Ubiquitous Computing as a Platform for Innovation

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New Era of Computing

I was deeply impressed that it was thirty years ago when NEC put forward its "C&C" concept. As was described in that vision, "innovation" is particularly important, and I would like to take this opportunity to share my thoughts on the meaning of "innovation" and about the importance of ubiquitous computing as a platform for innovation.

During the past 100 years, computer and information technology has made remarkable progress, and I have broadly divided these advances into three eras of computing development: the birth of the microprocessor in the 1970s, the widespread penetration and adoption of the Internet in the 1990s, and the age of ubiquitous computing, which commences from the 2010s. These generational transitions are not simply a matter of advances in technology, but also are accompanied by changes in academia, culture and the overall social infrastructure. From a technology-centric era, we are entering an age that is placing a priority on leveraging technology and the design of systems and organizations. The new era also erases traditional academic divisions, resulting in a fusion of the arts, science, and engineering. With the advance of ICT (information and communications technology), the speed and scope of social change is increasing at a geometric rate.

What Do We Want from Innovation?

The idea that all problems can be solved by technology only and the idea that we need to change social systems as well obviously differ. There are also cultural differences in the attitude with which we approach the application of technology to a real-world problem. For example in Japan, the electronic toll collection system (ETC) was introduced for expressways, and has achieved approximately 70% penetration. It is a sophisticated system that can judge whether or not a moving vehicle is equipped with an onboard ETC device, but it is also an expensive one. On the other hand, the Electronic Road Pricing (ERP) vehicle-mounted device was made mandatory in Singapore if the driver wanted to enter controlled area. The mandatory requirement has made nationwide deployment of simpler system possible, kept the costs down and supplied the onboard devices at a lower cost. This is the result of adopting a different system.

Technological innovation has no set formula or textbook. Japanese innovation in the 21st century demands the tackling of new concepts such as the case studies I have just described.

Ubiquitous Computing – the Infrastructure of Innovation

I would like to return to the topic of generational transition with a focus on infrastructure. Today the Internet is already an integral part of our lives. It has become the vital platform for the ICT Society because of its open and universal characteristics. In ICT, the merit of universality is an especially major factor. Technology which is restricted for some specific purpose, and "closed" infrastructure result in a high cost. The national road grid system is a good example of open system. It will be prohibitively expensive to build roads for a single purpose.

Right now, the most important universal technology is the family of ubiquitous computing technologies. They compose the infrastructure that links the virtual world of computers and networks with the real world. Ubiquitous computing technology has given birth to a diversity of innovation ranging from products (goods) and processes (methods and operation) to social innovation (systematic and structural). Technology to recognize situation (context awareness in a broad sense) will lead to the realization of capabilities such as traceability of the movement of goods, assistance for free mobility, virtual companies, multi-modal transportation, and robot guidance. By transcending the conventional boundaries separating industries, corporations, organizations and even countries, and connecting them, ubiquitous computing technologies will enable the optimum management of society.

"uID Architecture", Linking the Virtual and Real Worlds

For the realization of this vision, I would like to propose the concept of "uID Architecture". With the "u" standing for ubiquitous and universal, the architecture assigns a unique 128 bit ID code to every object, place and even concept that we want to identify. The code itself carries no meaning. All attribute data are stored in a database. Tags that hold the codes could be read by various devices such as PDAs, mobile phones and even wristwatches, and could even be attached to roads and tourist spots. The architecture becomes a new infrastructure that supports identification of objects, support for free mobility, and much more.

Already we have performed many feasibility study experiments. I urge all who are thinking of ubiquitous computing technologies as the platform for 21st century innovation to examine its importance not only as a technology per se but also as the foundation to build social infrastructure.