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As a result of its remarkable economic growth, China became the world's second-largest economy in 2010. This rapid economic growth has led to mass migration into the cities, a trend toward motorization and the development of social infrastructure at a pace that has never been experienced by any of the developed nations. At the same time, however, it has also caused traffic congestion, serious air pollution and other problems. To address these issues, expectations are given to the use of information and communications technology (ICT).

One example of these efforts, as mentioned by Premier Wen Jiabao in August 2009, is the "Internet of Things (Wu Lian Wang)," which is currently attracting considerable attention and is positioned as one of the strategic emerging industries in the country's 12th five-year plan (2011 to 2015). The Internet of Things is a combination of an information and communications network and sensor technology making use of a range of sensors and RFID (radio frequency identification) tags, and is expected to contribute to resolving an assortment of problems associated with the explosive growth of China's economy and cities. Specific activities on this project are currently underway in many provinces and cities throughout China.

The Internet of Things is part of the concept known as the Ubiquitous Network in Japan, and is also a component of the Smart City. When we look back, since the period of high economic growth, Japan has employed the technology that was the most advanced at the time in an attempt to resolve various issues in fields such as transportation, logistics, manufacturing, disaster preparedness and environmental protection. Accordingly, Japan has accumulated experience and expertise in these activities, which gives it a good chance to enter China's Internet of Things (IOT) market.

The significance of the entry of Japanese companies into the Chinese IOT market would not just be limited to generating a source of revenue. It also includes establishing Japan-China partnerships toward developing international standards and contributing to addressing problems in countries and regions throughout the world by means of the Internet of Things. In January 2011, jointly with the Beijing University of Posts and Telecommunications, Nomura Research Institute (NRI) established the China and Japan Business Alliance on the Internet of Things, and commenced activities to develop proposals for China's IOT projects.

I Rapid Growth of Economy and Social Infrastructure and Informatization in China

1 Rapid growth of economy and social infrastructure

Between 2003 and 2007, the Chinese economy achieved double-digit real economic growth rates each year in a row, and has come to play a leading role in the global economy. Because of the global financial crisis set off by the collapse of Lehman Brothers in the U.S., China's growth fell below 10 percent in 2008 and 2009, but recovered to 10.46 percent in 2010. With a nominal GDP (gross domestic product) of $5.8 trillion in 2010, China overtook Japan to become the world's second largest economy. Furthermore, at the end of January 2011, the total market capitalization of companies listed on the Shanghai and Shenzhen stock markets reached $3.9571 trillion, surpassing the value of the Tokyo stock market[1].

China's population has started to concentrate in the urban areas. Between 2000 and 2009, the average annual rate of population growth was 0.6 percent for China as a whole, while it was 2.8 percent for Beijing and 4.2 percent for Shanghai[2] due to the influx of people from the rural areas into cities. Meanwhile, China's urbanization rate (the percentage of population living in urban areas) has not yet reached 50 percent, which remains very low in comparison with 70 to 80 percent in developed countries[3]. Because the 12th five-year plan (2011 to 2015) includes an increase in the level of urbanization, we can assume that the trend for the population to concentrate in cities will continue for some time in the future.

By keeping pace with this economic growth, the development of social infrastructure such as transportation and communications networks has progressed rapidly. For example, while there were only 1.4 million km of roads in the country in 2000, this figure had increased to a total of 3.86 million km by 2009 (about a 2.8-fold increase). During the same period, the number of vehicles on the road grew from 16.09 million to 62.81 million (about a 3.9-fold increase)[2], clearly illustrating that the trend toward motorization is moving at a faster pace than infrastructure development.

The information and communications infrastructure such as telephone and the Internet has also been expanding rapidly. While landline subscribers totaled 144.82 million in 2000, this subscriber base had grown to 313.73 million by 2009 (about a 2.2-fold increase). Within the same period, the number of mobile phone subscribers increased from 84.53 million to 747.21 million (about a 8.8-fold increase) to reach a penetration rate exceeding 50 percent of the total population. Again within the same period, the number of Internet users grew extremely quickly from 22.50 million to 384.00 million (about a 17.1-fold increase)[2] (Table 1).

2 Problems associated with rapid growth and expectations placed on informatization

China's rapid economic growth and progress in urbanization have enriched the lives of its people, but have also led to serious social problems mostly due to the failure of social infrastructure to keep pace with such growth. To solve these problems, expectations are being placed on information and communications technology (ICT) that can increase the efficiency with which social infrastructure is utilized.

For example, traffic congestion is one of the major problems facing China's urban areas. In 2010, the U.S. magazine *Foreign Policy* named Beijing as one of the "five places where soul-crushing gridlock is a way of life[4]." While Beijing has many expressways including six ring roads, in just the four months of January to April

Table 1. Rapid growth of economy and social infrastructure in China

	Item	2000	2009	Compound annual growth rate
Basic data	GDP (gross domestic product)	$1,198.5 billion	$4,984.7 billion	17%
	Population	1,267.43 million	1,334.74 million	0.6%
	Beijing	13.63 million	17.55 million	2.8%
	Shanghai	13.22 million	19.21 million	4.2%
Transportation	Total road length (km)	1.40 million	3.86 million	12%
	Number of vehicles on the road	16.09 million	62.81 million	16%
Communications	Number of landline subscribers	144.82 million	313.73 million	9%
	Number of mobile phone subscribers	84.53 million	747.21 million	27%
	Number of Internet users	22.50 million	384.00 million	37%

Source: "China Statistical Yearbook 2010" and "Beijing Statistical Yearbook 2010" compiled by the National Bureau of Statistics of China.

2010, the number of new car registrations amounted to about 248,000 (about 2,100 per day), which is a rate of proliferation that far outstrips the development of transportation infrastructure.

In an attempt to solve this problem, on December 23, 2010, the Beijing Municipal Commission of Transport announced its "opinions on the promotion of the scientific development of capital traffic and measures to ease traffic congestion." This report included the themes that are expected to become solutions through the utilization of ICT such as the "development of next-generation smart traffic management systems" and "development of smart parking management systems" (Table 2).

In addition to social infrastructure, there is also enormous room for ICT to contribute to public services. For example, China faces a problem that not all patients are able to receive medical treatment at medical facilities because of a lack of highly specialized doctors compared to the number of outpatients, which is a hot topic as a social problem among the Chinese people.

Furthermore, medical services are concentrated in urban areas. There are relatively more doctors in cities. In 2009, the national average of the number of people per doctor was about 700. However, this number was about 300 in Beijing and about 360 in Shanghai, both roughly half the average. Even though the number of

Table 2. Opinions on the promotion of the scientific development of capital traffic and measures to ease traffic congestion

	Objectives and goals
1	Improving traffic conditions. In particular, ensuring that traffic congestion in central city areas does not deteriorate
2	Raising proportion of public transport trips in central city areas to 50 percent by 2015
3	Reducing motor vehicle emissions of major pollutants; 2015 emissions are not higher than 2010 levels
4	Enhancing road traffic safety; controlling road traffic accident death rate per 10,000 vehicles to 1.7 or less by 2015

1	**Shifting the functions and population in central city areas to peripheral areas**
	(1) Implementing the overall urban plan of Beijing (2004 – 2020) (2) Developing public transport hub facilities and securing land for public parking (3) Linking development projects with transport-related facilities
2	**Accelerating the development of road transport infrastructure**
	(4) Developing urban rapid roads, reconstructing underground roads and railroad crossings and developing pedestrian bridges (5) Constructing urban microcirculation roads (6) Constructing 50,000 or more additional public parking lots in central areas (7) Constructing additional parking lots for 200,000 vehicles according to each area's situation (8) Constructing the national highway network and the Beijing municipal highway network
3	**Promoting the use of public transport**
	(9) Constructing rail transit networks in central city areas (10) Renovating existing rail transit facilities (11) Constructing rapid public transport commuting networks (12) Adjusting public bus operations (13) Constructing integrated transport terminals and bus stops
4	**Green travel, eco-friendly travel by bicycle and on foot**
	(14) Completing public bicycle service systems (15) Promoting school and commuting bus service systems and taxi sharing (16) Constructing bicycle and car parking facilities around subway stations (17) Advocating a new transport philosophy and improving transport-related courteousness (18) Introducing videoconferencing and flextime system
5	**Rational use of cars**
	(19) Limiting the number of small passenger cars available for purchase (20) Limiting traffic volume in specific areas during rush hour (21) Area-specific control of parking fees
6	**Applying scientific concepts for traffic management and improving transport service**
	(22) Implementing projects for relieving traffic congestion (23) Developing next-generation smart traffic management systems (24) Developing area-specific traffic management systems (25) Developing smart parking management systems; managing the operations of parking facilities (26) Developing road traffic information, accident warning and forecasting systems (27) Establishing organization for discussing the easing of traffic congestion; clarifying the responsibility of management (28) Annually determining measures to ease traffic congestion; evaluating achievements based on congestion reductions

Source: Compiled based on materials published by the Beijing Municipal Commission of Transport.

doctors is greater in cities, the national average number of cases in which a single doctor sees and treats patients in a year was 1,009 in-person visits[5], while the figure in Beijing was 1,417 and that in Shanghai was 1,820. The reasons include that people other than high-income earners in cities cannot easily afford high medical expenses and that patients who are not treated satisfactorily at the level of regional clinics are sent to urban hospitals. To prevent outpatient congestion, therefore, some large urban hospitals have had to resort to distributing admission tickets, leading to patients queuing in front of the hospital all night to be first in line for the morning rush for tickets when the hospital opens.

Although it is difficult for ICT alone to resolve this problem, there would appear to be considerable scope to improve the efficiency of hospital operations through the use of information systems. In addition, by developing a system employing electronic medical records, sharing consulting data and test results between hospitals and clinics in an environment ensuring information security and introducing telemedicine equipment, it should be possible to alleviate the issue of patient congestion at urban large hospitals.

II The Internet of Things (IOT) is Positioned as an Important National Strategy

1 IOT projects started with a top-down approach

In August 2009, Premier Wen Jiabao visited the CAS (Chinese Academy of Sciences) Wuxi Hi-tech Micro-nano Sensor Network Engineering and Technology R&D Centre in Wuxi, Jiangsu Province, and initiated the concepts of "Sensing China" (the development of the sensor network). Premier Wen also stated his intention to "accelerate the development of the Internet of Things as an important field of national science and technology research," and announced the establishment of a research facility to be known as the "Sensing China" center. Since then, full-scale efforts to develop this technology have started on a national level. For example, the Ministry of Industry and Information Technology, which has jurisdiction over the information and communications field, established a standardization committee for sensor network technologies, and model cities were designated with the aim of conducting R&D activities related to the Internet of Things and promoting the development of the IOT industry.

In March 2010, at the National People's Congress (NPC), together with "new energy vehicles" and "three network convergence" (convergence of broadcasting, communications and the Internet), the Internet of Things was identified as the area for which investment and support measures would be strengthened and was positioned as an important strategy that should be promoted at the national level.

The Internet of Things means "the network connecting things." In the late 1990s when RFID (radio frequency identification) began to attract attention in the logistics and retail fields, a great deal of interest was shown in this concept. Currently, the concept has been developed into a broader concept in which a system automatically recognizes information about a thing such as "unique attributes," "state at that time" and "location" by using sensors and cameras connected to the Internet, and creates value-added information by comprehensively analyzing the state and locations of two or more things. At the same time, the system uses such information to automatically control equipment and devices. IBM's "Smarter Planet" and Cisco Systems' "Smart + Connected Communities" are based on the same idea.

Table 3 shows IOT model projects that were publicly invited in June 2010 in Jiangsu Province. As is clear by looking at this table, the use of the Internet of Things is

Table 3. IOT model projects in Jiangsu Province

Field	Project examples
Manufacturing	• Intelligent control of manufacturing process, inspection and management
Agriculture	• Real-time monitoring and control of room temperature, humidity and illumination
Logistics	• Monitoring and adjustment of goods, containers, vehicles and personnel; traceability of food and chemicals
Power distribution	• Monitoring the state of transmission and substation equipment and pylons; remote meter reading
Transportation	• Monitoring traffic volume; vehicle violation crackdown; parking lot management and fee collection
Public safety	• Monitoring commercial areas and intersections; monitoring buildings, bridges and tunnels
Environmental protection	• Monitoring water and air quality; monitoring data on pollutant emissions
Disaster preparedness	• Early warning of floods, meteorological disasters and geological hazards
Housing	• Ensuring safety and security of residential areas; energy conservation management such as for home appliances and lamps
Medical care	• Monitoring vital signs of patients suffering serious conditions; health management of individuals

expected in a very wide range of fields, including industrial fields such as manufacturing and logistics, social infrastructure such as power supply and transportation and fields that affect people's lives such as the environment and medical care. Furthermore, we often see cases in which the term "IOT" is prefixed to the names of products and services, such as "IOT air conditioner" that uses sensors to automatically control room temperature and that can be operated remotely from a mobile phone. As described above, in China, with the initiative of Premier Wen, a top-down approach has been adopted for the start of IOT projects. These movements have gradually become a major force even in rural areas.

2 Competition among regional governments in forming IOT industrial cities

Regional governments such as provinces and cities play a central role in promoting the Internet of Things. Wuxi, where Premier Wen made his announcement about the development of the Internet of Things, has been particularly quick in its moves. In September 2009, Wuxi applied to the State Council of the Central Government to become an "IOT model city" and this application was formally accepted in December of the same year. In Wuxi, the Sensing China Center, which was mentioned in Section 1, was built. Wuxi has been successful in inviting leading research institutions such as the Chinese Academy of Sciences (CAS) and Tsinghua University, as well as companies such as IBM and China Mobile.

Inspired by the moves in Wuxi, many other Chinese cities have begun their own IOT initiatives. In Zhejiang Province, adjacent to Jiangsu Province, activities aimed at "promotion of the IOT industry" are ongoing, mostly in Hangzhou (provincial capital) and Jiaxing. In partnership with the Chinese Academy of Sciences, the Hangzhou municipal government established an RFID innovation center with the intention of playing a leading role in the field of RFID technology. Hangzhou also built an IOT industrial park to promote industrial development in the fields of intelligent transport systems (ITS), city management and information security.

In Beijing, Zhongguancun, otherwise known as "China's Silicon Valley," is home to many IT (information technology) companies, research institutes and universities. With these companies and organizations as members, the Zhongguancun IOT Industry Association was established in November 2009. In addition, in response to the central government's "Sensing China" initiative, Beijing's municipal government has launched its own "Sensing China" plan, which is intended to promote the development of IOT industries in Beijing. The Beijing municipal government publicly invites model projects in the IOT field and commends those that it considers outstanding. In 2010, 60 million yuan was invested in 43 model projects. From among these projects, 17 were selected as being outstanding, which include an "IOT-based carbon monoxide and fire monitoring and prevention system" and an "operation and monitoring system for Beijing's power transmission cable network."

As of October 2010, Chengdu in Sichuan Province announced that investment in IOT-related projects had exceeded 10 billion yuan (including the construction of the RFID chip R&D center). Chengdu was successful in attracting many leading companies in the fields of RFID, software and middleware development, and information security. Chengdu hopes to pull in investment to promote industrial development in the fields related to the Internet of Things.

China's promotion of the Internet of Things is marked by two notable characteristics. The first relates to fierce competition between cities, with a variety of activities being announced and implemented on the municipal and provincial levels. In response to Premier Wen's initiative, each province/city throughout China is creating its own IOT strategy, establishing research centers and implementing model projects, which now constitutes a nationwide movement (Table 4).

There is no doubt that such competition between cities has made a huge contribution to the upsurge of activities related to the Internet of Things in China. Many provinces and cities have created appealing visions for the Internet of Things and have gone on to make careful plans for its implementation with the aim of differentiating themselves from other provinces/cities by promptly implementing such measures. However, the services and applications that will be realized by the Internet of Things are not necessarily limited to being within a given city or province. Rather, in the future, efforts must be made for developing standard technologies and interfaces to enable the Internet of Things to spread throughout China and even globally.

The second characteristic stems from the fact that there is hope that the Internet of Things will not only solve many social problems but, by attracting related companies, will also lead to economic growth and increased employment in a region.

In this regard, we should note that the ultimate goal is likely to be limited to "attracting companies and research institutes." Industrial development does not necessarily follow from moves by companies and research institutes related to the Internet of Things to a given city/province. To ensure that the Internet of Things is not just a passing fad and, instead, will bring ongoing development to a region, there is a need for a long-term strategy that addresses related issues including taxation and human resource development. Above all, a vision that fully exploits the characteristics of the region must be created.

In March 2011, at the National People's Congress, Premier Wen stated that the government will "accelerate the research and development aimed at the practical applications of the Internet of Things." As such, the

Table 4. IOT-related moves by China's regional governments

Province/City	Major moves
Wuxi	Wuxi was designated as the first IOT model city by the State Council in December 2009, and the "Sensing China" Center was built; "2010 China International IOT (Sensor Network) Conference," which was the highest level conference for the Internet of Things in China, was held in October 2010
Beijing	In November 2009, the Zhongguancun IOT Industry Association was established, and the "Sensing Beijing" Forum was held in December of the same year
Chengdu	As of October 2010, investment in IOT-related projects had exceeded 10 billion yuan (including the construction of the RFID chip R&D center); "Sensing Chengdu" IOT industry development projects have been implemented
Chongqing	In December 2010, Nan'an District in Chongqing was designated as the national IOT industry model base; contracts amounting to 20 billion yuan were signed for related projects in March 2011
Shanghai	IOT 2010 – 2012 "Three-year action plan" was created; priority was given to themes such as "smart home appliances" and "vehicle collision prevention systems"
Hangzhou	In January 2010, Hangzhou started the construction of the IOT industrial park; priority was given to themes such as intelligent transport systems (ITS), city management and information security
Fujian	In April 2010, the Fujian IOT development plan (2010 – 2012) was announced, which included the construction of two model districts and the implementation of model projects in nine fields such as manufacturing, agriculture and transportation
Jiangsu	In June 2010, Jiangsu publicly invited proposals for IOT model projects in ten fields such as manufacturing, agriculture and distribution

Source: Compiled based on various materials and news reports.

activities related to the Internet of Things will become even more intense all over China. We will see related projects in various settings in cities, industries and people's lifestyles.

III Opportunities and Challenges Presented to Japanese Companies by China's Internet of Things Initiative

1 Global trends point to the Internet of Things being an inevitability

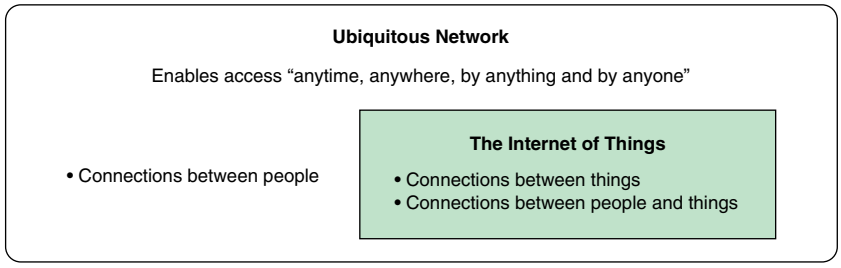
The notable feature of China's Internet of Things initiative is that it is expected to help resolve, through the application of ICT, the problems arising from the rapid growth of the country's economy and cities while, at the same time, aiming to develop the industries providing such solutions and helping them take root in relevant provinces/cities. The former idea corresponds exactly to the concept of the "smart city" in which many emerging countries and developing countries have shown increasing interest. Nevertheless, the principal characteristic of China's Internet of Things initiative is that its goals strongly lean toward development of the latter.

As mentioned in Chapter II, increasing attention is also being paid to the Internet of Things in the U.S. and Europe, with IBM's Smarter Planet and Cisco Systems' Smart + Connected Communities being based on the same idea. In Japan, meanwhile, the government, companies, research institutes and universities have accelerated their efforts to develop the ubiquitous network since early 2000. These efforts are being made to build and utilize diversified and sophisticated information and communications networks that enable access "anytime, anywhere, by anything and by anyone," using the wired/wireless communications environment, digital broadcasting, etc. The Internet of Things is considered part of the ubiquitous network (Figure 1).

In 2004, Korea announced its "USN (ubiquitous sensor network) Master Plan" in an effort to accelerate the development and application of RFID and sensors. These efforts at the municipal level are aimed at realizing the Korean version of a smart city, known as the "U-City" (a city in which ubiquitous network technology is applied to the facilities of the urban infrastructure to enable efficient management at the municipal level and provide a wide range of services to citizens).

If we view these moves in each country from the perspective of the development of the Internet, which started to be increasingly used in the mid-1990s, we can regard the Internet of Things as being the third phase of the development. That is, in the first phase, the use of the World Wide Web (WWW), which began in the mid-1990s, provided people with a means of collecting and disseminating information worldwide. In the second phase, Web 2.0 arose in the mid-2000s. This technology facilitated the creation of value and communities through collaboration among people who use the Internet as a "venue," as well as direct transactions involving goods and services. The third phase, the beginning of which we are now seeing, involves the "convergence of the Internet and the real world." Specifically, RFID and sensors are being used to send data on the status and any change of the real world to the Internet. The system automatically recognizes the entire real world in real

Figure 1. Relationship between the ubiquitous network and the Internet of Things



Note: IOT = Internet of Things.

Table 5. Positioning of the Internet of Things from the perspective of the development of the Internet

	First phase (Starting in the mid-1990s) Spread of WWW	**Second phase** (Starting in the mid-2000s) Upgrade to Web 2.0	**Third phase** (Starting in the late-2000s) Practical use of IOT
Significance of the Internet	Means of collecting and disseminating information	Venue for value creation and community formation through collaboration among people, and direct transactions involving goods and services	Means of collecting data from the real world by using sensor technology; means of automatically controlling equipment and devices
Principal subject connected to the Internet	People	People	Things
Principal technology	WWW	Search engine	Analytical engine for huge amounts of data

Note: WWW = World Wide Web, IOT = Internet of Things.

time and creates information that has value by analyzing huge amounts of data. This information is used to automatically control equipment and devices (Table 5).

2 Differences between Japan and China in introducing ICT

In Japan, the systems at the third phase are mostly those that had been developed before the use of the Internet and mobile phones had become widespread by using the wired and wireless communications lines, and these systems are now widely used in many industries. If we look at the ten fields where IOT model projects are underway in Jiangsu, which was described in Chapter II, we find that in Japan, the systems have already been developed in the nine fields of manufacturing, agriculture, logistics, power distribution, transportation, public safety, environmental protection, disaster preparedness and housing by employing the wired and wireless communications lines and a range of sensors as mentioned above (Table 6).

Currently, it has become possible to develop these systems more easily and at lower costs thanks to many factors. These factors include the spread of the Internet since the mid-1990s, the growth of high-speed mobile communications since the early 2000s, progress in RFID and sensor technologies, higher PC and server performance, emergence of cloud computing, the popularity of smartphones (multifunction mobile phones) and improvements in system development productivity. Conventional systems that had been built and are in use in developed countries including Japan continue to be upgraded by incorporating these changes.

Furthermore, in addition to the resolution of technical issues, studies are now underway to ensure that all of the following programs function as a set to provide an environment where IOT systems operate.

(1) Establishment of safety standards and legal systems
(2) Establishment of an operation structure and organization
(3) Education of system operators
(4) Accumulation of expertise in operation and equipment/device maintenance
(5) Establishment of a revenue model that covers investment and operating costs

Since the period of high economic growth, Japan has spent a great deal of time to establish these functions in step with the development of social infrastructure and industries.

On the other hand, China's IOT projects need to take on the following issues.

- Faced with the recent rapid growth of the economy and social infrastructure, systems must quickly be introduced in parallel with the development of social infrastructure.
- The world's leading-edge technologies can be used, including the Internet, high-speed mobile

Table 6. Examples of ICT systems used in Japan for a long time

Field	System
Manufacturing	• Factory automation (FA) at plants
Agriculture	• Using sensors to control greenhouse temperature
Logistics	• Using GPS installed in trucks for transportation and delivery management
Power distribution	• Remote monitoring of power transmission facilities
Transportation	• Using sensors installed on roads to measure traffic volume
Public safety	• Using cameras to monitor public space
Environmental protection	• Connecting nationwide measurement stations to monitor air pollution
Disaster prevention	• Monitoring road environments such as precipitation, wind velocity, snowfall, freezing
Housing	• Home security systems

Notes: 1) For comparison purposes, the fields listed above correspond to those listed for IOT model projects in Jiangsu Province in Chapter II. 2) GPS = global positioning system.

communications, cloud computing, RFID and a variety of sensors.
- In addition to resolving technical issues, there is also a need to simultaneously develop safety standards and legal systems.

The need to simultaneously implement the "development of social infrastructure," "introduction of latest ICT such as the Internet of Things" and "design and establishment of legal systems and human resource development programs" is a feature that is not limited to China alone, but is being faced by every emerging and developing country.

3 Opportunities and challenges for Japanese companies in China's IOT market

While there are differences in the best way to proceed, when we look at China's IOT projects as a market in which Japanese companies participate, we can definitely find opportunities. Since the period of high economic growth, Japan has endeavored to develop the systems described so far, and the use of these systems has now become widespread in many Japanese industries. As such, Japan has technologies, products and systems, as well as knowledge and expertise to stably operate these products and systems and to bring about their effects, all of which are needed to achieve the Internet of Things. The systems and expertise possessed by Japan include those for matters that are now under study in China and mentioned in Items (1) to (5) in Section 2, including the establishment of safety standards and legal systems, as described in Item (1), and the establishment of a revenue model that covers investment and operating costs, as described in Item (5).

In addition, as symbolized by the fact that it has been continuously formulating and implementing the national ICT strategy since 2001 when the e-Japan Strategy was first created, Japan has been working on R&D and the utilization of ICT through the collaboration of industry, government and academia. As a result, Japan has already embarked on verification tests for and actually introduced many systems in almost all fields where China's IOT projects are planning to develop.

Furthermore, the systems that have not yet been widely used due to the problem of "which comes first, the chicken or the egg" could well be adopted in China without any problems. In the case of RFID systems, for example, RFID tags that are attached to merchandise and the reader/writer devices that read and write the information contained in the tags must be disseminated as a set. In China's IOT projects, as described in Section 2, it is possible to consider that the development of social infrastructure will proceed in parallel with application of the latest ICT tools. Accordingly, it can be expected that both RFID tags and reader/writer devices will spread simultaneously at an extremely fast pace and in huge quantities. For example, it is reasonable to assume that the use of electronic vehicle license plates to which these technologies are applied will spread over a very short period.

While these opportunities can be expected for Japanese companies entering China's IOT market, there are also many problems to be addressed. The four major issues are described in the following sections.

(1) Gaps between China's needs and Japanese specifications and prices

Services provided by systems used in Japan satisfy Japanese safety standards and legal requirements in terms of operational stability and reliability, and offer the specifications and levels that are required by Japanese companies and consumers. As a result, the initial investment and operating costs are somewhat higher than the international average, which could hinder the introduction of such systems in China. Accordingly, services should be adapted to comply with Chinese safety standards and

legal systems, as well as to meet the needs of Chinese companies and consumers, including costs.

(2) Lack of ability to offer comprehensive proposals in response to customer needs

While Japan has an excellent track record for component technologies and individual products, it has not performed well when offering comprehensive proposals for major systems based on the needs of overseas customers.

(3) Need for being in harmony with China's "indigenous innovation"

China's basic policy for economic development is "indigenous innovation." This policy is aimed at reducing dependence on other countries and developing and strengthening China's own technologies and brands. Given the expectations for the Internet of Things to grow as one of the strategic emerging industries, it is very likely that China will place an emphasis on this policy in developing its projects, which will make it difficult to directly bring in any Japanese technologies and brands. On the other hand, for Japanese companies, careful consideration is required to determine what technologies, products, knowledge and/or expertise should be offered to China's IOT market in order to establish the continuing relationships that benefit both China and Japan.

(4) Limited means of finding reliable business partners

In China, regardless of where we look in that vast country, there are a large number of various companies, from those that operate in the global market to newly established venture companies. From among such a large number of companies, it is difficult for Japanese companies to develop a means of finding partners that they can rely on and work together with.

IV Launch of the China and Japan Business Alliance on the Internet of Things

1 Start of collaboration with China

Because China's Internet of Things activities are expected to first develop as Chinese government projects, it is reasonable to assume that Chinese enterprises will participate in these projects. It is natural to consider this method of procurement by the government because the same thing can be said of Japanese government projects, in which Japanese companies participate.

However, as we described so far, given various problems associated with the rapid growth of cities and industries and the need to address these challenges quickly, it would probably be wise for the Chinese government and Chinese enterprises to draw on the technology and experience that have already been accumulated in advanced countries such as Japan and consider more advanced systems based on such available technology. In particular, Japan's technology and experience in the fields of transportation, logistics, disaster preparedness and environmental protection could immediately contribute to addressing China's problems. In addition, through collaboration between Japanese and Chinese companies, universities and research institutions, contributions could be made to resolving problems in emerging and developing countries.

For example, despite the occurrence of the Great East Japan Earthquake on March 11 of this year, the Shinkansen (high-speed railway) trains all stopped immediately without any derailments thanks to the Urgent Earthquake Detection and Alarm System (UrEDAS) for the Shinkansen trains that uses seismometers installed along the railway lines. The Shinkansen tracks and electrical equipment are regularly inspected by dedicated inspection trains, known as "Doctor Yellow," which are equipped with a range of sensors to inspect tracks and electrical equipment as the trains move, contributing to the safety and reliability of the Shinkansen system. We can say that these systems are a physical representation of the Internet of Things. Japan's technology and experience related to disaster preparedness should have widespread applications around the world.

In addition, activities to promote the standardization of devices, communications and data in China's IOT market are important for spreading the concept in the future. The same thing can be said of Japan's and Korea's "Ubiquitous Network" as well as of the Internet of Things in Europe and the U.S. Given that standardization activities usually tend to be driven by the U.S. and Europe, it is significant that Japan aims to join forces with China, Korea and other Asian countries in order to form an Asian drive toward global standardization.

As such, the significance of China's IOT projects for Japanese companies is not limited to providing a source of revenue through market participation, but includes establishing Japan-China partnerships toward developing international standards and contributing to resolving problems occurring in countries and regions throughout the world in the fields of transportation, logistics, disaster preparedness and environmental protection.

2 Establishment of the China-Japan business alliance and proposals for the Chinese IOT market

In January 2011, jointly with the Beijing University of Posts and Telecommunications, Nomura Research Institute (NRI) established the China and Japan Business Alliance on the Internet of Things. NRI, which has long advocated the possibility of the ubiquitous network in

Japan and was actually involved in establishing policy and provided support for the development of related businesses, established the secretariat on the Japan side. The Beijing University of Posts and Telecommunications, which is a leading Chinese university in the field of information and communications, set up the secretariat on the China side. Companies, research institutions and universities that endorsed the purpose of this alliance joined as managing members, which are composed of nine entities on the Japan side and 16 entities on the China side as of January 2011 (Figure 2).

To establish this alliance, considerable support was given by China's Ministry of Industry and Information Technology, the Beijing Economic and Information Technology Committee and the Beijing Information & Telecommunication Association.

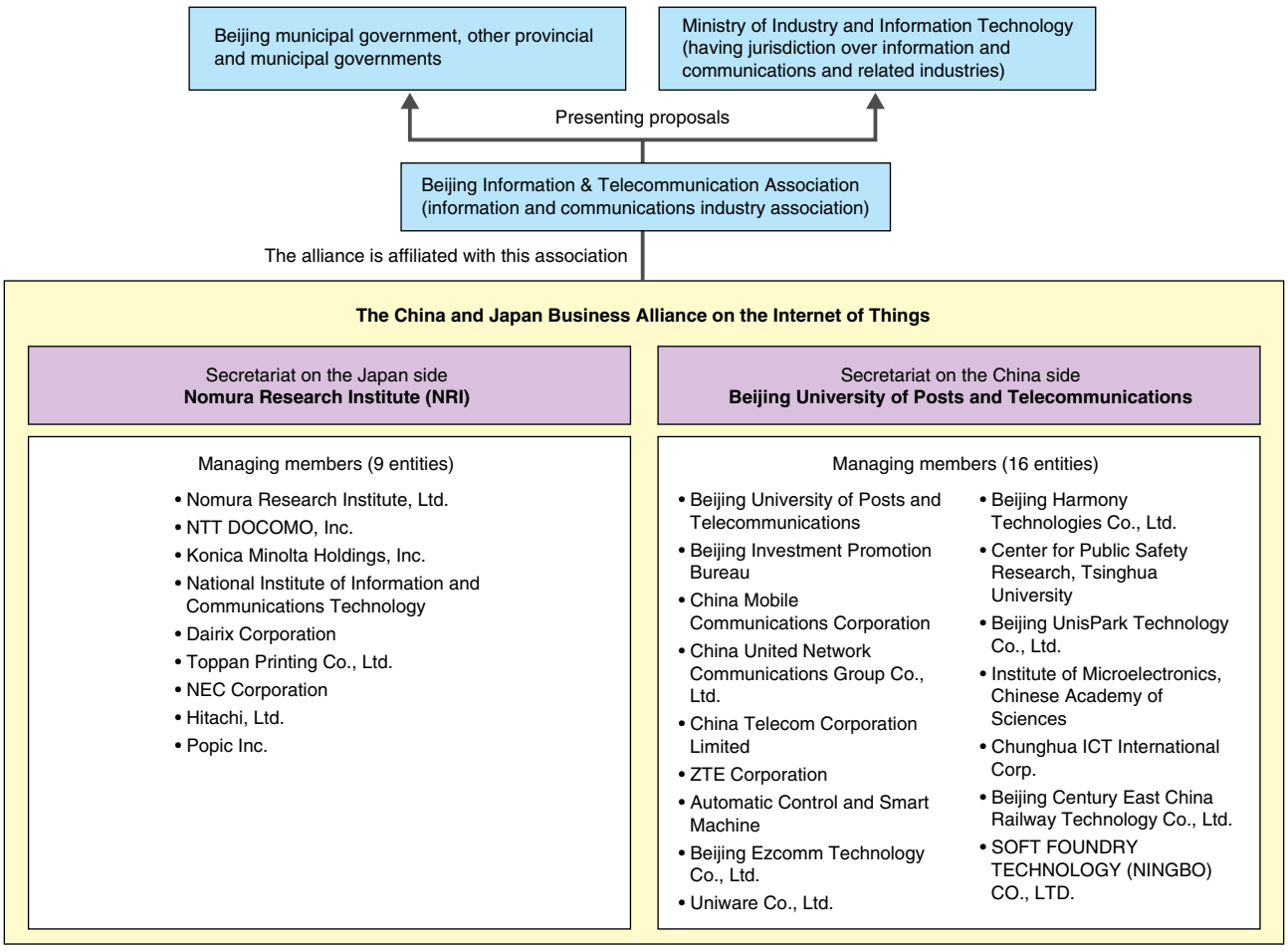
When developing the structure of this alliance, we placed special emphasis on creating an organization that enables the partnership to jointly make highly effective proposals, in addition to promoting information exchange and building a human network. Therefore, we requested the participation of Japanese and Chinese companies and research institutions that showed high interest in the Internet of Things and have solutions and products that can be used to make effective proposals.

Moreover, the alliance aims to provide major support for the solutions needed by the projects that are implemented by the central government as well as by provincial and municipal governments, which would be difficult for any single Japanese or Chinese enterprise to undertake.

As described in Chapter II, IOT projects have started in many Chinese provinces and cities. However, the first goal of the alliance was to participate in the projects being undertaken by the government of Beijing, which is the capital of China, and has a large influence on the policy of other cities as well as the entire country. Initially, the alliance intends to make proposals to IOT projects planned by the Beijing government through the collaboration of Japanese and Chinese companies and research organizations. The fields where our efforts will first be made include transportation, logistics, medical service and disaster preparedness. Through interaction with the Beijing government and discussions with participating companies, research institutions and universities, we plan to make proposals for other areas as well.

The alliance intends to facilitate the activities throughout China with Beijing being the base of such activities. With respect to standardization, the alliance aims to approach the central government and international

Figure 2. Organizational structure of the China and Japan Business Alliance on the Internet of Things (as of January 14, 2011)



standardization organizations based on its experience in Beijing.

In recent years, in Japan, "infrastructure export" has been talked about a great deal with the aim of participating in investment projects for developing infrastructure in emerging and developing countries. To this end, many Japanese companies are adopting an "all Japan" approach in various fields. The alliance launched this time has adopted a new form of exporting Japanese strengths in cooperation with the companies, research institutions and universities of the partner country. We believe that this alliance will provide Japanese companies with new opportunities for participating in areas where it was previously difficult to enter such as participating in the government projects of a partner country and being involved in international standardization efforts. Together with our partners in Japan and China, we intend to make highly effective proposals and support their implementation.

Notes:

1 WFE (World Federation of Exchanges).

2 "China Statistical Yearbook 2010" and "Beijing Statistical Yearbook 2010" compiled by the National Bureau of Statistics of China.

3 Work report delivered at the 11th National People's Congress.

4 "The World's Worst Traffic," Foreign Policy, August 24, 2010.

5 Figure obtained by multiplying the number of patients by the number of visits. When one person sees and is treated by a single doctor once, the formula is: $1 \times 1 = 1$ in-person visit.

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