

U-Essence

*The essence and future of U as in ubiquitous in
Korean and Japanese Information and
Communications Technology*

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1. U-Reality or U-Buzz?

The *u* as in *ubiquitous* has established itself as, well, a ubiquitous concept in Korean and Japanese information technology. There are so many u-words. U-city, u-Korea, u-Japan, u-home, even u-life. It seems almost anything may be converted to the u-era by adding the letter u. Is this just buzz, or how much u-substance is there?

This report attempts to find out (from a Western perspective) the essence of ubiquitous computing in Korea and Japan.

- What is the core of ubiquitous computing?
- What are some trends in ubiquitous computing?

Unless stated otherwise, references to Korea in this report refer to the Republic of Korea, commonly known as South Korea.

Markers in the style of [ABCyy] are references found at the end of the report.

2. The U-Word

This chapter is devoted to language twists behind the almost volcanic eruption of u-terminology. The topic has also been covered extensively in a previous report [SOD08].

As a first simple fact, the *u* in u-words like *u-city* and *u-tourism* means *ubiquitous*. This is certain.

A harder question remains: Exactly what does *ubiquitous* mean when it appears in the context of Korean or Japanese high tech? It is natural to expect the answer from a dictionary. A typical entry tells you that *ubiquitous* means,

found or seeming to be found everywhere; ever-present [from Latin *ubique*, everywhere] (*Chambers English Encyclopedic Dictionary*)

There is no reason to distrust this explanation until you run into concepts like *u-home* or *u-city*. A home or a city cannot even seem to be everywhere. So, are we ready to dump dictionaries?

The dictionary is right, of course. But it is English, not Korean or Japanese. To discover the true meaning of *ubiquitous* in this special setting we must consider that the term has been on a tour. In fact, it has made a round trip from English to Japanese and Korean, and then back to English again. A journey often makes impressions, and this one is no exception.

A Word Travels the World

The classical *ubiquitous computing* concept emerged in the West during the 80's. Mark Weiser was a well known spokesperson [WEI91]. A decade later the concept faded and lost some of its magic in the West. It travelled east and was picked up and energized by the Japanese and the Koreans.

The governments of these two countries launched ambitious national ICT programs. A concept was needed for marketing abstract technology trends to the general public. *Ubiquitous computing* became the term of choice. It was suitable not only as a marketing catchword. It also matched their long-ranging visions.

As the visionary Japanese and Korean IT programs gathered momentum the word *ubiquitous* penetrated the native languages. It became a loan word in Japanese as well Korean.

ユビキタス

유비쿼터스

Left: *Yu-bi-ki-ta-su* (Japanese). Right: *Yu-bi-kwo-to-su* (Korean).

When a loan word enters a language it often passes through a narrow gate. The original word may represent a cloud of related meanings and connotations, but only one of them is brought into the new environment. At least, this is true about *ubiquitous*.

The new loan word was used exclusively for high tech and ICT. Its association with *computing* became automatic. *Ubiquitous computing* could be cut down to *ubiquitous* without losing precision. In Japan and Korea *ubiquitous* simply *is* computing and high tech, no less.

“In Japan and Korea *ubiquitous* simply *is* computing and high tech”

Full Circle

Japan and Korea embraced the *ubiquitous* technology with creative enthusiasm and energy. *Ubiquitous* was found to be a bit long and was trimmed down to just *u*. Almost every aspect of society was envisioned being transformed into its *u* counterpart. There is u-Japan and u-Korea, u-city, u-home, u-tourism, u-business, even u-life, and many more.

The u-word began its return trip when the flourishing u-activity was communicated back to the rest of the world in English. Since *ubiquitous* is an English word many Japanese and Korean authors naturally assume it is understood without explanation in an English context.

As a result many Westerners scratch their heads over expressions like *the ubiquitous economy* or *the ubiquitous society*. These terms just do not make sense unless you go beyond the dictionary definition. They do not refer to an economy or society *found or seeming to be found everywhere*, as the dictionary would suggest. In a Japanese or Korean context they refer to an economy or society transformed by a *technology* where computing power is found everywhere.

A Reasonable Translation

After this lengthy explanation, here is a handy translation for Westerners puzzled by Japanese or Korean u-terminology:

ubiquitous means: **connected**, or **cool and connected**

Ubiquitous refers to something that is always online, always having access to relevant information over the Internet. The optional addition of *cool* is intended to reflect some of the positive overtones inherent in u-words.

In summary: In Japan and Korea “ubiquitous X” does not mean that X is found everywhere or seems to be found everywhere. There is definitely an “everywhere” factor, the ability to be online everywhere. “Ubiquitous X” means that X takes advantage of uninterrupted connectivity to the Internet. In short, X is *connected* or even *cool and connected*.

“*ubiquitous* means *connected*”

Test Case: Ubiquitous Sensor Networks

As a linguistic test case, consider the following term: *Ubiquitous Sensor Networks*, or USN. USN is an important technology in the u-era. How should the term be translated?

Some u-terms, like *u-home*, are meaningless if you stick to the dictionary definition. *Ubiquitous Sensor Networks*, on the other hand, has a plausible dictionary meaning: “Networked sensors found, or seeming to be found, everywhere.” However, this is **not** how the term is understood in an Korean or Japanese ICT context. It means *connected* sensors. Sensors become accessible wherever they are by virtue of an omnipresent Internet.

Because of this potential ambiguity the term WSN, *Wireless Sensor Networks*, is preferred in the West.

3. U-Essence

After settling the language issue we may turn our attention to the core of ubiquitous computing. What is required to make something belong to the u-era in Korea or Japan?

The Internet of Things

First of all the u-era is not constrained to people-to-people communication, as the e-era. There is a “device big bang”, that is, an explosive growth in the number of devices with communication ability. Many kinds of objects enter the u-circle. Object-to-object and object-to-person communication is imminent.

As an example, one of many features in the u-home concept is to allow you to connect to appliances in your home while you are away on the job, or in the car. A more complex example is remotely monitoring the condition of a bridge by means of sensors measuring strain, vibration and other vitals.

“things are bound to outnumber people on the Internet”

The entire field of Ubiquitous Sensor Networks, or USN, is devoted to things (objects, machines) communicating with people or with other things.

Digital devices become smarter while their price drop dramatically. They are bound to outnumber people on the Internet, creating the *Internet of things*.

Connectivity

Connectivity is definitely the centerpiece of anything aspiring to recognition in the u-era. Ubiquitous computing is all about devices and people being connected.

Connectivity spells Internet, but not exactly the Internet we see today. The vision of ubiquitous computing implies an Internet accessible anywhere, with sufficient bandwidth, and using many kinds of terminals, stationary and mobile. Nomadic use is the rule rather than an exception.

The Internet of the u-era is given new names to differentiate it from the Internet we see today. It is called the *ubiquitous network* in Japan, the

broadband converged network (BcN) in Korea. In spite of their different names they share some main characteristics.

- Available anytime, anywhere to anyone
- Safe, security, easy to use
- Affordable, high speed, low latency

It is a truly “everywhere” network, a network that lives up to the dictionary definition of *ubiquitous*.

Seamlessness

Seamlessness is freedom from noticeable service junctions. It is a vital part of the ideal of an uninterrupted, “bump free” user experience. A seamless service follows you like a faithful dog that stays at its master's side through varying circumstances.

The user experience is the sum of the seamlessness on several levels.

Transmission seamlessness implies that a user does not drop a network connection when moving around. This is a quite well understood mechanism called hand-over. It is complex, but is built into modern communications standards. As mobile phone users we have come to take it for granted. Moving between different types of networks is not as common, but solutions exist. For example, some mobile phones are able to switch between 3G and WiFi networks.

The level above transmission is the device level and *device seamlessness*.

As an example, consider your media collection. You want it to go with you during the day, using whatever terminal at hand. You don't expect the same quality from all devices. The “sameness” is on a different level.

Device seamlessness begins when devices communicate in order to migrate service sessions from one to another.

On a still higher level there is *service seamlessness*. This is when you move from one service to a related service without having to tell the second service who you are or your focus in the first service.

“seamlessness is connectivity taken to new levels”

Seamlessness is about staying in touch. It is connectivity taken to new levels. Seamlessness may seem natural, but it comes at a cost and only by careful design.

Convergence

Convergence is not exactly a condition for classifying a service as ubiquitous. It is the sum of general trends reflected by many ubiquitous services. Convergence means that distinct services develop in a way that brings them closer to each other and ultimately makes them combine into one.

Here are a number of examples of convergence trends that are already evident.

- Telecom and IT used to be easily distinguishable. Today they are very difficult to tell apart. Perhaps the term ICT will disappear with time because information and communication are inseparable.
- Media and IT used to be quite different. Beginning with the written word, then audio, then video, media went digital.
- Person-to-person communication (telephone) used to be distinct from broadcasting (radio and tv). Today the same network may be used for both.

“convergence has the power to upset business models”

Convergence is a strong force. By inverting established truths it has the power to upset traditional business models, even entire industries.

One make take a different view of convergence: IT is being absorbed by other disciplines and vanishes from sight. For instance, in the early years of personal computing there was “desktop publishing”. The computer was a visible and exotic citizen in the world of publishing. Today the “desktop” prefix has been dropped because there is no other publishing. The attention has shifted away from the computer even though it is more indispensable than ever.

Advancing Society

Ubiquitous computing in Korea and Japan cannot be fully understood by considering the technology level only. It is driven and motivated by a strong desire to advance society and to promote the well-being of its citizens. There is a firm belief in the potential of technology to solve real problems. A u-service is expected to have noble goals of improving and supporting daily life.

4. Megatrends

This chapter considers overall megatrends to set the context for specific ubiquitous computing trends in the subsequent chapter.

Computers and Communication

“the first computers computed, nothing else”

Let us take a brief look at computing history. What did the first computers do? The answer is very simple: they computed. Nothing else. Of course that's where their name came from.

- One of the first uses of computers was to calculate artillery trajectories. The computer produced reams of numbers that were copied and printed as booklets to be used by artillery operators.
- In the late 1960's a typical computer program was a pack of punched cards that included the input to the program. You fed the cards through a card reader and a while later output was printed on paper, upper case only. Interactive systems were in their infancy.

The common point about the examples is that early computers just did not communicate. They solved problems, but they were detached from the world where the problems existed. A human intermediary was required to interpret computed results and apply them to the original problem.

The overall trend has been to reverse this situation. Today perhaps the main purpose of computers is communication. Improved communication means computers definitely inhabit, and even control the reality they are a part of.

“today perhaps the main purpose of computers is communication”

The computer has become the natural instrument for communicating text, voice, music, still pictures, moving pictures. For better or for worse, modern artillery is controlled by computers directly, without a human intermediary.

Another common trend emerges in these examples: Although the computer takes control it vanishes from sight. For example, a mobile phone is packed with computing power, but we do not consider it a computer. What we call a digital camera is literally a computer with a lens.

Radio Communication

Now a few words on a trend that is well known, but deserves special mention: the revolution in radio communication. Radio is no longer about big boxes with projecting antennas. There are now so many wireless gadgets that we almost forget they use radio.

Mobile phones and wireless computer networks do things that were unthinkable just a few decades ago. In the 1960's the early transistors could be used in middle wave radio receivers. For the VHF band and for transmitters electronic tubes were necessary. Today's mobile phones operate at 1000 times the frequency, both as receivers and transmitters.

A recent development is low cost, short range wireless communication. A wireless headset, a wireless keyboard and mouse, to mention just a few examples, are now affordable to vast groups of consumers. The radio has been miniaturized to the extent you hardly see it even if you look for it.

“short range radio is affordable to vast groups of consumers”

Consumers are happy to replace cables by wireless gadgets, but the real potential of going wireless is more than a matter of convenience. A cable network has to be wired by humans. A wireless network may be formed by intelligent objects without human intervention.

Megatrend Summary

Computers originated as uncommunicative number-crunching monsters behind glass walls. They have evolved to become inseparable from human communication. Even though computers are now everywhere they vanish from sight, being perceived as appliances. Inexpensive short range radio is increasingly used to create ad hoc local networks.

Ubiquitous computing is part of these global trends, both by riding on the wave and as an energizing force.

5. U-Trends

Where is the u-era heading? Rather than attempting an exhaustive answer this chapter probes two important directions.

An Infrastructure for Things

These days a home in a developed country may contain a hundred embedded processors, a mobile phone per person plus a few portable computers and a wireless network. So, is the u-era here?

Phones have their network, personal computing has its Internet. But how about the refrigerator, the heating and air conditioning systems, and lighting? We do not yet see them networked on a large scale. When they are it is a mark of the u-era. Currently an important component is missing: an infrastructure to hook up to.

Why would u-services need more infrastructure than the Internet? There are several reasons, like security and ease of use. The need is real. It will probably be met by ad hoc proprietary solutions until widely accepted standards have been developed.

U-Media

In a previous section (page 7) we stated the convergence between telecom and IT, between media and IT, and between broadcasting and point-to-point. This convergence is already visible, but its full impact is still ahead.

The capacity of mobile Internet is growing dramatically. 100 megabit per second is expected in just a few years from fourth generation telephony networks, paving the way for video and other demanding services.

If transmitting a full-length movie to a mobile phone was charged the dollar per megabyte cost of sending an SMS (text message) the subscriber would face a bill in the order of a million dollars. However, the increasing network capacity is accompanied by decreasing subscriber cost. Measured over a number of years the cut may be as drastic as a million to one.

Given such a striking development it becomes feasible to replace physical media like CD and DVD by virtual ones. This is not a prediction, media

enterprises are already being shaken by this trend. Telecom operators will also face disruption of their traditional business models when subscriber focus changes from connectivity to contents.

The power of convergence transforms the very nature of the mobile network from primarily telephony into everywhere media supply. This is u-media in a literal sense. Traditional telecom is reduced to a side effect.

It is natural for the affected industries to offer mixed responses to the forces of change. Consumers will probably have to endure shifting business models until new practices have been established.

Trends: Summary

A “device big bang” is populating the Internet with communicating *things*. Devices will outnumber people on the Internet, creating the *Internet of things*.

The devices need an infrastructure to hook into. In all likelihood a period of proprietary solutions comes before universally adopted standards.

The rapid development in the area of mobile Internet pushes telephone networks to transform into everywhere media suppliers.

These trends have the potential to upset traditional business models and create opportunities for new ones.

A comparison with the history of telephone systems is relevant. The International Telegraph Union (ITU) was established in 1865 to facilitate international telegraph interconnection [ITU09]. After over 100 years of telephony the ITU (now the International Telecommunication Union) is constantly churning out new standards, and new versions of existing standards.

The ITU is a prominent example of international cooperation, but its work is not unchallenged. ICT standards are not only about cooperation, they are also a battlefield. A pragmatic assumption is that the u-arena will have its share of both.

6. Conclusion

Ubiquitous is a key concept in Korean and Japanese national ICT strategies. The word itself has taken on a new meaning in this context. It means *connected* and has strong positive overtones of high tech coolness.

The u-era brings with it a vision of ever-present IT services with a focus on improving the life of many citizens. One of the major trends is communicating devices outnumbering people in homes, workplaces and on the Internet. Much of the required technology already exists, but the new breed of u-devices needs a new u-infrastructure to hook into as painlessly as telephones do.

As the mobile Internet quickly develops into a high speed everywhere network its role will change from primarily telephony to primarily media.

Some of these changes are dramatic enough to overthrow traditional business models. In the process of operators adapting to new opportunities consumers are likely to meet a rapid succession of new service offers. Widely accepted standards are crucial for mass deployment, a strong motivation for international cooperation.

7. Terminology & References

Terms and Abbreviations

The following terms and abbreviations are used in this report.

ICT	Information and communications technology
IT	Information technology

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