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Machine-to-Machine - Real Opportunity in Wireless Data Business

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1. Executive Summary

We have recently witnessed a series of fundamental changes in communication culture and technologies. Almost twenty years ago, the introduction of mobile devices freed personal voice communication from location. Subsequently, customers learned to satisfy some of their other communication needs using data services on their devices. A mobile connection to the Internet was introduced for mobile device 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 World and a true independence of location, we have to enable communication between individuals, devices and systems. In the context of wireless data, machine-to-machine (M2M) solutions are an ideal bridge from 2.5G business to the third generation world. The service-focused business models of tomorrow may already be here in the form of M2M solutions. Together with mobile devices targeted for personal communication, Nokia also offers a platform for creating and operating M2M solutions, thereby enabling the true exploitation of the opportunities offered by wireless data.

Nokia supports open technologies in M2M business and will actively drive the market toward global M2M standards. Our partners in M2M business will benefit from our long experience and competitive position in the mobile marketplace. Furthermore, the highly advanced Nokia M2M Platform, consisting of Nokia GSM Connectivity Terminals and Nokia M2M Gateway, will benefit corporate customers, carriers, application developers as well as service and solution providers in creating and maintaining industry-leading M2M solutions.

2. Introducing the M2M Concept

2.1 Connecting People, Devices and Systems

M2M stands for machine-to-machine, mobile-to-machine, and machine-to-mobile and is often related to the concepts of telemetry and telematics, which can be considered as subsets of the overall business scope of M2M. In the Mobile World, M2M is about combining telecommunication and information technology (IT); wireless data is used to establish a link between remote devices or locations, systems, and people. M2M broadens the scope of communication from how we have are used to perceiving it - it is not only people that utilize telecommunication and Internet technologies to communicate but the machines around us as well.

The M2M business is about creating solutions aimed at improving existing

business, creating totally new opportunities, and essentially making daily life easier. By means of M2M solutions, which are often tailored to meet the specific demands of each situation, companies can automate their processes and integrate their assets with their IT systems. The goal is to increase the performance and competitiveness of the company through increased efficiency, cost savings, additional revenues or better service levels. It is rather typical that the rationale for utilizing M2M solutions is the avoidance of physical visits, e.g., meter reading visits, and the cost savings that can be attained through exploiting the real-time information provided by the wireless data connection. Furthermore, through M2M solutions, companies can better analyse their current business and processes and thereby detect the areas that can be further improved.

2.2 The Ever Expanding Field of M2M Communication

M2M solutions are typically created for collecting information, setting parameters, sending indications of unusual situations or taking care of an on-line transaction by means of wireless data connection. There are several different application segments, in which these data links can be exploited. 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 the range of M2M applications. However, in order to give a concrete picture of the total business potential, some of the recognized M2M applications are presented and grouped based on their uses and application environments in figure 1.

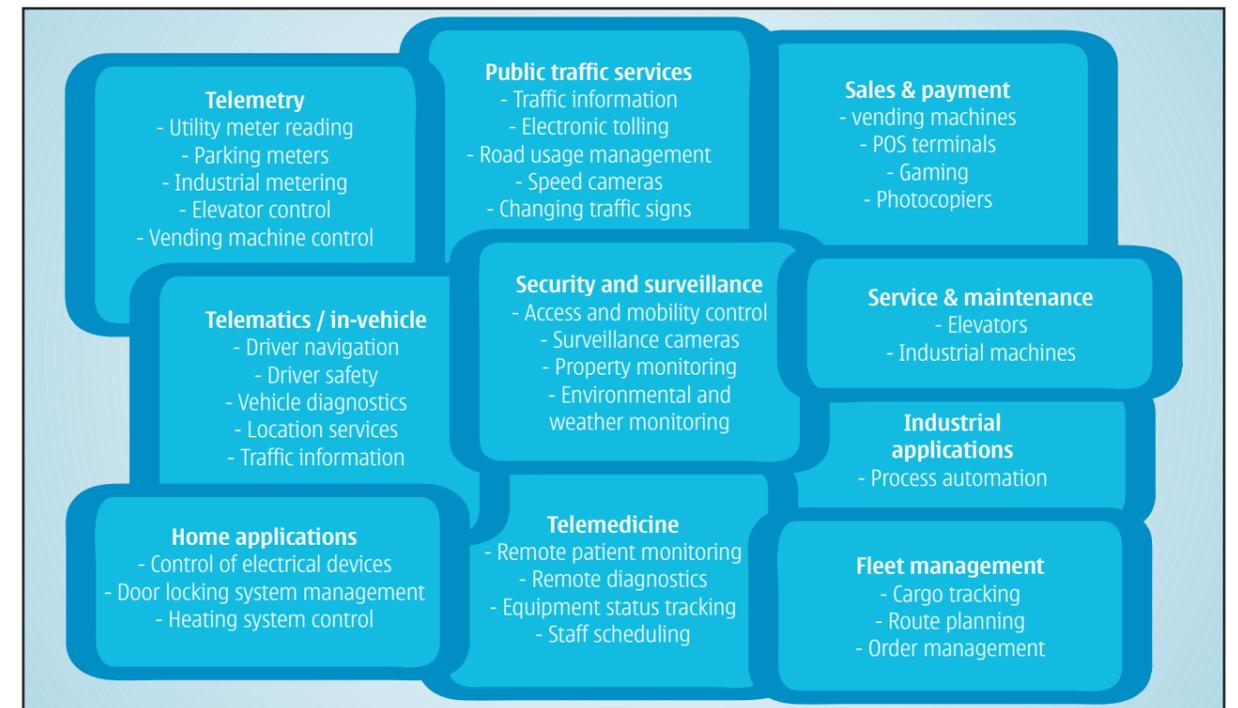


Figure 1. Some identified M2M applications.

Currently, the majority of the M2M solutions are company internal, and their focus is on improving processes within the company. However, an ever growing number of M2M solutions also aims to serve the customer base of the company by offering value adding services to them. Virtually, all the machines can be networked into the Internet. Later, these networked machines provide a number of local information points and services for mobile device users. Thereby M2M can be seen as an entity creating information and content that is needed in the fulfillment of the Mobile World vision.

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. Vending example below illustrates an M2M solution that develops over time and that ultimately combines both company internal applications and consumer services. It even generates new business.

Similar types of opportunities as in this example can be found in almost any segment or operating environment. The solutions just have to be tailored to serve

the needs of each specific business. M2M solutions should not be seen as merely narrow vertical applications, isolated from the external world, but rather as a tool to integrate devices, various applications, people and companies so they become interactive parts of the Mobile World.

An M2M Solution for a Vending Business

The first target of the solution is to minimize the costs of vending machine operation by using remote monitoring, data collection and configuration of the machines. Maintaining optimum stock in each machine, undertaking proactive maintenance, immediately fixing malfunctions and changing prices remotely are just a few of the options for improving efficiency that this M2M 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 cooperation with a carrier, and the evolution of mobile devices will enable new concepts to be applied in the future. Creating a direct link to the consumer through his/her mobile device will for the first time make it possible to build customer profiles and provide personalized services and offerings to customers based on their individual needs.

The next step of the M2M solution in the vending business could be to expand 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 draw people to the machine and make them spend an extra dime for a snack or a beverage while there.



2.3 Requirements for Successful M2M Solutions

The requirements of a successful M2M solution are reliability, upgradeability 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 efforts will be needed to fulfill these three basic requirements. As the number of different M2M solutions is high and the requirements presented by the customers are case-specific, application development and system integration are often defined as the most problematic areas of M2M solution creation. So, developing and utilizing efficient tools for this area are one of the key issues in meeting M2M solution requirements.

M2M solutions will typically link a company's remote assets (e.g., game machines,

vehicles and containers) to its existing IT infrastructure. Therefore, expertise in both mobile and Internet protocol (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 the development work. In addition, some applications, e.g., mobile payment or transferring price information, set higher requirements for security than others. Efficient information security measures, such as data encryption and authentication, are needed to provide adequate security.

Upgradeability means that the customer must be able to take advantage of the latest technology, whether in terms of lower equipment costs, higher data transmission rates, or more affordable operating costs. However, solution upgrades cannot lead to expensive re-development cycles

because this is likely to lead to the loss of much of the benefit achieved with the solution. Therefore, easy upgradeability of both software and hardware 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; optimizing only one of them could be achieved only at the expense of the others. One can minimize the application creation and upgrade costs by selecting reliable products with efficient development tools and standard, open interfaces. Operational costs may be minimized by, for example, using different data bearers flexibly.



3. M2M Solutions - An Essential Part of the Wireless Data Market

As we move rapidly toward the third generation Mobile World, more attention than ever is being paid to the wireless data market, particularly to the service offering aspects of it. While the core of the communication business remains in the increasingly saturated and very competitive voice market, there is a constantly growing demand to look for alternative revenue streams - revenue streams generated by the utilization of wireless data. In order to achieve the future growth in the diversity of data business, completely new strategies and business concepts are to be conquered. The Short Message Service (SMS) has already evolved from a means of personal communication to a popular service delivery medium and a real revenue source for innovative carriers; it is a good example of how technological innovations influence the process of service evolution and thereby offer new possibilities to enhance customer satisfaction.

But only the first steps have been taken toward the future Mobile World. The wireless data market is continuously

growing; it would be shortsighted to believe that Web browsing is all that the wireless data business will be about. As the number of different wireless data uses and applications increases, it gets rather challenging to come to grips with the full variety of these applications. By analysing wireless data services and applications through customer identity, network environments, access methods, and interaction modes, the complex field of wireless data business can be clarified.

When concentrating on communication and the means of data access, one can identify three types of wireless data service segments: messaging, browsing, and M2M. Each segment has its unique requirements for service creation and strategy development. It should be noted that M2M applications may be combined with applications from the other two areas in order to create solution packages that best satisfy overall customer needs.

Content is the real driving force behind the wireless data business. Also strong service

and application concepts are required as a foundation for successful business cases before the data market will really take off. By means of M2M solutions, the desired content can be created in bi-directional manner. M2M applications enable meaningful, interesting and tangible real-time content for the professional and consumer third generation applications.

M2M solutions will be a significant sector in wireless data business, as they enable mobile connectivity and Internet access everywhere. As noted, the importance of wireless data is increasing rapidly. Nokia will provide a full product portfolio for exploiting wireless data business opportunities - together with mobile devices targeted for personal communication, Nokia also offers a platform for creating and operating M2M solutions, enabling the true exploitation of the opportunities offered by wireless data.

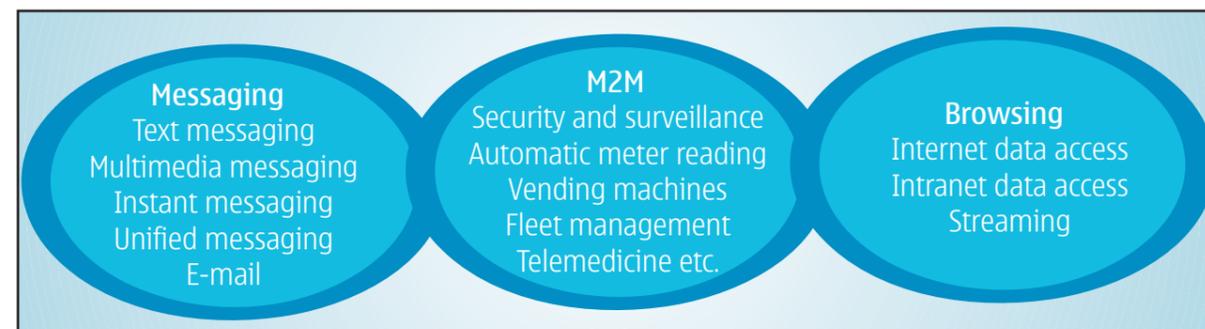


Figure 2. Wireless data segments.

4. GSM - The 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 M2M application or a solution, the question of what technology is the most suitable is to be considered carefully. This decision could have a far-reaching impact on the operational costs or the possibilities for expanding the solution. There are several alternatives, from landlines to proprietary data technologies. But it has become rather evident that, where available, Global System for Mobile Communications (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 standardization of GSM enables the creation of global M2M solutions. With the introduction of 850 MHz bandwidth beside the 1900 MHz bandwidth, widespread M2M solutions will become a reality also in the Americas. Therefore, it is not an exaggeration to state that GSM technology enables 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.

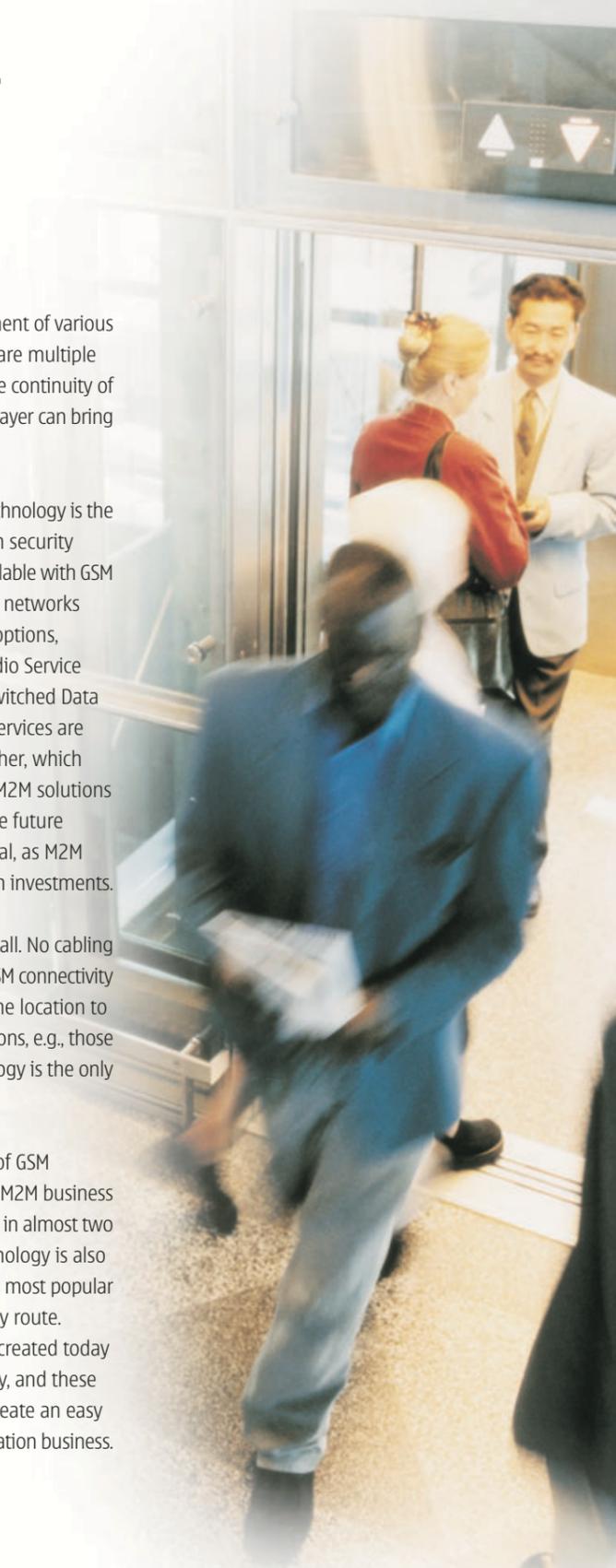
The GSM market has faced a huge growth during the past decade, and the trend is continuing. Consequently, the prices of GSM technology and communication are decreasing, benefiting M2M solutions from the beginning. In addition, the high number of GSM product and communication

providers enables the fulfillment of various customer needs. That there are multiple providers also guarantees the continuity of GSM technology - no single player can bring down the GSM market.

A great benefit of the GSM technology is the high-level data services, with security features, that are already available with GSM networks and products. GSM networks usually offer several bearer options, including General Packet Radio Service (GPRS), High Speed Circuit Switched Data (HSCSD) and SMS. The data services are continuously developed further, which enables a long life cycle for M2M solutions build on GSM technology. The future development path is essential, as M2M solutions are often long-term investments.

A GSM solution is easy to install. No cabling is needed; equipment with GSM connectivity can be easily moved from one location to another. For mobile applications, e.g., those in a vehicle, wireless technology is the only option.

The most important aspect of GSM technology is that it enables M2M business entry now. With GSM systems in almost two hundred countries, the technology is also rapidly becoming the world's most popular third generation evolutionary route. Advanced solutions may be created today based on existing technology, and these solutions and services will create an easy evolution path to third generation business.



5. Business Networks in the M2M Market - Several Business Opportunities

The overall business trend of networking, partnering, and focusing on core competencies applies also to the M2M business. Networks of companies are needed in M2M solution creation. Specific knowledge of the business environment, communication technologies, software development, total system integration, customer care and billing is required when creating a successful M2M solution. Therefore, such solutions are always produced as a joint effort from experts in several different fields. The variety of activities needed in creating and operating an M2M solution is illustrated in figure 3.

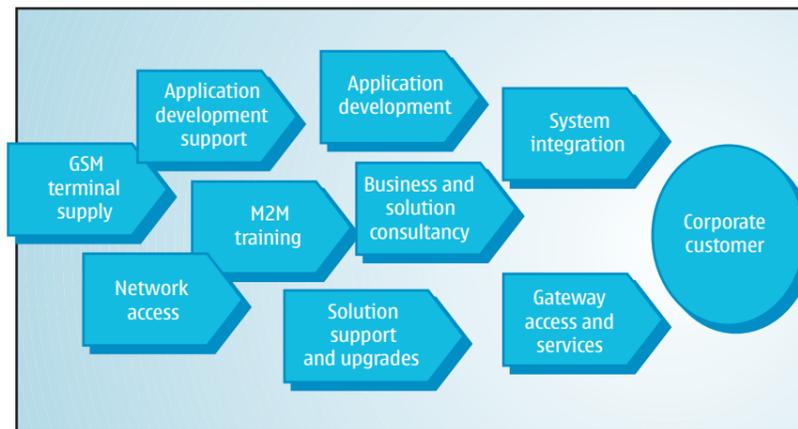


Figure 3. Activities needed in M2M business.

As described earlier, the variety of M2M application segments is almost limitless. The solution requirements and the optimal division of the roles between the parties within the value networks differ accordingly. Furthermore, one company may adopt several roles within the network if the required competencies are in place. The optimum division of activities and roles must be defined individually for each M2M solution.

One of the greatest challenges of the M2M business seems to be that of mastering the complexity of the value network which provides total solutions. Customers do not 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 that succeed in establishing and managing partner networks with a top competence portfolio for creating end-to-end solutions.

The business opportunities offered by M2M business from the perspectives of selected M2M counterparts, i.e., corporate customers, carriers and service providers, and M2M solution providers, are discussed in the following. However, these are not the only parties benefiting from M2M solutions. In fact, we all may benefit from M2M - value is generated for consumers through M2M business networks, in the form of new, better services.

5.1 Corporate Customers

The obvious beneficiaries of M2M applications are corporate customers i.e. customers of total 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 recognized in several industries. By means of M2M solutions, companies can more easily analyse their current business and processes, which enhances the continuous improvement in the company.

Furthermore, 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 a way to maintain profitability.

An M2M solution integrates all assets of a company in one complete system, including those in the field and even in various locations around the world. Operation costs can be minimized when needless site visits for service, maintenance, machine updates and so on can be avoided thanks to online connections with all machines. Manpower can thus be used more productively. The amount of downtime can be minimized or even eliminated. Sometimes, M2M solutions can also help meet requirements set by legislation. For instance, energy meters should be read a certain times a year - an M2M solution can ease this task.

5.2 Carriers and Service Providers

With the voice market becoming saturated

and competition in the mobile business tightening up, carriers are looking for new revenue streams. M2M solutions provide a new, appealing opportunity to strengthen a carrier's position in the profitable corporate sector and to expand its business scope toward providing total solutions.

From the carrier's point of view, the M2M business scenario is ideal in many ways. Traffic can often be concentrated in the off-peak hours to balance capacity utilization, and much of the traffic flow is predictable. With M2M solutions it is possible to expand the customer base to new market segments, and win all mobile traffic of the customers by bundling traditional telecom services with company-specific solutions. M2M solutions make it possible to generate significant additional revenues with a minimum initial investment. Furthermore, M2M applications offer good means for the content creation, which is especially needed in the third generation world.

The Nokia approach enables the emergence of a new business model into the M2M market - some companies, including carriers, can adopt the role of offering M2M gateway services to several different companies. M2M service providers play a critical role in developing and expanding the M2M business, and their significance will only increase along with the growing demand for M2M solutions.

Basically, offering gateway services means managing and hosting the data link between customers' remote and server applications. However, the business scope of M2M service providers may vary considerably. Probably the best known business model is that of an application service provider (ASP), which manages and hosts software on the basis of renting or leasing it to companies wishing to minimize the cost of their IT resources and equipment. In addition, M2M service provision may include application

development, system integration, mobile virtual network operator activity, content provision, or a combination of any of these.

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 business areas. Also, companies currently acting in completely different fields may find M2M service provision gives them a way to expand their business scope and fully capitalize their business understanding. It could raise their profitability to a whole new level.

5.3 M2M Solution Providers

While, in the creation of M2M solutions, value networks consisting of several companies are needed and the customer is "owned" by the whole network, it is rather evident that the customer typically wants to deal with a specific company instead of the whole network when acquiring an M2M solution. These specific companies can be defined as M2M solution providers that actually offer the total M2M solutions to the customers. Thereby, they are in the central role when interacting with the customers.

M2M solution providers will typically have competence in some particular aspect of M2M solution creation, e.g., in system integration or application software development. However, it is most likely that they need partners in their solution creation efforts. Therefore, successful orchestration of the M2M business networks is of central importance, particularly from the solution providers' perspective.

Because many corporate customers will find that M2M provides the way to make their operations more profitable than before, there are plenty of untapped

business opportunities for companies that understand these needs and are able to adopt the role of an M2M solution provider. By noticing and utilizing these business opportunities in the corporate sector, current and future solution providers can expand their business and thereby increase their revenue streams. Also, carriers can choose to take the role of a solution provider rather than that of a data carrier. M2M solutions complement a carrier's existing service portfolio well.



Abbreviations

ASP	Application Service Provider
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
HSCSD	High Speed Circuit Switched Data
IT	Information Technology
M2M	Machine-to-Machine, Machine-to-Mobile, Mobile-to-Machine
SMS	Short Message Service



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