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Ubiquitous Network Vision for New Growth

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1. What is the “Ubiquitous Network”?

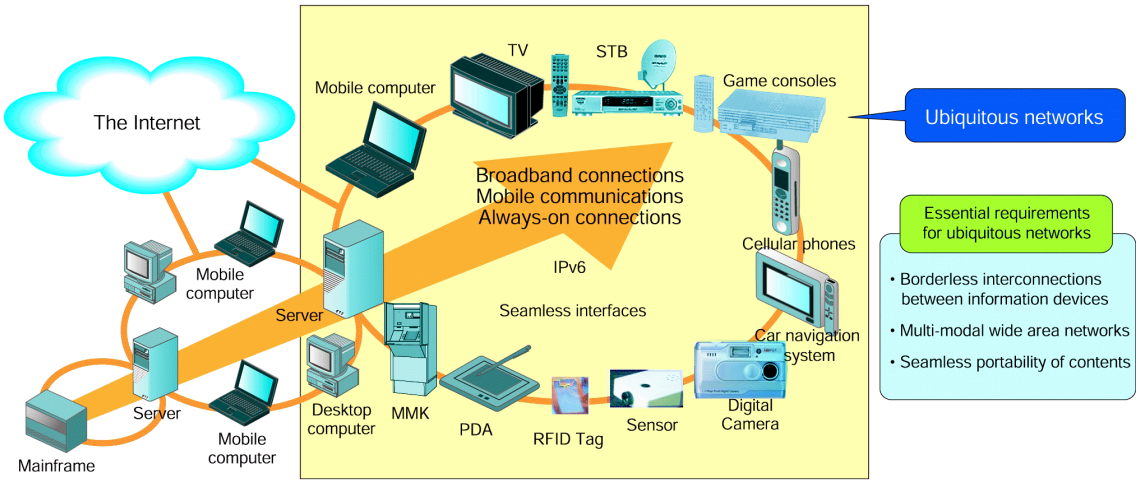
The capacity and cost performance of communications networks have expanded gradually and steadily. However, until 1995, users of networks saw no such dramatic improvement in performance as they had with computers. One explanation for this can be found in the peculiarities of regulation-based communication industries. Communication service infrastructure includes civil engineering technologies and its technology innovations were modest and developments have a long depreciation period.

Communication capacity started to explode in 1995 due to several developments that occurred coincidently around that period. Firstly, as a result of privatization and deregulation in the communication field, new businesses were set up and, consequently, competition accelerated. Secondly, the second-generation mobile telephony spread and became very popular. The wireless technology enabled developing countries to install infrastructure relatively easily and this factor has made mobile communication a truly global phenomenon. Thirdly, the emergence of WDM (Wave Division Multiplexing) in the field of optical communication networks enabled transmission of huge capacity data. Fourthly, the private sector including smaller companies started to take up the Internet. ISPs (Internet Service Providers) began migrating to fixed charges from the arcane usage-sensitive charges and this stimulated the creation of new e-commerce and communication-rich applications. Many new business ventures emerged and investment in these fields increased.

Unfortunately, between 2001 and 2002, the Internet bubble burst. As with other bubbles, the major reason for the Internet bubble was excessive

expectations. With the burst of the bubble, many dotcom companies that had invested in the Internet business model disappeared. Among the hardest hit were those who invested large amounts of money for the installation of sub-oceanic cables and trunk lines in expectation of high demand for Internet communication. Regrettably, the effort has left a capacity glut.

Figure 1. Image of Ubiquitous Networks



Notes: IPv6=Internet protocol version 6 (next-generation Internet protocol); MMK=Multimedia kiosks; PDA=Personal data assistant (portable data terminals); STB=Set-top box.

The auction system for third-generation mobile service prompted astronomical bid prices that ended up putting a significant strain on the European mobile operators. With the subsequent downturn of the stock market, the auction fiasco resulted in tremendous fiscal problems among the operators and halted the installation of the third-generation mobile infrastructure in several European countries.

The communication industries are currently recovering from the burst of the bubble. Many dotcom companies that have survived have started to make profits and some telecommunication operators are returning to profit as well. But we are not just witnessing a recovery in the telecommunications industry. A fundamental change in the communication paradigm toward the Ubiquitous Networks has occurred. This breakthrough open up the entirely new scenery of the ubiquitous world.

In Japan, the convergence between the Internet and mobile phones started with i-mode in 1998. This convergence has gained momentum and has created a big push around the world. GPS (Global Positioning System) and camera sensors are being exploited, a marriage that has created new demand. Attaching

a small RFID (radio-frequency identification) tag to an item or component will enable the diffusion of tracing applications that will lead to a new social system paradigm – and soon we will realize the Ubiquitous Network as a new paradigm in which networks exist everywhere.

2. Changes brought about by the Ubiquitous Network

What is the power of the Ubiquitous Network? There are three major ways in which the development of networks will have fundamental socio-economic impact. They are:

1. through expansion of information sharing
2. through community empowerment
3. through increased sensing and tracking capability

2.1 Expanding information sharing

The broadband is the most important factor in network progress. Broadband networks enabled the media industries to easily transmit visual content and opened a big new market opportunity for them. But the more essential advantage of broadband is that it allows people to share knowledge and collaborate more efficiently, which will benefit a wider range of industries.

In the 1990s, call centers set up in particular counties or regions represented the first step in BPO (business process outsourcing). More recently, expanding the trend, medical and image diagnoses, accounting, and other professional activities are being outsourced across national borders, an indication that BPO is finding big markets. Broadband changes the organizational features of companies and, as a consequence, they may disperse their activities across national borders as their sophistication increases. This trend will have a huge impact in the world.

2.2 Empowering communities

As network capability extends from connecting nations to businesses and to ordinary citizens, it brings increasing power to communities and more complicated, non-linear information flows. The trading model, such as an auction, is one good example. Another example is the case of the large voluntary

community of Linux users that cooperatively produces a high-quality product. Obviously, business management also needs to adapt to this movement. Community empowerment is complicated. It depends on the network capability that develops with inexpensive communication power and it will constitute a fundamental economic and social force.

2.3 Expanding sensing and tracking capabilities

Implanting RFID tags and sensors into items and networks has a multitude of important applications such as efficiently tracing and distributing food products. Recently, mobile phones are equipped with a visual sensor from CCD (Charge-coupled device).

Sensing and tracking capabilities will expand and the convergence of the physical world and virtual information that can be communicated will create huge market demand in both communication and socio-economic applications.

3. Service Innovation and Creation of New Industries

3.1 Shifting from process innovation to product and service innovation by responding to actual demand

What kind of market opportunities will arise from shifting toward the ubiquitous network society? Needless to say, the Ubiquitous Network will not only improve processes but also create innovative products and services. Of course, new products have to be targeted at people's actual demands and at the needs of society. According to the Surveys of 10,000 Consumers[1] conducted by Nomura Research Institute in 1997 and 2001, the main concerns facing Japanese today are:

1. Own and family members' health problems
2. Deterioration of law and order, increase in crime
3. Environmental problems including global warming
4. Education and schooling
5. Employment

[1] NRI 1997,2000

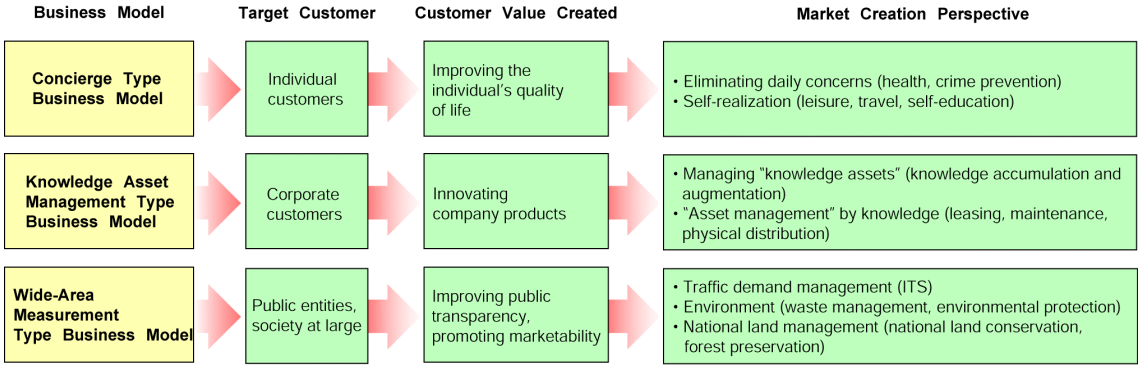
Japan will experience the aging of its population in the near future and this phenomenon leads to a society where the elderly participate to an unprecedented extent in producing and consuming cycles. In this regard, new products and services related to older people and an aging society are one of the big issues to be considered in the era of the Ubiquitous Network.

3.2 Three Innovative Business Models

Analyses of pioneering cases and technological roadmap conducted by colleagues at Nomura Research Institute identified three major innovative business models:

1. “Concierge type business model” aimed at consumer markets.
2. “Knowledge-asset management” schema focused on corporate users.
3. “Wide-area measurement” systems targeting public service fields

Figure 2. Three Innovative Business Models



Note: ITS = intelligent transport systems.
Source: Nomura Research Institute.

3.2.1 Concierge-type business model

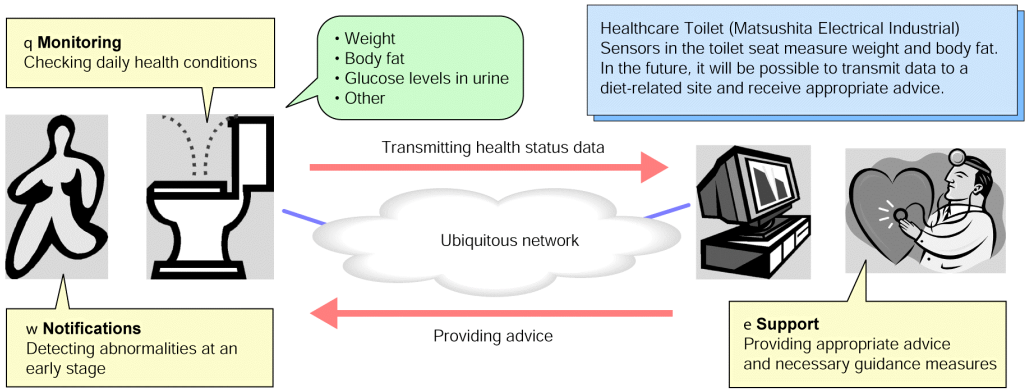
A hotel concierge (along with supporting staff) looks after guests by offering various services, such as making sightseeing arrangements, offering guidance, and responding to other customer requests. Based on this concept, the term “concierge” can be applied to customer assistance personnel who provide information and assistance in specific fields. Accordingly, concierge-type business models can be positioned as “very attentive services provided when needed” that support the everyday life of people in a non-intrusive manner.

A prototype example of a concierge-type service is the Healthcare Toilet by Matsushita Electrical Industrial Co. Ltd. The seat of this toilet is equipped with sensors to measure such data as body weight and fat and to automatically

monitor glucose levels in the urine to check the user's health status. This sort of equipment will create a concierge-type business opportunity not only for medical service providers but also for insurance vendors.

Another example of concierge-type service is the use of GPS (global positioning system) and sensors to manage and monitor the condition of equipment in the field from a remote headquarters. When any abnormality occurs that information is reported to the central headquarters, which can take appropriate action, such as dispatching replacement parts or repair vehicles. For a company, this system would provide high-value added services including downstream processes of the value chain that would benefit its customers. In the era of the Ubiquitous Network, this kind of concierge-type service will not only be available with expensive construction equipment but it will even be available through inexpensive home electronic equipment to be used in people's daily lives.

Figure 3. Health Management Service Using Toilet



Source: Nomura Research Institute.

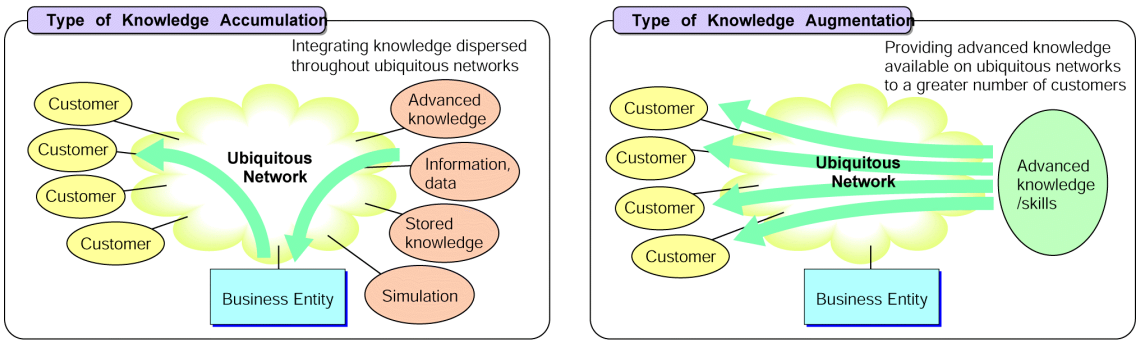
3.2.2 Knowledge asset management type-business model

Along with global offshore business process outsourcing, home-related services, experts at home handling business processes, will become popular. Through networks, experts in various fields can create and share their accumulated knowledge.

The Ubiquitous Network will open new markets for knowledge-based businesses such as aggregation services offered by financial organizations, education and training offered by renowned experts and expanded capability and performance of knowledge-guided machines. An example of the latter is a recently developed tunnel-digging machine with sensors that are supported by a central

knowledge base and can direct the equipment to respond to local conditions.

Figure 4. Knowledge Asset Management (Knowledge Accumulation and Knowledge Augmentation)



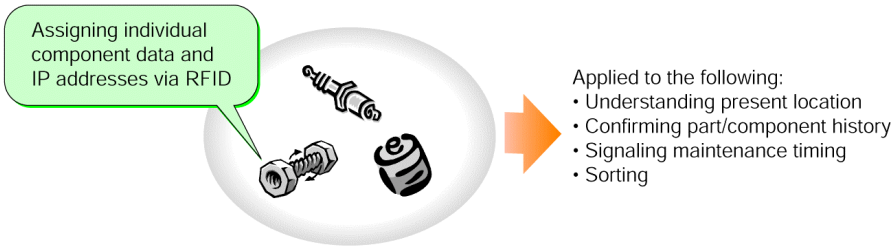
Source: Nomura Research Institute.

3.2.3 Wide-area measurement-type business model

Fields such as the environment and distribution require efficient planning at a both global and national level. In the field of ITS (intelligent transport systems), the safety and efficiency of transportation can be heightened by the use of the Ubiquitous Network. Through use of the Ubiquitous Network, ITS (intelligent transport systems) can increase the safety and efficiency of transportation.

With respect to the protecting the environment, implanting RFID tags in parts and components will enable improved recycling and trace-ability of components. In the near future such kinds of social infrastructure and applications will increase tremendously.

Figure 5. Wide-Area Measurement Business Model (Applied to Environmental Fields)



Note: IP = Internet protocol.
Source: Nomura Research Institute.

3.3 Estimation of the Economic Impact of the Ubiquitous Network

There are several ways to estimate the economic impact of the Ubiquitous Network. Just to illustrate, here is an estimate done by Nomura Research Institute.

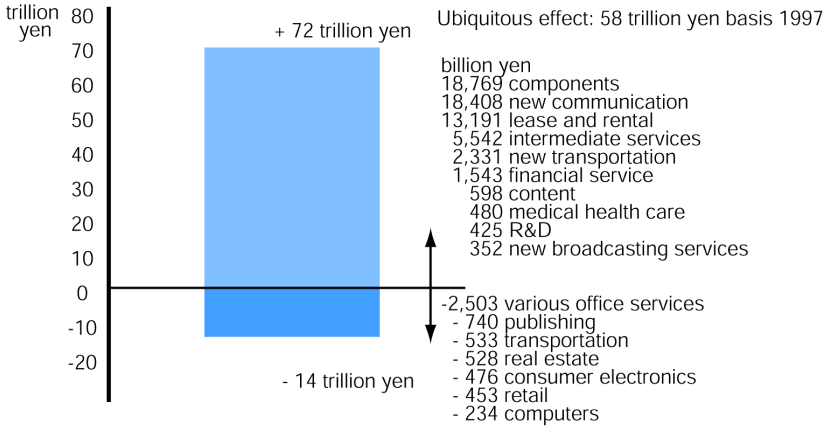
3.3.1 Input-Output Analysis

As mentioned earlier, the arrival of the Ubiquitous Network will involve new industries. Therefore, the effect of investment in information and network dissemination is not limited to the supplying industries in the IT sector only. For this reason, NRI analysts re-categorized the input-output matrix for Japan, taking into account changes in intermediate inputs and industry growth as a result of investment in the information industry during the 1990s.

Without going into further detail, the result was an estimated additional ¥58 trillion in output by the year 2005 (from a 1997 base) attributable to the Ubiquitous Network. This is the net of a ¥73 trillion positive output effect and a ¥14 trillion negative effect. Among the industries experiencing a positive effect, output of high value-added components such as electronic devices and spare parts of cars increases by an estimated ¥18 trillion while “leasing and renting” output, which includes installation, will increase by ¥13 trillion, and output of intermediary services will expand by ¥6 trillion due to the Ubiquitous Network.

Perhaps surprisingly, the shift to the Ubiquitous Network will have a negative effect on the computer manufacturing industry. This means that the value-added ratio of computer production will decrease along with the growth rate, compared to the projected without the network paradigm. As the PC industry becomes a more assembly-type industry, its value-added ratio will eventually decrease. Thus, the core apparatus of the 1990s, the PC, will not retain this place in the era of the Ubiquitous Network.

Figure 6
Market estimates of the impact of the ubiquitous network



4 New governance issues in the Ubiquitous Network society

What will be the impact of the Ubiquitous Network on regulation of

telecommunications and on e-commerce?

4.1 Paradigm shift in Electronic Communication Policy

4.1.1 Convergence between the physical world and the communication world

The convergence of communications and broadcasting is transforming the regulatory framework from the existing vertical structure into a horizontal one, where content and infrastructure would be regulated separately and where competition policy would play a central role. One example of this shift is the new regulatory framework that takes effects this year in the European Union.

In the era of the Ubiquitous Network, networked connections are spread throughout society and reach every aspect of an individual's life through sensors and actuators. Transportation and healthcare and many other everyday services in the real world will converge with the information/communication world.

What sort of regulatory structure might bring about this change? One answer could be found in a transition toward a horizontal regulatory framework including transportation, healthcare, and other areas. With increased interaction between different service industries, separate regulation by industry will be replaced by overall regulation under competition policy.

4.1.2 Transition in the Communication Business Model

Cost of providing electronic communication used to be high and it was considered economically rational, therefore, to regulate telecommunication operators. But in the coming Ubiquitous Network age there will be a much wider variety of communication models than the familiar Communication Operator Model.

For example, Japan uses a faster, two-way communication system called DSRC (dedicated short range communication) to send signals from cars to tollgates and other social infrastructure such as garage doors and gates. This system could also be applied to communicate among cars on the highway to enable drivers to react quickly when another car faces trouble, increasing the

safety and comfort of driving. At the same time, this communication system can become an ad hoc roadside network. In another example of diverse models of communication, personal devices connected to each other, to home electronic and information devices, and to the information environment in the workplace can transmit data to one another.

Such communication service is not supplied by network operators. In most cases, information equipment vendors will implant the communication function in their equipment. So it can be called a Communication Vendor Model.

At the same time, installing a wireless LAN on rooftops can connect entire communities in a network. Such non-profit type networks already exist in some communities.[2] This could be called a Communication Users model.

In the Ubiquitous Network Age, the existence of various models that provide diverse communication functions and services will be important.

4.1.3 Allocation of the frequency spectrum resource

Originally, the frequency spectrum was mainly used for collective purposes such as national broadcasting. Thus, until recently, allocation and licensing of the frequency spectrum was a national matter, in what could be called a "command and control model."

With the rapid growth of private sector mobile phone business came a new model for effectively allocating use of the frequency spectrum through a market auction system. The skyrocketing prices in European 3G mobile auctions and the resulting management crisis for telecommunication operators have shown how difficult it can be to plan such a Market Model.

Nevertheless, some type of market mechanism is becoming generally acknowledged as necessary for the optimal usage of the frequency spectrum. There are proposed and actual solutions to prevent the cost of obtaining frequency from surging. They include allowing MVNOs without network infrastructure to enter the market and deregulating antitrust laws so that

[2] See Shinohara T.,(2002) “Community-oriented Communication Development in Rural Japan.” *ITU-D Focus Group 7*,Geneva.

operators can jointly own infrastructure. Another solution would involve transferring and leasing the rights to spectrum use, i.e., creation of a secondary market, which would be very close in concept to outright private ownership of frequency spectrum.

Alongside the trend toward relying on the market mechanism to allocate spectrum, increasing numbers of new communications media, such as wireless LAN, will not require licensing at all. More precisely, a number of low-output radio station users will share a uniform frequency spectrum band. This could be called a Shared or Commons Model, in contrast to the Control and Market Models. Today's wirelesses LAN, uses the ISM (Industry Science Medical) band, which does not require a license. Originally this low-frequency spectrum was not intended for communication use and had a limited and narrow usage for devices such as microwave ovens and medical equipment. But technological progress made multiple usage of low frequency spectrum possible. This technological trend and usage of low frequency band will proliferate in the Ubiquitous Network Age.

Accordingly, radio licensing policy and frequency spectrum allocation policy must create incentives to exploit new business areas and technological innovation in the Ubiquitous Network age.

4.1.4 Immunity problem

As the use of mobile phones became popular, interference with pacemakers and medical equipment was reported. The details of guidelines on the use of mobile phones have been debated for some time. In the regulation of mobile phone usage in public places, including public transportation, there is a trade-off between the usefulness of the mobile phone from a socio-economic standpoint and the risk that accompanies this convenience.

Regulation of mobile phone use on public transportation has gone through a trial-and-error phase in Japan, but recently it is settling into uniform voluntary rules. These require users to turn off mobile phones in the vicinity of courtesy seats for the elderly and to set them on silent mode in other places inside public transportation. (Use of mobile phones for mobile-mail and Internet surfing is allowed.)

Mobile phone usage in hospitals may cause serious interference with medical equipment but, on the other hand, it is also essential for contacting medical staff. Presently, PHS (personal handy phone system), which is similar to the European DECT, is used in hospitals and other medical facilities in Japan due to its low radio frequency output.

These are some of the critical issues that may arise with the expansion of Ubiquitous Network equipment including RFID tags. It is important to consider not only how to regulate the parties emitting the radiation but also how to regulate the companies that manufacture pacemakers and other medical equipment. The ability of equipment to shield itself from radiation needs to be enhanced.

4.2 Rules on e-commerce in the age of the Ubiquitous Network

4.2.1 Rule-making problem of e-commerce

Since 1995, together with the expansion of the Internet and the prosperity of e-commerce, many of the rules on commercial transactions have been re-examined. Effort has been made to tackle various issues that arise in an open environment such as the Internet where transactions take place without physical proximity; these issues include the legal validity of contracts, verification of the purchaser, security and privacy. Due to the global nature of the Internet, other issues such as the responsibility of intermediaries, taxes, and jurisdiction must also be re-examined.

Topics related to these issues are:

1. Validity of contracts and digital authentication
2. Consumer protection
3. Protection of privacy
4. Security
5. Tax and tariffs
6. Intellectual property rights
7. Business Model Patents
8. Internet domain names

9. Responsibility of intermediaries

Self-regulation, government regulation, technological approaches and a combination of these are all possible means to address these issues. The pioneering guidelines on security and privacy protection announced by the OECD are particularly important. At the same time, the continued development of the Internet depends on the power of the private sector. From this perspective, the notion of relying on self-regulation is fundamental while making rules. Government, international organizations, private companies, civilians and members of many other groups are rivaling and cooperating in making the rules for the Internet.

The balance of power among these actors is shifting as well. For instance, in an area such as privacy protection and security, self-regulation is not enough. Because of growing problems, government regulation is required. In particular, security became a critical issue after the incident of September 11, 2001. One concern is the safety of the national information system and the other is to strengthen the security management in the private sector.

Rule making and the development of e-commerce continue. Here comes the question, what would be the objects of rule making in the era of the Ubiquitous Network? Privacy and security are the two most pressing issues.

4.2.2 Privacy and Security Issues in the era of Ubiquitous Network

According to news reports[3], a large apparel manufacturer announced a plan to implant RFID tags in its products but the company had to cancel the plan because consumer groups complained about invasion of privacy. This incident raises several arguments.

Lately, as low-cost chips have made implanting RFID tags into clothing feasible, the efficiency and security of the entire business cycle has improved because companies are able to track stock, not only through the distribution

[3] On April 4, 2003 , Benetton Group declared no microchips (Smart Labels) are present in the more than 100 million garments produced and sold throughout the world under its brand names, including the Sisley brand. For further information see:
http://www.benetton.com/investors/en/pressreleases/2003/20030404.html

system but also through the POS (point of sale) system in retail stores. These tags can help prevent counterfeiting and pilfering goods and items from stores as well. On the other hand, the concerns of consumer groups are also understandable. With RFID tags implanted into clothes, there is a possibility that a person's every single action can be monitored and his/her privacy will be invaded. And this information could be used even for criminal purposes.

This problem illustrates a conflict between socio-economic convenience and privacy protection. A similar contrast with the usefulness of a technological innovation occurred when the steam automobile first appeared a century ago. In order not to startle horses, authorities limited the speed of the steam automobile to 2 miles per hour and ordered a man to walk in front with a red flag[4].

In the Internet era, the ability of ordinary citizens to state their views is enhanced and their influence will increase accordingly. In the coming Ubiquitous Network age, dialog among people with differing opinions is essential and, consequently, codes of conduct or guidelines are necessary. Technological development must accommodate this aim as well.

Referring back to the RFID example, the apparel maker can simply cut off the information-collecting function of the RFID tag once the item is sold and leave the fabric composition and laundering instructions intact. In short, one compromise plan in this case could be to discard the information that would identify an individual.

At the same time what is also crucial is for industries to protect the information they have on customers to prevent any data security breach. That will ensure credibility of electronic marketplace in the eyes of individual consumers as well as any businesses involved in commercial transactions.

In the age of Ubiquitous Network, the central issue of technological development is to find a way to realize the OECD's principles, which requires the control of individual's private information and security issues.

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[4] The Red Flag Act of 1865 limited the speed of mechanical road vehicles to four miles per hour (6kmp) in Britain. For more information see:
http://www.public.iastate.edu/~f2002.hist.488/auto.html

6. Conclusion

In the Ubiquitous Network society the function of communication technologies should be seamless and largely unobtrusive. Photo imaging, video sensors, and location sensors are implanted inside mobile phones already. Due to the dramatic reduction in cost, RFID tags, wireless ID sensors, can now be implanted in anything and everywhere. In this way, we are on the verge of the Ubiquitous Network age.

The application system in the Ubiquitous Networks is different from that in the PC-centered world. Transportation, medical care and education—our everyday life will be wrapped in safety and comfort. This emerging scenario contains tremendous economic possibilities for the post-bubble world.

In order to make this development into reality, several issues have to be solved. A new electronic communication policy, solutions for the problems of radio frequency allocation, and new rules for protection of privacy and security have to be devised.

In the era of the Ubiquitous Network, new applications and services will affect individuals' safety and security. The balance between the efficiency of industry and the protection of individual privacy, for example, has to be carefully considered. Communication technologies will substantially affect not only governments and businesses but also daily lives of individuals. In such expansion, the rules based on diverse governance are needed. International organizations, governments, businesses, and ordinary civilians will need to have a dialog when making the rules.

Compared to the speed of technological development, progress in social systems and people's recognition of the change will be slower. An unexploited field always needs a trial-and-error approach. The diffusion of the Internet and e-commerce started circa 1995, and merely 8 years have passed. Astonished by its achievement and progress, a new progress toward the age of Ubiquitous Network society is expected in the next ten years.

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