

Smart City: MTS leadership in M2M segment



MTS

a step ahead

TABLE OF CONTENTS



| | |
|--|----|
| Introduction | 3 |
| About company | 5 |
| Telecom market | 6 |
| Development trends | 6 |
| LTE – new generation network | 8 |
| M2M: machine-to-machine interaction | 9 |
| M2M market | 10 |
| MTS: development of M2M solutions and telematics | 11 |
| Smart city concept | 13 |
| Smart city components | 14 |
| Transport | 15 |
| Energy, water consumption and disposal | 16 |
| Social infrastructure | 17 |
| Supplements | 18 |
| Supplement 1. Examples of "smart cities" | 19 |
| 1.1. Singapore Transport | 19 |
| 1.2. Seoul Technology | 20 |
| 1.3. Stockholm Ecology | 21 |
| Supplement 2. Rating of "smart cities" | 22 |
| Supplement 3. Map of "smart cities" | 23 |
| Supplement 4. "Smart city": major components | 24 |

This case focuses on development of telematic (M2M) solutions by MTS. M2M solutions are essential for building a Smart City that uses all the latest data communication solutions for improved resident convenience and economy of resources. Participants are encouraged to formulate MTS development strategy for M2M segment over the next five years, suggest a feasible approach to MTS telematic solutions monetization, and evaluate M2M technology economic and social effects.

The authors do not intend to illustrate effective or ineffective management. Certain names in this case study, together with other identification data might have been altered for confidentiality purposes. Case study data might not be valid or accurate, and also might have been altered to comply with commercial confidentiality policy. All rights reserved, unauthorized use is prohibited. In order to purchase the case and for distribution purposes please contact us: info@changellenge.com.

Andrey, being head of the strategic development department of MTS, never even imagined that the largest telecom summit would impress him so much. The main part of the conference took place against the backdrop of the Boston gulf on a boat cruising along the north-eastern coast of America. A magnificent view of the business center of Boston opened aboard the yacht. This was an exciting format for a conference: the lower deck of the boat accommodated a conference hall having room for about 500 persons and equipped with video broadcasting facilities, projectors, special areas for discussion. The boat had totally everything that is needed for an active discussion of the most topical subject in the telecom area—M2M—technologies¹. The today's discussion was dedicated to implementation of this technology for development of intelligent cities — and this was the topic Andrey came to the conference for. Of all others, the machine-to-machine interaction in the large cities of Russia over the past six months has been the top priority for MTC and a personal job task of the head of strategic development department. The presenters reviewed the most interesting examples of European, American and Asian cities: Amsterdam, Singapore, New York, Boston ...

At today's session of the conference, Andrey made acquaintance with the representatives of the American largest network operator, and they gave him every detail on how to efficiently control the entire city infrastructure by means of gadgets supporting sim-cards. Though still noticeably in arrears, Russia has already made quite a number of steps in this direction, and the western colleagues were very excited to hear about MTS success in the projects of “intelligent Housing & Public Utilities (HPU)” in the Volga region, “intelligent water supply” in Nizhni Novgorod, “intelligent transportation” in Samara, Yekaterinburg, Ufa, and other cities. But, the projects his colleagues presented him were just implausible!



Standing on the deck during breaks between sessions and musing on the quietness of the Boston gulf, Andrey considered. For several years already, MTS has been deeply involved in promoting telematics — the company owns about 50 % of the M2M market. Just a few days before going to the conference, during the final meeting, the company management adopted a new strategy of its development with a focus at strengthening its positions in the M2M segment over the closest 3-5 years, and increasing the revenue from data transmission in means of various gadgets by 30 % every year³. «It has already been long since the mobile networking overran the confines of conventional concepts of telecom-services. The main driver for the mobile network market growth these days is the data transmission services.

¹² Machine-to-machine interaction (telematics, machine-to-machine interaction, M2M), see details below in the text

³ The strategy described in the Case may not coincide with the actual MTS strategy

Systematic infrastructure updating, provision of carpet covering by hi-speed networks in large resident places allows for active implementation of the services based on high-speed data transmission», — Andrey recalled the words of his manager.

The management has challenged Andrey with a task to articulate a strategy of business development in the M2M segment — provision of “smart” solutions for a city and its social services to satisfy the primary urban objectives and issues. For the company, this also means a need for a stable profit by monetization of M2M-services and data transmission traffic from various gadgets.

Before the end of month, Andrey will need to elaborate a strategy of development in the M2M-technology segment for the nearest five years. This strategy must include development a mechanism of monetization of the company’s M2M-services, and identify in particular how actually should an efficient complex of “smart” solutions and social services look like to facilitate development of the urban environment, being formed on the basis of data transmission networks capabilities. It will also be necessary to work out how exactly to increase the profitability of such services and their contribution to the revenue structure of the company.

The announcement of the commencement of the next conference session has brought Andrey out of these speculations. He will surely make note of every successful practice of his western colleagues, will analyze which technology concepts in terms of mobile services and applications can be used on the pilot ground in Moscow.

Andrey has made up a plan in his mind’s eye, which he will certainly follow once back at home:

- 1) review various areas and spheres (from industrial to social), utilizing data transmission networks and gadgets in Moscow;**
- 2) conceive a strategic approach to development of promising areas and MTS strategy of achieving leadership in the M2M segment;**
- 3) describe the financial and social impact — the way the urban problems may be resolved by means of the data transmission technologies and MTS networks.**

Andrey is positive of the fact that MTS has every chance to become a leader at the dramatically growing market of machine-to-machine interaction. This will require thinking over a competent strategy of presenting the clients to popular, innovative, reliable and high-quality M2M-services and forming a stable business model supporting these technologies. And this conference will surely be of great service to him!



Mobile TeleSystems OJSC ("MTS") is the leading telecommunications group in Russia and the CIS, offering mobile and fixed voice, broadband, pay TV as well as content and entertainment services in one of the world's fastest growing regions. Including its subsidiaries, the Group services over 100 million mobile subscribers.

The Group has been awarded GSM licenses in Russia, Ukraine, Turkmenistan, Armenia and Belarus, a region that boasts a total population of more than 200 million. Since June 2000, MTS' Level 3 ADRs have been listed on the New York Stock Exchange (ticker symbol MBT). The Company's shares have been listed locally on the Moscow Exchange since November 2003 under the symbol MTSI. The free float of the Company's shares is approximately 48.54%. MTS is 51.46% majority-owned by Sistema JSFC, the largest publicly-traded diversified holding company in Russia and the CIS.

MTS launched its current brand in 2006, building on the reputation as the leader and highest quality operator in the region. The brand was developed to attract customers in a variety of cultural, socio-geographic and income segments with the consistent message of quality and leadership.

The strength of the brand was recognized internationally in 2008, when MTS became the first and only Russian company to enter BRANDZ™ Top 100 Most Powerful Brands, a ranking published by the Financial Times and Millward Brown, a leading global market research and consulting firm. Also MTS has made its way onto the Millward Brown Optimor list of the ten most valuable global telecom brands, reaching ninth place for 2013 with a brand value of \$10.63 billion.

MTS's revenues grew by a solid 5% year-over-year to RUB 190 bn in H1⁴ 2013, in line with management expectations, with Russia (88%) and Ukraine (10%) the key revenue-generating markets. The company's appears to be on track with its strategy of increasing smartphone penetration (28% of all registered mobiles on the MTS network -- the highest rate in the peer group) by selling low-cost devices with the aim of increasing data usage. The 39% growth in the use of data services drove revenues higher in Russia. The company sees revenue growth of 5-7% in its core Russian and Ukrainian markets in 2013-2015 and has revised its EBITDA margin guidance to at least 43% in 2013, while in 2014-2015 the margin is expected to stay at around 42%. MTS's results in the first half of this year reflect the resolution of several operational issues that had been weighing on its performance, such as the settlement of litigation over Kyrgyz unit Bitel and the discontinuation of operations in Uzbekistan. The return to profit (RUB 42 bn compared with a loss of RUB 7.5 bn in H1 2012) was aided by these settlements (overall positive impact of RUB 15 bn). However, on the downside the company posted an foreign exchange loss of RUB 4.6 bn.

⁴ First half-year

Development trends

MTS is a leader at the Russian telecom market: the company keeps hold of 31 % of subscribers. The shares of “MegaFon” and “VimpelCom” make up 27 and 24 % of subscribers respectively. Around 10 % of the market is owned by Tele2, which is not represented in Moscow. The subscriber base in the capital is distributed among the “big three” companies: 38 % for MTS, 35 % for “VimpelCom”, and 26 % for “MegaFon”.

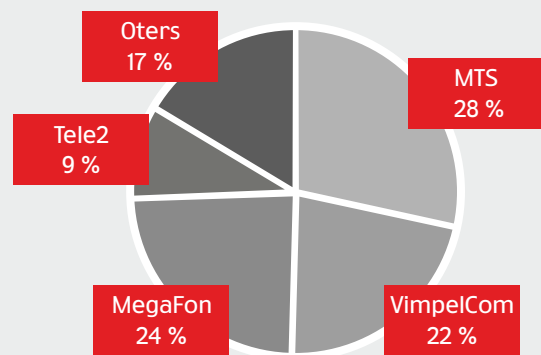
These days, we can speak about saturation of the telecom market: all-in-all, the struggle for subscribers is already over, the growth of new subscriber quantities is moderating. As of the second quarter of 2013, the penetration coefficient of mobile networks amounts to 150 %, i.e. two subscribers accrue three sim-cards. The telecom operators are working their way depthward, and not broadwise: they develop services and plans for existing subscribers. On second thought, it is possible that the law of mobile slavery abolition (making an opportunity to preserve the phone number while switching

to another operator)⁵, which officially came into force on December 1, 2013 года (but de facto, will not become effective until April 1, 2014), can change the subscriber distribution situation. The effect of redistribution are so far difficult to forecast, although an assumption has a right to exist that competition will grow stronger, and the winners will be the operators, which can offer more flexible plans, more state-of-the-art solutions and high quality of communication.

One of the prominent trends over the past 2-3 years was the massive spread of smartphones, which took place due to technological breakthrough. Russia is in the arrears in terms of smartphone penetration to market as compared with the leading countries. This indicator in Russia only forms 36 %, while in Great Britain it strikes 62 %, in the USA and Canada — 56 %, and in Singapore the penetration of smartphones is one of the highest in the world and makes 72 %.

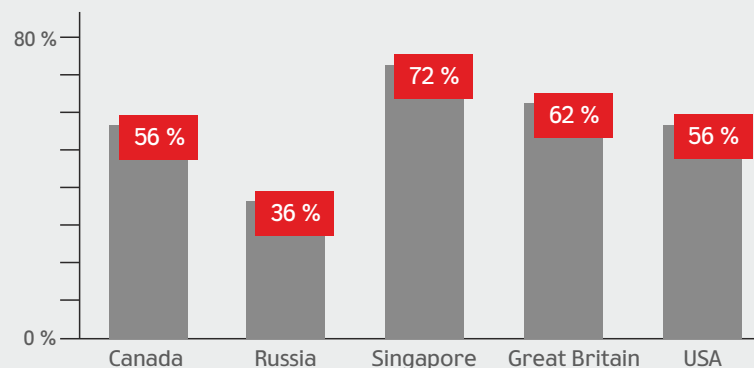
Such wide spread of smartphones sets another important trend in the telecom area — the growth of the data transmission segment. As per the Ericsson Mobility Report, over the period of the first quarter of 2012 through the first quarter of 2013, the data traffic volume has doubled, and it is anticipated that by the year 2018 it will increase 12 times.

Distribution of subscribers by Russian operators



Source: ACM-consulting

Spread of smartphones



Source: Our mobile planet, Google

⁵ <http://www.rg.ru/2013/07/22/svyaz-site-dok.html>

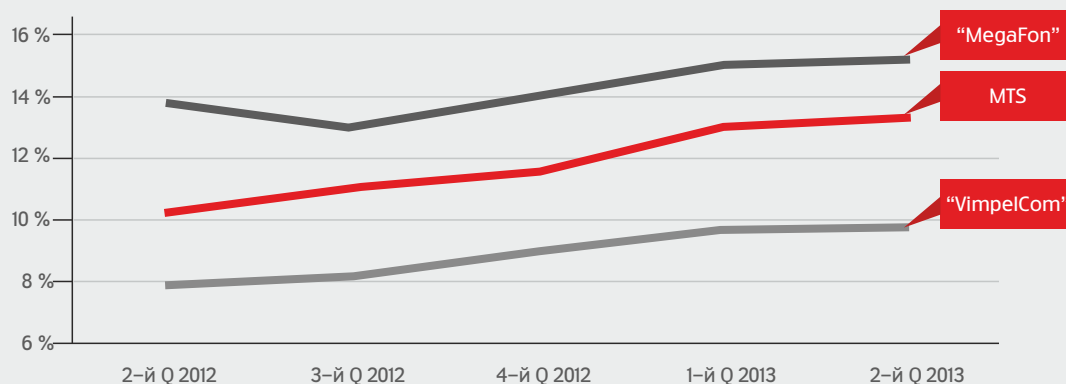
Development trends

The global trends in Russia are also visible. The MTS representatives point out that the mobile business today reorientates from voice services as a base mobile service to development of mobile data transmission. The monthly volume of input traffic per MTS subscriber has more than doubled over 2013, up to 999 Mb, and almost equals to that of “MegaFon” (1,254 Mb).

The dynamics of the mobile data transmission share over the past year is positive. The data transmission share correlates positively to commercial effectiveness.

Over the year 2013, the quantity of mobile Internet users exceeded 43 % of the total quantity of MTS subscribers. The daily volume of data transmitted by means of the most popular 3G⁶ technology, has increased from 2,600 to 4,300 Tb. All-in-all, the volume of Internet traffic consumed by MTS subscribers has doubled as compared with 2012. Transmission of data and consumption of media content require Internet speeds higher than 3G. Therefore, the capabilities that become available to smartphone users give rise to another large-scale trend in the telecom area — deployment of the fourth generation network LTE.

Mobile data transmission share in revenue structure, %



Source: Bloomberg

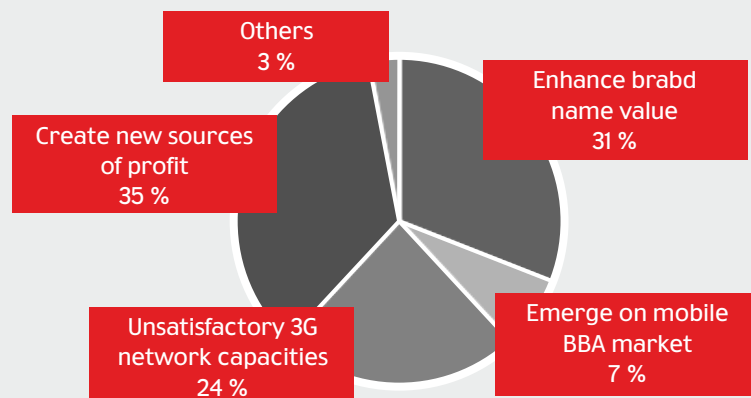
⁶ 3G (“third generation”), third generation mobile network technology — a range of services combining both the high-speed mobile access to Internet services, and radio communication technology creating a data transmission channel

LTE — new generation network

LTE⁷, or 4G (“forth generation”), is a mobile network technology, which supports data transkission speeds of over 100 Mbit/s (up to a max of 1 Gbit/s)n and allows for three basic services: voice, data and video transmission. The objective of LTE is to eliminate the difference between the wire and wireless connections.

By September 2013, 81 countries worldwide reported 213 commercial LTE networks, and a growth of up to 400 networks in 120 countries is forecasted by 2017. A presumable number of subscribers will grow from 100 million in mid-2013 up to 900 million by end of 2017. The share of five countries (USA, Canada, Japan, South Korea, and Australia) is about 90 % of LTE-connections. The most rapidly developing LTE market is in Korea, which became the first country having a hundred-percent coverage. It was here that the VoLTE service (voice services in LTE networks) was first launched. Korea is noted to have the highest smartphone penetration rate and the highest level of LTE network quality.

Prerequisites of LTE network implementation by operators



Source: Mobile telecommunications, November, 2013

The operators invest in LTE with a vïw to obtain new profit sources, bring up the value of their brand names, and expand enhance the bandwidth capacity of their existing networks. For non-mobile operator companies, implementation of the LTE is one of few ways of emerging on the fast-growing market of mobile broadband access (BBA).

The networks in Russia began to actively operate on a commercial basis in 2012. “MegaFon” was the first company to emerge on the Russian LTE market. At the moment, the Russian market of the fourth generation network involves all players of the “big four”. However, notwithstanding the fact that the market is no longer monopolized by “MegaFon”, the prices are still too high.

Aside from the high prices for LTE plans, the development of the fourth generation network in Russia is hindered by some other factors. Firstly, the line of gadgets supporting LTE is still limited. Secondly, Russia is seeing a deficiency frequencies qualified for LTE networks. Moreover, some Russian LTE frequencies are not compatible with the limited set of smartphone models.

The LTE network of MTC was launched in 13 regions of the country. The Internet connection as fast as up to 100 Mb/s is available to the residents of Moscow and Moscow region, of places in Tambov, Amur, Rostov and Kaluga regions, the Zabaikalye territory, Kirov region, republik of Udmurtia, North Ossetia, Pskov and Novosibirsk regions. MTC was also the first Russian operator to launch the option of international LTE roaming. Before the end of 2014, MTC is planning to build the fourth generation network in over 600 cities of Russia.

The LTE technology is not only noted for opening new options for subscribers in terms of data transmission and content downloading, it also allows for rational use of existing resources. For example, LTE makes it possible to implement M2M technologies, which are the basis for future cities.

⁷ Long Term Evolution

M2M: MACHINE-TO-MACHINE INTERACTION



Machine-to-machine interaction (M2M) is a generic name for technologies that allow machines to communicate information to each other or transmit it in a one-way fashion.

These could be wire and wireless systems for monitoring sensors or any device parameters (temperature, level of reserves, location, etc.). One of the M2M types is an interaction between machines using mobile solutions, which can be the M2M acronym (Mobile-to-Mobile).

The capabilities of the M2M technology are vast: inter-machine interaction has been already actively utilized in security systems, health care service, production, power generation, HPU, systems of positioning of mobile objects based on GLONASS/GPS systems, and others. The M2M technology increases efficiency of IT-solutions for business and the state, while telematics solutions are applications for various economic sectors: industry, agriculture, construction, health care service, public security.



M2M: MACHINE-TO-MACHINE INTERACTION

M2M market

As per Json Partners Consulting⁸ report, the leaders in this area are the companies from the USA (AT&T, Sprint, Verizon) and Europe (Telenor Connexion, Vodafone, Telstra). The estimated number of wireless M2M connections in the world exceeds 100 million as of the end of 2013, where the increase by the year 2012 is about 25 %. By 2017, according to epy expert forecasts, the number M2M gadgets will increase 4.3 times with the biggest share going to medicine sector and consumer devices (over 25 % of total volume).

The Russian market of M2M services at the end of 2013 has grown up by 40 % and amounted to an order of 4.8 million sim-cards. As per MTS forecasts, the Russian market by 2017 will reach 18.5 million sim-cards, while the world market of telematic services by 2017 will amount to 400 million gadgets. So far, at the end of 2013, the biggest market share is held by solutions for commercial automobile transport sector.

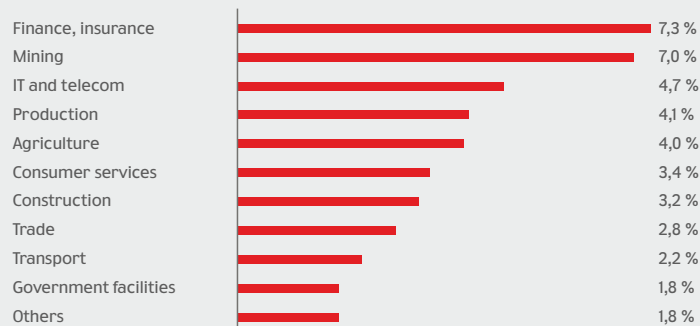
The Russian leader in the market of M2M solutions is MTC with a share of approximately 50 %. The second place is going to “Beeline”, and the epy is closed by “MegaFon”. The share of the rest of the operators is 15 % of clients.

In 2013, the highest spread of mobile gadget communications has been reported in financial (7,3 %), insurance (7 %), and mining (4,7 %) industries⁹.

In 2014–2015, what with establishment of new requirements for mandatory equipment of all new cars, and means of passenger transportation (including taxis) and conveyance of hazardous materials, with the “ERA–GLONASS” system, it is only natural to expect a growth in the general number of mobile M2M devices.

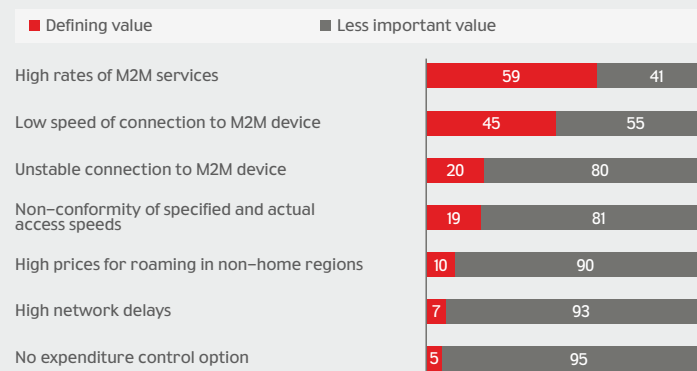
In spite of the evident prerequisites to market growth, there are after all some constraining factors that inhibit its development. These are basically high rates of M2M services and low connection speed.

Penetration of M2M services in Russia by business areas



Source: Json Partners Consulting

Factors impeding penetration of M2M services



Source: Direct Info

⁸ http://www.json.ru/poleznye_materialy/free_market_watches/analytics/rynok_m2m-kommunikacij_v_rossii_i_mire_2013/
⁹ A share in the total amount of companies in the industry

MTS: development of M2M solutions and telematics

MTS follows the market trends and offers a wide range of services in the area of telematics. About 40 % of the M2M market in MTS is covered by transport monitoring (over 1 million μ n sim-cards) – mainly related to monitoring of mobile objects. This service allows for tracking of location of a vehicle (car, taxi, truck) and its status, and maintaining of communication with the driver. The operator can call for the driver or transmit a text message..

The second popular M2M segment is security – the security and anti-theft systems cover about 20 % of the market. Such systems support remote immobilization, coordinate data transmission to the security system console, alarming in case of theft or house break-in. The share of sim-cards applied in the security systems did not change over 2013. Though the total number of these sim-cards increased up to 500 thousand counting from 290 thousand of sim-cards in 2012.

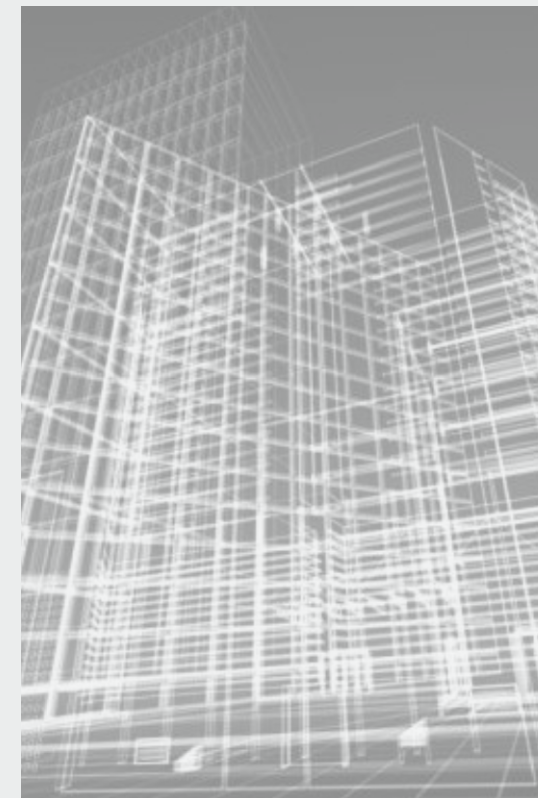
Around 15 % of M2M-sim-cards are shared by banking and financial services. This sector also engulfs payments in ATM, slot-machines and payment terminals, tracking payment system status, availability of bank notes and receipt paper in ATMs, etc.

Among other market segments, remote measurement is worth being singled out (sensors in HPU systems or production measuring liquid/gas flow rates, temperature and other parameters), telematics in personal vehicles (navigation system display of information about traffic jams, security

button, call for tech support) as well as consumer electronics (navigators, trackers, domestic appliances). The HPU and medicine sectors have become leaders if judged by the dynamics of growth in number of M2M-sim-cards. Over a year, the number of sim-cards used in HPU has increased two and a half times, and three times so in medicine. The number of sim-cards applied in these areas amounts to 250 thousand (HPU) and 75 thousand (medicine).

The share of consumer electronics in M2M is one percent, i.e. 25 thousand sim-cards. At the current stage of market development, this industry owns the highest potential of growth at the expense of increasing of penetration of M2M-devices: trackers, consumer navigation equipment, “smart insurance” services, development of client applications for computers and smartphones.

MTS notes that at the present time the telematics services market in Russia is mainly developing the corporate segment – the companies use state-of-the-art telecom solutions to reduce expenses, optimize business processes, and increase profit. All indications are that the mentioned segments shall provide development of this area in the years to come. Among the fastest-growing and promising areas of M2M application in Russia, the company sees distant medicine, electronic government services, machine-based sales of goods and services.



M2M: MACHINE-TO-MACHINE INTERACTION

MTS: development of M2M solutions and telematics

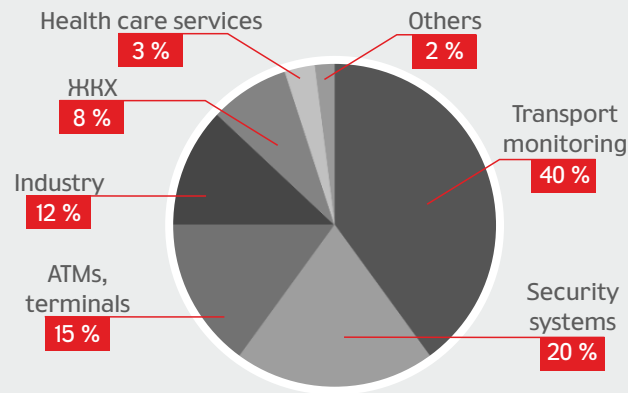
For the past six months of 2013, from July through December, the number of operating MTS M2M-sim-cards increased by 450 thous. and exceeded 2.5 million. By MTC estimate, this amounts to 52 % of the total number of telematic sim-cards in Russia.

In 2013, MTC consolidated its leading positions in the market of innovative services for corporate clients. The progressive growth of the M2M-sim-card sales is determined by development of the global positioning system GPS/GLONASS, stable demand in the transport monitoring area, security systems, and terminal solutions, as well as expansion of application of this technology in HPU, health care services, and video surveillance. For example, the experience of M2M implementation for transport monitoring shows that as early as withing the first months of using, the operating costs of a medium-size motor pool drop by 15-20 %.

In the cell network expence structure of corporate clients, the VAS¹⁰-services secure about 7-10 %. The M2M share in the VAS structure, in its turn, exceeds 80 %. Most active use of M2M is noted with the representatives of financial sector of economic activity, government structures, power companies, retailers, and oil industry.

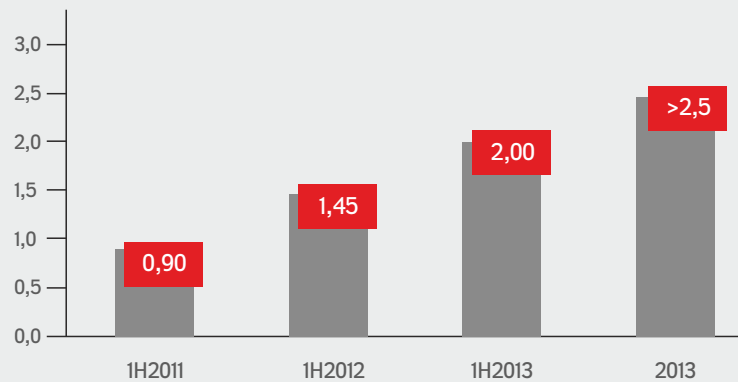
M2M technologies are the future technologies. They are revolutionary in this world and a symbol of a final transition to the informational age. Today, the world is focused at environmental friendliness and optomized consumptin of resources, so that many countries are interested in applying M2M solutions at the nationwide level. The notable growth is seen in the direction of "smart cities", which development is impossible without machin-to-nachine interaction - M2M.

Use of MTS M2M sim-cards by business sectors



Source: MTS

Use of MTS M2M sim-cards



Source: MTS

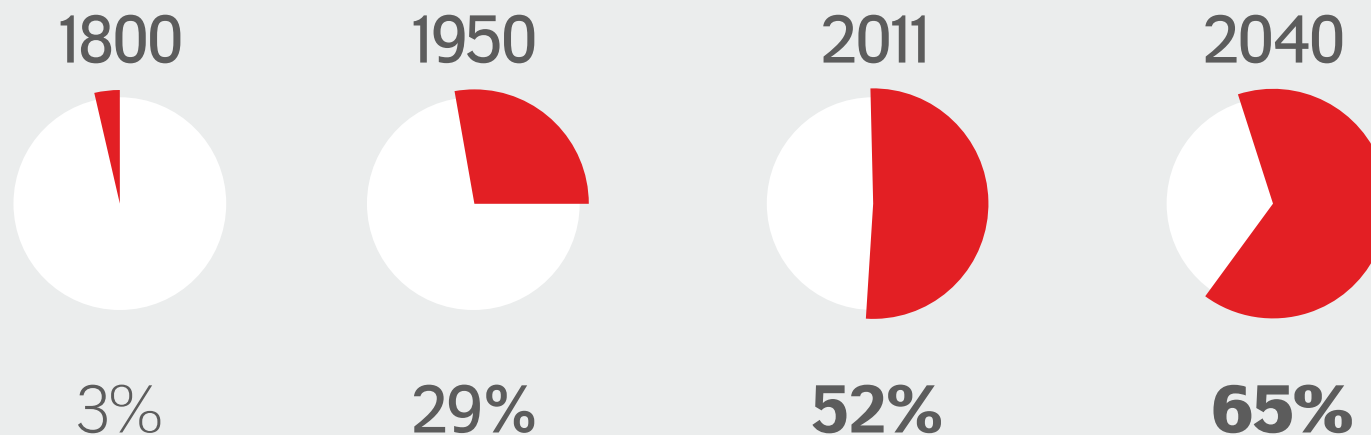
¹⁰ VAS-services (Value Added Services) – non-voice operator services. Here – APN, M2M, FMC, electronic signature, etc., exclusively of Internet

The percentage of people living in cities undergoes a steady increase. While in 1800 the share of urban population was only 3%, in 2011 this figure reached 52%. There is an ascending trend: by 2040 the percentage of city dwellers under 65 years old is forecasted to increase.

The same dynamics can be observed also among major cities with population over 1 million people. In the beginning of the 20th century there were only 12 such cities, while now this number is above 500. In addition, there are 21 metropolitan cities in the world with population over 10 million people. The largest of those is Tokyo, with population of 36 million people.

Though cities occupy approximately 2% of our planet's territory, they account for 60 to 80% of energy consumption, and 75% of CO2 emissions. Increased traffic, pollution, resource consumption – there is no doubt that they all threaten people's health and harm the environment. It is easy to see and understand that city arrangement based on convenience, safety for people, and optimal use of natural resources, is one of the critical tasks facing the humanity in the 21st century.

% of population living in cities



Source: Anatomy of a Smart City, Postscapes¹

¹ <http://postscapes.com/anatomy-of-a-smart-city-full>

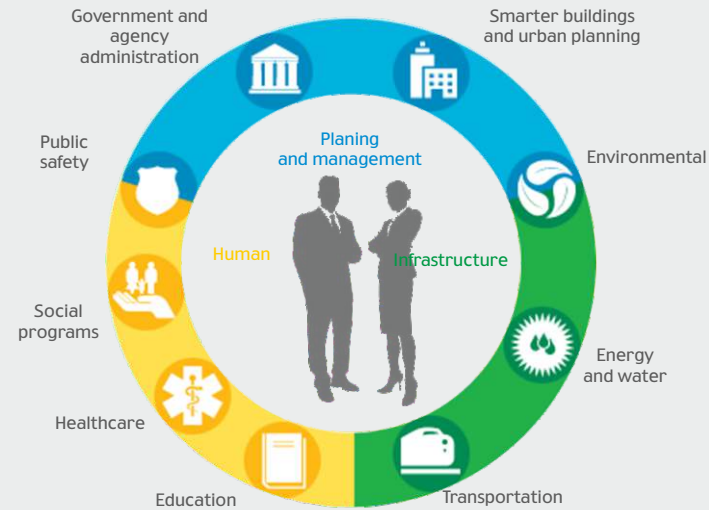
Smart city components

Any city is a sophisticated system of interconnected components: people, infrastructure, and management. Although, the concept of “smart city” is no mere synthesis – all components must have specific features. People must be responsible, infrastructure must be advanced, and management must be efficient. Being a “smart city” means to reasonably utilise all available resources and technologies.

A “smart city” accumulates five kinds of capital: economic (GDP, economic growth, foreign investment), human (talent, innovation, education), social (traditions, customs, families), ecological (energy, resources, waste processing, water treatment), and institutional (authority, administrative resources, city management).

For most elements of this system, there exist state-of-the-art technological solutions to be implemented in order to substantially increase the quality of specific services in the city. Let us consider each of these areas in more detail, focusing on three spheres: transport, energy, and social infrastructure.

Components of smart city



Source: IBM

Transport

Intelligent transportation system (ITS) is a system, which uses advanced technology in modelling transportation systems and regulating transport flows. Perceptive traffic rerouting has been organised, for example, in Hong Kong and Singapore. Public transport operation is a good indicator of city's transport system. In Helsinki, there is an interactive map (HLS Live) that shows operation of transport vehicles around the city in real time. It can be used to track, where the needed bus is, and to calculate the time of its arrival.

In a "smart city", public transport is equipped either with free Wi-Fi, or with high-speed mobile Internet, operating throughout the city and suburbs. For example, in Amsterdam there is a Wi-Fi network in virtually every place in the city. In Seoul, you can pay for all transport with a single card, which is called T-money. Moreover, this card does not do just that - it can also be used for parking payments and petty shopping.

Charging a fare for entering certain zones is also a popular and effective measure to tackle heavy traffic. In Stockholm in 2006, there appeared a charge to drive into the city centre. The project paid off in four years, the number of vehicles entering city centre decreased by 25%, and public transport passenger flow increased by 40,000 people daily.

A well-organised parking is a crucial component of city transport sector. This component of transport infrastructure is operated through an online notification system monitoring free spaces and automatically giving directions for drivers. A system like this has been introduced in Los Angeles and many other cities of the United States. In "smart cities" for the convenience of residents, it is possible to pay for parking using their mobile phones.

Informational systems and up-to-date information about transport timetables and delays is another important transport characteristic of a "smart city". San Francisco has an integrated information system, which allows city dwellers to check timetables and changes thereto in real time.

These informational systems must work both ways: not only authorities inform residents, but residents also help by sending important information to authorities. For example, in Boston there is an intelligent system to improve the quality of roads. Upon city administration request, mobile application Street bump was developed. If a car gets into a pothole, the driver's smart phone sends GPS coordinates of this place to a specialised centre.

Transport system of a "smart city" consists of four elements:

- intelligent transportation system
- adequate pricing policy
- "smart parking"
- informational systems



Energy, water consumption and disposal

"Smart meters" featuring remote access were introduced in the first-world countries a long time ago. They are used to calculate electricity consumption in over 90% households in California. Meters of this kind are used also for measuring water consumption. In Toronto, they are used by 95% of residents. In São Paulo, there is a centralised system, which monitors water supply. Across the whole of Melbourne, there are information panels that display energy and water consumption in a particular neighbourhood for a particular period. All buildings in Melbourne are equipped with meters and displays that visualise the use of resources (electric energy, gas, water) in real time. In addition, every building has its own website.

As long as oil deposits are limited and non-renewable, abandoning oil products and search for alternative sources of energy become an important task. An important milestone in this direction was introduction of electric powered vehicles – cars that are capable of moving without consuming petrol. In France, when starting a new development they take into account necessary infrastructure for electric cars. In addition, electric cars and charging stations appear in the US.

Bicycles represent a different kind of environment-friendly transport. "Smart city" government aims to increase the percentage of people, who choose this kind of transport, creating appropriate infrastructure. In Barcelona, there is a widespread network of bicycle lanes.

A characteristic feature of Barcelona is "smart collection of waste". Apart from separating waste, garbage cans are equipped with sensors that are connected to an integrated management system. Full garbage cans signal their status, and

waste collection service is prompt to visit the required location. Their vehicles are also equipped with a system that provides them with an optimal route in real time.

In Wien, only 8% of all waste ends up in landfills, while all the rest goes to processing. In addition, the city has a refuse incineration plant. There they incinerate waste that was impossible to separate, or pointless to sort for economic or technical reasons. Owing to state-of-the-art technologies, the plant does not pollute the air of the city, and even brings profit in the form of energy. In 2010, the city received an international award for waste utilisation management system that is near stable. Wien puts a stake on measures to prevent waste, or aimed at their thermal processing.

In a "smart city", houses should follow the pattern. This is why it is important to elaborate a sophisticated intelligent system right away, when developing buildings and residential houses.

To economise on energy, buildings are equipped with solar batteries. It is worth mentioning that this solution is viable not for all cities, but only for those, which have enough sunny days.

A unified centralised building management system allows to simultaneously control a chain of buildings. With its help, it is easy to optimise energy consumption and control various parameters, such as temperature, air conditioning, and lighting. Such system, commissioned by IBM, has been installed in Rochester.

Members of the public also can manage their home directly using their smartphones. It concerns lighting, media systems, heating, air conditioning, power supply, and security. Telecommunication technologies, such as control via GPRS, allow performing operations remotely.

The 21st century follows the trend of saving resources, their adequate utilisation, and minimising harm to the environment. This is why a "smart city" cannot survive without a corresponding infrastructure. It consists of "smart meters" for electricity and water, environment-friendly transport, "smart collection of waste", and "smart houses".



Social infrastructure

Public safety, perhaps, is the major component of a "smart city". There are several ways to enhance it without changing society or living standards. For instance, in Madrid there was introduced an intelligent public safety system that ensured integration of services and systems. Consequently, response time in emergencies decreased by 25%, and there appeared an opportunity to direct all resources of available services in case of emergency.

Another example is Crime Centre in New York City. Such structure uses vast volumes of data for analysis, including inputs from video cameras in real time. As a result, New York is the safest major city of the USA.

Information technologies may also help people in case of natural disaster or catastrophe. In Japan, there is an early warning system via text messaging. It is worth mentioning, that even in the situation of a major earthquake in Japan, followed by temporary mobile network outage and unavailable landline connection, high level of latest generation Internet penetration helped people keep track of events and avoid panic.

"Smart medicine" is a no less important component of "smart city" social infrastructure. In Barcelona, a system of this kind was implemented as a pilot project in one of the hospitals. "Smart medicine" allows leaving healthcare establishment much earlier. Patients receive special bracelets, and medical centre controls physical condition of its clients, receiving necessary data about the parameters of blood pressure, heart rate, blood sugar level, etc., that is sent at the required intervals. The program took a beneficial effect and saved €9,000.

Another element of "smart social infrastructure" is e-Government. One of the best examples of electronic government is Stockholm. In 2006–2007, the city started to actively invest in electronic government. Around €70 million were spent to create e-Government services and make them user-friendly and available for population. For instance, citizens can use the Internet to observe the meetings of City Council, and familiarise themselves with documents debated there. In addition, using the net, residents can file an application to the office of civil registration, or request for admission to kindergarten. Electronic system not only economises on city resources, both monetary and human, but also encourages cooperation between government agencies.

City social infrastructure encompasses three components:

- public safety,
- e-Government
- "smart medicine"



Supplements



Examples of "smart cities"

1.1. Singapore Transport

Singapore is a city-state located on islands – provided the lack of natural resources, its life has always been based on inventions. Having a vision of Singapore as a "smart city", its government created a universal program to build the corresponding infrastructure. As a result, it took Singapore half a century to turn from a poor third-world country into a leading centre of finance and innovation in Asia.

Singapore became the first city in the world, where computer manages road traffic. All highways are equipped with video surveillance systems, where cameras are installed at intervals of 1 km. Motor vehicles are equipped with transponders¹² that record location and speed. Information from cameras and transponders flows to the integrated management centre. Roads are entirely free from human control: checkpoints are equipped with reading devices, and vehicles have cash cards that are used for payment.

Taxis will also operate without human interference. A group of scientists from Nanyang University of Technology released a car named Induct. Induct operates using an electric motor that allows this vehicle to reach the speed of up to 20 km/h. And Singapore underground is already pilotless.

At pedestrian crossings, green light is turned on by request at the touch of button. Disabled persons may put their smartcard against an electronic device, and crossing time will increase as compared to standard. City intelligent transportation system is managed at a specialised intelligent centre, which operates 24/7. It allows lessening the burden on traffic environment and decreasing the number of incidents at highways.



¹² Transponder (transmitter-responder) is a device that transmits a signal after receiving a signal

Examples of "smart cities"

1.2. Seoul Technology

Seoul is the capital and financial centre of South Korea, and it is not only one of the largest megacities in the world, but it is also among most technically advanced ones. In 2011, the city was ranked first among "smart cities" globally, according to a survey commissioned by Ericsson¹³.

In 2003, Seoul implemented its fibre-optic network that partially acted as incentive for technology development. Now this network is not supported by many modern smartphones. In order to bypass this obstacle, a new 192-km network was built. It is separated into three sub-networks: Wi-Fi network, video surveillance network gathering information from 30,000 cameras, and a service connecting the websites of all government establishments and granting citizens access to any public service. Electronic government in Seoul has been acknowledged as the best in the world.

Since 2008, Information Security Service has been in operation. "Smart devices" are used for its work. If an owner of such device leaves the pre-defined safe area or presses emergency button, the signal will be delivered to their guardians, to the police, the fire brigade, or TV surveillance situation centres. The device is intended for watching over children, elderly people, and people with disabilities.

In 2012, Seoul started to give away previously used "smart devices" free of charge to low income families and other

members of public, who required assistance. Citizens, who donate their devices, are stimulated by reduced tax burden. After that, manufacturers repair the equipment, and then authorities distribute them at no cost among low-income sections of the population.

In the interest of public safety, every road intersection is equipped with intelligent TV surveillance cameras that automatically record any attempts of trespassing on private property. High-tech street lamps installed in the city decrease power consumption, transmit sound signals, and provide access to wireless Internet access for the population. Neighbourhood residents and guests may receive latest news; obtain bus timetables and other useful information through a digital wallpaper.

In the framework of interaction between public and private sector, a NFC-based mobile electronic payment system has been developed. This system is available for every owner of compatible smart phone or smartcard. In order to pay for any purchase it is enough simply to place your smart phone next to specific reader device, which will receive information necessary for transaction. This system also allows transferring funds from one smartphone user to another.



¹³ <http://www.ericsson.com/news/1565894>

Examples of "smart cities"

1.3. Stockholm Ecology

Telecommunications industry in the capital of Sweden and the financial centre of Scandinavia has been continuously developing during the last 100 years. In particular, a major driver for that development was Ericsson Company, whose headquarters is located precisely in this city.

First steps on its path towards "smart city" Stockholm made in 1990s with the foundation of Stocab – a local company that laid a wide fibre-optic network throughout the city with the aggregate length of 25 circles around the globe. The aim of the city was to create a uniform competitive environment for all operators. Now, around 50 providers use this fibre network.

In addition, Stockholm became the first city to implement next generation 4G network. Information technologies are actively utilised in environmental protection sector. By 2050, Stockholm plans to stop utilising fossil fuels, and it has more than once taken the first place among the most eco-friendly cities of Europe. Transport pollutions and energy consumption in the city are staggeringly low, as compared to cities with matching population numbers.

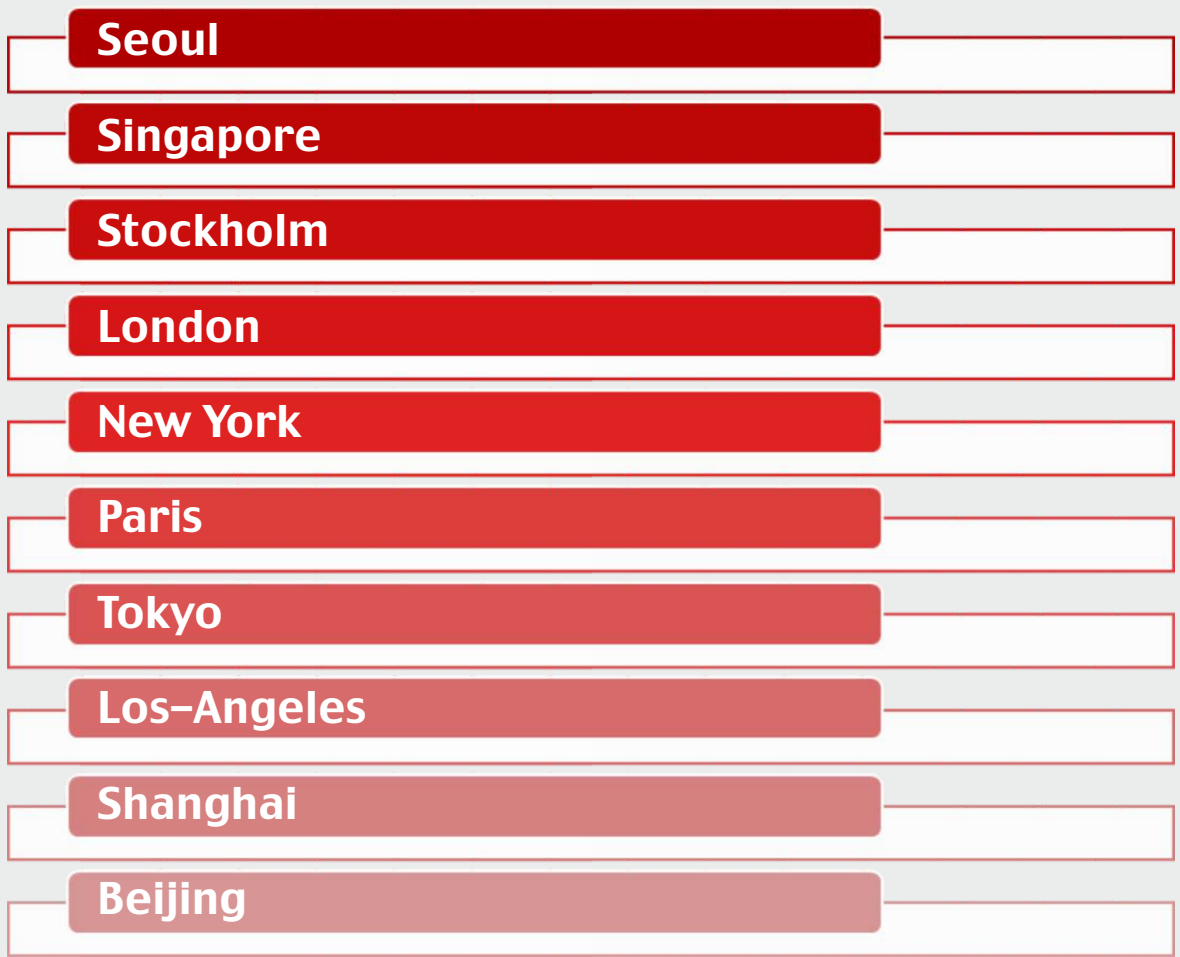
The Royal Seaport is a large area in Stockholm that they plan to make totally harmless for the environment by means of

using state-of-the-art technologies. In this area, they plan to develop around 12,000 residential and 35,000 office "smart buildings", equipped with sensors that adjust electricity and water consumption during the day. In 2012, this area welcomed its first residents. Ericsson will be the operator to implement the project. The Royal Seaport will follow the example of eco-friendly neighbourhood Hammarby Sjöstad, which already exists in Stockholm.

Hammarby Sjöstad was developed in the place of industrial area. Now it is one of the most prestigious parts of the city. The houses are designed in such a way that they use much less water and energy, than Stockholm average. Municipal system Hammarby processes all waste that residents discard to specialised containers located inside their blocks of flats. Leftover food they discard in specific bags made of cornstarch. After that, the waste is transformed to biofuel and is utilised for heating the area. Water is processed for repetitive use, and solar batteries are installed on rooftops.

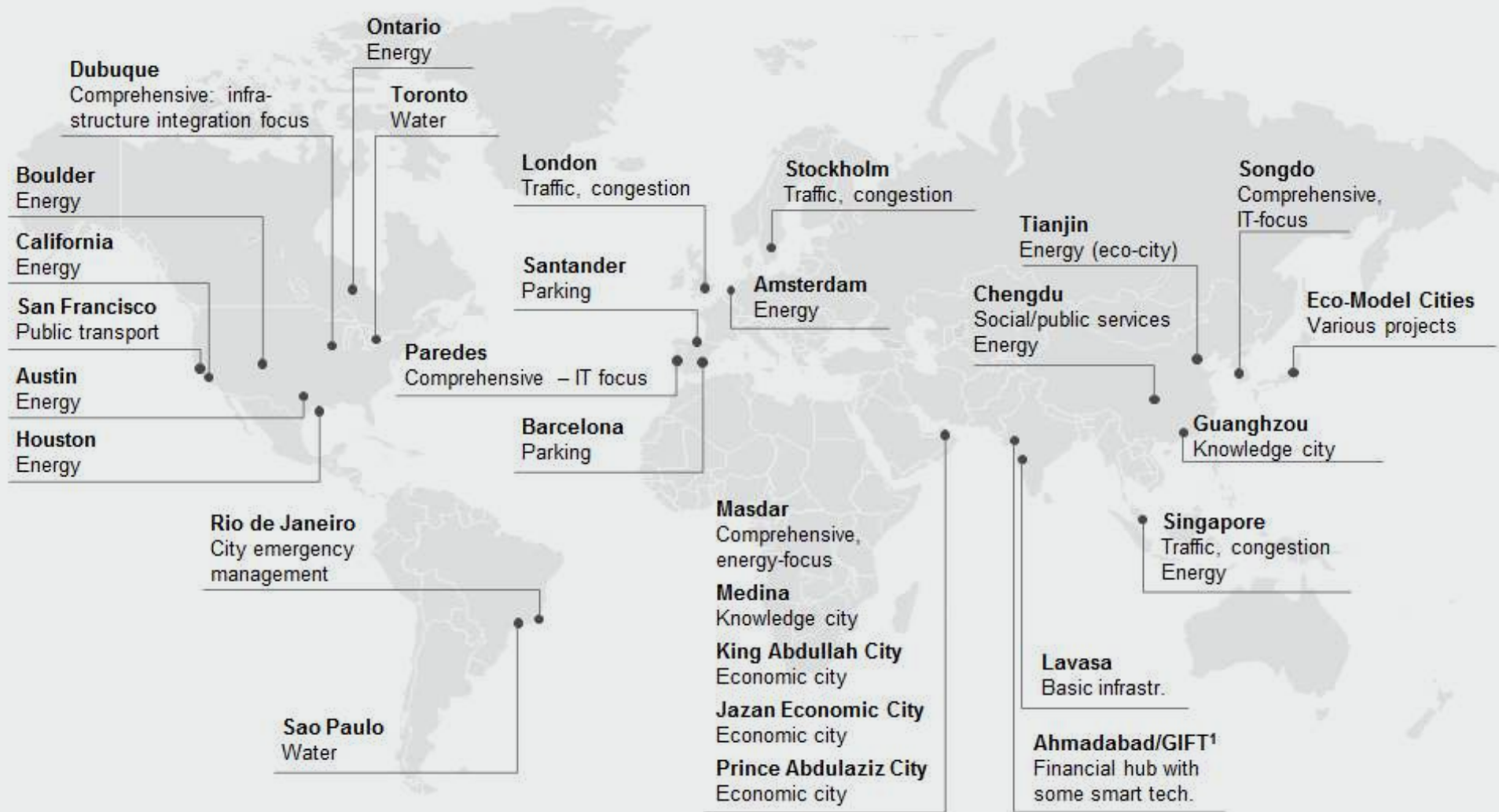


Rating of "smart cities"

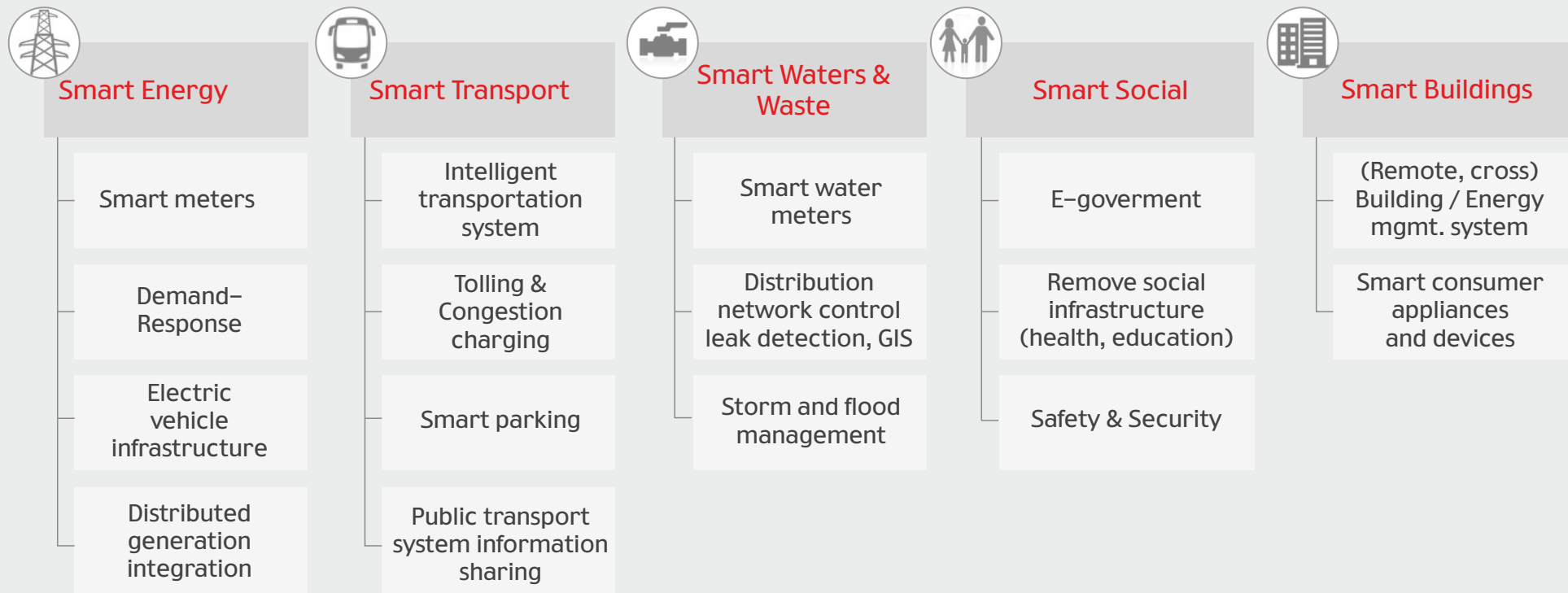


Comprised by Ericsson Company in 2011

Map of "smart cities"



"Smart city": major components





This case study was prepared
by Challengence>> —
the leading case organisation
in Russia
www.challengence.com
info@challengence.com
vk.com/challengenceglobal
facebook.com/challengence



This case study was
written for Mobile TeleSystems
OJSC («MTS»)
<http://www.mts.ru/>