

# 3G Market Profile

## Existing Services for 3G

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### HIGHLIGHTS

- SMS success is spreading and showing positive effects on the average revenue per user. SMS has shown its revenue potential and has also become a bearer technology for profitable value added services, launched daily.
- Multimedia Messaging will follow the SMS path to be a major driver for person-to-person communications. With SMS, it will generate revenue equivalent to the total size of the global mobile market revenue in 1999.
- Initial WAP experiences are turning into a successful offering and WAP is gaining user acceptance. Growing evidence shows that churn among WAP service users is falling as loyalty and usage increases.
- The possibility of downloading an initial WAP service page with GPRS is up to three times faster than before. Together with always-on capability, this will boost WAP services.
- GPRS will be used to meet the growing demand of mobile data services in a mass market. Networks, first terminals, initial services and tariffing models exist now with mass market terminals coming during third quarter this year.
- Experience gained with GPRS applications today will speed the take-up of 3G services. Moreover, 3rd generation is optimised for offering services in the IP world and thus allows further cost-efficiency for a mass market.
- Consumers have indicated a clear willingness to subscribe and pay for the new services.
- Continued, incremental steps in all sectors will build the 3G revenue streams and cost-efficiency.

Some of the statements in this document are forward-looking statements, including without limitation those regarding (i) the timing and expectations for GPRS and 3G deliveries, launches and roll outs, (ii) estimates of market share, values of contracts, and volume growth, (iii) estimates of revenues, the size of markets, and customer usage of various types of services and products, and (iv) statements concerning the timing of the development and acceptance of 3G technologies and applications. Because these statements involve risks and uncertainties, actual results may differ materially from these forward-looking statements. For a discussion of the factors that could cause these differences, readers are directed to the risk factors specified on pages 21 to 23 of the Company's Form 20-F for the year ended December 31, 1999 and the factors listed in the final paragraph of the Company's press release dated March 15, 2001.

*A market worth almost  
€1,000 billion a year by 2006*

## INTRODUCTION

Today's mobile operators face many challenges, not least of which is the move from "plain vanilla" voice-limited data to a marketplace that is being recreated around existing and new digital content. Consumers will increasingly demand access to new services and information, anywhere and at anytime. To meet that demand we must accept that change is inevitable, and to begin to plan now for a seamless evolution to 3G.

*200 billion SMS messages  
forecast for 2001 by GSA*

SMS and WAP services are already creating the revenue streams of the future 3G business. The mobile operator business today is generating around €300 billion in annual service revenues, the majority of which is voice. However, a growing amount is data, led by a phenomenal take-up in Short Message Service (SMS). The GSM Association announced (Feb 12th) that a record 15 billion SMS text messages were sent over the world's GSM wireless networks during December 2000. The figure indicates a five-fold increase in the volume of text messages generated every month by GSM wireless customers around the globe in the past year. The forecast from the same source is that SMS traffic will increase to 25 billion messages per month by the end of 2001 and will achieve 200 billion in total for 2001. Vodafone has recently reported that the growth of SMS is having a positive effect on Average Revenue Per User (ARPU). No operator can afford to ignore this change in behaviour and revenue opportunity both in the consumer and business markets.

*Multimedia Messaging –  
the next killer application?*

*"This is truly staggering demonstration of the increasing popularity of the SMS facility".*

*"SMS has become an integral part of people's lives – business and personal".*

**Rob Conway**  
CEO of the GSM Association  
Feb 12th 2001

To succeed in this evolving mobile industry, it is important to gain a more precise understanding of user behaviour and market forces. The goal is a market estimated to be worth almost €1,000 billion a year by 2006, of which 40–45% will come from services now under development. Voice revenues still dominate this new market, accounting for over €500 billion a year. SMS and Multimedia Messaging will generate close to €250 billion a year which represents a market size equivalent to the total global mobile market revenues of 1999.

In evaluating the market shift, we must consider both current services and how those services are likely to evolve in the near future. It is only natural that SMS and Wireless Application Protocol (WAP) services will evolve to the new technologies. Multimedia Messaging (MMS) will be one of the main drivers for GPRS and eventually for 3G. Person-to-Person (P2P) communication could account for 75% of mobile communications revenue by 2006. This new mix will encompass voice, rich calls and MMS, and will include text, picture and video messaging as well as e-mail and chat services.

We can expect Multimedia Messaging (MMS) to drive the move to data services. This will spur on the deployment of content such as entertainment, gaming, m-Commerce and information, and users are expected to subscribe to between one and three of these new services.

We also expect that within the next 18 months, MMS will reverse the decline in voice ARPU experienced by some operators. Recent Nokia tariffing studies with research agency MORI show that early adopters of new data services are willing to pay for valued mobile content.

If, as expected, this messaging phenomena continues, operators must find a more effective means of delivering text and rich content services. While SMS was initially envisioned as a way to send information from the operator to consumers, the industry

*GPRS needed to meet the data market growth*

*Customers are more demanding today*

*Growing WAP numbers increasing also average revenue per subscriber and making customers loyal*

*Customers see the value*

soon realised that SMS could also provide two-way customer-to-customer text communications. Given the growth projections for SMS, operators will not be able deliver these services quickly or cost effectively using current technologies. To meet this demand, many operators are now building the migration to General Packet Radio Service (GPRS). GPRS provides a more cost-effective delivery solution and allows operators to offer richer content. GPRS will facilitate the move to Multimedia Messaging Services (MMS) where pictures, sounds and short videos will be attached to messages and delivered instantly. More importantly, this new technology supports the delivery of MMS at a low enough price to ensure mass market take-up.

Most industry observers agree that while WAP has not yet achieved its full potential. WAP today is, by any definition, a commercial success. The initial high expectations may not have been realised as quickly as first thought, but this will not effect the ultimate potential of WAP technology. Out of a total global market of 750 million handsets, there are currently 50 million WAP phones in the market and this number is increasing. BT Cellnet reports a 40% increase in WAP page impressions for their Genie offering in January 2001 alone. The early i-mode experiences in Japan have been noted by numerous industry observers over the past year. The same pattern is starting to show in Europe. According to Goldman Sachs at the London Financial Times Conference in September 2000, Sonera Zed has shown clear growth in revenues (+15% when compared to other Sonera customers). Goldman Sachs also reports that Sonera Zed customer churn rates have fallen by 47% over the same period of time.

WAP churn rates are falling as both loyalty and usage increase. This pattern has been evident in the NTT DoCoMo i-mode deployment. i-mode has enjoyed 24 months of remarkable subscriber growth, and has seen increases in both data and voice ARPU, indicating that data users also tend to use more voice services.

To provision these new services, operators will need a flexible and reliable delivery platform. Such a platform will allow operators to create their own local content and ensure that 3rd party content providers can easily deliver new applications and content via the operator's mobile portal. Acceptance of GPRS-based services depends on the operator's ability to deliver content that users will pay for and on maintaining the quality of service subscribers now get from GSM voice and SMS. If users are constantly forced to reinitiate a packet data connection, they will quickly become frustrated and abandon the service.

Data rates in GPRS will be between 20–30 kbps from the beginning since the first true mass market handsets available in the 3Q this year will support 3 x 13.3 kbps end-user data rate in the downlink to the mobile and 1 x 13.3 kbps end-user data rate in the uplink. This means receiving mobile data will be faster than sending mobile data. This is unlikely to be a problem since once the user has pressed the send button, data will be sent in the background while the user continues with another service or voice call. An always-on GPRS feature provides instant access, thus eliminating connection set-ups each time the service is needed and thus improving also the user experience of WAP services.

We expect to see a range of services for these early GPRS data rates including MMS, cartoon strips delivered to the mobile terminal, notification of coming films and concerts, and entertainment ranging from simple quizzes to more complicated games such as chess and community contests.

The mobile industry has taken the first important steps towards fully functional, profitable 3G networks. As those systems are implemented and optimised, the evidence from various operators around the world indicates that consumers are showing readiness to subscribe and pay for new kind of mobile data services.

## CHANGES IN COMMUNICATION BEHAVIOUR

Powerful forces are reshaping the mobile communications landscape. Recent years have seen tremendous growth in the number of mobile handsets, and consumer demand for increasingly personalized, content-rich services. By the end of 2003, more people will use mobile devices to access the Internet than fixed connections. Subscribers, who now accept mobile voice as a part of their daily lives, are expected to drive the take-up of mobile data communications.

patterns that rely increasingly on messaging and visual content. For this new generation, messaging is the most natural way of personal communication. They will want to create and consume content such as greetings, notes, snapshots/postcards, moving pictures, instant voicemail on the fly, at any time and in any place.

The mobile Internet is not only about youth, although the habits of younger users plays a key role in overall consumer behaviour. The mobile phone is becoming a life management tool for business, work and leisure. Employees who are on the move now communicate seamlessly with expanding networks of organizations and other individuals located across town or across the globe.

Formal work structures have adapted by emphasizing connectivity for both central office and remote workers. The balance of many workdays is spent in meetings, commuting, travelling to meet customers and colleagues across the city, the country, or even globally. Work is clearly 'no longer a place'. Work now takes place wherever and whenever people need to be in touch with colleagues, customers or their local surroundings. Using the mobile handset as a personal trusted device, consumers can access intranets and the Internet, news,

*It is about lifestyle*

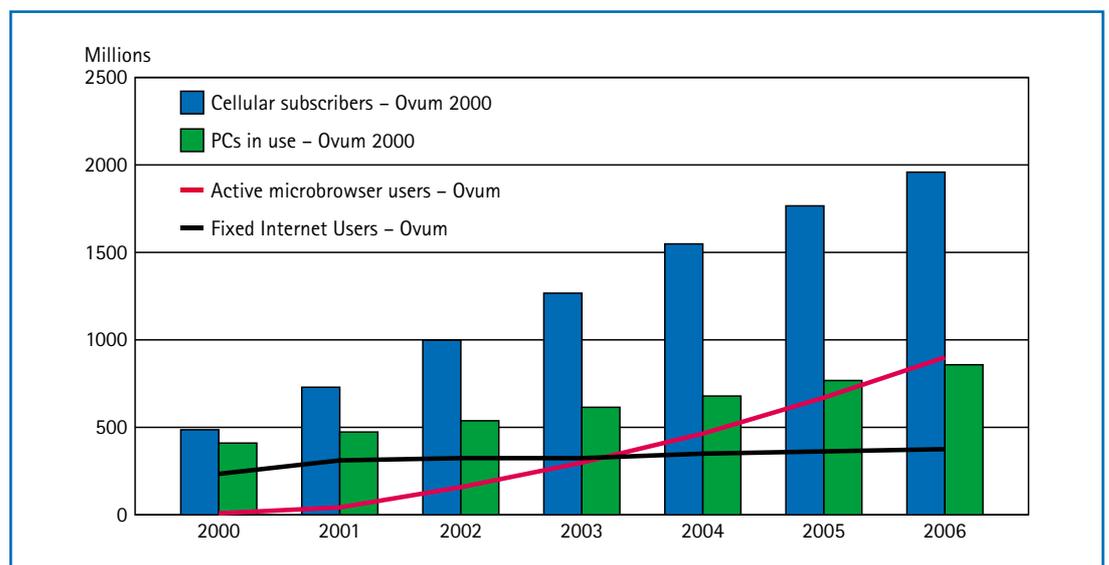
*It is efficiency*

Through both internal research and independent market analysis, we have compiled a comprehensive perspective on the consumer trends, technology developments and operator needs that are driving the evolution to 3G services. Our research suggests the following trends in the marketplace:

Mobile devices will become an integral part of most consumer lifestyles. The "wireless literate generation" of today (under 25s) provides a revealing snapshot of tomorrow's mobile society. These on-the-move consumers want convenience, coolness and immediate contact with their friends, family and business associates. As a result they are creating dramatic new usage

*Figure 1. Mobile connections to the Internet*

*(Ovum definitions: A cellular terminal is a device that can originate or terminate a communication over a cellular operator's network. A voice-centric device has an integrated speaker and microphone for mobile communications. A microbrowser-enabled terminal is a small-screen device that also incorporates a browser.)*



weather, sports, as well as local service and direction information while on the move. Mobile handsets will also provide reliable, anywhere/anytime connectivity to key business processes and tools.

## FOCUSED ON END-USER NEEDS

### End-user perspective

To ensure the success of any mobile communications service, we must focus on the experience of the end-user. Based on research and real-world experience, we think that the end-user experience can be improved in two ways:

- by providing new services and
- by enhancing the existing user experience (an example of enhancing the user experience could be adding graphical information to a text-based weather report)

To fully appreciate the migration to subscriber-driven 3G services, it may be helpful to highlight the end-user experience through the evolution of current mobile services:

GSM was the first globally accepted technology to introduce voice mobility. *Mobility* is the benefit end-users pay for each month, and in fact end-users do not know or care about the underlying technologies that make mobility possible. SMS took the experience a step further, giving users the experience of value-added communication, information and

*It is also entertainment*

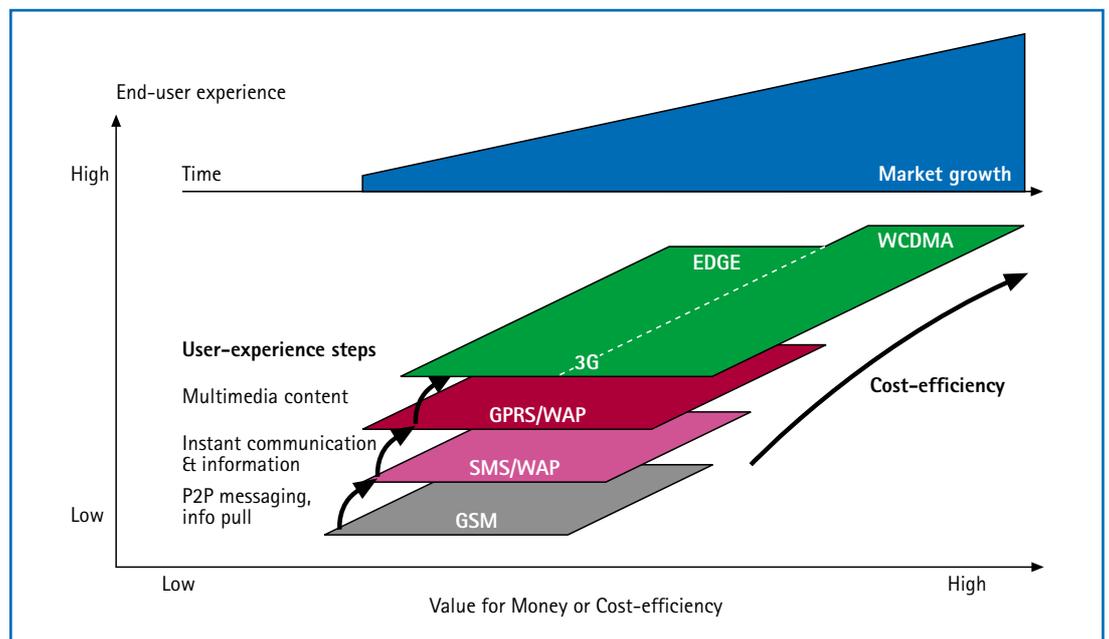
*End-users want services, content and value*

Consumers familiar with telephone – or web-based banking and stock trading will be eager to perform these activities while on the move through a device of their choice. Travellers are expected to purchase, check and update airline reservations via a trusted mobile device. When it comes to entertainment, these devices will give consumers the content that they want, be it games, music, video or information. Subscribers will use their mobile devices to catch up with their favourite soap opera, check out the weekend's football highlights, or view trailers of the hottest new movie releases.

Consumers will enjoy a wide variety of choices in both the types of devices they carry and the applications they use. Content, such as web-based information, will be appropriately matched to the device. People will no doubt own multiple devices and will carry the instrument most appropriate for the services they expect to use, the portability they need, and their overall lifestyle.

*Figure 2. Improving end-user experience*

*It is about improving the end-user experience*



entertainment services. Whilst SMS has been phenomenally successful with users, the limitation of the 160-character message capability has led to the development of a richer experience through some recently refined technologies, which enable pictures to be sent using a sequence of several SMS messages. Users are now enjoying higher interactivity through WAP and are able to get instant access to information, e-mail on the move and enhanced messaging with the introduction of GPRS.

Many explanations of technologies, especially those concerning the rationale for moving towards 3G, currently focus on data rates. This gives the impression that the higher the data rate, the better the end-user experience. This type of explanation is usually given because raw numbers are easy to compare, but this simplicity of explanation masks the real issues and confuses end-users for two reasons. First, initial users might be expecting all the improvements from a new technology immediately, when in reality they take time to introduce. Secondly, the end-user only really finds technologies and data speeds relevant to the extent that they support new services, expand access or improve value. At this stage in mobile evolution, these qualities are not directly related to enhanced data rates.

A valuable end-user experience can be created for most of today's applications using data rates of no more than 128 kbps

(Figure 3), but in the long-term the new 3G technology will deliver high-value service and content improvements that older systems simply cannot provide in the same cost-effective manner. That means that whilst the foundation for 3G (services, business models and customer satisfaction) can be created with capabilities available right now through SMS, WAP and GPRS, the migration to 3G is essential.

An operator also has to focus on end-user experience in order to differentiate.

There are two basic ways in which an operator can gain a competitive edge:

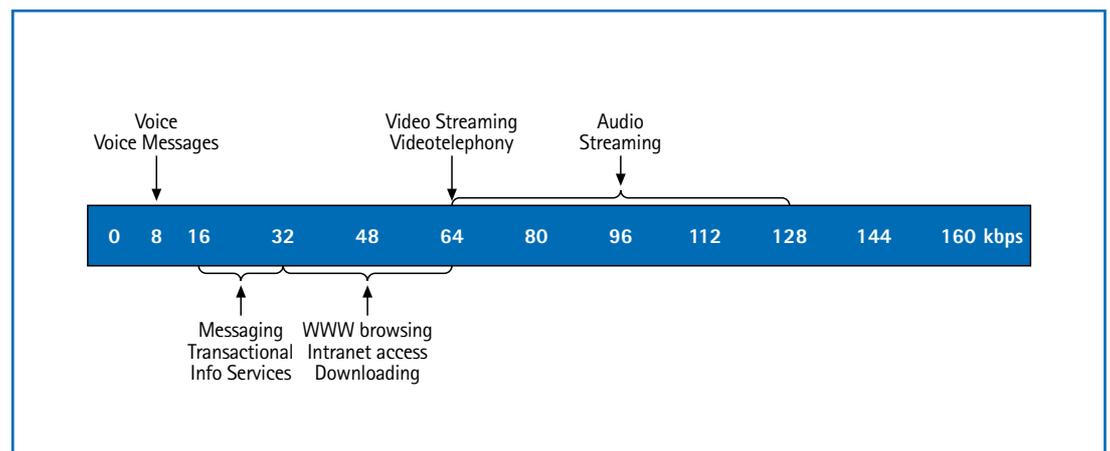
- by implementing a new technology which lowers the cost structure
- by implementing a new technology which delivers an enhanced user experience

GPRS can provide a cost-efficient evolutionary path from basic SMS messaging to richer, more satisfying types of messaging. At their most fundamental level, the 3G technologies, EDGE and WCDMA, also fulfill both the criterion above: 3G makes it possible to enhance user experiences by adding more multimedia content to the services, and 3G is also more cost-efficient. If EDGE is implemented in the same network as WCDMA, then the end-user will not perceive a great difference in experience when using the technology, but the cost of the radio access network for the operator will be lower with WCDMA technology in a growing mass market.

*3G is about cost-efficiency in a growing market*

*128 kbps is ok for today's applications*

*Figure 3. Data rates for today's applications*



## DRIVEN BY DEMAND

In 2000, there were about 730 million cellular subscribers and the growth is forecasted to continue (Figure 4). Those mobile consumers will demand access to a growing universe of data-driven applications. As the mass market is opening, cost-efficiency provided by 3rd generation also becomes crucial.

On the revenue side the goal is a service market estimated to be worth almost

€1,000 billion a year by 2006 (Figure 5), of which 40–45% will come from services that are currently under development. A forecast made by Ovum (Nov 2000) estimates revenues of about \$700 billion for 2004, which reflects the same revenue growth rate. Even in this new market, voice revenues still dominate, accounting for over €500 billion a year. SMS and Multimedia Messaging accounting for close to €250 billion a year which is a market equivalent to the total global mobile market revenues of 1999.

Figure 4. Cellular subscribers

(Ovum, Nov 2000  
(in 2005 1.7 billion cellular connections fundamentally associated with an individual or individuals))

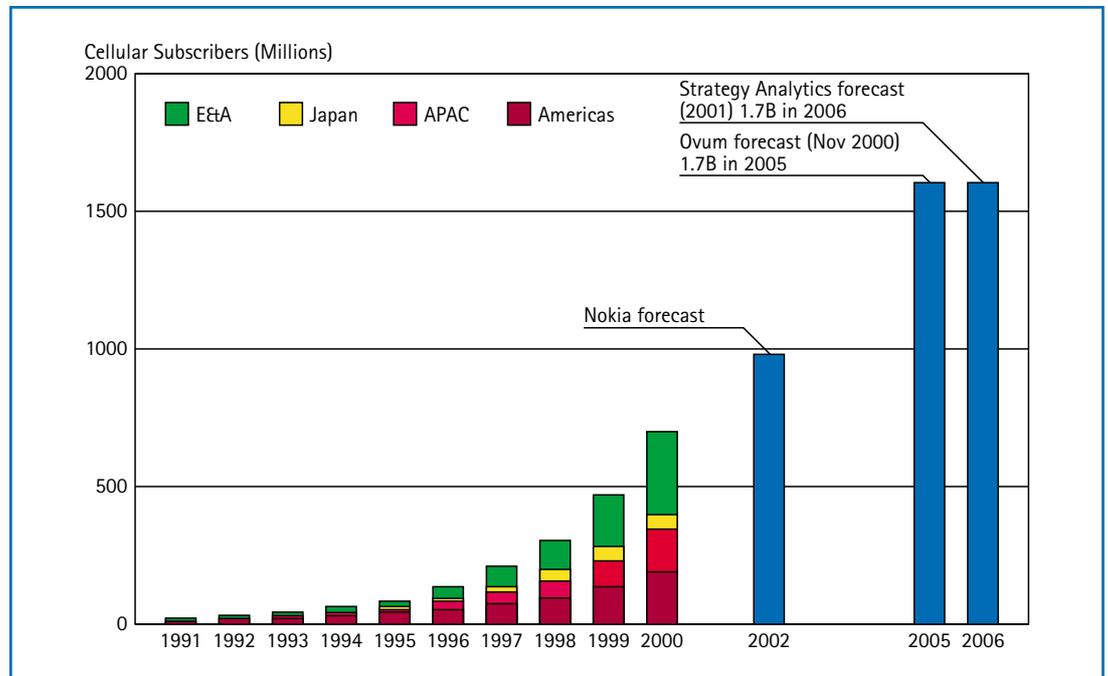
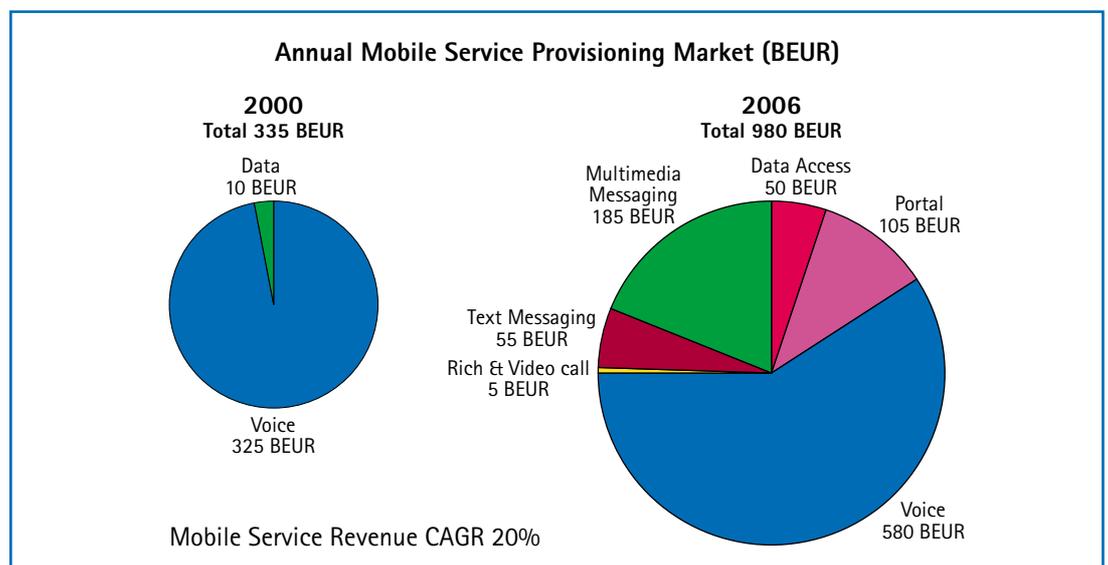


Figure 5. End-user Mobile Communications Spending

(Includes voice, messaging + mobile operator share on Internet/intranet services (e.g. bearer and content fee on portal services), CAGR = Compound Annual Growth Rate)

Source: Nokia 2001.



## SMS SUCCESS

SMS was originally intended to be used by operators when they wanted to send short one-way information announcements to the mobile end-users. Within the network, SMS uses the signalling channel and was not designed to be a bearer for end-user services. However, it was later realised that SMS could be used for two-way transmission so that end-users were able to communicate with each other. It was originally assumed that SMS would be primarily a business application, that it would be used mainly to send short text alerts regarding meeting times or other short messages.

*SMS changed the mobile communication culture*

But SMS turned out to be a great deal more than a simple announcement service. This revolutionary service has become a highly popular bearer for business and personal communications, information and entertainment services. Even though writing an SMS message with a mobile phone is not simple due to one key having multiple characters, the value it delivers to consumers easily overcomes this barrier.

Today, EMC estimates that over 80% of SMS traffic consists of social messages. Some UK users have even proposed marriage by SMS. Instant messaging is one of the most popular mobile activities and it is the youth generation that is driving the adoption of the new communication culture. Many new uses for SMS are being introduced that will boost its popularity even further.

*SMS services launched daily*

SMS-based services are being launched every business day. In addition to basic m-Commerce applications, corporate services, sports, financial, news and weather-based information services are now available as well as ring-tone downloads and icon messaging. SMS chat rooms are appearing, and it's now possible to participate in auctions, advertise, gamble, or receive jokes via SMS. In Finland, young people can send an SMS saying that they are attracted to someone and that

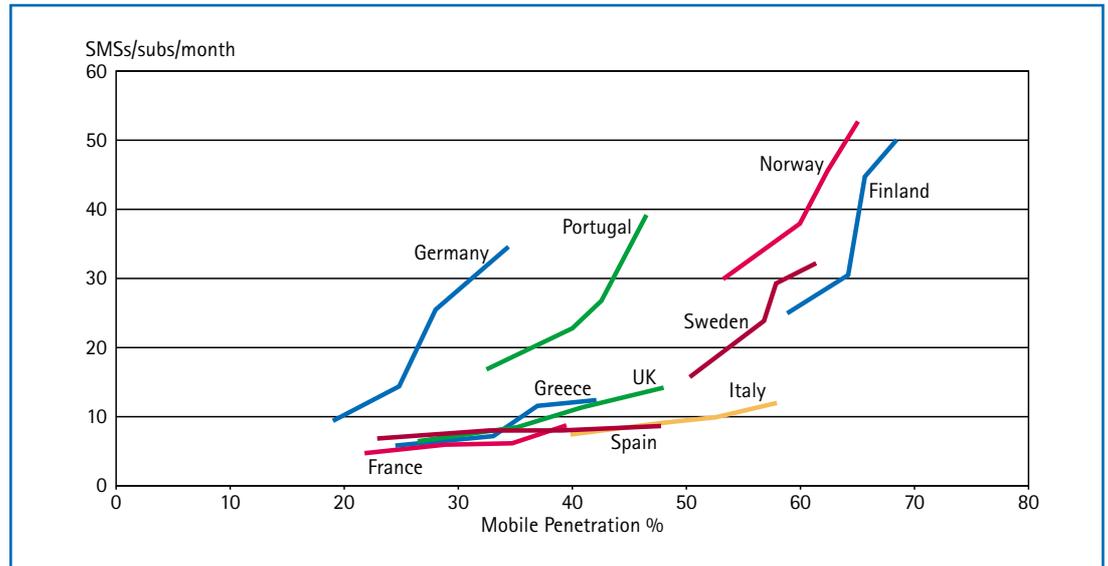
person will receive an SMS telling them that they have an anonymous admirer. The receiver can reply with a mobile phone number of the person the receiver is attracted to and both can hope that the number matches. In the UK, the National Blood bank donor service uses SMS to generate calls to younger age group donors and to remind volunteers of appointments. In some European countries, Muslims use SMS services to send daily calls to prayer.

Worldwide, the popularity of SMS continues to grow. In the Philippines in 2000, 55 million messages were sent every day from a subscriber base of 5.25 million GSM users and today the daily average is 70 million messages. Initially the service was introduced free of charge. To encourage 'responsible messaging', a token charge had to be added for the service. Following Sprint and AT&T's introduction of two-way messaging last year, the United States is poised to join the SMS revolution.

The continued worldwide popularity of SMS places strain on already stretched 2G networks. The average SMS traffic per GSM customer has grown from 0.4 in 1995 to an average 35 messages per GSM customer per month by the end of December 2000. It has been forecasted that 25 billion SMS per month will be sent in December 2001 (Source: GSM Association). According to a Durlacher UMTS Report (March 2001) SMS generated revenue of 4.3 BEUR in Europe in 2000.

The exponential growth of SMS typically starts when a market reaches the 20–40% penetration level for mobile phone acceptance. This trend is illustrated by the results from European markets shown in Figure 6.

Figure 6. SMS growth in Europe, IDC, 2000



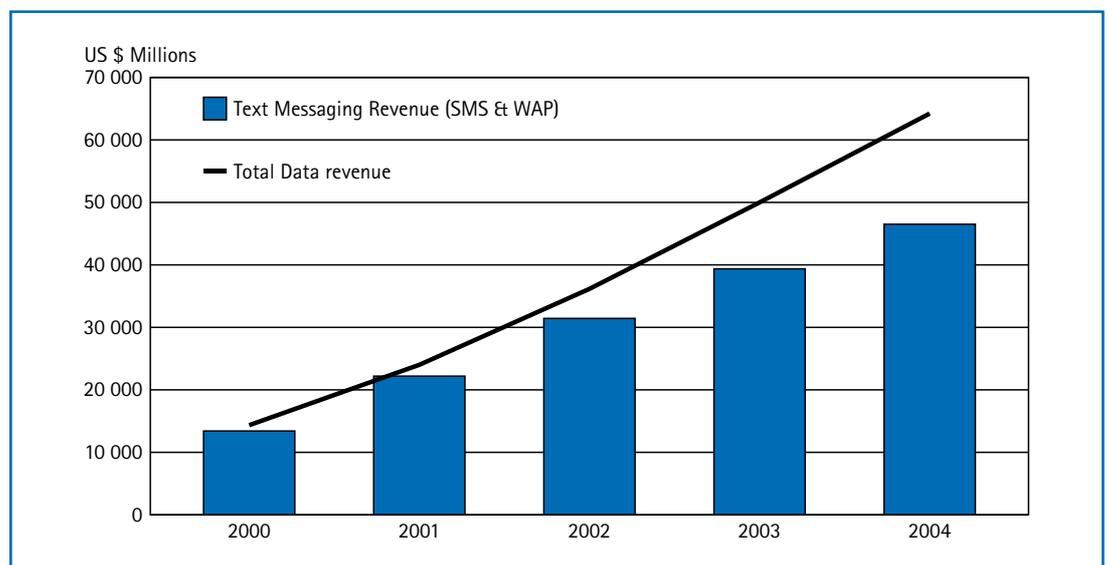
Multimedia Messaging will follow the path of SMS

Based on the experience in other markets, indications are that SMS, in countries such as Germany and the UK, has yet to reach its full potential. SMS growth has shown that once about 15–20 SMS/user/month is reached then the growth happens exponentially. As a first strategy, operators need to focus on achieving this figure to drive up SMS usage as this is the first behavior change. We believe that in countries that have high SMS usage the Multimedia Messaging usage will grow fastest. In one leading European SMS market today the revenue from SMS is of the size of commercial TV broadcasting revenue. These are all good reasons to focus

on SMS now and continue with Multimedia Messaging in the future.

The growth in SMS will be strengthened by the enriched user experience that GPRS/3G make possible, as well as by mushrooming end-user demand for person-to-person communications. For the operator, messaging is a 'sticky' service that can help to reduce churn and build revenue in the growing data market. In 2000/2001, nearly all data revenue consists of SMS and WAP, but as GPRS is launched and other applications are introduced, more and more revenue will be generated from non-text messaging applications (Figure 7).

Figure 7. SMS/WAP revenue forecast (Ovum 2000)



*WAP today is a growing success*

## WAP TODAY

WAP is showing the way to mobile data success. Current WAP applications include m-Commerce in shopping, ticketing, reservations; finance; m-billing; enterprise access; m-care; entertainment; messaging; travel and location-smart services. WAP is making a difference for both consumers and corporations. DHL, the international courier company, has introduced a WAP-based system for parcel tracking. In the first 12 months, DHL had 250,000 hits on its WAP tracking service compared to only 36,000 in the first 12 months of its PC-based web tracking service.

*“WAP is emerging as a strategic business channel.”*

*“And the value to the company is considerable.”*

*“Companies such as DHL have had to adapt to using the Web – it’s crucial for our evolution.”*

**Colum Joyce**  
Global e-commerce Strategy Manager,  
DHL  
(Total Telecom, 12 Feb 2001)

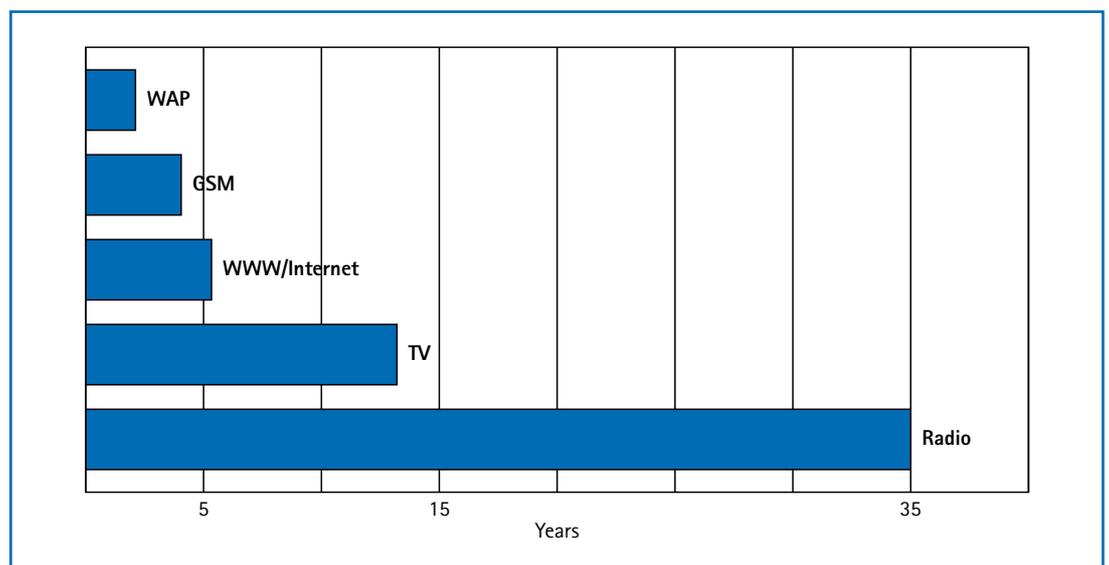
The DHL WAP service cost only \$18,000 to deploy in six days compared to \$350,000 and nine months for the PC-based solution. It also decreased the cost of the tracking service from \$2.50 to just 0.1 cents per track.

Outside of Europe, operators are also demonstrating the growing usage. WAP is growing in Asia Pacific. Even in Japan, where i-mode currently has the most subscribers, EZWeb is offering WAP services to its 5.8 million nationwide subscriber base.

Sonera’s Zed is showing the kind of growth in revenue (15%) that has been experienced with i-mode in Japan. In the UK, BT Cellnet Genie has seen a 40% monthly increase in its WAP page impression, to 88 million hits, in January 2001. Registrations for the same period grew by 10% to 1.85 million. This is all compared to fixed web traffic in the UK, Netherlands, Germany, Italy and Spain that averaged 34.2 million page impressions and 1.8 million unique visitors for the same one-month period in January 2001.

*Figure 8. New technology adoption (time taken to reach 50 million users)*

*WAP is growing faster than the Internet*



The GSM Association predicts that 100 million WAP-enabled devices will be in use by the end of 2001. Nokia estimates that there will be 200 million mobile Internet handsets by this time – with i-mode accounting for 20–30 million units and WAP accounting for 180 million.

Other notable WAP facts include:

- 436 operators in 162 countries use WAP
- The WAP Forum has 600 members and tens of thousands of developers
- There are already 50 million WAP-enabled handsets worldwide
- 61% of WAP users are satisfied with their WAP experience
- 71% of WAP users say that WAP is meeting or exceeding their expectations
- The number of WAP/WML pages has reached 7.8 million

WAP has achieved this success for many reasons. Not only does it enhance the user experience that started with SMS, but WAP also gives users a taste of the 3G future. WAP lets users get on-the-move information in a format that is ideally suited to a handheld device. GPRS will further improve the mobile data experience by removing the dial-up connection. Then 3G will go an important step further in creating enhanced user-experience by delivering a richer content.

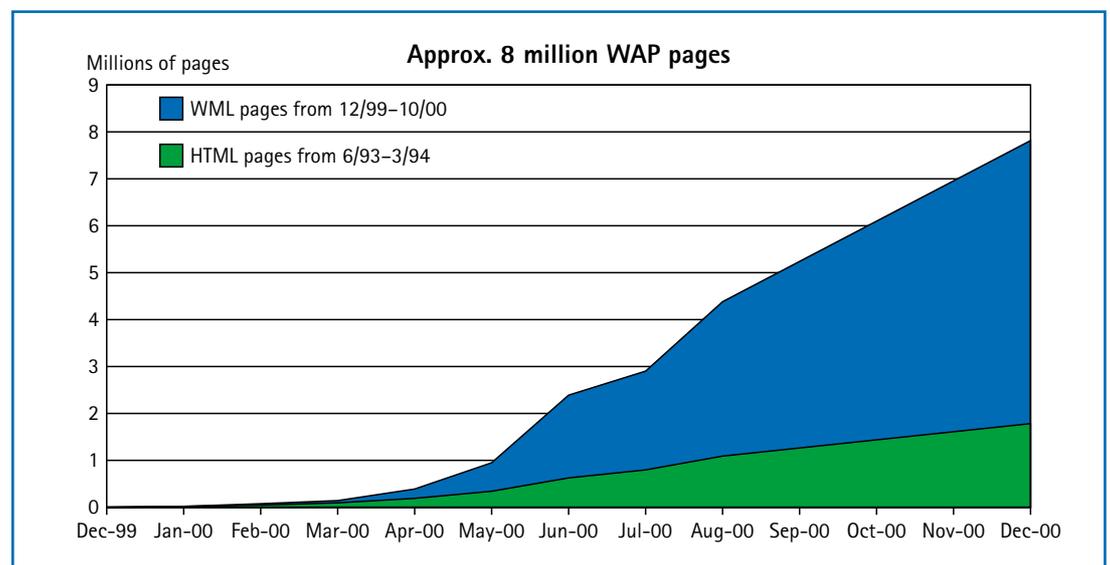
We expect games to be a growing revenue stream, especially from the youth market. As one example of this evolution Digital Bridges WAP game site received 23 million hits in 6 months. Consumers will use their mobile phones to find everything from the nearest fast food restaurant to booking a gourmet meal. They will buy movie tickets for the adjacent theatre after having watched a streaming video preview of the film – all with anywhere, anytime convenience right on their personal handset.

WAP offers an open, global and non-proprietary solution. It is device and bearer independent and is built by consensus amongst the 600 members of the WAP Forum. WAP has created a non-proprietary environment that encourages the creation of innovative, market-making applications. This openness has driven the growth of WAP pages from 25,000 in January 2000 to 7.8 million just one year later (Figure 9).

*WAP is open, global and non-proprietary*

*Figure 9. Number of WAP/WML pages*

*Source: WAP Forum and Pinpoint Networks*



## WAP EVOLUTION

*WAP is an evolving standard*

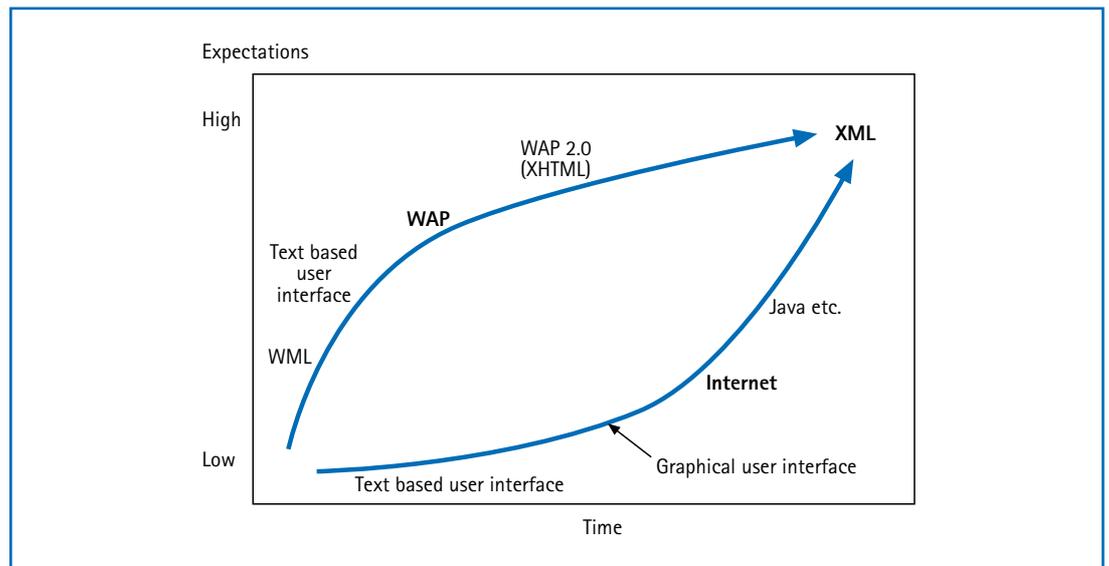
*Pictures, graphics, sound and colour*

As shown in the Figure 10, it took years for the world to recognize the potential of the Internet but once that potential was understood, the change happened rapidly. SMS followed a similar path, and is realising its potential now. For some users WAP's ability to access information conveniently from anywhere has not been enough. Familiar with the mature Internet browsing technology of a PC, they have been disappointed by the WAP experience, expecting features such as a high-quality

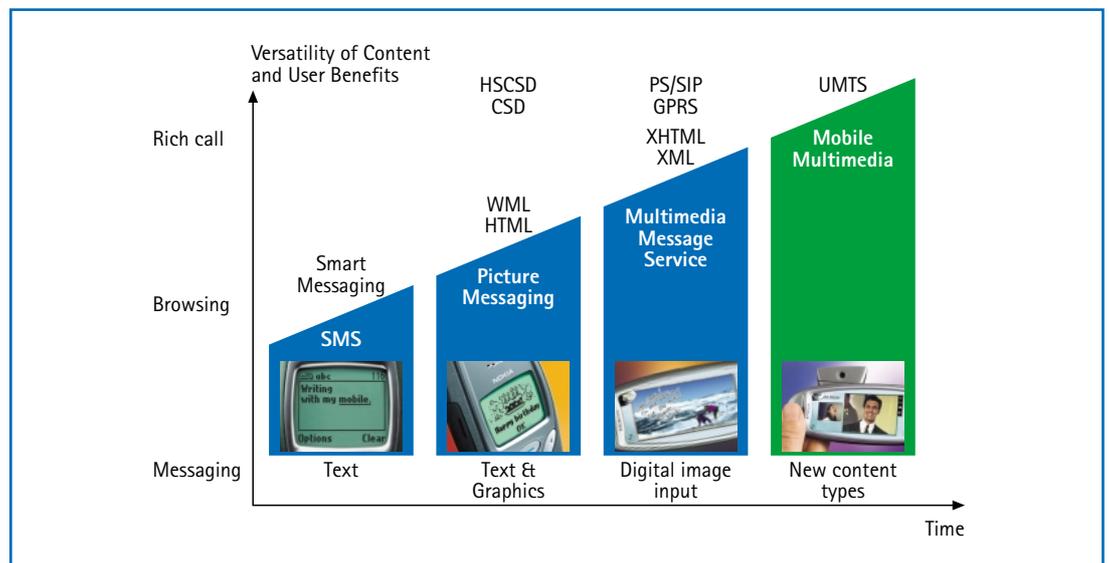
colour graphic display. WAP, however, is a developing standard, and with continued improvements confirms its place as a key enabling technology.

WAP is not superseded by GPRS or 3G (the role WAP plays in the development of mobile data is shown in the Figure 11 Role of WAP). Instead, WAP will evolve to leverage the potential of these new bearer services, which offer always-on capability, and the network capability and terminal enhancements required to deliver pictures, graphics, sound and colour text to the user.

*Figure 10.  
WAP and the Internet*



*Figure 11. Role of WAP*



*User Interface for WAP services to support instant access – no browsing.*

WAP offers a number of benefits for mobile applications. One-touch navigation allows customers to use applications while on the move. Optimisation of content allows information to be displayed in a usable way on a small easily portable device. WAP's telephony integration capability allows also numbers to be downloaded to the screen, then called with the simple push of a button.

WAP is continually improving, and new WAP developments are provided in WAP 2.0 to supplement earlier capabilities. These new developments include:

- XHTML support in WAP
- More content written in XML, accessible via either WAP or the web. This will enable WAP access to a greater proportion of Internet content
- Colour graphics and animation that will bring WAP content to life, and enable new applications such as game playing and graphics download
- Large file downloading capability
- Location-based services that will allow personalized information relevant to the current location to be pushed to the customer. This capability will also minimize the information that must be input when requesting location-based services such as travel directions or a local weather forecast
- Context-sensitive pop-up menus that will make navigation of services more efficient
- Data synchronisation with a personal info management system on PC that provides one consistent and up-to-date view of contact information and diary events.

*From SMS to GPRS because of efficiency*

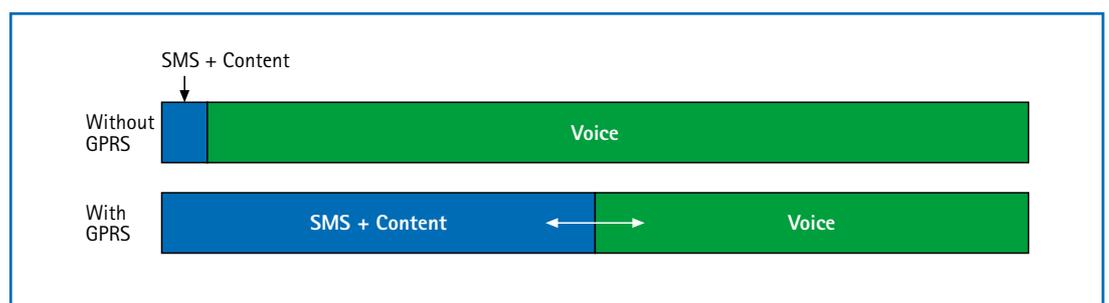
Together these developments will transform WAP, supporting innovative new applications, and providing a user-friendly experience. WAP will become the method of Internet access for the mass market.

The WAP experience will, however, remain fundamentally different from the fixed Internet experience. The smaller screen size required for convenient portability does not encourage 'browsing'. Instead WAP will be used to access specific information, which will provide a high-value service to on-the-move consumers. Consumers will be able to choose to accept push services, which will allow providers to continuously refine their customer profiles, and to offer a more personalised mobile Internet portal. The most successful services will be those that best anticipate and meet a customer's needs without being intrusive.

## GPRS – THE STEP TO 3G SERVICES

GPRS utilises packet switching technology in which information is transmitted in short bursts of data over the network. GPRS provides continuous IP connectivity repeating a similar type of user experience that is familiar from LAN or xDSL networks. It allows fast session set up and efficient network utilisation from transmission speeds of a few hundred bits per second up to 20 to 30 kbps. GPRS can use fractions of a timeslot or multiple timeslots for data transfer as opposed to normal single time slot. GPRS allows a flexible utilisation of the network capacity to be shared between voice and data services (Figure 12).

Figure 12. GPRS and SMS



*Cost-efficient GPRS*

The development of GPRS is the first and the most significant step towards true 3G services. As a convergence of mobile telecommunications and data networking, GPRS brings IP-based services to the mobile mass market.

*GPRS is ideal bearer for WAP*

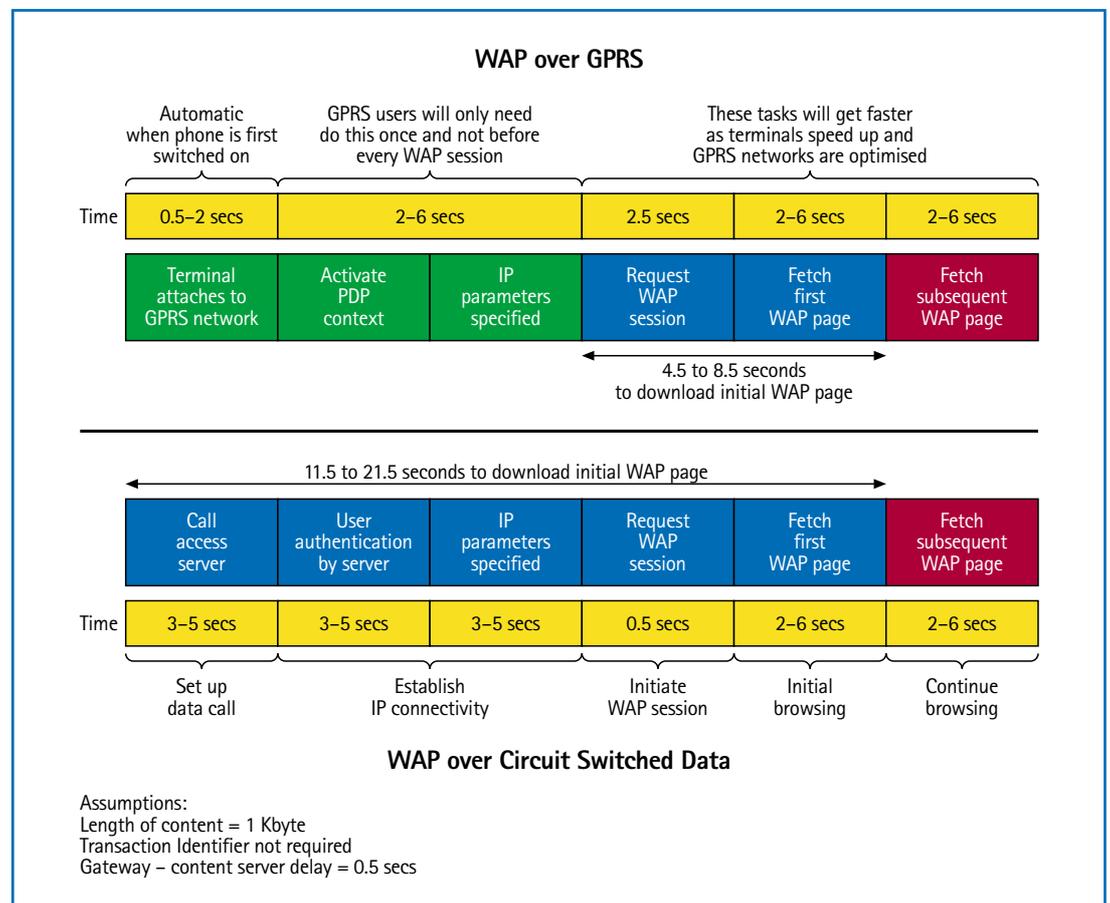
GPRS is an ideal bearer for WAP services. By using GPRS, WAP services can be established two to three times faster than with traditional circuit switched solutions. As shown in Figure 13, the majority of any transactional delay can be attributed to variables other than basic speed. With GPRS, information retrieval and database access are more usable and convenient.

*GPRS is always on, always ready*

WAP over GPRS brings cost savings to both mobile operators and consumers. GPRS radio resources are only needed for the transfer of WAP messages, and up to 60 WAP users can share one timeslot in one minute. This means that radio resource usage with GPRS is 10–100 times more efficient than with circuit switched data. This can lower operator network costs, and allow high user densities in areas with low network capacity, such as a train or bus moving through a rural area.

With GPRS, subscribers can stay permanently connected but they only pay for the services they use or the data quantity transferred. The user can interrupt browsing and continue later – as the session remains on and waiting.

Figure 13. Typical transaction delays with WAP over GPRS and CS



As the end user may be continuously connected, authentication and security procedures can be performed only at the beginning of each session. With this arrangement, users may be tolerant of the more involved and comprehensive security procedures needed to make applications more secure.

For long lasting sessions such as games, a GPRS terminal transmits uplink data only when a message needs to be transferred. This results in lower power consumption, and a longer battery life in the terminal.

The deployment of GPRS calls for the creation of new charging and billing methods, because subscribers are no longer charged on a per-call basis. Operators will offer innovative charging mechanisms to attract and retain customers. The charging options might include:

- Charge is proportional to volume of data transferred
- Charge is proportional to the value of data transferred
- Charge one subscription rate, data is free
- Combinations of above, e.g. several subscription tariffs with different bundled data volumes, charge proportional to volume of data sent over bundled limit

There are advantages and disadvantages to each of these methods. Whichever method is chosen, it is important that the end users understand the charging scheme and feel that they are in control of their mobile communications costs.

In order to achieve fast take-up of GPRS services and applications, end-users should be offered complete solutions, including a package of applications that meet the users requirements, an appropriate terminal, an optimum level of security appropriate to the application used, and an attractive connectivity service.

## **GPRS – CUSTOMER BASE AND EXPERIENCE FOR 3G**

For mobile operators, GPRS offers a solid business case on its own, while at the same time helping operators build additional revenue and experience in crucial areas that can assist in later 3G growth. The payback period for a GSM operator introducing GPRS is fairly short, allowing the operator to capitalise on its existing customer base while winning new customers through attractive application packages.

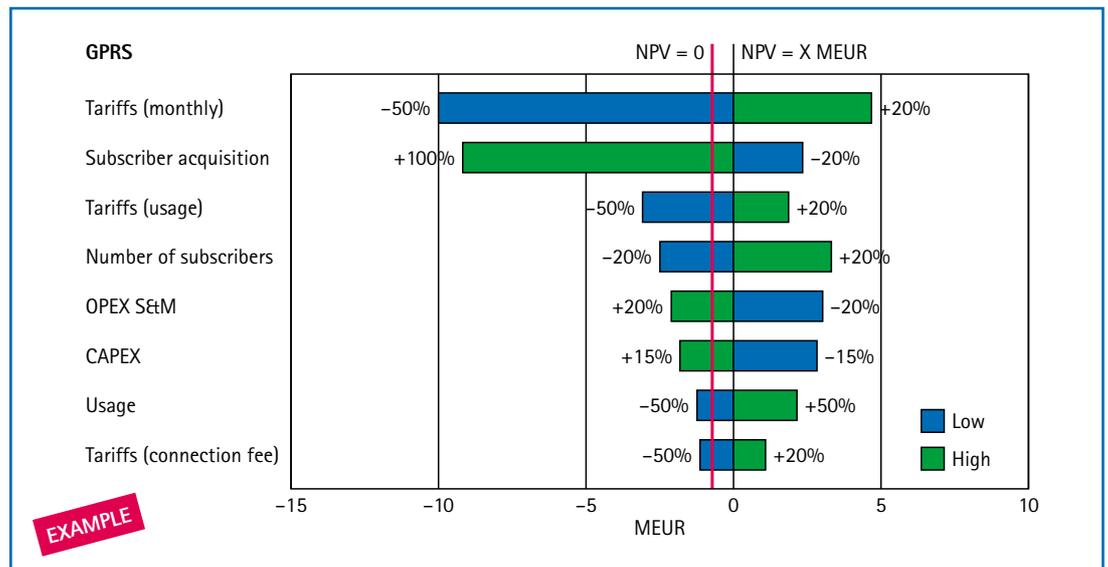
Nokia business consultants have analysed GPRS business cases with operators worldwide using forecasts for subscribers and data usage from the operator's own marketplace. It has been shown that the CAPEX (Capital Expenditure) is not the major factor affecting the payback period. Shorter payback periods and higher net present value are produced by an early increase in the number of subscribers.

The same GPRS business case analyses show clearly that the major factors influencing the success of a GPRS implementation will be the tariffing and application usage figures, rather than network costs or the total costs of ownership. Initially, operating expenditure (OPEX) focuses on building the subscriber base and the large expense items are for the most part marketing costs. As GPRS penetration increases, OPEX migrates towards those costs that are driven by the number of subscribers, such as terminal subsidies, customer care, marketing and content acquisition, or revenue sharing.

These analyses show that operators can succeed best by acquiring subscribers in the early phases and then by applying proper tariffing strategies to those customers. The most successful tariffing strategy, indicated by the analysis, is typically a mix of flat rate monthly fee and some Mbyte-based volume tariffing.

Figure 14. Changes in % to NPV with different factors (sensitivity analysis)

The horizontal axis reflects the changes in NPV (Net Present Value) to both positive and negative directions when changing one factor at a time (e.g. lowering or increasing tariffs). The biggest affects on NPV are in factors on the top and less influential factors are in the lower part ("tornado graph").



#### Prepare for 3G with GPRS

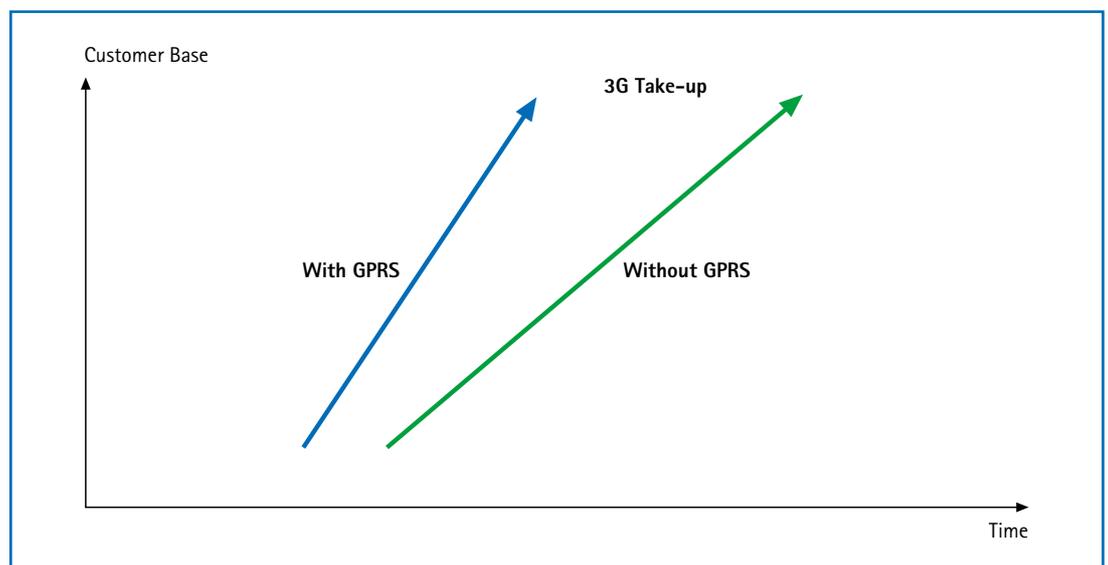
By targeting the mass market take-up of new services supported by GPRS, we expect operators to gain valuable experience that will improve their success when deploying 3G services (Figure 15). GPRS implementations require operators to focus on charging and billing solutions for packet data services rather than traditional time-based charging for circuit-switched voice. Application packages for different market segments may be tested, new customer care expertise may be developed, all of which are directly relevant to 3G roll-out. A GPRS implementation offers the chance to train personnel to provide the high levels of customer service,

especially while customers are becoming accustomed to the applications and billing.

A GPRS deployment also encourages operators to create attractive applications packages and to better understand the needs and expectations of their customers. WAP applications play an important part in determining the early application packages.

The experience and market presence gained from GPRS will make it possible to attract and retain a broader customer base for 3G services.

Figure 15. 3G take-up



## INITIAL GPRS STRATEGIES

To successfully deliver mobile data services, there is a clear need to know more about end-users than is necessary when offering voice-only services. Mobile data consumers expect end-to-end solutions, including fully capable terminals, and application and content packages.

Operators are expected to offer simple application packages, with specific benefits messages targeted at appropriate customer segments. The initial customer segmentation will be greater than today, allowing the operator to quickly target broad sections of the market. Over time, as customer knowledge increases, the segmentation may become more sophisticated, and application packages will become more varied.

Recent discussions have shown that in order to encourage market growth the operator's marketing messages need to focus on the end customer benefits, not on the underlying technology. The applications chosen for initial launch should be easy to use, and have broad market appeal. These applications might include chat, WAP services, and person-to-person messaging.

Table 1 shows the tariff structures set by some of the first operators to launch GPRS

services. These tariffs are based on a tiered flat-rate structure, with users billed in buckets/bundles of megabytes – the simplest proposition for the customer. However, we should expect significant changes to these tariffing models by mid to late 2001 as customers begin to move to GPRS in larger numbers. Pricing models will also most probably vary from market to market.

Customer services are of course another important factor to consider when introducing GPRS-based services. Data applications involve multiple systems, and efficient fault reporting and diagnosis will require re-training of existing customer services personnel or the deployment of a new category of more technical agents.

To bring world class application and content packages to the marketplace quickly, operators may need to partner with one or more external parties. GPRS enables early development and adoption of 3G applications and business models. Early players in the mobile Internet world will have the opportunity to sign up the most powerful industry partners. For the operator and service provider, market positioning will be as crucial to success as the 3G services to be launched. GPRS enables market players to position themselves as leaders in 3G applications and services.

*Keep it simple – simple applications and solutions have always proved successful*

*Table 1. GPRS Tariffs in Europe (Dec 2000)*

*Source: Strategy Analytics*

Tariff plan	Monthly \$/data	Run-on
<b>Commercial trial</b>		
Sonera GPRS	\$14.50 / unlimited	no charge
Sonofon GPRS	\$11.70 / none	\$2.35–\$2.90
<b>Higher volume</b>		
BT Cellnet GPRS	\$25.25 / 50MB	\$2.52
Europolitan GPRS Surf	\$39.60 / none	\$2.51
TMN Data (GPRS)	no fee / no data	\$2.18
<b>Low volume / WAP only</b>		
Europolitan GPRS WAP	\$22.00 / no data	\$17.60
TMN WAP (via GPRS)	\$2.40 / unlimited	no charge

*For the end-user richer interaction of services*

## MOVING TO THE ALL-IP ARCHITECTURE

### A Natural Migration

Mobile networks will continue to evolve, from the 2G networks of today to initial 3G systems and on to All-IP networks of the future.

*For the service provider – speed in service introduction*

The introduction of GPRS heralds the arrival of IP technology into the mobile network and 3G is optimised for evolution to IP. GPRS will also play an important role in the introduction of IPv6 (IP version 6). Key factors with IPv6 are that it enables IP addresses for the growing market cost-effectively enough and provides also service quality classes.

*Staying on the lowest cost-curve*

3rd Generation mobile networks will certainly accelerate the shift towards mass-market real-time IP-based applications. 3rd Generation mobile networks provide new technology that expands the available radio spectrum needed to support the growing demand for packet services. The key forces driving the evolution of mobile networks towards IP include:

- end-user demand for a richer, more integrated mobile communications experience
- revenue requirements that will demand shorter and more efficient service times-to-market
- powerful new economies of scale in service delivery technology

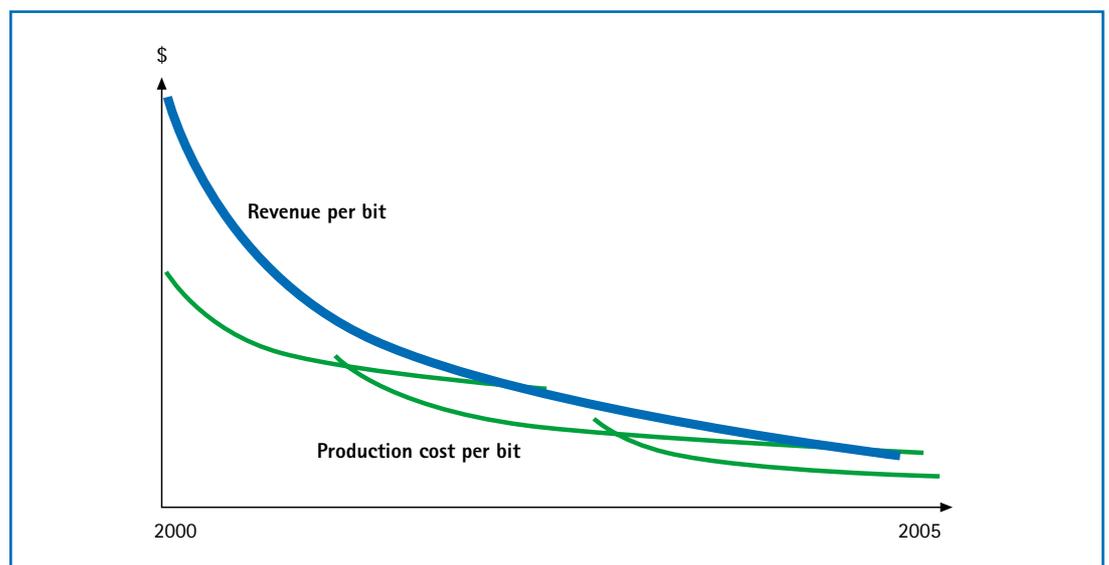
From the end-user perspective, the primary benefit of IP is in integration and interaction of services creating the rich end-user experience. Voice, video, messaging and other services can all interact within a single mobile communication session.

For the service provider, IP will support faster and simpler service creation and integration. Operators can create their own service packages faster to differentiate themselves and build more rapid and sustainable revenue streams. Astute operators will also leverage the offerings of creative third-party partners to expand their service capabilities, generate new revenue and encourage subscriber loyalty.

Up to now the industry has focused on the adoption of IP transport, IP mobility (e.g. GPRS, Mobile IP), and VoIP protocols (e.g. SIP). As today's networks evolve, IP capabilities will be added in a gradual manner to the existing circuit switched networks.

The All-IP target architecture, including both core and radio networks, will eventually support faster service introduction, greater cost efficiency and continually improving QoS performance.

Figure 16.  
All-IP improving efficiency



## CONCLUSION

Mobile communications culture has changed with SMS, which is a fast-growing revenue stream for operators today. The SMS success is spreading from the early markets showing positive effects on the average revenue per user. SMS has clearly shown its potential in person-to-person communication. It has also become a bearer technology for profitable value added services and the number of these services is growing rapidly. Multimedia Messaging following the SMS path is expected to be a major driver for person-to-person communications in the next few years.

Initial WAP experiences are turning into successful offering and WAP is gaining user acceptance. Growing evidence shows that churn among WAP service users is falling as loyalty and usage increases. This facilitates a build-up of a loyal customer base for other mobile data services to come. The possibility of downloading an initial WAP service page with GPRS up to three times faster than before, added to the always-on capability of GPRS, will boost WAP services.

GPRS will be used to meet the growing demand of mobile data services in a mass market. Networks, terminals, and first tariffing models are already in place to enhance existing services with GPRS and to launch new services enabled by GPRS.

All experience gained today in tariffing, processes, and partnership models will speed up the take-up of 3G services. 3rd generation will further enhance the user experience, but is also optimised for offering services in the IP world and thus allows the further cost-efficiency for a mass market.

Consumers are more demanding today than they were in the early days of GSM. They take the GSM quality as a reference for the new services. But consumers have also indicated a clear willingness to subscribe and pay for the new services, assuming operators can meet their expectations for connectivity, richness of content, QoS and value. In this process, continued, incremental steps in all sectors will build the 3G revenue streams and cost-efficiency.