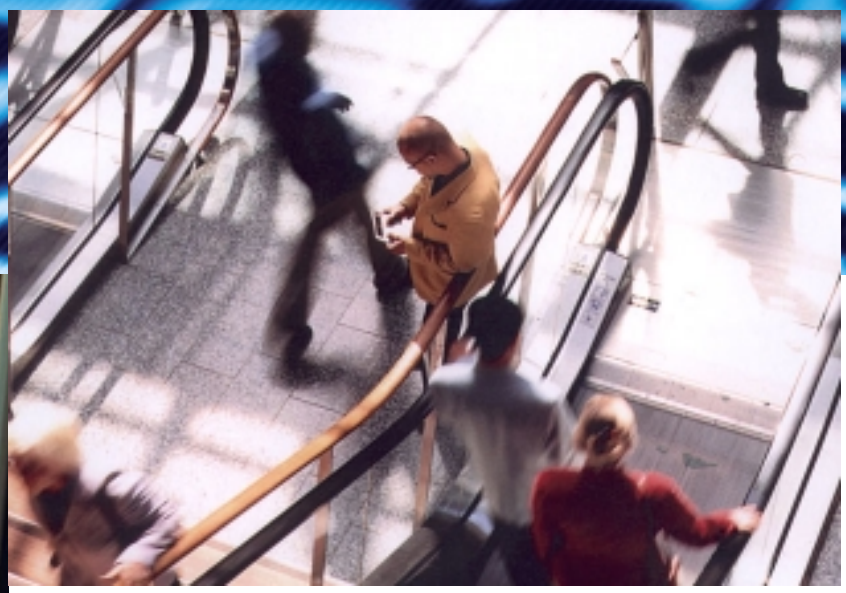
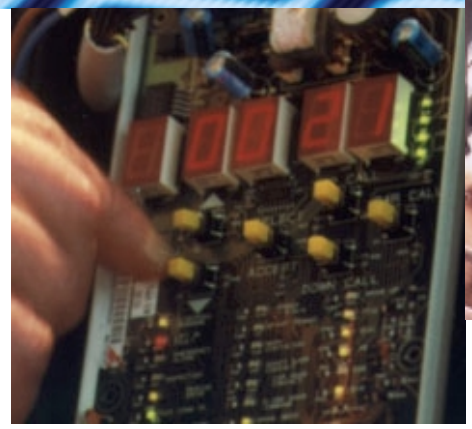
White Paper

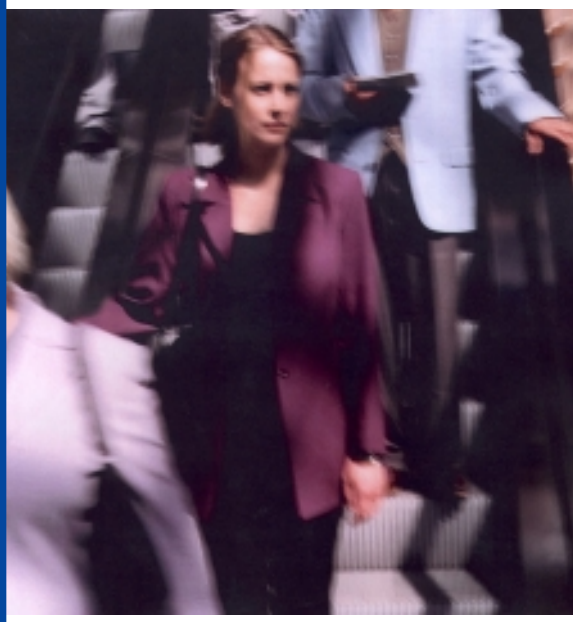




M2M - New Opportunity in Wireless Data Business

NOKIA
CONNECTING PEOPLE

Contents



Executive **summary**

We have recently witnessed a series of fundamental changes in communication culture and technologies. Almost twenty years ago, the introduction of mobile phones freed personal voice communication from location. Subsequently, customers learned to satisfy some of their other communication needs using data services on their phones. A wireless connection to the Internet was introduced for mobile phone users, expanding their communication options even further.

The next step in the evolution of communications is extending this connectivity beyond human beings. To enable the vision of a mobile information society and true independence of location, we have to enable communication between individuals, devices and systems. This paper introduces Machine-to-Machine, or M2M solutions and outlines the business opportunities they offer. In the context of wireless data, M2M solutions are an ideal bridge from 2.5G business to the 3G world. The service-focused business models of tomorrow may already be here in the form of M2M solutions.

Nokia supports open technologies in M2M business and will actively drive the market towards global M2M standards. Our partners in M2M business will benefit from our long experience and competitive position in the cellular marketplace. Furthermore, the highly advanced Nokia M2M Platform, including GSM terminals and M2M Gateway, will benefit corporates, cellular operators, application developers and service providers in creating and maintaining industry-leading M2M solutions.

M2M combines telecommunication and information technology to automate processes, to integrate all company assets with its IT system, and to create value-added services.

2. Wireless data market evolution

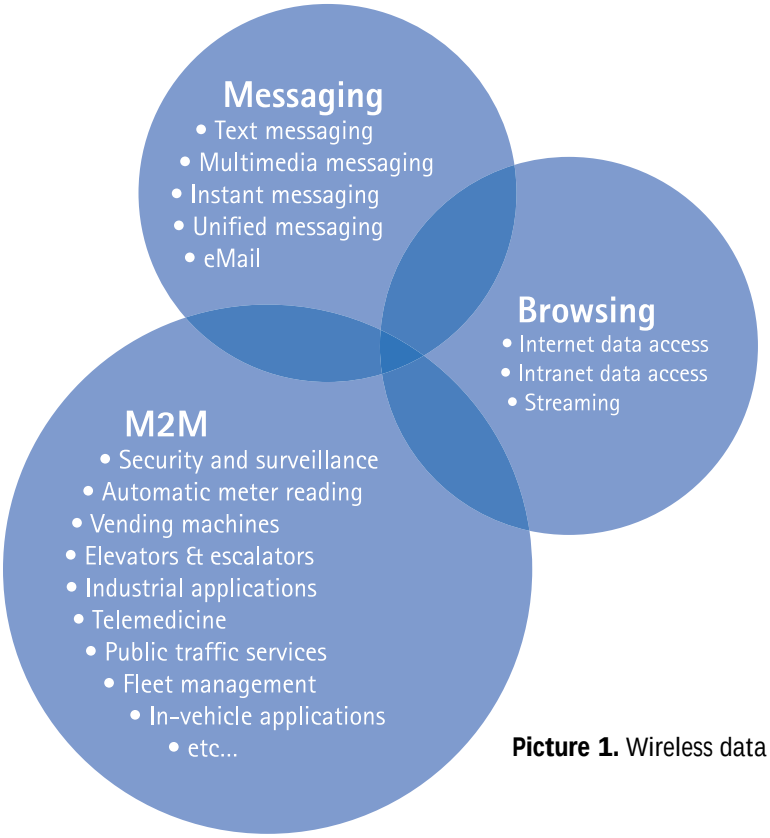
As we move rapidly towards the third generation (3G) mobile world, more attention than ever is being paid to the wireless data market. While the core of the business remains in the saturated and very competitive voice market, there is a growing demand to look for alternative revenue streams. To achieve future growth in the diversity of data business will require completely new strategies and business concepts to be conquered. SMS (short message service) has already evolved from a means of personal communication to a popular service delivery medium and a real revenue source for innovative cellular operators. The growing popularity of Wireless Application Protocol (WAP) is another good example of how technological innovations influence the process of service evolution.

But we have only taken the first steps towards the future mobile information society. The wireless data market is continuously growing and it would be shortsighted to believe that web browsing is all that the wireless data business will be about. Content is the real driving force behind the business. Strong service and application concepts are required as the foundation of successful business cases before the data market will really take off. In addition to the horizontal applications relying on web content, more and more specialised services with tailored content will be introduced.

As the number of different wireless data uses and applications increases, it is confusing to group together the full variety of applications from web browsing to remote device management. A more extensive picture of the business may be attained by analysing wireless data services and applications based on end-user identity, network environments, access methods and interaction modes. When concentrating on communications and the means of data access, three types of wireless data services can be identified that all have unique requirements for service creation and strategy development. Picture 1 describes these three segments: Messaging, Browsing and M2M.

This paper outlines the fast evolving business area called M2M communication. In this context it is to be understood that M2M stands for a much broader business scope than that of telemetry or telematics, even though both terms are often used to refer to M2M business in general. Clarification of M2M segmentation will be given in Chapter 3.

Although M2M applications are here discussed as a separate group, it should be kept in mind that they may be combined with other applications to create solution packages that best satisfy overall customer needs.



Picture 1. Wireless data segments.

3. M2M Applications

M2M refers to the terms machine-to-machine, man-to-machine, and machine-to-man. This segment covers applications in which wireless data is used to create a link between systems, remote devices or locations, and individuals. This link is typically used for collecting information, setting parameters, sending indications of unusual situations or taking care of an on-line transaction.

New M2M applications are continuously emerging, and they may serve almost any business area and physical environment. It is fair to say that only imagination limits M2M applications. However, in order to give a concrete picture of the total business potential, the best known M2M applications are presented here and grouped based on their uses and application environments.

Telemetry
- AMR (utility meters)
- parking meters
- industrial metering
- elevator control
- vending machine control

Telematics / in-vehicle applications
- driver navigation
- driver safety
- vehicle diagnostics
- mobility services
- traffic information

Public traffic services
- traffic information
- electronic tolling
- schedule synchronisation
- optimising road usage
- speed cameras
- changing traffic signs

Industrial applications
- process automation

Security and surveillance
- access and mobility control
- surveillance cameras
- asset monitoring

Sales & payments
- vending machines
- POS terminals
- gaming

Fleet management
- cargo tracking
- route planning
- order management

Telemedicine
- remote patient monitoring
- remote diagnostics
- equipment status tracking
- staff scheduling

Public services
- information kiosks
- web access points

4. Characteristics of M2M solutions

The M2M business is about creating solutions aimed at improving existing business or creating new opportunities. M2M combines telecommunication and information technology to automate processes, to integrate all company assets with its IT system, and to create value-added services to be used by the employees or customers of a company.

M2M solutions are often vertical applications tailored to serve the specific needs of one company or corporate body. The ultimate goal is to increase the performance and competitiveness of the company and that may be achieved through increased efficiency or better service. Although some of the M2M solutions are internal to a company and focus is on improving processes, an ever-growing number of M2M solutions also aim to serve the customer base of the company.

M2M solutions should be designed to grow along with the company and its needs. Technology development or changes in the business environment may create a need to introduce new applications or services. The following example illustrates an M2M solution that develops over time and that finally combines both company internal applications and customer services. It even generates new business.

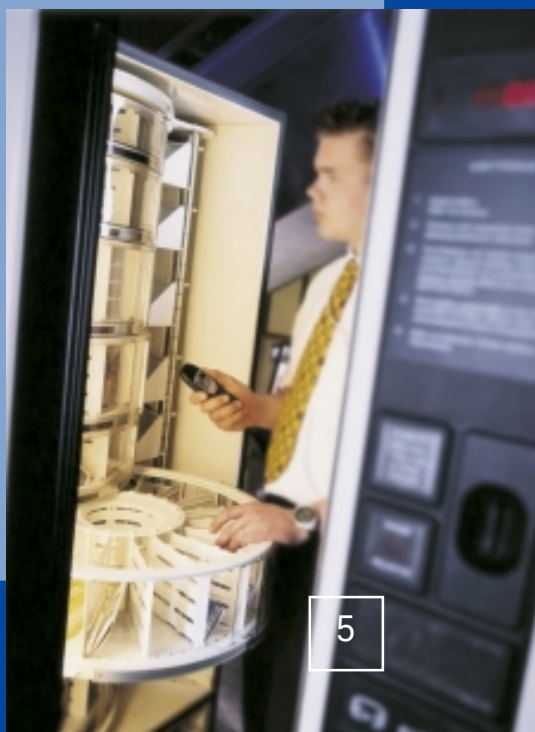
Similar types of opportunities as in this example can be found in almost any segment or environment. The solutions just have to be tailored to serve the needs of each specific business. M2M solutions should not be seen as narrow vertical applications, isolated from the external world, but rather as a tool to integrate devices, applications, people and companies to become interactive parts of the mobile information society.

An M2M Solution for a Vending Business

The first target of the solution is to minimise the costs of vending machine operation by using remote monitoring, data collection and configuration of the machines. Maintaining optimum stock in each machine, proactive maintenance, immediate fixing of malfunctions and changing prices remotely are just few of the alternative ways to improve efficiency that this telemetry application provides.

The M2M solution in the vending business may be expanded by providing the customers with the possibility of mobile payment. In addition to getting rid of the trouble and cost of handling coins, mobile payment increases sales. The mobile payment solution can be implemented today in co-operation with a mobile operator, and the evolution of mobile handsets will enable new concepts in the future. Creating a direct link to the end user through his or her personal handset will for the first time make it possible to build customer profiles and provide personalised services and offerings to customers based on their individual needs.

The next step of the M2M solution in the vending business could be expanding the business scope of a vending operator. The M2M-enabled machines could be used to provide information or content - e.g. news or games - that are financed by a third party content provider. The same content may also attract people to the machine and make them spend an extra dime for a snack or a bottle while there.



5. M2M Business Opportunities

5.1 Corporate bodies

The obvious beneficiaries of M2M applications are corporate bodies, the customers of M2M solutions. Companies are constantly looking for new ways to increase efficiency, cut costs and improve customer service to gain a competitive edge in their core business. The possibilities raised by M2M solutions are already widely recognised in several industries. When competition in the traditional business area is getting more intense and eating into profits, expanding the business - for example, in terms of service provision -- with the help of an M2M solution may be the way to maintain profitability.

An M2M solution integrates all the assets of a company in one complete system, including those in the field and even around the world. Labour costs can be minimised when needless site visits for service, maintenance, device updates and so on, can be avoided thanks to on-line connections with all devices. Manpower can thus be used more productively. The amount of downtime can be minimised or even eliminated, and the risk of fraud can be diminished by emptying coin boxes in time or getting rid of cash as a payment method. Sometimes legislation sets requirements that can be best fulfilled by introducing an M2M solution.

Many businesses will find that M2M provides the way to make their operations more profitable than ever before, because M2M solutions both improve competitiveness and enable them to focus on core business development. Thus there are plenty of untapped business opportunities for providers that understand these needs and are able to offer turnkey M2M solutions for the corporate sector.

5.2 Cellullar operators

With the voice market saturating and competition in the cellular business tightening up, cellular operators are looking for new revenue streams. For an operator, M2M solutions provide a new, appealing opportunity to strengthen its position in the profitable corporate sector and to expand its business scope towards providing total solutions.

From the operator's point of view, the M2M business case is ideal in many ways. The traffic can often be concentrated in the off-peak hours to balance capacity utilisation, and much of the traffic flow is predictable. With M2M solutions it is possible to expand the customer base to new segments, and win all cellular traffic of new clients by bundling traditional telecoms services with company-specific solutions. Furthermore, M2M solutions make it possible to generate significant additional revenues with a minimum of initial investment.

Those operators that choose to take the role of a solution provider in M2M business, rather than that of a data carrier provider, have a huge opportunity to drive the fast growing M2M market. The natural position and relationships of a cellular service provider are an extremely good basis from which to enter the M2M business. M2M solutions also complement the existing service portfolio very well. The first movers have already shown that a clear strategic focus and competence development in M2M business will be generously rewarded.

5.3 Service providers

Perhaps the least noticed and understood interest group in the M2M business is the service providers. Nevertheless, service providers play a critical role in developing and expanding the M2M business and their significance will only increase with the growing demand for M2M solutions.

The business scope of an M2M service provider may vary considerably. Probably the best known business model is that of an ASP (application service provider), which manages and hosts software on a basis of renting or leasing it to companies wishing to minimise the cost of their IT resources and equipment. In addition, M2M service provision may include application development, system integration, MVNO (mobile virtual network operator) activity or content provision, or a combination of any of these.

M2M service providers may play the role of a cellular operator, but as the demand for M2M services increases there is a need for a broader spectrum of service providers. M2M service provision is an outstanding business opportunity for existing ASPs that may use M2M services in expanding their portfolio for existing customers or to penetrate new businesses. Also companies currently acting in completely different fields, such as manufacturing, may find M2M service provision gives them a way to expand their business scope and fully capitalise their business understanding. It could raise their profitability to a whole new level.

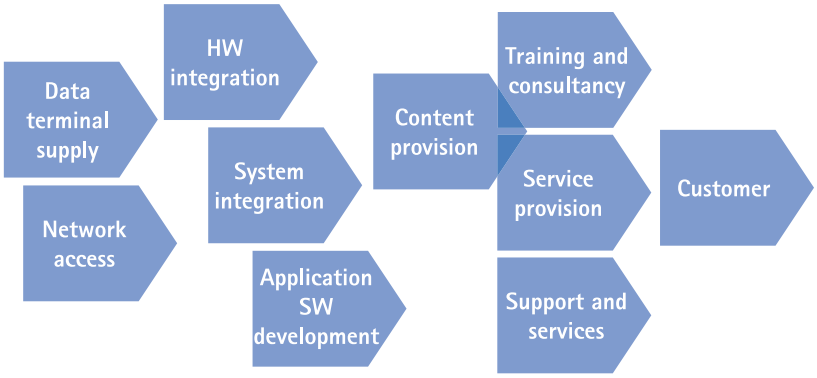
6. Value systems in M2M solution creation

The overall business trend of partnering and focusing on core competencies applies also to the M2M business. Specific knowledge of the business environment, communication technologies, SW development, HW integration, customer care and billing are required to create a successful M2M solution. So it is always produced by a joint effort from experts in different fields.

As described earlier, the variety of M2M application segments is almost limitless. The solution requirements and optimal division of roles between parties within the value systems differ accordingly. Some roles, such as those of service provider or end user, are simply irrelevant in some cases. Furthermore, one company may adopt several roles within the value system if the required competencies are in place. The optimum division of value system shares must be defined individually for each M2M solution.

One of the greatest challenges of the M2M business seems to be mastering the complexity of the value network in providing total solutions. Customers don't want to purchase the solution piece by piece from different companies and instead of reliable components they want end-to-end solution reliability.

Therefore, the winners of the M2M race will be those companies who succeed in establishing and managing partner networks with a top competence portfolio for creating end-to-end solutions.



Picture 2. M2M Value System.

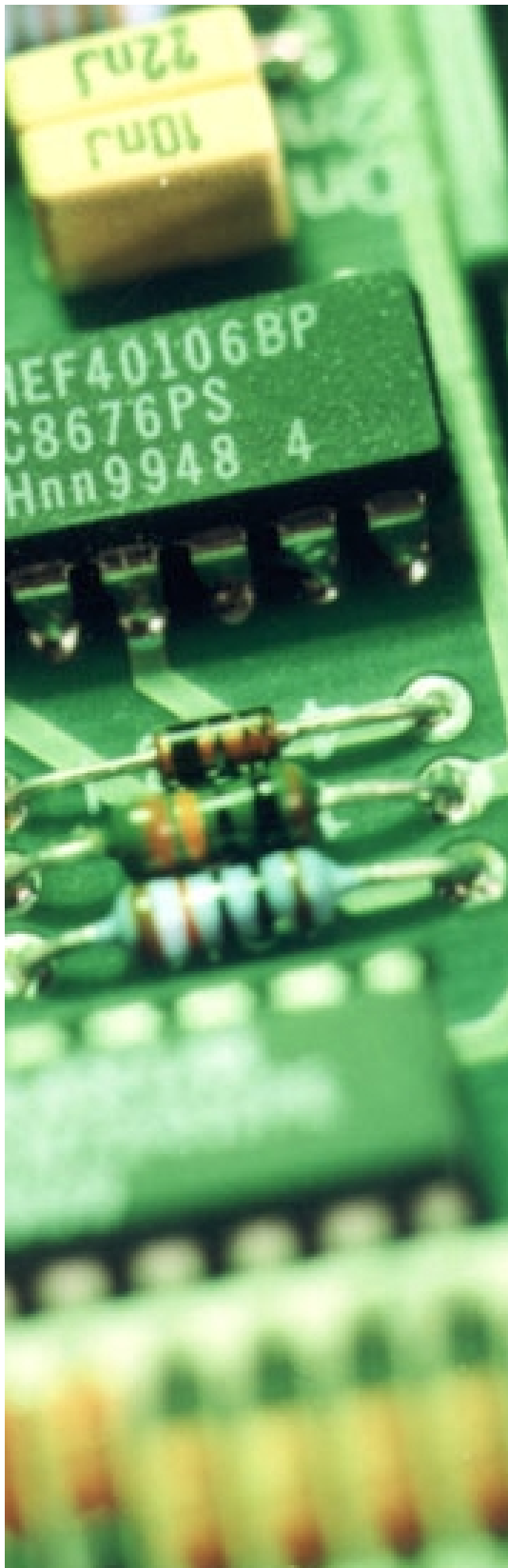
7 Requirements of successful solutions

The requirements of a successful M2M solution are reliability, upgradability and affordability. Today it is not always easy to meet all these requirements, and even though M2M business is in a phase of rapid growth, even more focus will be needed to fulfil these three basic requirements. Application development and system integration are often defined as the most problematic areas of M2M solution creation. So developing efficient tools in this area is one of the key issues in meeting M2M solution requirements.

M2M solutions will typically link a company's remote assets (such as vending machines, vehicles and other equipment) to its existing IT infrastructure. Therefore, expertise in both cellular and IP technologies will be required for effective application development. The reliability of a solution can be guaranteed only by taking an end-to-end approach to development work. In addition, some applications set higher requirements for security than others, such as in the case of mobile payment or transferring price information. Efficient information security measures such as data encryption and authentication are needed to provide adequate security.

Upgradability means that the customer must be able to take advantage of the latest technology, whether in terms of lower equipment costs, higher data rates, or more affordable operating costs. However, solution upgrades cannot lead to expensive re-development cycles, because this is like to lead to the loss of a big part of the benefits achieved with the solution. Therefore, easy upgradability of both SW and HW components is one of the key elements of an M2M solution.

The factors affecting the affordability of a solution are the costs of application creation, system components, operation and upgrades. The optimum cost can be reached only by considering all these factors; optimising only one of them may be achieved at the expense of the others. Application creation and upgrade costs may be minimised by selecting reliable products with efficient development tools and standard, open interfaces. Operational costs may be minimised, for example, by using different data bearers flexibly and by negotiating bulk tariffs with cellular providers.



8. Market estimate

The M2M business is in a phase of fast growth. The total number of M2M connections is estimated to exceed 100 million during year 2004. The benefits of wireless data in creating connectivity and all-IP solutions are being used more and also more widely by companies as the awareness of the possibilites increases. On the other hand, new technologies and more appropriate M2M products and paltforms enable the development of application and services that have not been possible or have been too difficult to implement before. The market share of GSM connections in M2M market is estimated to grow from 30% to 60% during 2001-2005.

Fulfilling the requirements described in previous chapters is the key to M2M market growth. This will happen while more intelligent products are being introduced and more competent players with extensive M2M strategies are entering the business and forming alliances. M2M solutions are becoming a part of any company's everyday life.

During the next few years, much of the market growth will come from after market solutions, where M2M connectivity is introduced to existing systems and products. The nature of the market is however shifting towards line-fit manufacturing. An increased number of products and systems will be equipped with data connectivity from the outset. The demand for retrofit solutions will nevertheless remain and generate part of the total volumes in the future.

GSM - The optimum technology for M2M solutions

It is obvious that solution functionality and user experience are the things that really matter to M2M customers; they simply do not want to be concerned with the underlying technologies. But when designing an application or a solution, what constitutes the best technology must to be considered carefully. This decision could have a far-reaching impact on operational costs or the possibilities for expanding the solution. There are several alternatives from landlines to proprietary data technologies. But it has become evident that, where available, GSM is most often the optimum technology for M2M solutions.

GSM is global, proven system with considerable benefits compared to other technologies. The history of openness and thorough standardisation of GSM enable the creation of truly global M2M solutions. GSM technology roadmaps are created jointly with all the major players in GSM industry to guarantee the same level of stability and global compatibility in the future.

The GSM market has faced a huge growth during the past decade and the trend is continuing. Consequently, the prices of GSM technology and communication are decreasing, benefiting M2M solutions from the beginning. In addition, the high number of GSM product and communications providers makes customers independent of a single supplier or network operator and increases their negotiating power.

A great benefit of the GSM solution is cheap and easy installation. No cable digging is needed and equipment with GSM connectivity can be easily moved from one location to another. For mobile applications, such as those in a vehicle, wireless technology is the only alternative. Further, high-level data services with full security features are already available in GSM networks and products, and there is a strong focus on developing them further to suit the needs of the consumer market.

The most important thing in GSM technology is that it enables M2M business entry now. GSM is also rapidly becoming the world's most popular 3G evolutionary route. Advanced solutions may be created today based on existing technology, and these solutions and services will create an easy evolution path to 3G business.

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