedia Messaging Service uses SMS as an analogy, focusing on the teenage and young adult market and using current pricing levels as the starting price point. The forecast assumes messages per user will increase substantially and that message prices will decrease at least by 70 per cent by 2010. In the forecast model, Multimedia Messaging Service is used by about 20 per cent of the 3G

subscribers, but heavily concentrated in the teenage and young-adult segments. Additional enhancements to Multimedia Messaging Service that could broaden the addressable market to include other age segments were not included as part of the forecast. With multimedia capability, the proportion of complex (more expensive) content and messages will increase, further increasing revenue per user.

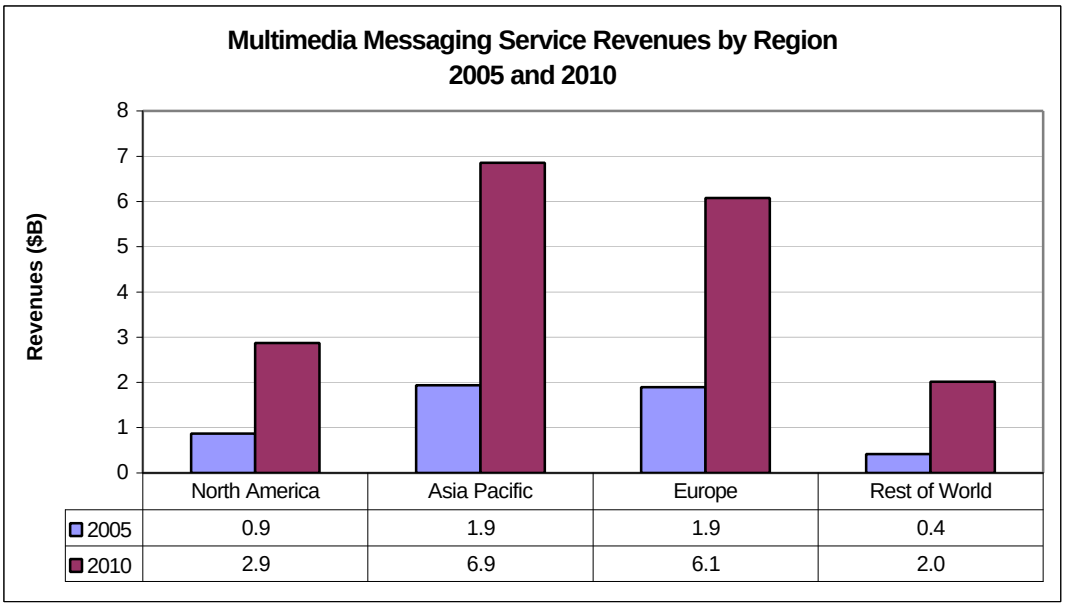
Figure 36. Multimedia Messaging Service subscriptions by region in 2005 and 2010.



	North America	Asia Pacific	Europe	Rest of World
2005	4.6	10.3	10.1	2.2
2010	20.7	49.5	43.9	14.5

Source: Telecompetition Inc., July 2000.

Figure 37. Multimedia Messaging Service revenues by region in 2005 and 2010.



	North America	Asia Pacific	Europe	Rest of World
2005	0.9	1.9	1.9	0.4
2010	2.9	6.9	6.1	2.0

Source: Telecompetition Inc., July 2000.

5.4 Regional Forecasts for Selected Services - 2000 - 2010

Regional forecasts divide the world into four regions: Europe, Asia Pacific,

North America and Rest of World. Rest of World includes primarily Latin America and Africa. Table 15 shows the countries and administrative regions included in North America, Europe, Asia Pacific and the Rest of World.

Table 15. Countries and administrative regions considered in 3G forecast.

Countries and Administrative Regions								
NORTH AMERICA	**EUROPE**		**ASIA PACIFIC**		**REST OF WORLD**			
Canada	Albania	Italy	Armenia	Macau	Algeria	The Gambia	Nicaragua	
United States	Austria	Latvia	Australia	Malaysia	Angola	Gaza Strip	Nigeria	
	Belarus	Lithuania	Azerbaijan	Maldives	Argentina	Ghana	Oman	
	Belgium	Luxembourg	Bhutan	Mongolia	The Bahamas	Guadeloupe	Other Melanesia	
	Bosnia and Herzegovina	Macedonia	Brunei	New Zealand	Bahrain	Guatemala	Panama	
	Bulgaria	Malta	China	Pakistan	Barbados	Guinea	Paraguay	
	Croatia	Moldova	China (Taiwan)	Papua New Guinea	Belize	Guyana	Peru	
	Cyprus	Netherlands	East Timor	Philippines	Benin	Haiti	Puerto Rico	
	Czech Republic	Norway	Fiji	Russia	Bolivia	Honduras	Qatar	
	Denmark	Poland	Georgia	Singapore	Botswana	Iran	Reunion	
	Estonia	Portugal	Hong Kong S.A.R.	Solomon Islands	Brazil	Iraq	Saudi Arabia	
	Finland	Romania	India	South Korea	Cameroon	Israel	Senegal	
	France	Slovakia	Indonesia	Sri Lanka	Cape Verde	Ivory Coast	South Africa	
	Germany	Slovenia	Japan	Thailand	Chile	Jamaica	Sudan	
	Greece	Spain	Kazakhstan	Turkmenistan	Colombia	Jordan	Surinam	
	Hungary	Sweden	Kyrgyzstan	Uzbekistan	Comoros	Kenya	Swaziland	
	Iceland	Switzerland	Laos		Congo (Brazzaville)	Kuwait	Syria	
	Ireland	Turkey			Costa Rica	Lebanon	Togo	
		United Kingdom			Cuba	Lesotho	Trinidad and Tobago	
					Dominican Republic	Liberia	Tunisia	
					Ecuador	Libya	Uganda	
					Egypt	Martinique	United Arab Emirates	
					El Salvador	Mauritania	Uruguay	
					Equatorial Guinea	Mauritius	Venezuela	
					Ethiopia	Mexico	Yemen	
					Gabon	Morocco	Zambia	
						Namibia	Zimbabwe	
						Netherlands Antilles		

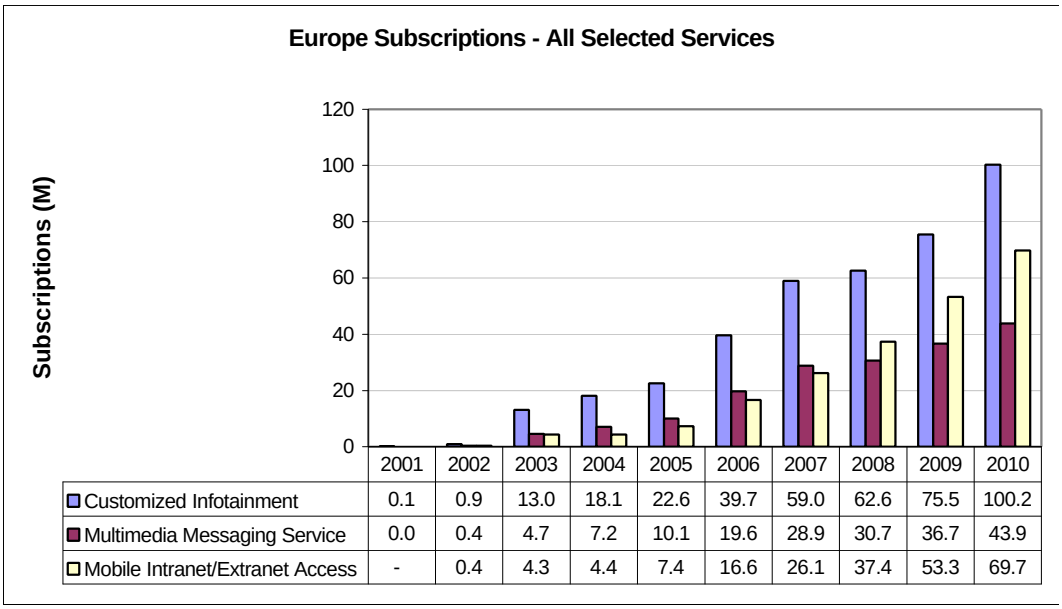
Source: Telecompetition, September 2000.

5.4.1 European Demand

Demand in Europe will be high given the lead in licence auctions and auction prices. New licence holders are motivated to generate revenue from their investment.

Figure 38 shows the European forecasts for the three services.

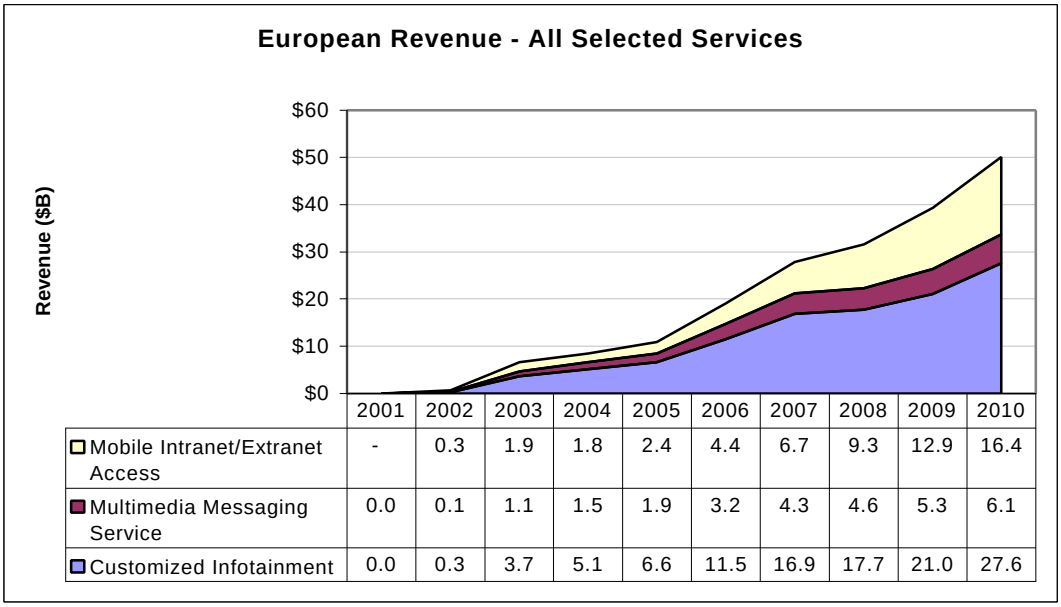
Figure 38. European demand for 3G services by subscriptions 2001-2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Customized Infotainment	0.1	0.9	13.0	18.1	22.6	39.7	59.0	62.6	75.5	100.2
Multimedia Messaging Service	0.0	0.4	4.7	7.2	10.1	19.6	28.9	30.7	36.7	43.9
Mobile Intranet/Extranet Access	-	0.4	4.3	4.4	7.4	16.6	26.1	37.4	53.3	69.7

Source: Telecompetition Inc., July 2000.

Figure 39. European demand for 3G services by revenue 2001-2010.



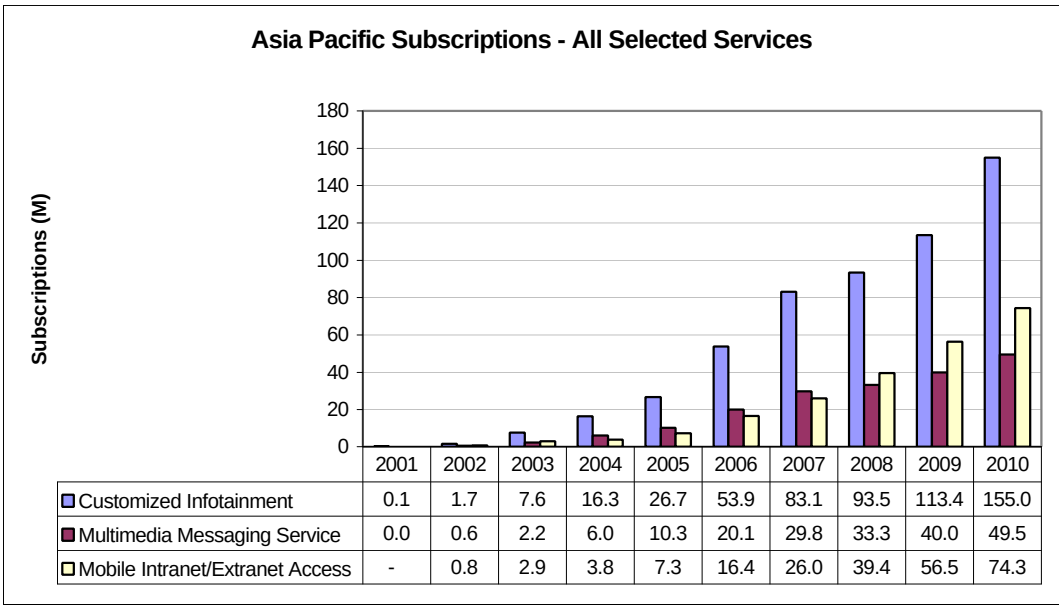
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mobile Intranet/Extranet Access	-	0.3	1.9	1.8	2.4	4.4	6.7	9.3	12.9	16.4
Multimedia Messaging Service	0.0	0.1	1.1	1.5	1.9	3.2	4.3	4.6	5.3	6.1
Customized Infotainment	0.0	0.3	3.7	5.1	6.6	11.5	16.9	17.7	21.0	27.6

Source: Telecompetition Inc., July 2000.

5.4.2 Asia Pacific Demand

Asia Pacific initially led the 3G market in both subscriptions and revenues due to its early entry into the market.

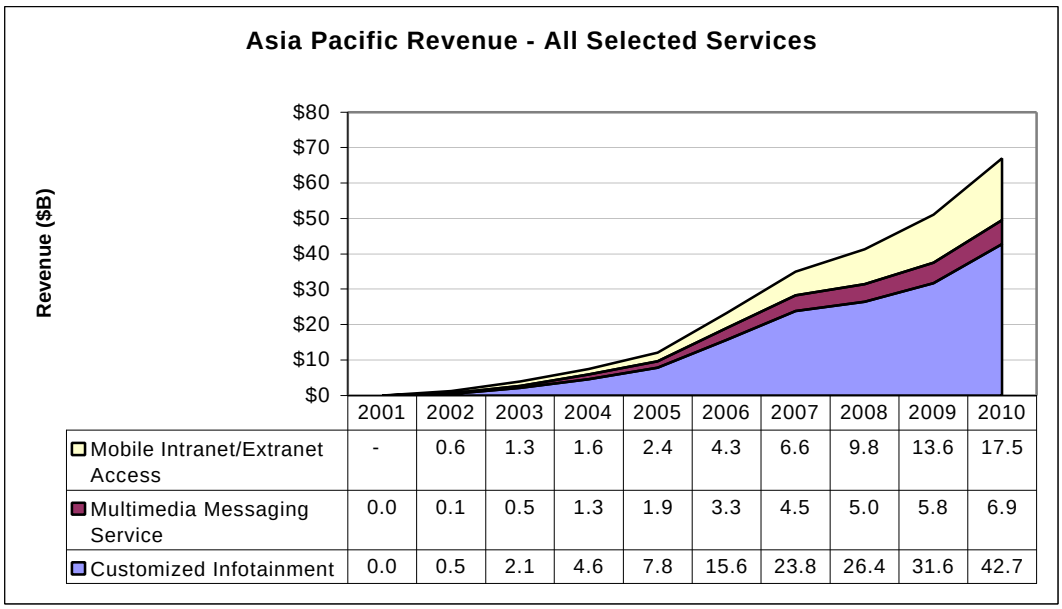
Figure 40. Asia Pacific demand for 3G services by subscriptions 2001 – 2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Customized Infotainment	0.1	1.7	7.6	16.3	26.7	53.9	83.1	93.5	113.4	155.0
Multimedia Messaging Service	0.0	0.6	2.2	6.0	10.3	20.1	29.8	33.3	40.0	49.5
Mobile Intranet/Extranet Access	-	0.8	2.9	3.8	7.3	16.4	26.0	39.4	56.5	74.3

Source: Telecompetition Inc, July 2000.

Figure 41. Asia Pacific demand for 3G services by revenue 2001-2010.



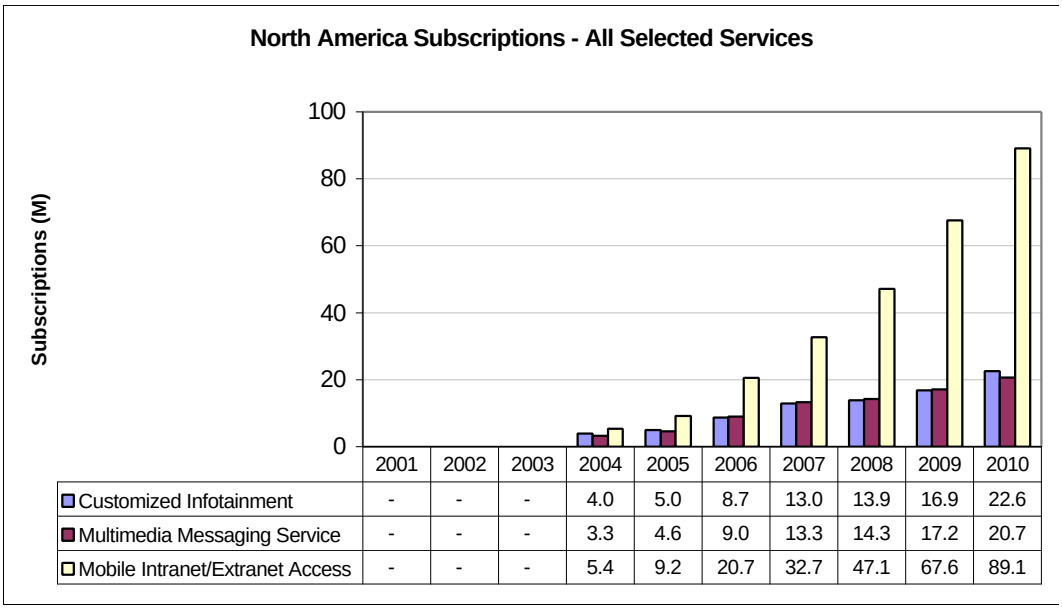
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mobile Intranet/Extranet Access	-	0.6	1.3	1.6	2.4	4.3	6.6	9.8	13.6	17.5
Multimedia Messaging Service	0.0	0.1	0.5	1.3	1.9	3.3	4.5	5.0	5.8	6.9
Customized Infotainment	0.0	0.5	2.1	4.6	7.8	15.6	23.8	26.4	31.6	42.7

Source: Telecompetition Inc., July 2000.

5.4.3 North American Demand

North America has a different history and approach to mobile than almost anywhere else in the world. This has resulted in an incompatibility of spectrum, multiple network standards and air interfaces. It has also resulted in a slow start for 3G. Deployment is not forecasted until 2004 driven primarily by capacity constraints.

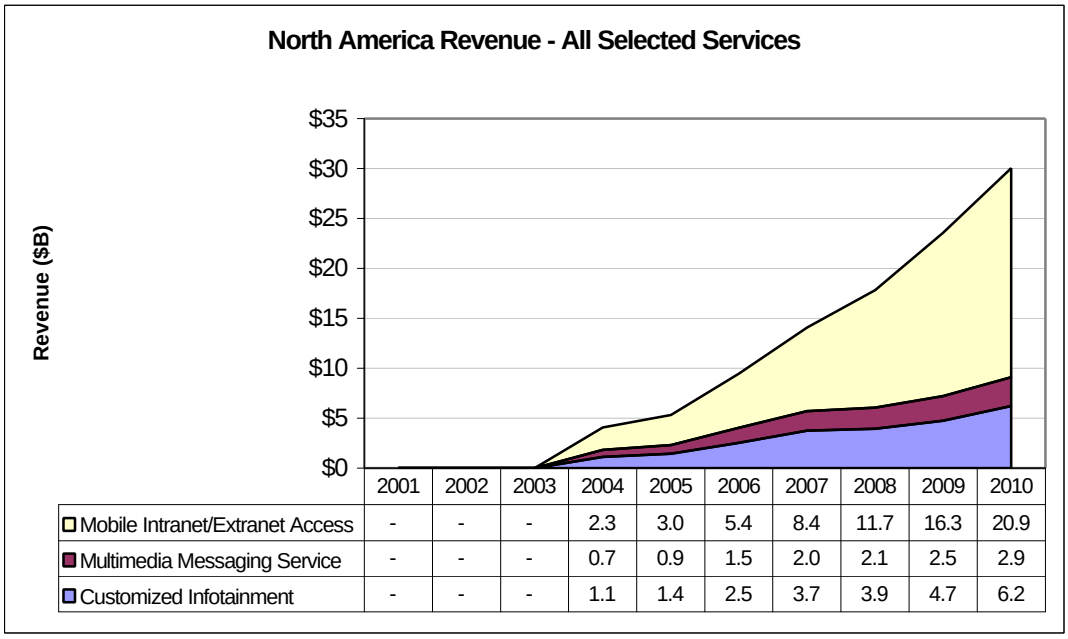
Figure 42. North American demand for 3G services by subscriptions 2001-2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Customized Infotainment	-	-	-	4.0	5.0	8.7	13.0	13.9	16.9	22.6
Multimedia Messaging Service	-	-	-	3.3	4.6	9.0	13.3	14.3	17.2	20.7
Mobile Intranet/Extranet Access	-	-	-	5.4	9.2	20.7	32.7	47.1	67.6	89.1

Source: Telecompetition Inc., July 2000.

Figure 43. North American demand for 3G services by revenue 2001-2010.



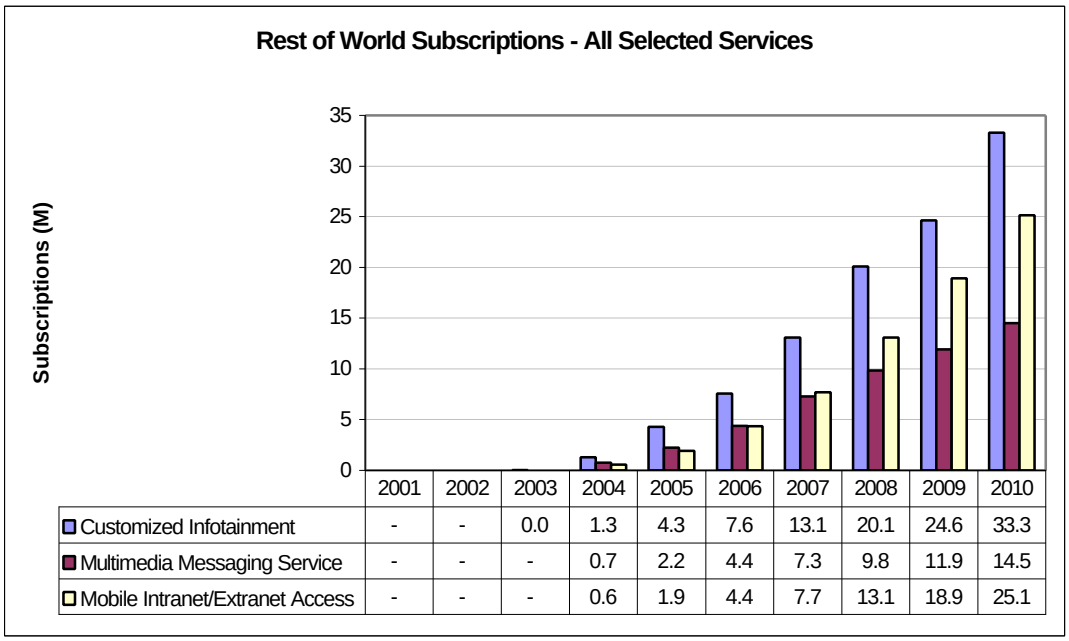
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mobile Intranet/Extranet Access	-	-	-	2.3	3.0	5.4	8.4	11.7	16.3	20.9
Multimedia Messaging Service	-	-	-	0.7	0.9	1.5	2.0	2.1	2.5	2.9
Customized Infotainment	-	-	-	1.1	1.4	2.5	3.7	3.9	4.7	6.2

Source: Telecompetition Inc., July 2000.

5.4.4 Rest of World Demand

Rest of World includes Latin America, Africa, and a number of other countries not included elsewhere. Latin American forecasts are included in Rest of World, but also shown separately. Latin America will be an important 3G market, especially given Brazil's recent lead in accepting the 1900 MHz spectrum for its 3G networks.

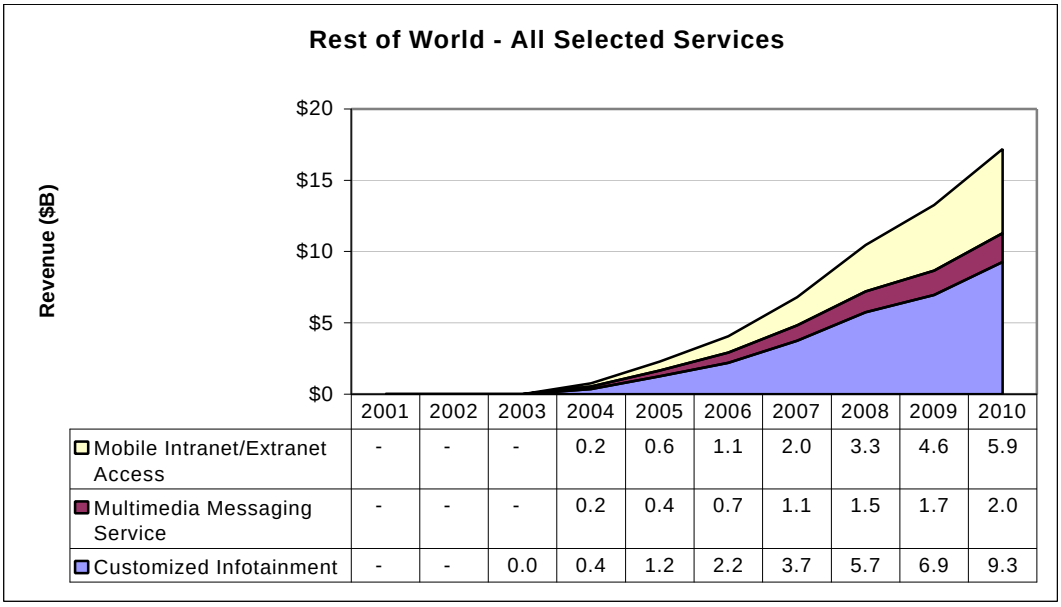
Figure 44. Rest of World demand for 3G services by subscriptions 2001-2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Customized Infotainment	-	-	0.0	1.3	4.3	7.6	13.1	20.1	24.6	33.3
Multimedia Messaging Service	-	-	-	0.7	2.2	4.4	7.3	9.8	11.9	14.5
Mobile Intranet/Extranet Access	-	-	-	0.6	1.9	4.4	7.7	13.1	18.9	25.1

Source: Telecompetition Inc., July 2000.

Figure 45. Rest of World demand for 3G services by revenue 2001-2010.



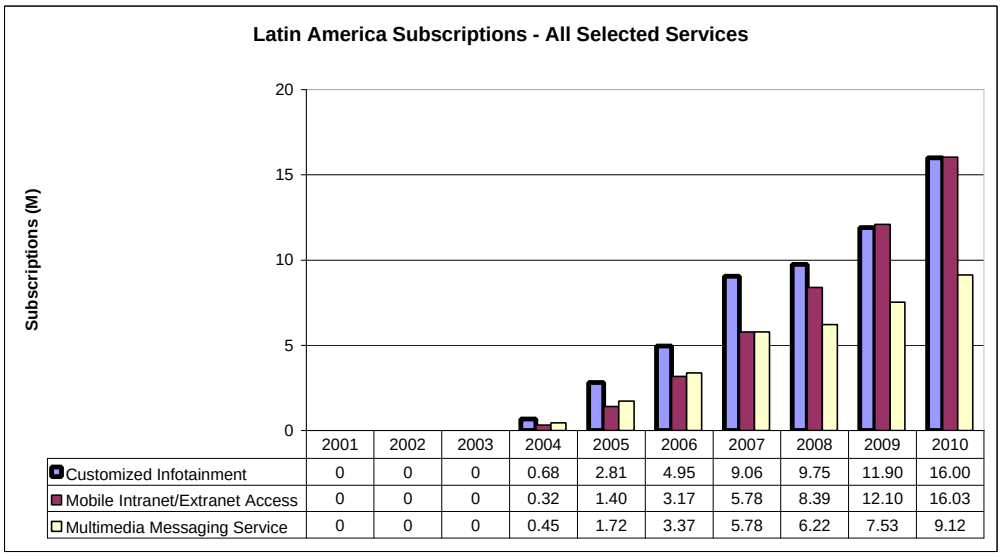
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mobile Intranet/Extranet Access	-	-	-	0.2	0.6	1.1	2.0	3.3	4.6	5.9
Multimedia Messaging Service	-	-	-	0.2	0.4	0.7	1.1	1.5	1.7	2.0
Customized Infotainment	-	-	0.0	0.4	1.2	2.2	3.7	5.7	6.9	9.3

Source: Telecompetition Inc., July 2000.

5.4.5 Rest of World Demand – Latin America

Latin America includes Mexico, Central America, South America and the Caribbean. Demand for just Latin America as shown in Figures 45-46 is also included in the previously shown rest of the world forecast.

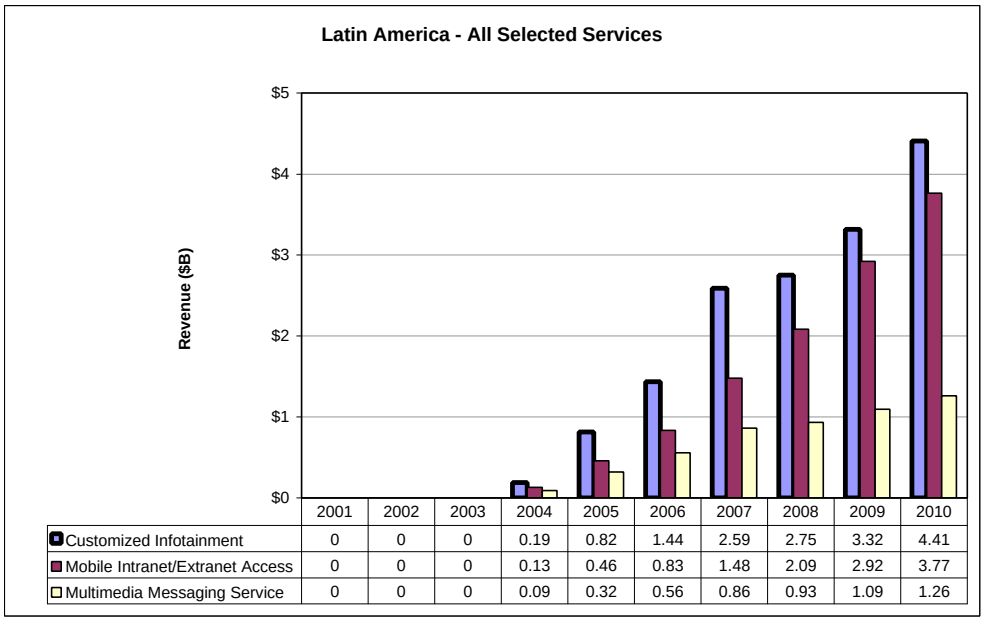
Figure 46. Latin American demand for 3G services by subscriptions 2001-2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Customized Infotainment	0	0	0	0.68	2.81	4.95	9.06	9.75	11.90	16.00
Mobile Intranet/Extranet Access	0	0	0	0.32	1.40	3.17	5.78	8.39	12.10	16.03
Multimedia Messaging Service	0	0	0	0.45	1.72	3.37	5.78	6.22	7.53	9.12

Source: Telecompetition Inc., July 2000.

Figure 47. Latin American demand for 3G services by revenue 2001-2010.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Customized Infotainment	0	0	0	0.19	0.82	1.44	2.59	2.75	3.32	4.41
Mobile Intranet/Extranet Access	0	0	0	0.13	0.46	0.83	1.48	2.09	2.92	3.77
Multimedia Messaging Service	0	0	0	0.09	0.32	0.56	0.86	0.93	1.09	1.26

Source: Telecompetition Inc., July 2000.

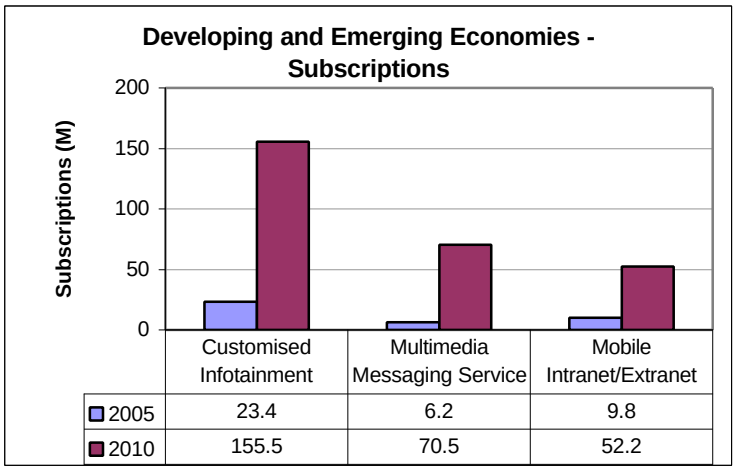
5.4.6 Developing World and Emerging Economies

Another way to look at worldwide forecasts is to look at the impact of the developing world. This has been done by using the same country-level data, but grouping countries by economic development instead of geographic region. The following forecasts are based on subtracting those countries and administrative regions considered part of the developed world by the ITU[52] (Western Europe, Greece, North America, Japan, Singapore, Taiwan, South

[52] ITU, World Telecommunication Development Report 1999 – Mobile Cellular.

Korea, Hong Kong, New Zealand and Australia) from the worldwide totals. These data are presented in Figure 48. Next those countries identified by the ITU as high or middle income were separated. We have termed these countries "Emerging Economies". Examples of these countries are Brazil, Czech Republic, Hungary, Israel and South Africa. Emerging Economies account for approximately 25% of these totals. Figure 48 shows the summary results.

Figure 48. Developing and emerging economies demand for 3G services by subscriptions 2001-2010.



	Customised Infotainment	Multimedia Messaging Service	Mobile Intranet/Extranet
2005	23.4	6.2	9.8
2010	155.5	70.5	52.2

Source: Telecompetition Inc., July 2000.

5.5 Implications

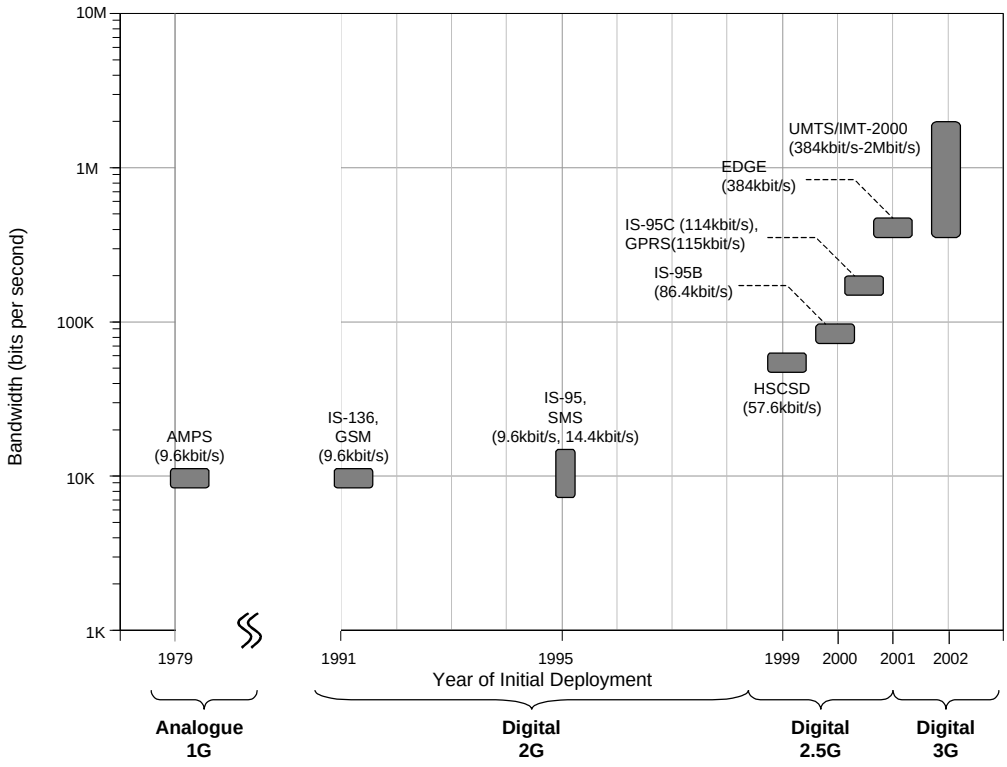
- **Customised Infotainment is forecasted to produce the highest revenues during 2000-2010 primarily due to its low cost and mass market appeal**
- **Asia Pacific and Europe will dominate other geographic regions during 2000-2010**
- **The US will continue to lag in the 3G market due to its lack of 3G spectrum and fragmented approach to the market—Mobile Intranet/Extranet Access revenues will however exceed other areas due to the current high penetration of the Internet**
- **3G represents a significant revenue opportunity for services providers, infrastructure and device manufacturers, applications developers, content providers, etc**

6. Technology Issues and Trends Impacting 3G Adoption

Nowhere is the destabilising and revolutionary power of technology change more evident than in the mobile arena. Global service providers in the past decade have invested hundreds of millions of dollars to select, acquire, build and operate the highly complex mobile infrastructure for their analogue and digital cellular systems. They have lived and survived through the analogue/digital wars, the TDMA/CDMA[53] wars and the GSM/PCS wars. 3G systems, enabled by the ever more complex Internet, multimedia and new mobile have made themselves felt.

Figure 49 shows this history.

Figure 49. Cellular telephone technologies chronology.



Source: PricewaterhouseCoopers, 2000

Telecommunication operators have seen the share of mobile voice and data increase as compared to falling revenues in wireline voice. They anticipate the rapid growth that data-centric Internet offers. A natural consequence of this growing market interest would be mobile data as a future source of revenue. Indeed, the 3G services market forecasts in this report support this

[53] CDMA = Code Division Multiple Access.

anticipation.

What are the technology issues that might impact fulfilment of the demand for 3G services? How can the services providers successfully navigate these waters that lead to the future wealth of subscribers and revenue? The following three technology areas have been selected based on their potential impact upon demand, and because they have not been addressed comprehensively in other secondary research. The areas are:

- Intelligence moving away from the core network
- Addressing moving to IP addresses
- Service demands driving capacity consumption

6.1 Intelligence Moves Away from the Core

The importance of the Internet on mobile is not the issue. The focus should be on the impact of mobile on the Internet with the industry creating faster access for mobile devices, user friendly schemes that consumers will better accept, and new service ideas linking the Internet to people anywhere, anytime, (i.e., m-commerce). On the other hand, wired applications aren't necessarily key to mobile Internet success. New product paradigms, customised packages, and IP-based networks will lead the way. True IP-based mobile data is a fundamental shift for services providers, similar to the one that faced fixed operators as the Internet became commercialised.

Unlike current mobile telephony networks in carrier environments where the intelligence and control is found in the core of the network, IP networks have the intelligence at the boundaries of the network— found in the access networks and end users' devices. Mobile end users will want great control over how they personally interact with these IP networks.

"The more powerful concept inherent in next generation IP wireless is letting the user decide, on a personal level, what integrated voice and data means to him."

Stu Jeffery, VP IP Networks, Synacom

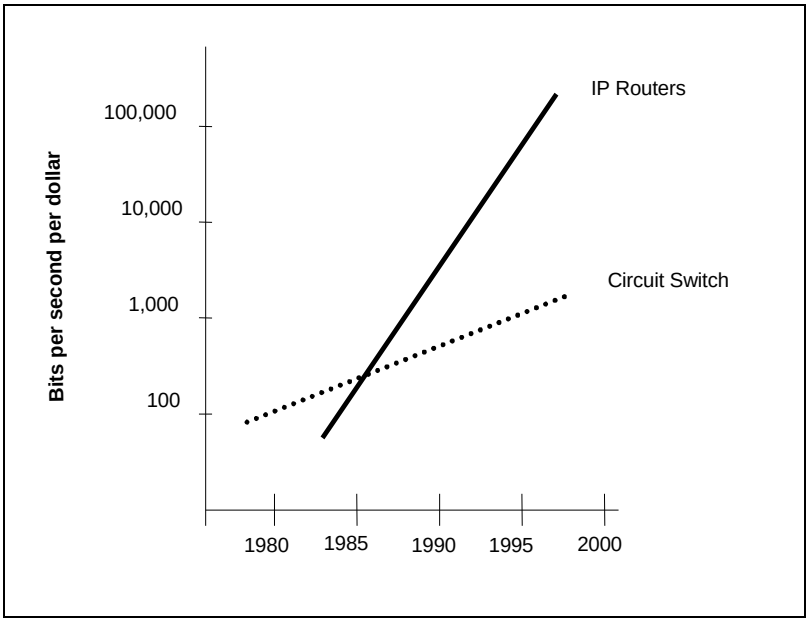
IP vendors will drive network platforms much like central office vendors did in the past with the exception that IP networks will be mere transport mechanisms–and much cheaper. Clearly, in order to achieve the vision of 3G services as described, 3G networks must be IP-based and packet-capable. In an IP network, the routers are the switches. Services and features are not created in these switches. The routers have a relatively simple switching function. The routers connect computers (terminals), where the intelligence lies. In mobile telephony, telephone numbers are used to complete connections.

In mobile telephony today, there is only one dominant application—voice. Everything is optimised for this single application with unique requirements starting with an analogue input and ending with a real-time transmission

requirement. In the data world, new distributed switching architectures that enable integration of voice and data, segregation of service creation, translation between IP addresses and telephone numbers, and SS7 signal processing are used. These new switches are called softswitches. While there is little effort today in adding mobility functions to softswitch requirements, this effort will begin in the near future.

Some network manufacturers are building 3G networks for increased capacity, not necessarily just for high data rates. However, almost all of the major mobile network suppliers are acquiring innovative technology start-ups or forming alliances with key Internet vendors to assure IP architectures are being built into 3G networks. Besides the need for interworking with Internet Protocols, 3G network suppliers are highly aware of the better economics inherent in IP networks. A simple comparison of IP router to circuit switches is shown in Figure 50. While IP networks are becoming more complex as they add both voice and quality of service functionality, this basic economic relationship will still hold, albeit not as dramatic.

Figure 50. Performance economics of IP vs. circuit-switched networks



Source: GTE IP Telecom Products and Services, 1999.

6.2 Numbering Moves to IP Addresses

In the data world, IP addresses are linked to names that send packets on their way to their destination. This eliminates dial up connections and enables the always-on capability, so important to the service demands forecasted in this report.

This report forecasts nearly three-quarters of a billion 3G subscribers by 2010, yet, the supply of IP addresses under the current IPv4 is expected to exhaust itself before then. The mobile community needs to support IPv6 implementation now to ensure address availability in the future. The sooner networks are IPv6-compatible, the easier the transition to this new standard.

6.3 Service demands drive up capacity consumption

The presence of an air interface together with the limited availability of spectrum creates inherent bandwidth/capacity constraints in current mobile cellular systems. Speed limitations in mobile cellular will continue to limit parity with fixed access speeds.

This study acknowledges all these issues and has still forecasted impressive growth in revenues and subscribers for 3G networks. The challenge now lies with the services provider to deliver services in this new IP-based world. Table 16 summarises the analysis of some of the technical characteristics of the services studied.

Table 16. Some distinguishing technical characteristics by services.

Service / Characteristic	Mobile Internet Access	Mobile Intranet/ Extranet Access	Customised Infotainment	Multimedia Messaging Service	Location-based Services	Rich Voice
Connection type	1:1 1:many (e-mail)	1:1 1:many (e-mail)	Primarily 1:1 Broadcast can be 1:many	1:1 1:many	1:1	1:1 1:many
Portable vs. Mobile	Portable	Portable	Mobile	Mobile	Mobile	Mobile
Latency[54]	Latency insensitive	Latency insensitive	Primarily latency insensitive	Latency insensitive	Latency insensitive	Real time
Person to Person				YES		YES
Person to Machine	YES	YES	YES		YES	Limited
Machine to Machine					YES	
Addressing and Call Control	IP and domain names	IP and domain names	IP and domain names	IP and domain names SIP[55]	IP and domain names	E.164 telephone numbers SIP/H.323
Access	Always-on	Always-on	Always-on	Always-on	Always-on	By invitation
Speed requirements	Medium to high	Medium to high	Low to medium	Low to medium	Low	Low
Service symmetry	Asymmetric	Asymmetric	Asymmetric	Asymmetric	Asymmetric	Symmetric

Source: Telecompetition Inc., Inc. September 2000.

This table shows how different Rich Voice is from the other services—service symmetry and latency being the key distinctions. Both these characteristics lead to the circuit-switched, permanent connections with call set-up that are the hallmark of telephony networks.

The other services, both those that are Internet-centric and those that take advantage of the always-on characteristic of IP are much more similar.

6.4 3G Platform Technology Alternatives

There will be substitutes for 3G that have an impact on the overall mobile data market. This section highlights key substitutes.

[54] Voice is the only true real-time application; everything else is latency insensitive.

[55] SIP = Session Initiation Protocol.

6.4.1 3G Development

While 3G continues its path toward first deployments in 2001, there are some technologies that will emerge sooner to fill a growing need for higher-bandwidth and more-efficient networks. The most compelling of these for operators with TDMA-based 2G networks is GPRS which promises data rates of 115 kbit/s and has the support of major vendors and operators to deploy. The most significant effect GPRS will have is providing WAP phones with more available bandwidth and always-on capability, but at the price of infrastructure upgrades. EDGE (Enhanced Data rates for GSM Evolution), another evolutionary technology that will come after GPRS, is an agreed 3G access technology for IMT-2000 and promises even higher data rates at 384 kbit/s.

6.4.2 Other Mobile Data Service Alternatives

Other technologies that could be regarded as alternatives to 3G are being deployed over the next few years. They are primarily dedicated mobile data networks offering portability at data rates as high as 128 kbit/s today. Their operators believe that business people want what they get in the office to be available remotely and portability of corporate applications is more important to business people than mobility!

Dedicated mobile data networks in the past have not been an unqualified success. They have suffered from a lack of easy-to-use services and roaming capability. Trunked mobile radio systems (Private Mobile Radio (PMR) and Public Access Mobile Radio (PAMR) in Europe, Specialised Mobile Radio (SMR) in the US) have established a healthy presence in certain domestic markets (such as transportation and public security). The current deployment of digital trunked mobile radio technologies such as TETRA (TErrestrial Trunked RAdio) that offer both voice and data capabilities represent an alternative to 3G technologies for many specific market segments. TETRA and 3G are more complementary than competitive; their combination could be a powerful one for many market sectors. TETRA is unlikely to be a strong direct competitor to 3G simply because of economies of scale.

High-bandwidth alternative services such as Local Multipoint Distribution System (LMDS) at data rates up to 2 Mbit/s are restricted to stationary environments. They effectively deliver portability rather than mobility. Alternative wireless access technologies will offer much higher data rates and will represent a strong challenge to 3G for the delivery of certain services inside buildings, where mobility or roaming capabilities are unimportant. For example, Table 16 shows both Mobile Internet Access and Mobile Intranet/Extranet Access 3G services are portable and latency insensitive. Wireless LAN technologies such as High Performance Local Area Network (HIPERLAN/2) and BRAN (Broadband Radio Access Network) are both part of the UMTS portfolio. Other broadband wireless access technologies such as LMDS, Digital Video Broadcasting (DVB) and future developments of Bluetooth could offer alternatives to 3G for the provision of Internet access services requiring high bandwidth.

Services providers deploying technologies such as GPRS and EDGE who do not obtain a 3G licence will be able to offer almost all 3G services, with the exception of those requiring the highest data rates. The major disadvantage for these services providers will be the lack of additional spectrum that comes with a 3G licence. They will also lose out on the economies of scale that will benefit 3G devices and infrastructure and will have limited influence on the supply of suitable multi-mode terminal devices to enable roaming. Their ability to compete in the world of mobile data services will be severely impaired.

6.5 3G Device Technology Evolution

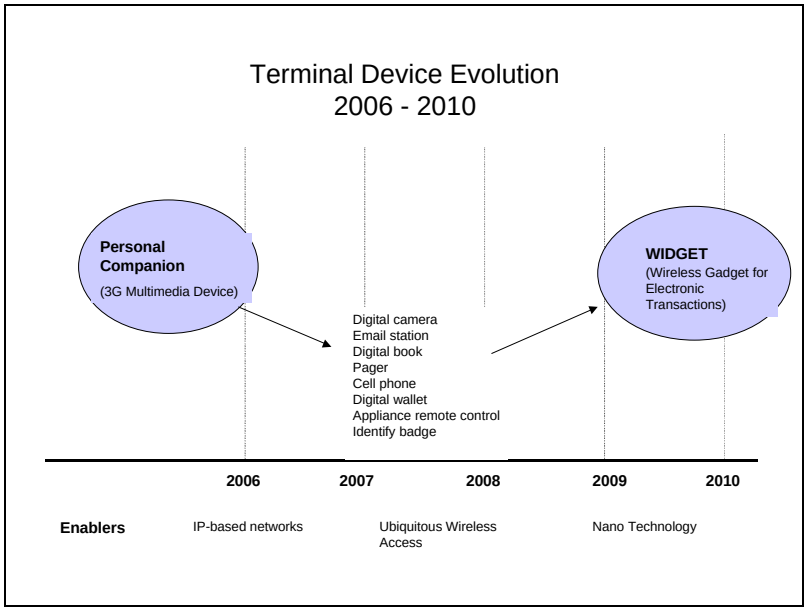
Device manufacturers want narrow product lines to maintain cost levels as they are squeezed by suppliers and customers. 3G services providers want special consideration from device makers with demands for customised or subsidised devices in order to differentiate from competitors.

The meeting point will probably be in the choices of keypads, screens, video cameras, colour, and device accessories individual 3G services providers will offer. The driver will be the enormous market potential for 3G devices. For example, forecasts of over 111 million subscriptions by 2005 for the three forecasted 3G services and 698 million subscriptions for the same set of services by 2010. With the sales of new 3G devices, replacements and upgrades over the forecast period, it is likely that over one billion device units will be sold–just for the three 3G services forecasted.

Once a personal companion is developed in the 2005 timeframe, users will have a rugged, feature-full, multimedia device for all 3G services. Further device development, post-2005, will be focused on improving quality and ease-of-use for electronic transactions, banking and video-on-demand. The personal companion will take on new features such as what Vinton Cerf of MCI WorldCom calls a “Widget or Wireless Internet Digital Gadget for Electronic Transactions.” These features will be called digital wallet for electronic transfers, or digital book; or perhaps, mobile Identification (ID) badge, or long range appliance remote control device, so you can telematically turn on your air conditioning from the car on the way home.

One compelling technology that will help bring these extraordinary features to 3G-device development is nanotechnology—the term given to the design and fabrication of molecular-sized devices and machines. Nanofabrication reduces the scale and costs of manufactured devices. This technology will enable a small personal companion with the power of a laptop and a very long battery life. It should also reduce the cost barriers for multi-mode, multi-band devices. Stan Williams, Vice President of Hewlett-Packard, recently predicted that this technology would be commercially available within five years. Figure 51 shows terminal device evolution including device functionality and technology enablers.

Figure 51. 3G device evolution 2006-2010.



Sources: Telecompetition Inc., MCI WorldCom, September 2000.

The term WIDGET shown in this figure was coined by Vinton Cerf to describe the ultimate, multi-purpose terminal device—WIDGET.

Development of multi-purpose devices will not preclude the parallel development of specific terminals tailored to specific services. There will always be a rich variety of terminal devices on offer.

6.6 Enabling and Inhibiting Factors of 3G Technology

Technology enablers for 3G fall into many areas.

- Key, of course, will be semiconductor evolution where system-on-a-chip (SOC) will allow increased computing power and miniaturisation of devices. Another semiconductor advancement is the low-power improvements from silicon-on-insulator (SOI).
- An alternative solution to the provision of multi-mode and multi-band terminals in the long term may be software-defined radio.
- 3G transport will bridge Intelligent Networks and IP mobile networks to create fast access to intelligent 3G devices in more economical ways.
- Advances in nanotechnology will diminish multi-mode device barriers by 2010.

Technology inhibitors for 3G are:

- For devices, multiple choices for browsers (e.g., WAP), operating systems (e.g., Pocket PC, Palm OS, EPOC), speech recognition, and built-in synchronisation (e.g., Bluetooth, Home RF) will delay the deployment of 3G services.
- 3G devices will need tremendously more power than today's PDAs, Smartphones and Web Tablets.

Matching the volume availability of suitable 3G devices to the requirements of 3G services providers will remain a significant issue.

- For those 3G services providers without the ability to quickly create new 3G billing systems based on multiple-tier pricing plans, there will be a slow movement toward 3G subscribership.
- Lack of support for IPv6 could delay new services.
- Lack of datacom experience within 3G services provider businesses will delay implementation of data-intensive services.

6.7 Implications

As discussed, 3G technological innovation over the next ten years is based in three areas—the movement toward IP networks where cost and transmission efficiencies will be gained as intelligence moves to the network edge; addressing moving to IP addresses; and service demands driving capacity consumption.

Some overarching technological implications to consider are:

- Standardisation delays between alternative browser and operating system solutions could delay the volume introduction of 3G terminal devices.
- Standardisation delays in 3GPP will result in proprietary network solutions and later compatibility issues.
- Enabling service portability when roaming is a priority.
- The lack of robust and feature-rich billing systems for 3G services could inhibit service deployment.
- Data communication expertise will be as valued as Radio Frequency (RF) expertise in a 3G environment.

7. Business Implications

This section discusses some business issues that might impact the 3G service forecasts.

7.1 Pricing Structures

A fundamental assumption underlying this study is that 3G will essentially free mobile networks from capacity constraints. The main factor behind this assumption is the inherent efficiency of all-IP packet-based networks. The identification of additional spectrum at WRC-2000 supports this assumption. However, significant amounts of additional spectrum may not become available in some regions until mobile services providers can demonstrate the need for it to be released for 3G. And in the US, services providers will have access to very little additional spectrum compared with other regions.

Capacity is not currently a significant issue in the US. In such circumstances the competitive nature of the mobile environment creates downward pressure on pricing and a decline in ARPU. Almost all 3G services providers will launch service in an ultra-competitive environment that will be focused more on data than on voice services. Mobile data is universally regarded as the mechanism for reversing the downward trend in ARPU.

Many 3G services providers will also be burdened with up-front investments in licence fees much higher than anticipated in their original business plans. The need to recover this investment as swiftly as possible has shifted the emphasis of many services providers from the business market to the consumer mass market for early 3G services. The competitiveness of the environment increases substantially with such a shift.

First mover advantage will be a paramount consideration. This is not a mere reflection of the Internet “land-grabbing” approach that sees the acquisition of market share at any cost as the means to build long-term advantage and (ultimately) revenues. First mover advantage will be important in the 3G mobile data environment because of the personalised nature of the key 3G services, which are designed to generate stickiness and minimise churn. That will increase the competitive nature of the environment even further.

This forecast shows significant revenue potential even though it assumes average mass-market pricing. Over the next five years, an element of mass-market pricing could be introduced to replace premium pricing in some regions. The average prices assumed in this study are compatible with a range of services provider pricing strategies.

7.2 Non-voice Services

Data services for the mass market are virgin territory for the mobile industry. The industry has failed to make a success of mobile data services targeted at the business community. But the industry has been pleasantly surprised by the unanticipated success of consumer mobile data services such as SMS and i-mode. Building on these successes will be the key to 3G.

One problem affecting the construction of successful mobile data services is user expectations. User expectations are still being set by the fixed-Internet experience in those countries with high Internet penetration—and that is a rapidly moving target. Another problem is that the addition of mobility to the fixed Internet experience has become part of user expectations for 3G. But paying a higher premium for this addition of mobility does not figure prominently amongst user expectations. Compromising on functionality in the mobile environment is not a market expectation. Mobile services providers will be expected to offer mobile ISP-type services, but it is hard to envisage profitable revenue being generated through this route.

Profitable revenue should, however, come from services that really take advantage of the unique characteristics of mobile and that have no immediate counterpart in the fixed environment. Customised Infotainment services through mobile portals, Multimedia Messaging Services and Location-based Services are the key weapons in the mobile services provider's armoury.

Relationships with partners will be key to success, particularly in the all-important mobile portal arena. Earlier predictions that content and media owners would grab and dominate this space are not coming true. This should not come as a surprise. Mobile is only one channel to market for content and media owners and is therefore not a channel to be acquired "at any price."

Partnerships between content/media owners and mobile services providers that capitalise on each party's strengths are the key to success, whether such partnerships are organised through joint ownership ventures or through mechanisms such as mobile virtual network services providers.

7.3 Roaming

Another dimension vital for success is the ability to roam with full data service capability in an international or inter-regional environment. Without such a capability mobile data will be constricted to a cordless or wireless access service. The need for roaming in the data environment places great demands on service portability and raises as yet unresolved issues concerning billing and tariffing across services providers.

It is clear that very significant advantages can be gained by those services providers who can construct a pan-regional presence (either through ownership or partnerships) and can integrate business procedures and commercial offerings to deliver seamless service to subscribers across national or regional boundaries.

The lack of a single global standard for 3G will complicate the situation for manufacturers and users. Paradoxically however, it could benefit UMTS. Of the multiplicity of multi-mode and multi-band terminal combinations that result from the family of systems solution in IMT-2000 and the spectrum bands identified at WRC-2000, only a limited number will find their way to market with sufficient economies of scale to permit acceptable pricing.

This will automatically support the already dominant players—the strong will

get stronger and the weak will get weaker.

Service portability is of course also a factor in roaming between 2Gand 3G networks. The regulatory intent to support new entrants in the early stages of network rollout is already evidenced by the requirements for national roaming imposed in certain countries. **Wide coverage for data services is a particularly important requirement in the marketplace that will be intolerant of any significant service degradation suffered when moving out of 3G coverage.** The consumer market is notoriously unforgiving and has a track record of condemning services whose availability is limited at launch. It is hard to recover from negative perceptions.

8. Conclusions

This study has approached potential 3G services from a user and market demand perspective, taking account of the unique characteristics of mobile multimedia. A new framework to study, plan and predict 3G-service development has been introduced. This framework consists of a comprehensive group of six 3G-service categories, associated business models and service diagrams that illustrate the major business relationships for the 3G service categories.

Using this framework, subscription and revenue forecasts for three of the service categories have been developed at a regional and country level. Input to the forecasts includes updated projections of worldwide mobile and 3G subscriber totals consistent with the earlier work of the UMTS Forum. A conservative approach to the forecasts has been adopted, assuming that users will no longer accept a substantial premium for mobility and that service pricing will decline inexorably over the next decade.

Despite this conservative approach, very significant revenue potential has been identified for the three services forecast.

These forecasts should be interpreted as one set of a number of different views that might be taken of 3G markets. The forecasts are based on a mass-market approach and average mass-market pricing. This gives the perspective from a business strategy of rapid market penetration to achieve advantage in a highly competitive environment.

The new framework could be used by the UMTS Forum to expand and update forecasts as well as to study alternative approaches to market entry such as premium pricing. Others are welcome to adopt the framework so that a meaningful global discussion on the market aspects of 3G can ensue.

9. List of Acronyms

2G – Second Generation Mobile Network
3G – Third Generation Mobile Network

AOL – America Online (company)
ARPU – Average Revenue per User
ATM – Asynchronous Transfer Mode

B2B – Business-to-Business
B2C – Business-to-Commerce
BRAN – Broadband Radio Access Network

CAGR – Compound Annual Growth Rate
CATV – Cable Television
CDMA – Code Division Multiple Access
CPP – Calling Party Pays
CTIA – Cellular Telecommunications Industry Association

DECT – Digital Enhanced Cordless Telecommunications
DSL – Digital Subscriber Line
DVB – Digital Video Broadcasting

EDGE – Enhanced Data rates for Global Evolution
EOY – End of Year
e-mail – Electronic Mail

FDD – Frequency Division Duplex

GDP – Gross Domestic Product
GPRS – General Packet Radio Service
GSM – Global System for Mobile communications

FPLMTS – Future Public Land Mobile Telecommunications System

HIPERLAN – High Performance Local Area Network
HSCSD – High Speed Circuit Switched Data
HTML – Hypertext Markup Language

ID – Identification
ILO – International Labour Organisation
IMT – International Mobile Telecommunications
IMT-DS – Direct Sequence radio interface for IMT-2000
IMT-FT – Frequency Time radio interface for IMT-2000
IMT-MC – Multi-Carrier radio interface for IMT-2000
IMT-SC – Single Carrier radio interface for IMT-2000
IMT-TC – Time Code radio interface for IMT-2000
IP – Internet Protocol
ISP – Internet Service Provider
IT – Information Technology

ITU – International Telecommunication Union

LAN – Local Area Network
LMDS - Local Multipoint Distribution System

MAG – Market Aspects Group
MMS – Multimedia Messaging Service

NTT – Nippon Telephone & Telegraph (company)

OS – Operating System
OSP – Online Service Provider

PAMR – Public Access Mobile Radio
PC – Personal Computer
PCIA – Personal Communications Industry Association
PCMCIA – Personal Computer Memory Card International Association
PDA – Personal Digital Assistant
PDC – Personal Digital Cellular
PMR – Private Mobile Radio

QoS – Quality of Service

RF – Radio Frequency

SIM – Subscriber Identity Module
SIP – Session Initiation Protocol
SMS – Short Message Service
SMR – Specialized Mobile Radio
SOC – Silicon-on-a-Chip
SOI – Silicon-on-Insulator

TDD – Time Division Duplex
TDMA – Time Division Multiple Access
TD-SCDMA – An IMT Time Code; Chinese proposal for the TDD mode
TETRA – TErrestrial Trunked RAdio

UMTS – Universal Mobile Telecommunications System
UTRA – Universal Terrestrial Radio Access

VoIP – Voice over IP
VPN – Virtual Private Network

WAP – Wireless Application Protocol
W-CDMA – Wideband CDMA
WIDGET – Wireless Internet Digital Gadget for Electronic Transactions
WRC – World Radiocommunication Conference

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11. Index

V

W

12. Appendix A – Telecompetition Inc. and ATIVA Research Tools®

Founded in 1996, Telecompetition, Inc. is committed to software and process development to produce reliable, refinable industry market data across a wide range of products. We provide consistency in global, national and local forecasts developed by Telecompetition as well as other well-respected industry analysts.

This is achieved with a proprietary, adaptive forecasting technology called ATIVA Research Tools©. This technology performs sophisticated computations on both demand and supply side industry data to produce historic and forecasted revenues and other market size information at the regional, national and sub-national levels.

ATIVA Research Tools® uses sophisticated algorithms to calculate product revenues to smaller geographic areas. Factors considered in the calculations include demographics, relative use by household income, age, industry characteristics, workforce population, propensity-to-buy profiles, deployment / service availability and other current market and technology drivers.

Telecompetition® products include a number of geographic forecasts on data files for other wireless and wireline telecommunications services such as 3G mobile, PCS, Cellular, Paging, SMR/ESMR, long distance and local access. Custom data queries, consulting and market research are also available.

The Telecompetition® TRAFFICast service provides standard and customised route-level forecasts for traffic sensitive services.

Figures 52 and 53 depict the ATIVA Research Tools®, system design and calculation process.

Figure 52. ATIVA Research ToolsÒ system design.

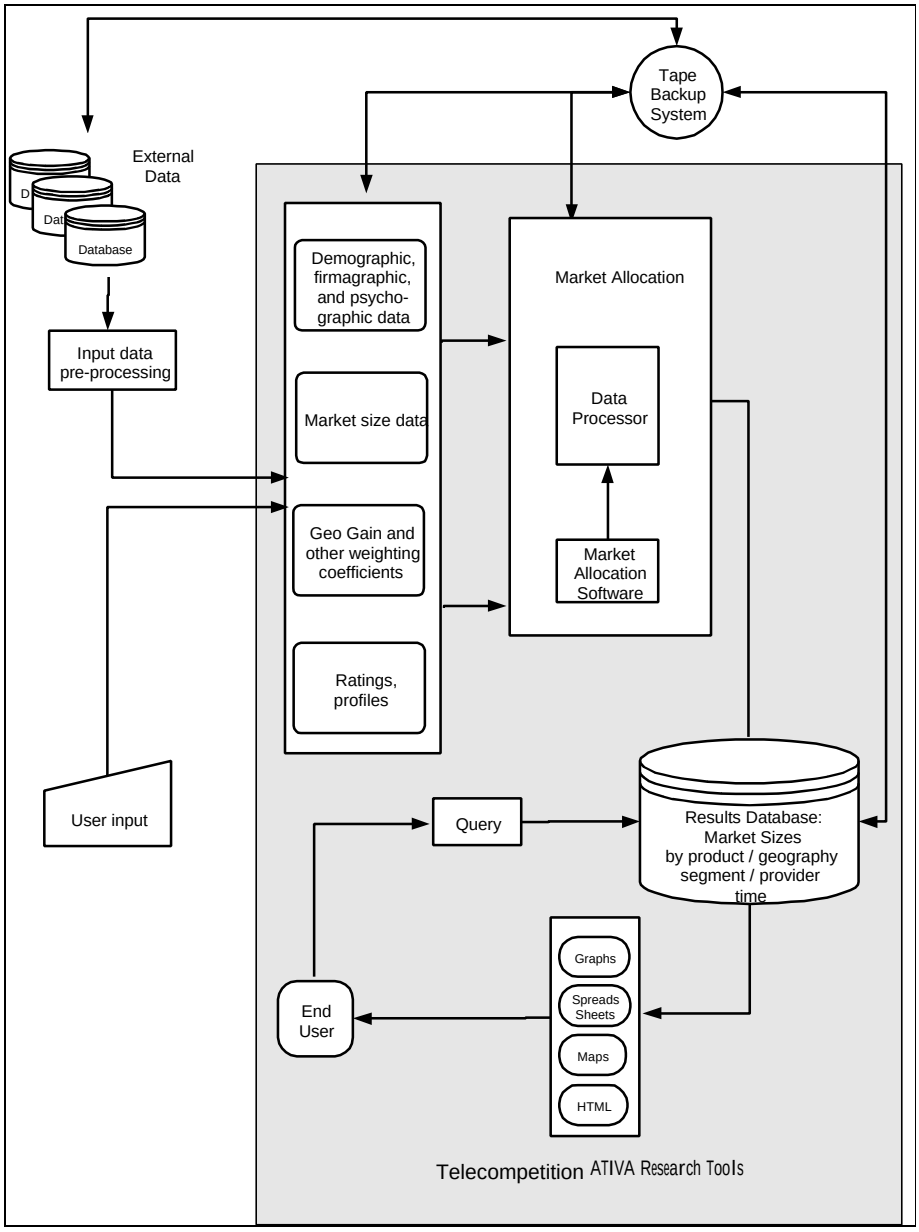
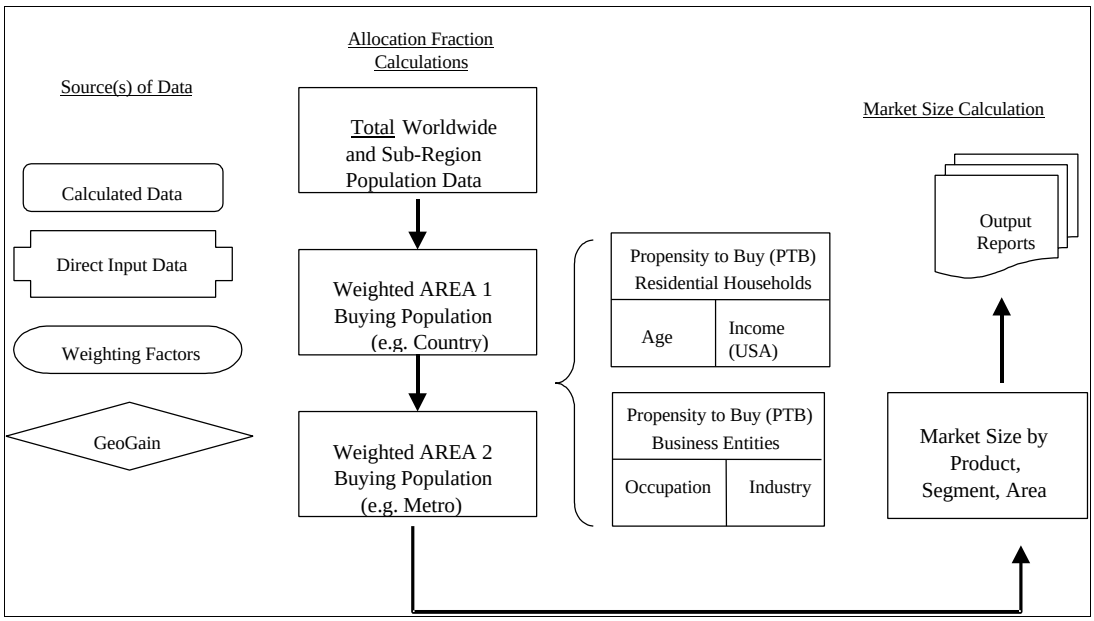


Figure 53. ATIVA Research TooIs® calculation process flow.



The ATIVA Research TooIs® Challenge

Data provided by Telecompetition ATIVA Research TooIs® is based on actual and forecasted values and other inputs consistent with accepted worldwide forecasts. Every effort was made to be as accurate as possible based on currently available information by country. These inputs can change rapidly. If you can provide documented data that improves or refutes Telecompetition calculated data, we will be happy to incorporate it into our next report. Please e-mail us at the address below.

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13. Appendix B – Interviews

Interviews were conducted with a small group of global industry leaders representing different industry perspectives.

David R. Ditzel

Chief Executive Officer

J. Gerry Purdy, Ph.D.
Founder & CEO

Philip Laven

Technical Director

Asok Chatterjee

Chairman of Technical Sub-committee T1P1

Ericsson Radio Systems - Vice President - Industry Standards

Vice Chairman – 3GPP, Project Co-ordination Group

13.1 Guidelines and Structure

Interviewees were asked their opinions on the hypotheses listed throughout this report and as well as selected questions from the following list.

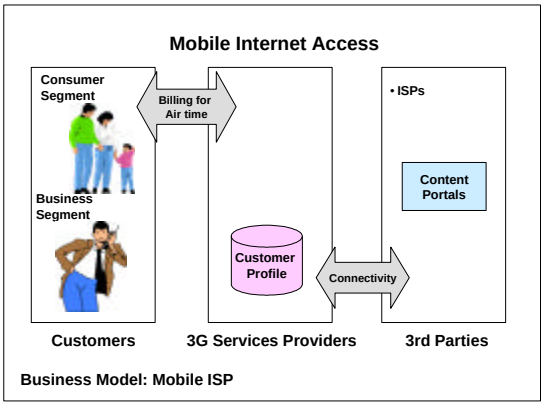
1. What is your view of how people in developed countries will change how they communicate for people to people, people to machine and machine to machine? In that timeframe, do you see these changes taking place?
2. What role will wireless service providers play in the Internet space? In other words, how will mobile Internet capabilities change the current business models for the Internet and wireless players?
3. Who will own the customer in the 3G environment by 2005? By 2010?
    - Content Providers
    - Content Aggregators/Portals
    - Service Providers
    - Network Operators
    - ISPs
4. Will wireless portals survive long term as separate entities?

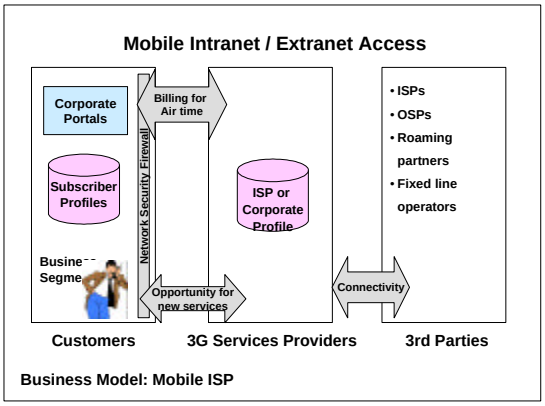
What 3G services, devices availability, devices capabilities, and/or applications do you see becoming commercially available (not just in trial) in:

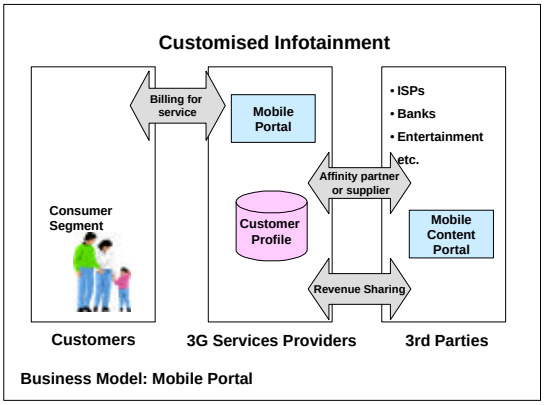
	Next 1-2 years	Next 5 years	Next 10 years	Devices Availability (H, M. L)	Device Capabilities With data rate
Data at 144 kbit/s					
Data at 384 kbit/s					
Data at 2 Mbit/s					
Two way Video					
Full Graphics					

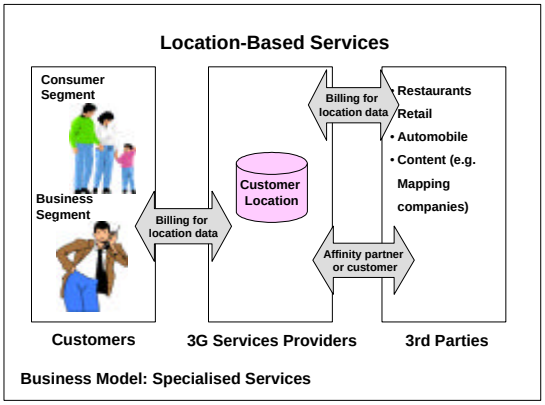
5. What non-technological forces will hinder the adoption of 3G (i.e., political, societal, etc.) and why?
6. What is the end-user value proposition for 3G?
7. What are the major demand drivers for 3G?
8. What economic incentives will exist for end-users to purchase 3G services by 2005 and by 2010 for business and residential users? Why or why not?
9. What type of consumer is most likely to buy 3G services?
10. What type of business user is most likely to buy 3G services?
11. What average price points must be achieved for 3G mass-market adoption in services at 144 kbit/s, 384 kbit/s, and 2 Mbit/s? And for handheld devices?
12. What technological and deployment barriers will remain to hinder mass-market adoption of 3G services by 2005? By 2010?

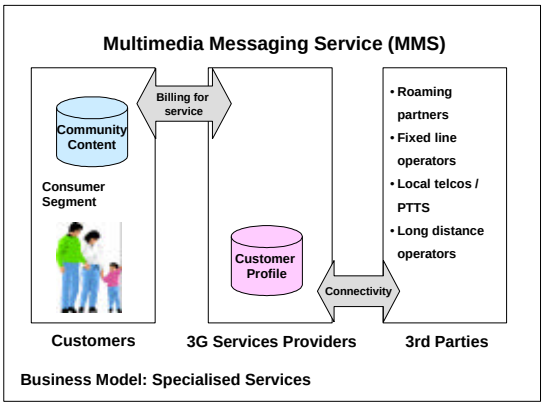
14. Appendix C – UMTS Forum Market Study: Service Diagrams

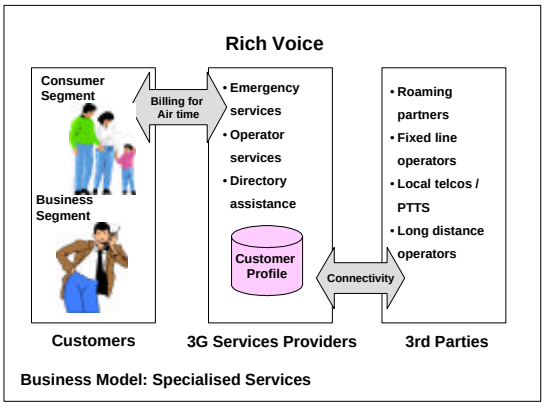












15. Appendix D – Selected Country-level Regional Revenue Contributions

The following pages contain country-level information by service for each country that contributed to forecasts in this report. The percentage of revenue by region that each country represents is shown.

The region used is printed at the bottom of each page and the regions are as follows:

- Europe
- North America
- Asia Pacific
- Rest of World

Every effort was made to be as accurate as possible based on currently available information by country. These data are regularly updated and new country information is always welcome. Please contact Telecompetition, Inc. by email at telecom@healy-co.com if you would like to comment on or provide updated information about your country.

Wireless: Customised Infotainment 2005

NATION INTL	Pct of Mkt Revenue
Armenia	0.0%
Australia	1.5%
Azerbaijan	0.0%
Bhutan	0.0%
Brunei	0.0%
China	43.1%
China (Taiwan)	3.1%
East Timor	0.0%
Fiji	0.0%
Georgia	0.0%
Hong Kong S.A.R.	0.8%
India	7.1%
Indonesia	3.0%
Japan	32.3%
Kazakhstan	0.0%
Kyrgyzstan	0.0%
Laos	0.0%
Macau	0.0%
Malaysia	0.0%
Maldives	0.0%
Mongolia	0.0%
New Zealand	0.3%
North Korea	0.0%
Pakistan	0.0%
Papua New Guinea	0.0%
Philippines	0.4%
Russia	0.0%
Singapore	0.4%
Solomon Islands	0.0%
South Korea	5.8%
Sri Lanka	0.0%
Thailand	0.4%
Turkey	1.7%
Turkmenistan	0.0%
Uzbekistan	0.0%

NATION INTL	Pct of Mkt Revenue
Armenia	0.0%
Australia	1.2%
Azerbaijan	0.1%
Bhutan	0.0%
Brunei	0.0%
China	44.5%
China (Taiwan)	2.5%
East Timor	0.0%
Fiji	0.0%
Georgia	0.0%
Hong Kong S.A.R.	0.6%
India	10.1%
Indonesia	2.4%
Japan	24.5%
Kazakhstan	0.3%
Kyrgyzstan	0.0%
Laos	0.0%
Macau	0.0%
Malaysia	0.4%
Maldives	0.0%
Mongolia	0.0%
New Zealand	0.3%
North Korea	0.1%
Pakistan	0.5%
Papua New Guinea	0.0%
Philippines	0.3%
Russia	4.4%
Singapore	0.3%
Solomon Islands	0.0%
South Korea	4.5%
Sri Lanka	0.3%
Thailand	0.3%
Turkey	1.4%
Turkmenistan	0.1%
Uzbekistan	0.7%

NATION INTL	Pct of Mkt Revenue
Armenia	0.0%
Australia	6.6%
Azerbaijan	0.0%
Bhutan	0.0%
Brunei	0.0%
China	23.8%
China (Taiwan)	4.9%
East Timor	0.0%
Fiji	0.0%
Georgia	0.0%
Hong Kong S.A.R.	2.3%
India	9.3%
Indonesia	1.0%
Japan	35.8%
Kazakhstan	0.0%
Kyrgyzstan	0.0%
Laos	0.0%
Macau	0.0%
Malaysia	0.0%
Maldives	0.0%
Mongolia	0.0%
New Zealand	0.8%
North Korea	0.0%
Pakistan	0.0%
Papua New Guinea	0.0%
Philippines	0.9%
Russia	0.0%
Singapore	1.6%
Solomon Islands	0.0%
South Korea	10.0%
Sri Lanka	0.0%
Thailand	0.5%
Turkey	2.3%
Turkmenistan	0.0%
Uzbekistan	0.0%

NATION INTL	Pct of Mkt Revenue
Armenia	0.0%
Australia	6.5%
Azerbaijan	0.1%
Bhutan	0.0%
Brunei	0.0%
China	22.9%
China (Taiwan)	4.7%
East Timor	0.0%
Fiji	0.0%
Georgia	0.0%
Hong Kong S.A.R.	2.2%
India	9.2%
Indonesia	1.0%
Japan	33.3%
Kazakhstan	0.0%
Kyrgyzstan	0.0%
Laos	0.0%
Macau	0.0%
Malaysia	1.3%
Maldives	0.0%
Mongolia	0.0%
New Zealand	0.8%
North Korea	0.0%
Pakistan	0.7%
Papua New Guinea	0.0%
Philippines	1.0%
Russia	1.5%
Singapore	1.6%
Solomon Islands	0.0%
South Korea	9.6%
Sri Lanka	0.3%
Thailand	0.5%
Turkey	2.3%
Turkmenistan	0.1%
Uzbekistan	0.2%

NATION INTL	Pct of Mkt Revenue
Armenia	0.0%
Australia	3.4%
Azerbaijan	0.0%
Bhutan	0.0%
Brunei	0.0%
China	35.4%
China (Taiwan)	2.6%
East Timor	0.0%
Fiji	0.0%
Georgia	0.0%
Hong Kong S.A.R.	1.0%
India	15.7%
Indonesia	1.1%
Japan	28.7%
Kazakhstan	0.0%
Kyrgyzstan	0.0%
Laos	0.0%
Macau	0.0%
Malaysia	0.0%
Maldives	0.0%
Mongolia	0.0%
New Zealand	0.4%
North Korea	0.0%
Pakistan	0.0%
Papua New Guinea	0.0%
Philippines	0.8%
Russia	0.0%
Singapore	0.7%
Solomon Islands	0.0%
South Korea	6.2%
Sri Lanka	0.0%
Thailand	0.8%
Turkey	3.1%
Turkmenistan	0.0%
Uzbekistan	0.0%

NATION INTL	Pct of Mkt Revenue
Armenia	0.0%
Australia	3.3%
Azerbaijan	0.2%
Bhutan	0.1%
Brunei	0.0%
China	33.2%
China (Taiwan)	2.5%
East Timor	0.0%
Fiji	0.0%
Georgia	0.0%
Hong Kong S.A.R.	1.0%
India	17.7%
Indonesia	1.0%
Japan	26.0%
Kazakhstan	0.0%
Kyrgyzstan	0.0%
Laos	0.1%
Macau	0.0%
Malaysia	1.0%
Maldives	0.0%
Mongolia	0.0%
New Zealand	0.4%
North Korea	0.0%
Pakistan	1.0%
Papua New Guinea	0.0%
Philippines	0.8%
Russia	1.1%
Singapore	0.7%
Solomon Islands	0.0%
South Korea	5.8%
Sri Lanka	0.3%
Thailand	0.7%
Turkey	3.0%
Turkmenistan	0.1%
Uzbekistan	0.2%

Wireless: Customised Infotainment 2005

NATION INTL	Pct of Mkt Revenue
Albania	0.1%
Austria	2.4%
Belarus	0.5%
Belgium	3.3%
Bosnia and Herzegovina	0.0%
Bulgaria	0.2%
Croatia	0.0%
Cyprus	0.0%
Czech Republic	0.6%
Denmark	0.9%
Estonia	0.1%
Finland	2.0%
France	11.7%
Germany	18.9%
Greece	0.8%
Hungary	0.7%
Iceland	0.0%
Ireland	0.9%
Italy	13.4%
Latvia	0.1%
Lithuania	0.2%
Luxembourg	0.2%
Macedonia, The Former Yugo. Rep. of	0.0%
Malta	0.0%
Moldova	0.0%
Netherlands	5.9%
Norway	0.8%
Poland	2.0%
Portugal	2.3%
Romania	0.9%
Slovakia	0.4%
Slovenia	0.0%
Spain	6.0%
Sweden	1.6%
Switzerland	2.6%
Turkey	2.0%

NATION INTL	Pct of Mkt Revenue
United Kingdom	18.6%

NATION INTL	Pct of Mkt Revenue
Albania	0.1%
Austria	2.4%
Belarus	0.5%
Belgium	3.3%
Bosnia and Herzegovina	0.3%
Bulgaria	0.2%
Croatia	0.0%
Cyprus	0.1%
Czech Republic	0.6%
Denmark	0.9%
Estonia	0.1%
Finland	2.0%
France	11.7%
Germany	18.7%
Greece	0.8%
Hungary	0.7%
Iceland	0.0%
Ireland	0.9%
Italy	13.1%
Latvia	0.1%
Lithuania	0.2%
Luxembourg	0.2%
Macedonia, The Former Yugo. Rep. of	0.1%
Malta	0.0%
Moldova	0.0%
Netherlands	5.9%
Norway	0.8%
Poland	2.0%
Portugal	2.3%
Romania	0.9%
Slovakia	0.4%
Slovenia	0.1%
Spain	5.9%
Sweden	1.6%
Switzerland	2.6%
Turkey	2.1%
United Kingdom	18.5%

Wireless: Intranet/Extranet Access 2005

NATION INTL	Pct of Mkt Revenue
Albania	0.0%
Austria	2.3%
Belarus	0.2%
Belgium	2.3%
Bosnia and Herzegovina	0.0%
Bulgaria	0.3%
Croatia	0.0%
Cyprus	0.1%
Czech Republic	0.8%
Denmark	1.8%
Estonia	0.2%
Finland	2.1%
France	13.1%
Germany	17.8%
Greece	1.2%
Hungary	0.7%
Iceland	0.1%
Ireland	1.0%
Italy	14.2%
Latvia	0.1%
Lithuania	0.2%
Luxembourg	0.1%
Macedonia, The Former Yugo. Rep. of	0.0%
Malta	0.0%
Moldova	0.0%
Netherlands	4.7%
Norway	1.8%
Poland	2.2%
Portugal	2.1%
Romania	0.4%
Slovakia	0.4%
Slovenia	0.0%
Spain	5.9%
Sweden	3.6%
Switzerland	1.8%
Turkey	2.3%
United Kingdom	16.2%

Wireless: Intranet/Extranet Access 2010

NATION INTL	Pct of Mkt Revenue
Albania	0.0%
Austria	2.4%
Belarus	0.2%
Belgium	2.3%
Bosnia and Herzegovina	0.2%
Bulgaria	0.3%
Croatia	0.0%
Cyprus	0.1%
Czech Republic	0.7%
Denmark	1.8%
Estonia	0.2%
Finland	2.1%
France	13.1%
Germany	17.7%
Greece	1.2%
Hungary	0.6%
Iceland	0.1%
Ireland	1.0%
Italy	13.9%
Latvia	0.1%
Lithuania	0.2%
Luxembourg	0.1%
Macedonia, The Former Yugo. Rep. of	0.0%
Malta	0.0%
Moldova	0.0%
Netherlands	4.7%
Norway	1.8%
Poland	2.3%
Portugal	2.1%
Romania	0.4%
Slovakia	0.4%
Slovenia	0.2%
Spain	5.9%
Sweden	3.7%
Switzerland	1.8%
Turkey	2.4%
United Kingdom	16.1%

Wireless: Multimedia Messaging Service 2005

NATION INTL	Pct of Mkt Revenue
Albania	0.1%
Austria	2.5%
Belarus	0.1%
Belgium	2.4%
Bosnia and Herzegovina	0.0%
Bulgaria	0.2%
Croatia	0.0%
Cyprus	0.0%
Czech Republic	0.5%
Denmark	1.8%
Estonia	0.1%
Finland	1.9%
France	12.0%
Germany	17.6%
Greece	0.8%
Hungary	0.5%
Iceland	0.0%
Ireland	0.6%
Italy	15.5%
Latvia	0.1%
Lithuania	0.1%
Luxembourg	0.2%
Macedonia, The Former Yugo. Rep. of	0.0%
Malta	0.0%
Moldova	0.0%
Netherlands	4.9%
Norway	1.6%
Poland	1.5%
Portugal	2.3%
Romania	0.4%
Slovakia	0.3%
Slovenia	0.0%
Spain	7.5%
Sweden	3.1%
Switzerland	2.3%
Turkey	3.0%
United Kingdom	15.9%

Wireless: Multimedia Messaging Service 2010

NATION INTL	Pct of Mkt Revenue
Albania	0.1%
Austria	2.5%
Belarus	0.1%
Belgium	2.4%
Bosnia and Herzegovina	0.3%
Bulgaria	0.2%
Croatia	0.0%
Cyprus	0.0%
Czech Republic	0.5%
Denmark	1.8%
Estonia	0.1%
Finland	1.9%
France	12.0%
Germany	17.5%
Greece	0.8%
Hungary	0.5%
Iceland	0.0%
Ireland	0.6%
Italy	15.2%
Latvia	0.1%
Lithuania	0.1%
Luxembourg	0.2%
Macedonia, The Former Yugo. Rep. of	0.0%
Malta	0.0%
Moldova	0.0%
Netherlands	5.0%
Norway	1.6%
Poland	1.5%
Portugal	2.3%
Romania	0.4%
Slovakia	0.3%
Slovenia	0.1%
Spain	7.4%
Sweden	3.1%
Switzerland	2.3%
Turkey	3.2%
United Kingdom	15.8%

Wireless: Customised Infotainment 2005

NATION INTL	Pct of Mkt Revenue
Canada	16.6%
United States	83.4%

NATION INTL	Pct of Mkt Revenue
Canada	16.6%
United States	83.4%

Wireless: Intranet/Extranet Access 2005

NATION INTL	Pct of Mkt Revenue
Canada	5.8%
United States	94.2%

NATION INTL	Pct of Mkt Revenue
Canada	5.8%
United States	94.2%

Wireless: Multimedia Messaging Service 2005

NATION INTL	Pct of Mkt Revenue
Canada	7.8%
United States	92.2%

NATION INTL	Pct of Mkt Revenue
Canada	7.8%
United States	92.2%

Wireless: Customised Infotainment 2005

NATION INTL	Pct of Mkt Revenue
Algeria	0.0%
Angola	0.0%
Argentina	13.6%
Bahamas, The	0.0%
Bahrain	0.2%
Barbados	0.0%
Belize	0.0%
Benin	0.0%
Bolivia	0.0%
Botswana	0.0%
Brazil	20.1%
Cameroon	0.0%
Cape Verde	0.0%
Chile	4.2%
Colombia	4.0%
Comoros	0.0%
Congo (Brazzaville)	0.0%
Costa Rica	0.0%
Cuba	0.0%
Dominican Republic	0.0%
Ecuador	0.0%
Egypt	8.5%
El Salvador	0.0%
Ethiopia	0.0%
Gabon	0.0%
Gambia, The	0.0%
Gaza Strip	0.0%
Ghana	0.0%
Guadalupe	0.0%
Guatemala	0.0%
Guinea	0.0%
Guinea Ecuatorial	0.0%
Guyana	0.0%
Haiti	0.0%
Honduras	0.0%
Iran	0.0%

NATION INTL	Pct of Mkt Revenue
Iraq	0.0%
Israel	4.8%
Ivory Coast	0.0%
Jamaica	0.0%
Jordan	0.0%
Kenya	0.0%
Kuwait	1.0%
Lesotho	0.0%
Liban	0.9%
Liberia	0.0%
Libya	0.0%
Martinique	0.0%
Mauritania	0.0%
Mauritius	0.0%
Mexico	15.1%
Morocco	0.0%
Namibia	0.0%
Netherlands Antilles	0.0%
Nicaragua	0.0%
Nigeria	0.0%
Oman	1.2%
Other Melanesia	0.0%
Panama	0.0%
Paraguay	0.0%
Peru	2.1%
Puerto Rico	0.0%
Qatar	0.2%
Reunion	0.0%
Saudi Arabia	4.5%
Senegal	0.0%
South Africa	11.5%
Sudan	0.0%
Surinam	0.0%
Swaziland	0.0%
Syria	0.0%
Togo	0.0%
Trinidad and Tobago	0.0%
Tunisia	0.0%
Uganda	0.0%
United Arab Emirates	1.2%
Uruguay	0.0%

NATION INTL	Pct of Mkt Revenue
Venezuela	6.9%
Yemen	0.0%
Zambia	0.0%
Zimbabwe	0.0%

NATION INTL	Pct of Mkt Revenue
Algeria	2.1%
Angola	0.1%
Argentina	8.1%
Bahamas, The	0.1%
Bahrain	0.1%
Barbados	0.0%
Belize	0.0%
Benin	0.2%
Bolivia	0.6%
Botswana	0.1%
Brazil	11.9%
Cameroon	0.7%
Cape Verde	0.0%
Chile	2.5%
Colombia	2.4%
Comoros	0.0%
Congo (Brazzaville)	0.1%
Costa Rica	0.3%
Cuba	1.0%
Dominican Republic	0.9%
Ecuador	0.5%
Egypt	5.2%
El Salvador	0.6%
Ethiopia	0.0%
Gabon	0.0%
Gambia, The	0.0%
Gaza Strip	0.0%
Ghana	1.3%
Guadalupe	0.1%
Guatemala	1.0%
Guinea	0.4%
Guinea Ecuatorial	0.0%
Guyana	0.0%
Haiti	0.2%
Honduras	0.2%
Iran	4.4%
Iraq	2.5%
Israel	2.9%
Ivory Coast	1.1%
Jamaica	0.2%
Jordan	0.3%

NATION INTL	Pct of Mkt Revenue
Kenya	0.6%
Kuwait	0.6%
Lesotho	0.2%
Liban	0.5%
Liberia	0.0%
Libya	0.4%
Martinique	0.1%
Mauritania	0.2%
Mauritius	0.0%
Mexico	9.0%
Morocco	2.9%
Namibia	0.1%
Netherlands Antilles	0.0%
Nicaragua	0.3%
Nigeria	4.5%
Oman	0.8%
Other Melanesia	0.0%
Panama	0.4%
Paraguay	0.4%
Peru	1.2%
Puerto Rico	0.8%
Qatar	0.1%
Reunion	0.1%
Saudi Arabia	2.9%
Senegal	0.5%
South Africa	7.1%
Sudan	2.0%
Surinam	0.0%
Swaziland	0.1%
Syria	0.6%
Togo	0.0%
Trinidad and Tobago	0.2%
Tunisia	1.0%
Uganda	1.1%
United Arab Emirates	0.8%
Uruguay	0.5%
Venezuela	4.2%
Yemen	2.2%
Zambia	0.4%
Zimbabwe	0.9%

NATION INTL	Pct of Mkt Revenue
Algeria	0.0%
Angola	0.0%
Argentina	11.2%
Bahamas, The	0.0%
Bahrain	0.2%
Barbados	0.0%
Belize	0.0%
Benin	0.0%
Bolivia	0.0%
Botswana	0.0%
Brazil	28.2%
Cameroon	0.0%
Cape Verde	0.0%
Chile	4.7%
Colombia	3.6%
Comoros	0.0%
Congo (Brazzaville)	0.0%
Costa Rica	0.0%
Cuba	0.0%
Dominican Republic	0.0%
Ecuador	0.0%
Egypt	4.5%
El Salvador	0.0%
Ethiopia	0.0%
Gabon	0.0%
Gambia, The	0.0%
Gaza Strip	0.0%
Ghana	0.0%
Guadalupe	0.0%
Guatemala	0.0%
Guinea	0.0%
Guinea Ecuatorial	0.0%
Guyana	0.0%
Haiti	0.0%
Honduras	0.0%
Iran	0.0%
Iraq	0.0%
Israel	6.6%
Ivory Coast	0.0%
Jamaica	0.0%
Jordan	0.0%

NATION INTL	Pct of Mkt Revenue
Kenya	0.0%
Kuwait	0.8%
Lesotho	0.0%
Liban	0.0%
Liberia	0.0%
Libya	0.0%
Martinique	0.0%
Mauritania	0.0%
Mauritius	0.0%
Mexico	14.5%
Morocco	0.0%
Namibia	0.0%
Netherlands Antilles	0.0%
Nicaragua	0.0%
Nigeria	0.0%
Oman	0.2%
Other Melanesia	0.0%
Panama	0.0%
Paraguay	0.0%
Peru	2.0%
Puerto Rico	0.0%
Qatar	0.2%
Reunion	0.0%
Saudi Arabia	2.1%
Senegal	0.0%
South Africa	10.4%
Sudan	0.0%
Surinam	0.0%
Swaziland	0.0%
Syria	0.0%
Togo	0.0%
Trinidad and Tobago	0.0%
Tunisia	0.0%
Uganda	0.0%
United Arab Emirates	1.8%
Uruguay	0.0%
Venezuela	9.0%
Yemen	0.0%
Zambia	0.0%
Zimbabwe	0.0%

NATION INTL	Pct of Mkt Revenue
Algeria	1.1%
Angola	0.3%
Argentina	8.5%
Bahamas, The	0.0%
Bahrain	0.2%
Barbados	0.0%
Belize	0.0%
Benin	0.1%
Bolivia	0.8%
Botswana	0.1%
Brazil	21.4%
Cameroon	0.0%
Cape Verde	0.0%
Chile	3.5%
Colombia	2.7%
Comoros	0.0%
Congo (Brazzaville)	0.1%
Costa Rica	0.5%
Cuba	0.1%
Dominican Republic	0.6%
Ecuador	0.7%
Egypt	3.5%
El Salvador	0.5%
Ethiopia	0.0%
Gabon	0.0%
Gambia, The	0.0%
Gaza Strip	0.0%
Ghana	0.3%
Guadalupe	0.2%
Guatemala	1.1%
Guinea	0.2%
Guinea Ecuatorial	0.0%
Guyana	0.0%
Haiti	0.2%
Honduras	0.2%
Iran	0.5%
Iraq	2.4%
Israel	5.1%
Ivory Coast	0.4%
Jamaica	0.2%
Jordan	0.4%

NATION INTL	Pct of Mkt Revenue
Kenya	2.5%
Kuwait	0.7%
Lesotho	0.2%
Liban	0.0%
Liberia	0.0%
Libya	0.0%
Martinique	0.2%
Mauritania	0.1%
Mauritius	0.1%
Mexico	11.1%
Morocco	1.8%
Namibia	0.1%
Netherlands Antilles	0.0%
Nicaragua	0.2%
Nigeria	1.0%
Oman	0.2%
Other Melanesia	0.0%
Panama	0.4%
Paraguay	0.4%
Peru	1.5%
Puerto Rico	1.1%
Qatar	0.2%
Reunion	0.1%
Saudi Arabia	1.8%
Senegal	0.4%
South Africa	8.2%
Sudan	0.0%
Surinam	0.0%
Swaziland	0.0%
Syria	0.5%
Togo	0.0%
Trinidad and Tobago	0.2%
Tunisia	0.6%
Uganda	0.7%
United Arab Emirates	1.4%
Uruguay	0.7%
Venezuela	7.0%
Yemen	0.4%
Zambia	0.0%
Zimbabwe	0.2%

NATION INTL	Pct of Mkt Revenue
Algeria	0.0%
Angola	0.0%
Argentina	9.1%
Bahamas, The	0.0%
Bahrain	0.2%
Barbados	0.0%
Belize	0.0%
Benin	0.0%
Bolivia	0.0%
Botswana	0.0%
Brazil	28.6%
Cameroon	0.0%
Cape Verde	0.0%
Chile	3.8%
Colombia	4.7%
Comoros	0.0%
Congo (Brazzaville)	0.0%
Costa Rica	0.0%
Cuba	0.0%
Dominican Republic	0.0%
Ecuador	0.0%
Egypt	5.1%
El Salvador	0.0%
Ethiopia	0.0%
Gabon	0.0%
Gambia, The	0.0%
Gaza Strip	0.0%
Ghana	0.0%
Guadalupe	0.0%
Guatemala	0.0%
Guinea	0.0%
Guinea Ecuatorial	0.0%
Guyana	0.0%
Haiti	0.0%
Honduras	0.0%
Iran	0.0%
Iraq	0.0%
Israel	4.2%
Ivory Coast	0.0%
Jamaica	0.0%
Jordan	0.0%

NATION INTL	Pct of Mkt Revenue
Kenya	0.0%
Kuwait	0.6%
Lesotho	0.0%
Liban	0.0%
Liberia	0.0%
Libya	0.0%
Martinique	0.0%
Mauritania	0.0%
Mauritius	0.0%
Mexico	21.5%
Morocco	0.0%
Namibia	0.0%
Netherlands Antilles	0.0%
Nicaragua	0.0%
Nigeria	0.0%
Oman	0.2%
Other Melanesia	0.0%
Panama	0.0%
Paraguay	0.0%
Peru	2.4%
Puerto Rico	0.0%
Qatar	0.1%
Reunion	0.0%
Saudi Arabia	2.0%
Senegal	0.0%
South Africa	9.3%
Sudan	0.0%
Surinam	0.0%
Swaziland	0.0%
Syria	0.0%
Togo	0.0%
Trinidad and Tobago	0.0%
Tunisia	0.0%
Uganda	0.0%
United Arab Emirates	0.8%
Uruguay	0.0%
Venezuela	7.4%
Yemen	0.0%
Zambia	0.0%
Zimbabwe	0.0%

NATION INTL	Pct of Mkt Revenue
Algeria	1.2%
Angola	0.2%
Argentina	6.3%
Bahamas, The	0.0%
Bahrain	0.1%
Barbados	0.0%
Belize	0.0%
Benin	0.4%
Bolivia	0.9%
Botswana	0.1%
Brazil	20.1%
Cameroon	0.9%
Cape Verde	0.0%
Chile	2.7%
Colombia	3.3%
Comoros	0.0%
Congo (Brazzaville)	0.1%
Costa Rica	0.4%
Cuba	0.1%
Dominican Republic	0.7%
Ecuador	0.7%
Egypt	3.7%
El Salvador	0.7%
Ethiopia	0.0%
Gabon	0.0%
Gambia, The	0.1%
Gaza Strip	0.0%
Ghana	0.8%
Guadalupe	0.1%
Guatemala	1.4%
Guinea	0.6%
Guinea Ecuatorial	0.0%
Guyana	0.0%
Haiti	0.2%
Honduras	0.3%
Iran	0.8%
Iraq	2.4%
Israel	3.0%
Ivory Coast	1.3%
Jamaica	0.2%
Jordan	0.3%

NATION INTL	Pct of Mkt Revenue
Kenya	0.8%
Kuwait	0.4%
Lesotho	0.2%
Liban	0.0%
Liberia	0.0%
Libya	0.0%
Martinique	0.1%
Mauritania	0.1%
Mauritius	0.0%
Mexico	15.3%
Morocco	2.1%
Namibia	0.1%
Netherlands Antilles	0.0%
Nicaragua	0.3%
Nigeria	2.9%
Oman	0.2%
Other Melanesia	0.0%
Panama	0.3%
Paraguay	0.5%
Peru	1.7%
Puerto Rico	0.6%
Qatar	0.1%
Reunion	0.1%
Saudi Arabia	1.5%
Senegal	0.9%
South Africa	6.8%
Sudan	0.0%
Surinam	0.0%
Swaziland	0.0%
Syria	0.5%
Togo	0.0%
Trinidad and Tobago	0.1%
Tunisia	0.6%
Uganda	1.8%
United Arab Emirates	0.6%
Uruguay	0.5%
Venezuela	5.3%
Yemen	0.5%
Zambia	0.1%
Zimbabwe	0.4%