Ubiquitous ID Technologies 2009

by

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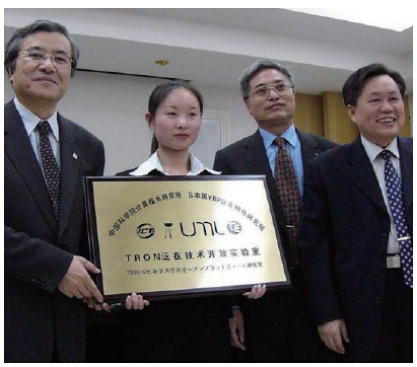
Activities in the World

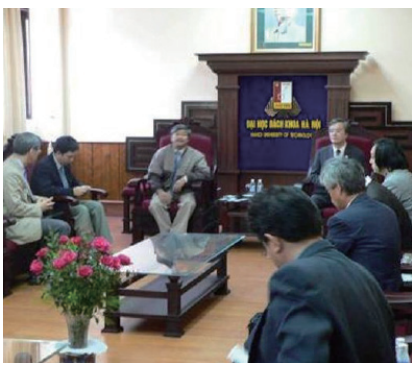
T-Engine/uID Technology Spreading Around the World

The next generation of embedded real-time technology with T-Engine/T-Kernel at the core and ubiquitous ID technology with ucodes at the core is being accepted worldwide due to the advanced level and openness. As a result, many activity sites have already been established throughout the world. For example, TEADEC (T-Engine Application DEvelopment Centre) established by Nanyang Technological University (NTU), Renesas, and the EDB (Economic Development Board), a governmental organization in Singapore, is a development center for embedded real-time systems using T-Engine/T-Kernel. In South Korea, KTEC (T-Engine Korea Center) was established as a similar organization and is busy proactively carrying out activities. Also in Korea, a collaborative project concerning the interoperability of ubiquitous ID technology and other RFID technologies is being implemented by the NIDA of South Korea (National Internet Development Agency of Korea). Sites have also been established in Peking University (China), Chinese Academy of Sciences (China), Dalian Software Park (China), NECTEC (Thailand), Vietnam National University -Ho Chi Minh City (Vietnam), Hanoi University of Technology, NEOTECK Business Solutions, Ltd. (Tasmania, Australia), etc.



Chinese Academy of Sciences

Singapore TEADEC

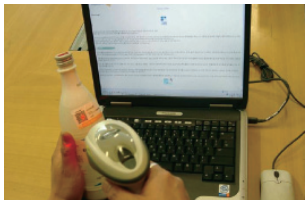


Vietnam National University -Ho Chi Minh City

Asia Ubiquitous International Study

In the Asian region, each country is closely connected economically and many products are traded among countries. Meanwhile, various problems have occurred in international trade among these Asian countries due to product quality. Therefore, ucodes are being attached to various products and commercial goods shipped through the international distribution network, and an approach to make product traceability possible not only to improve the distribution efficiency but also to ensure product quality is under test. In 2006, Aoyama Trading, an apparel manufacturer in Japan, implemented

"Onigiri (Rice ball)-Tei" study in Bangkok, Thailand



Counterfeit check of mail-order products between Korea and Japan

product traceability systems by storing all information generated in the supply chain process of manufacturing in factories in Shanghai, importing to Japan and finally shipment to retail stores. The stored information was associated with ucode in the tag attached to men's suit. In 2008, a pilot food traceability system between Thailand and Japan as well as a traceability system of products traded by mail orders between South Korea and Japan was tested. Furthermore, a pilot system using ucodes to manage celebrity character goods was implemented between Taiwan and Japan.

Shanghai/Fudan University uID/RFID Open Laboratory

In July 2006, the YRP Ubiquitous Networking Laboratory in cooperation with Sakamura Laboratory at the University of Tokyo jointly established the "Shanghai/Fudan University uID/RFID Open Laboratory" at Fudan University in Shanghai, China as a site for research/development/promotion of ubiquitous ID technology in China.
Within the Open Laboratory, a permanent, technology exhibition space was set up for introducing ubiquitous ID technology and T-Engine related technology. In China, Fudan University is considered to be the most prestigious university in the south, ranking with Beijing University in the north, and has a history of more than 100 years. The Software School housing the uID/RFID Open Laboratory was set up in Zhangjiang in the east of Shanghai. Research on OSs, language processing, and e-Commerce are being carried out, and their research on RFID for e-Commerce is considered to be the most advanced in all of China.

Ubiquitous ID Center, Taipei

On January 31, 2008, Ubiquitous ID Center, Taipei was established. It was established as an NPO and is scheduled to provide not only food traceability in Asia but various business system infrastructures. Expectations in Taiwan are extremely high, and its opening ceremony was held with more than 200 people from various quarters of Taiwanese politics, business, and academia in attendance.

Memorandum with the VTT Technical Research Centre of Finland

On June 24, 2008, a memorandum concerning research cooperation in the field of ubiquitous computing was signed between the Sakamura Laboratory of The University of Tokyo and VTT Technical Research Centre of Finland (Valtion Teknillinen Tutkimuskeskus). VTT was established in 1942 and is currently the oldest technical research organization in Northern Europe. The organization predominately carries out research in application fields, in which fundamental research results are connected to commercialization, and many contracted and joint research studies are conducted according to requests from private companies. This memorandum concerns the research being promoted in overlapping fields by the T-Engine project and ubiquitous ID architecture as well as VTT, in particular, the NoTA architecture, which is currently being researched in collaboration with Nokia. Joint research, human exchange, and workshops are also scheduled in each field from both the technical and application aspects.

Participation in CASAGRAS European Project

CASAGRAS (Coordination and Support Action for Global RFID-related Activities and Standardization) is a large project supported by the EU for investigation and fundamental research on the development and standardization of RFID related technology. In Europe, the approach to integrate the real world and virtual world using networks and RFIDs is often called, "The Internet of Things." CASAGRAS is an important project for the entire EU to promote the required standards for identifying and implementing the technology necessary in making "The Internet of Things" a reality.
YRP Ubiquitous Networking Laboratory participates in CASAGRAS as a partner from outside the EU region and contributes to the creation of a future vision by presenting ubiquitous ID technology.

CASAGRAS website: http://www.rfidglobal.eu/

Activities in International Conferences

In 2008, achievements concerning T-Engine, T-Kernel, and ubiquitous ID technology were announced in various international conferences held all over the world. For example, in April 2008, Professor Ken Sakamura of the University of Tokyo held a speech titled, "RFID as a platform of innovation," in the Thailand RFID Forum 2008. In addition, he held another lecture titled, "The Ubiquitous Computing Revolution," in the Finland Ubiquitous Forum, "JokaPaikan Tietotenkniikan (=Ubiquitous Computing) Summit" (JPT Summit 2008). Other major activities include the participation of half-day seminars of ubiquitous ID technology in the 1st EU – Japan Symposium on NGN and Future of Internet held in Brussels, Belgium in June and ITU-Workshop "Ubiquitous Technologies: Concepts and Applications" held in Pusan, South Korea in July. Furthermore, in September, we participated in "GRIFS (The Global RFID Interoperability Forum for Standards) Workshop Tokyo" in Tokyo and "The Internet of Things - Internet of the Future" in Nice, France in October. These international conferences are extremely important events for the international collaboration of information communication technology, and we will continue to value and participate in these conferences in the future.

Hangzhou

The Chinese government is currently promoting energy conservation, and the monitoring and control of energy are important issues. Homewell, in Zhejiang, is beginning to apply a wireless sensor network to energy monitoring systems for air conditioners and electricity in hotels, office buildings, and public facilities. Since large, multi-story buildings have already existed in China for many years, it is difficult to install wiring later for monitoring and control. Therefore, this wireless sensor network is attracting much attention. YRP Ubiquitous Networking Laboratory has been involved in technical cooperation with Homewell in the area of application of ucodes to the ID management of sensors, and sensor networks. As a part of this technical cooperation, YRP Ubiquitous Networking Laboratory held a joint booth with Homewell in the Electronics & Information Fair, Hangzhou, China 2008 from September 3 to 6, 2008. Moreover, YRP Ubiquitous Networking Laboratory was involved in technical cooperation on a ticket system using ucodeQR in the fair. As a result, the effect of the fair on market cultivation through the real-time understanding of visitors and guidance to booths, etc. was improved further.

Ubiquitous ID International Standardization Activity

ITU-T

The YRP Ubiquitous Networking Laboratory has promoted activities to standardize ubiquitous ID technology internationally since 2005 in the ITU-T (Telecommunication Standardization Sector, International Telecommunication Union, United Nations, Headquarters: Geneva, Switzerland). Our laboratory proposed two standards of F.MID and H.MID, and assumed the role of editor. These standards received consent as ITU-T recommendations in May 2008 and acquired approval through the AAP process in August. Following approval, F.MID received recommendation number F.771[1] and H.MID received recommendation number H.621.[2]
These standards are the first international standards for infrastructure concerning network type information access for providing information services through networks using electronic tags etc. The F.771 recommendation concerns requirements for network type multimedia information access triggered by tag-based information such as RFIDs and the H.621 recommendation stipulates the architecture for realizing this multimedia information access based on ubiquitous ID architecture. These standards can be applied not only to distribution and logistics, which have been a major application of electronic tags, but also to a wide variety of applications such as food traceability, location dependent type information access, and free mobility assistance services.
In the future, the international standardization of more detailed technology will continue to be promoted and two new standardization work items named H.IDscheme [3] and H.IRP [4] are already approved in the Study Group 16. H.IDscheme is a draft of standard for ID code systems which includes ucodes and H.IRP is a draft of standard which includes a ucode resolution server standard. The YRP Ubiquitous Networking Laboratory will serve as editor for both H.IDscheme and H.IRP.
The international standardization of more technological items are scheduled for the future.

ISO/TC211

TC211 was established in ISO (International Organization for Standard) to handle “Geographic information/Geomatics” which mainly consists of GIS (Geographical Information System). An ad-hoc group, UBGI (UBiquitous Geographical Information), was established within TC211 to promote research aiming at the international standardization of advanced ubiquitous location information systems like the one implemented by Ubiquitous ID Center. In October 2007, an ISO/TC211 general meeting was held in Xian, China, and Ubiquitous ID Center participated in the “ISO/TC211 Standards in Action Workshop” and made a presentation titled, “ucode: An Efficient Tag-based Location Identification System for Ubiquitous Geographic Information.” Here, the importance of ubiquitous location information systems was emphasized, and their achievements using ucodes in Japan were promoted. The importance of ubiquitous technologies highlighted in this general meeting was approved, and the ad-hoc UBGI group was successfully promoted as a WG (WG10). In the future, the promotion of international standardization of ubiquitous location information systems will be expected. Ubiquitous ID Center would like to contribute proactively to promoting international standardization in ISO/TC211 along the lines of the contributions made to the ITU-T.

ISO/TC211 website: http://www.isotc211.org/

CJK (China, Japan and Korea) NID Working Committee

The China, Japan, Korea NID Working Committee is chaired annually in turn by each country and held two to three times a year for the purpose of information exchange among China, Japan, and Korea and for the advance arrangement of documents to be submitted to ITU-T, ISO, etc. Currently, the chairperson is Associate Prof. Noboru Koshizuka (The University of Tokyo).

[1] F.771: “Service description and requirements for multimedia information access triggered by tag-based identification” (Editor: Y. Takashima/YRP UNL)
[2] H.621: “Tag-based ID triggered multimedia information access system architecture” (Editor: Y. Takashima/YRP UNL)
[3] H.IDscheme: “ID schemes for multimedia information access triggered by tag-based identification” (Approval schedule: 2009) (Editor: N. Koshizuka/YRP UNL and J.S. Lee/ETRI, Korea)
[4] H.IRP: “ID resolution protocols for multimedia information access triggered by tag-based identification” (Approval schedule: 2009) (Editor: N. Koshizuka/YRP UNL and J.S. Lee/ETRI, Korea)

Ubiquitous ID Core Technology

Ubiquitous ID Architecture

Ubiquitous ID Center aims to identify information distribution structure based on numering system, ucode (ubiquitous code), to identify objects, places, and concepts in the same framework. Ubiquitous ID architecture is the information distribution infrastructure based on ucode and has the following characteristics:

・Infrastructure for identification
Ubiquitous ID architecture is the next-generation information infrastructure which can recognize and identify objects, places, concepts, and digital information on those entities, etc. and it can also retrieve pertinent information considering the relationship between two such identified objects.

・Can be used universally
Ubiquitous ID architecture is highly versatile information infrastructure; therefore it can be applied to various application fields such as product management, supply chain management (SCM), traceability and offering customized information in accordance with user's location. Also, ubiquitous ID architecture can be used across application, organization and industry boundaries.

・For ubiquitous computing
Ubiquitous ID architecture is the bridge between virtual world consisting of digital information and the actual world where we are living.

・Open architecture
The common technical specifications for realizing Ubiquitous ID architecture have been developed by T-Engine Forum / Ubiquitous ID Center consisting of companies, research institutes and universities around the world, and its development result is open to the world.

Ubiquitous computing is the technology to support human life through the collaborative operation of embedded computing nodes in every object in the living space such as electric household appliances as well as walls, furniture and floors. We make these nodes act autonomously and have them exchange the information among themselves (Figure 1) for collaborative behavior. Ubiquitous computing is the technology to support human life indoors as well as outdoors by embedding computing nodes to electric poles and signs outdoors, for example (Figure 2).
In order to realize such ubiquitous computing, it is important to recognize the context in the real world (context: in other words, status or situation). This is called context-awareness. In order to realize context-awareness, it is essential to recognize various objects, places, and concepts in the real world, which can be considered parts of context.
The first thing you need to know in order to recognize context is to "know one object from another object." As the simplest method to realize this, we have decided to allocate a number to each object to be identified. Ubiquitous ID architecture manages the numbers to be allocated to respective objects, places, and concepts to be identified and manages the information concerning

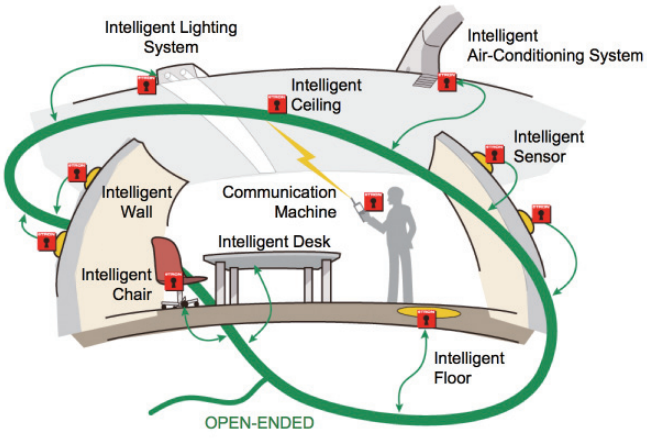


Figure 1: Image of indoor Ubiquitous computing

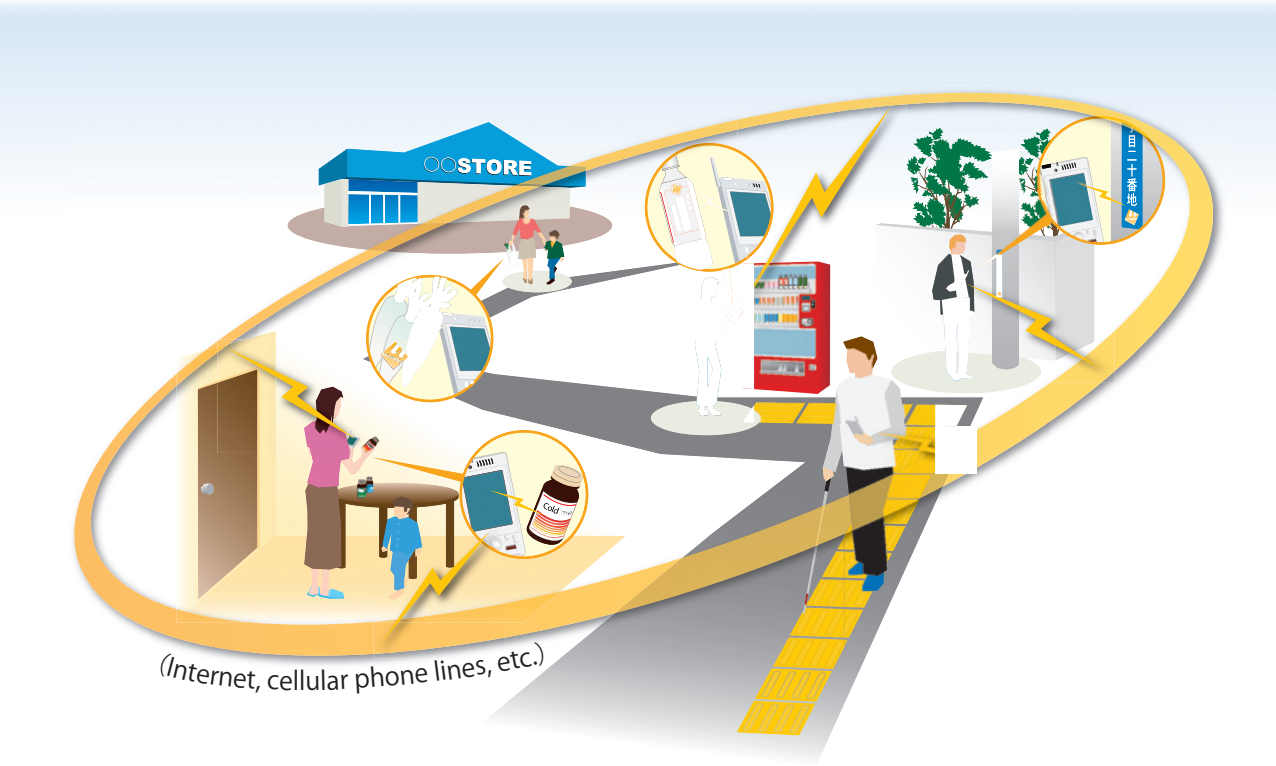


Figure 2: Image of outdoor Ubiquitous computing

the respective objects, places, and concepts.
Ubiquitous ID architecture calls the specific numbers to be assigned to respective objects, places and concepts to be identified as "ucodes." Ubiquitous ID architecture has the feature to handle objects, places, and concepts in the same framework.
The media to store ucodes is called a ucode tag. Ubiquitous ID architecture can handle various kinds of tags such as bar codes, RFID tags and active sensors as ucode tags. This ucode tag basically stores only ucode, a number, and the information on objects and places to which ucode is assigned will be stored in the database on the network. By separating the identification of object (and place) and the management of information, it is possible to update the information on the object, obtain the latest information on the object, and obtain the information on other objects related to a given object. The information which is subject to less frequent renewal can be stored in the ucode tag itself. Both information to be stored in ucode tag and the information stored in the database on the network is represented in the description framework called ucR Framework.
The terminal for reading ucodes and for providing services based on ucodes to users is called Ubiquitous Communicator. Ubiquitous communicator reads the ucode tag, retrieves the information related to ucode, or the location of ucode information server where the information is stored by using the ucode in the tag as the key to search the information. The wide-area distributed database, ucode Relation Database, manages the information related to ucodes such as the relation between ucodes, explanatory contents on the objects to which a ucode is assigned, and the location of the server where the contents are stored.
Ubiquitous ID architecture is a secure wide-area distributed infrastructure architecture which, in turn, uses eTRON architecture to protect valuable information from various threats such as forgery, copying and alteration using tamper-resistant hardware (Figure 3).
Ubiquitous ID architecture is a common platform for acquiring the information on the status of devices, controlling them, and providing information and service using ucode as a trigger to identify objects and places in the real world. Ubiquitous ID architecture can be used for various applications across industries (Figure 4). Ubiquitous ID architecture is the important infrastructure architecture to connect the entities in the real world such as objects or places with ucode tags, and the virtual world such as the associated information stored in information servers. Moreover, Ubiquitous ID

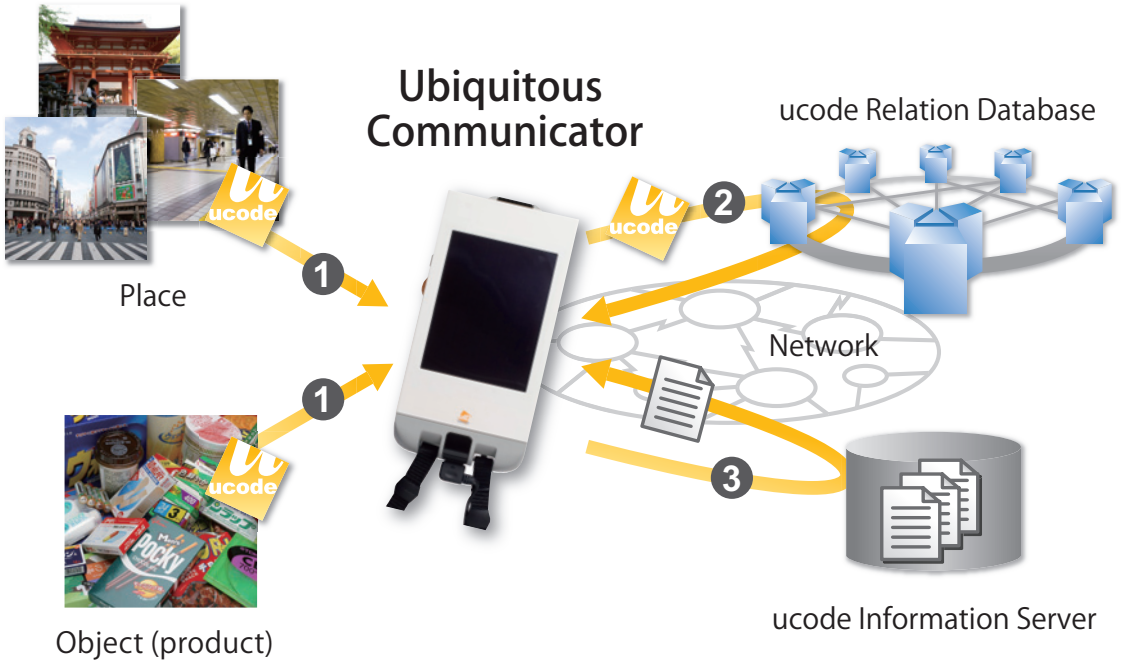


Figure 3: Ubiquitous ID architecure: Basic Operation Mechanism

architecture is an open architecture whose specifications are open to the public.

ucode

ucode (ubiquitous code) is a number to be assigned to objects, places, and concepts in the real world to be identified by Ubiquitous ID architecture.
ucode has the following five features.

1. Fixed length

ucode is 128 bits long. This is a huge space consisting of 2^{128} (=340,282,366,920,938,463,463,374,607,431,768,211,456 $\fallingdotseq 3.4 \times 10^{38}$) ucodes. This means that if each of one trillion person uses one trillion ucodes per day, he or she can use it for one trillion years and there will be still more ucodes left. Also, the ucode coding system is designed so that we can extend the code length in 128 bits unit to 256 bits, and then to 384 bits.

2. It identifies individual objects

ucode is the identification number assigned to individual objects. Unlike the system "to represent the type of products" used in current barcodes, it is possible to identify each PET bottle by assigning different ucodes to the same brand of tea PET bottles for example.

3. ucode can be obtained by any group or individual

If any group or individual asks for ucodes to Ubiquitous ID Center, which is the non-profit organization to manage and administrate ucode and the entire ubiquitous ID architecture, or other organizations which issue the ucode under the authorization of Ubiquitous ID Center, a set of ucodes can be obtained.

4. It is possible to embed existing codes.

ucode has the framework to embed the existing code systems such as JAN, ISBN, IP address and telephone number by using the vast code space of 128 bits.

5. ucode itself has no meaning.

Unlike the current prodcut code used in barcode, ucode itself has no meaning. Therefore, it is applicable to the process where the meaning of the ucode may change in the course of use such as distribution across industry. ucR (ucode Relation) framework is the mechanism to associate (or link) the ucode and the meaning.

ucode Tag

In order to achieve information service using ucodes, a mechanism to associate objects and ucodes is required. The media to store ucodes, in other words, the device that stores ucodes and is attached to objects is called

Figure 4: Ubiquitous ID architecture versatile application

ucode tag in ubiquitous ID architecture.
RFID, which is often used as a ucode tag, attracts attention globally today. In ubiquitous ID architecture, RFID is treated as one of the important ucode tag devices. However, rather than limiting ucode tags to RFID only, a framework to use various ucode tags is provided. In ubiquitous ID architecture, for example, you can use barcode and two dimensional optical codes attached to objects representing ucode as the most inexpensive ucode tag. You can also use smart cards with cryptography and authentication as more secure ucode tag. Ubiquitous ID architecture offers the framework to select various ucode tags in accordance with the use or application demanded of ucode. RFID is often assumed to replace barcode in the future. However, Ubiquitous ID architecture is designed so that barcode and RFID can co-exist, and they should be used for different applications depending on their merits and demerits. uID architecture also uses various types of RFID tags from inexpensive ones to expensive high-performance RFID rather than limiting it to a single type. Also, the many different radio wave frequencies are supported in non-contact communication for different applications depending on the application requirements. Ubiquitous ID center provides two types of classification criteria for ucode tag system to cope with diversification of tag hardware and refinement of classification criteria. One of the classification criteria is the security class (Class) and the other is the interface category (Category). Security class is the classification based on the functions concerning security and privacy protection to be equipped by tags. Interface category is the classification based on the physical interface device of the tags. Table 1 shows the classification criteria of ucode tag by

Table 1: Classification of ucode tag by interface category

Category	Contents
0	Print tag
1	Passive RFID tag / non-contact smart card
2	Active RF tag（battery incorporated）
3	Active infrared tag（battery incorporated）

Table 2: Classification of ucode tag by security class

Class	Contents
0	Function to detect missing or lost data
1	Anti physical duplication / forgery
2	Function to prevent identification
3	Tamper-resistant function / function to control access by resource
4	Function to construct secure communication channel with unknown node
5	Resource management function using timer
6	Update function of internal program / security information

interface category and Table 2 shows the classification criteria by security class.

Information description with ucode — ucR Framework

ucR Framework is the framework to represent information on objects, places, and concepts to which ucodes are assigned.
In ucR Framework, information to which ucode is not assigned such as character strings, URL and numerical data are called atoms. Also the number to identify the relation between ucodes, and between the ucode and atom is called relation ucode.
The minimalist description of the information attached to ucode is the set of three elements of ucode, relationship ucode and ucode, or the set of ucode, relationship ucode and atom. This is called ucode Relation unit (ucR unit). ucR unit is the basic unit of ucR Framework and illustrated in the method as in Figure 5. The typical structure of ucR unit is shown below. Figure 6 shows the respective ucR unit.

1. Suppose ucode: u_1 is allocated to place P_1 and ucode: u_2 to place P_2, and ucode: u_A is allocated to the relation that "they are adjacent." In this case, the ucR unit to indicate that "place P_1 and place P_2 are adjacent" will display an arrow from u_1 to u_2 with u_A on it.

2. Suppose we allocate ucode: u_3 to a certain PET bottle of tea present in real space and ucode: u_B to the relationship of "name." The ucR unit to show that the name of this PET bottle of tea is "Delicious tea" will be an arrow from u_3 to atom of "Delicious Tea" with u_B on it.

When describing ucode-related information in combination with ucR unit starting from certain ucode, you can make a directed graph linking ucodes, or ucode and atom with relation ucode. This is called ucR graph (ucode Relation graph). For example, you can make a ucR graph as shown in Figure 7 by starting from a menu of stuffed cabbage and adding information such as ingredients, recipe and producer of ingredients.
The ucR graph can be thought of as a structure leading from ucode to the information through the relationship. Take a product as an example. You can attach not only the information such as product name and introductory text but also relate it using the ucR graph such as ucode of stores handling the products, ucode of manufacturers and ucode of product ingredients.

ucode Relation Database and ucode Resolution

ucode Relation Database manages ucR graph. In other words, ucode relation database comprehensively manages the information on the relation between multiple ucodes, in addition to the contents of information and service associated with each object to which ucode is assigned. For example, they can associate not only the contents of introductory text of products to the ucode of the said product, but can also associate with the product, the ucode of stores handling the product, ucode of the company producing the product, and the ucode of the raw material out of which the product is produced.
To identify appropriate information in accordance with the status of the ucode relation database based on ucode as input is called ucode resolution. For example, identifying the location of ucode information server which stores the information on ucode is a ucode resolution process. Access protocol to ucode relation database is called ucode Resolution Protocol: ucodeRP. A client who wants to obtain the information related to ucode will make an inquiry to ucode relation database based on ucode resolution protocol. ucode relation database searches the database upon the request from the client and returns the information or the location information (IP address and URL) of the service server

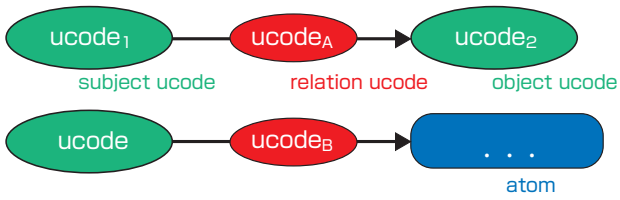


Figure 5: ucR unit

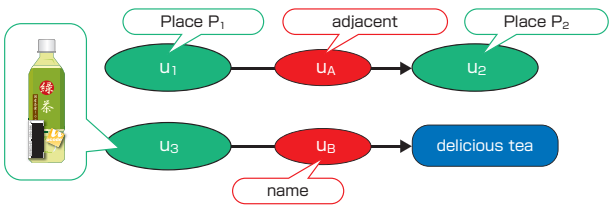


Figure 6: Example of ucR unit

that stores the information to the client. Thus the client can obtain the information related to ucode in the end (Figure 3).
ucode relation database is a wide-area distributed database, and it is possible to manage vast number of ucodes with the relation information. Also, it supports efficient search methods using gateway or cache, realizing real-time ucode resolution. This wide-area distributed ucode relation database is not managed by a single organization.

Use and Operation of Ubiquitous ID Architecture

Any company or individual who wants to provide an information service solution related to objects and places using ucode tag such as RFID, sensor node or barcode, can use ubiquitous ID architecture if a proper application is made to Ubiquitous ID Center or the organizations authorized by Ubiquitous ID Center. Ubiquitous ID Center administrates and operates only the root part of the server hierarchy, along with the infrastructure of ucode space and ubiquitous ID architecture. The organization participating in ubiquitous ID architecture operates the ucode sub-space by being assigned with the administration authority of the "bundle" of ucodes within that subspace. Also, using the ubiquitous ID resources of which administrative authority is assigned, it is possible

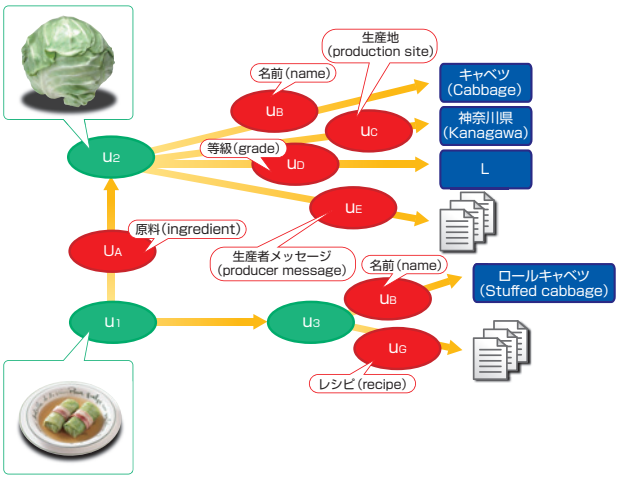


Figure 7 : Example of a ucR graph

for such an organization to offer ucode provider service which further divides ucode space for general users (Figure 8).
A-members and e-members of T-Engine Forum can use 48 bits ucode subspace.

Certified Tags

ucodes are one of the central technologies of ubiquitous ID technology. ucode is a unique ID used to identify

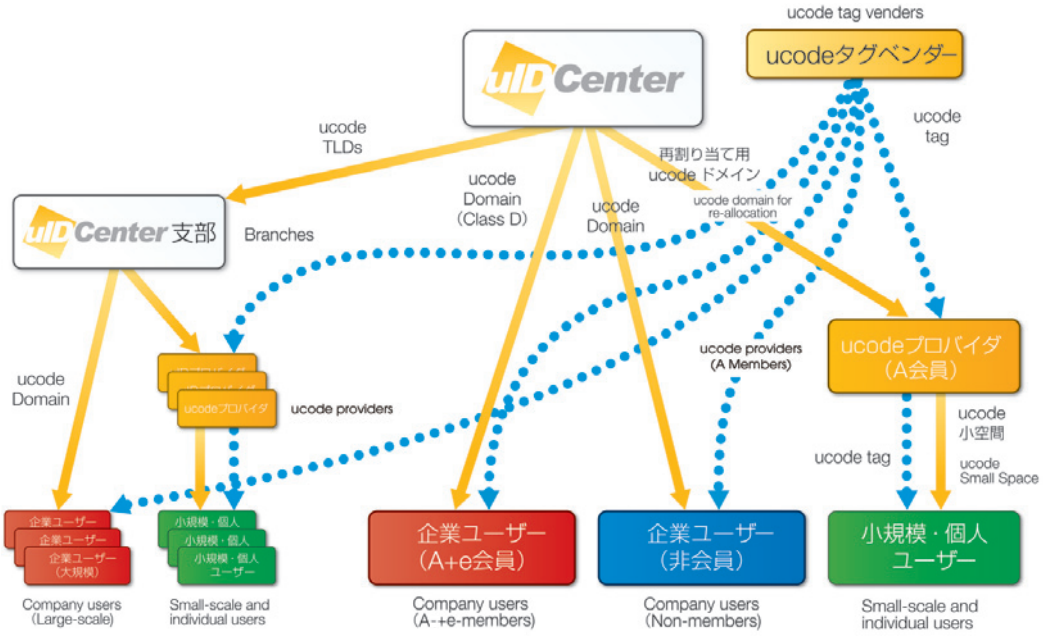
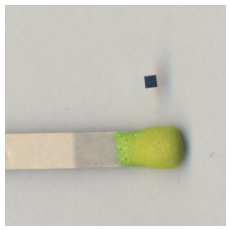
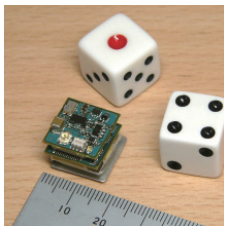
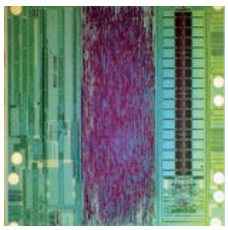
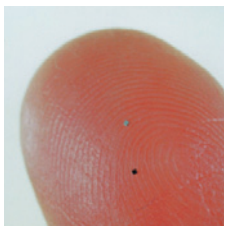


Figure 8: Operation of the ubiquitous ID Architecture





Certification No.	Certification Class		Tag Name	Vendor	Certified date	note
	Category	Class				
00-001	0	0	Barcodes (Code-128)	SATO CORPORATION	2003.12.3	
00-002	0	0	Barcodes (Code-128)	TOPPAN PRINTING CO., LTD.	2003.12.3	
00-003	0	0	Barcodes (Code-128)	Dai Nippon Printing Co., Ltd.	2003.12.24	
00-004	0	0	2D barcode (QR)	SATO CORPORATION	2003.12.3	
00-005	0	0	2D barcode (QR)	TOPPAN PRINTING CO., LTD.	2003.12.3	
00-006	0	0	2D barcode (QR)	Dai Nippon Printing Co., Ltd.	2003.12.24	
00-007	0	0	Digital Watermark	NTT	2003.12.3	
00-008	0	0	ColorCode	ColorZip Japan Inc.	2006.5.17	
00-009	0	0	FPcode	Fujitsu Limited	2007.11.28	
01-001	1	1	Mu-Chip	Hitachi, Ltd.	2003.6.23	
01-002	1	1	T-Junction	TOPPAN PRINTING CO., LTD.	2003.6.23	
01-003	1	4	eTRON/16-AE45X	YRP Ubiquitous Networking Laboratory, Sakamura Laboratory at the University of Tokyo, Renesas Technology Corporation	2003.6.23	
01-004	1	1	MB89R116	Fujitsu Microelectronics Limited	2004.3.19	ISO/IEC15693
01-005	1	1	MB89R118	Fujitsu Microelectronics Limited	2004.3.19	ISO/IEC15693
01-006	1	1	Mu-Chip R/W	Hitachi ULSI Systems Co., Ltd.	2004.12.7	ISO/IEC18000-4
01-007	1	1	MB97R7020	Fujitsu Limited	2005.7.7	ISO/IEC18000-6 Type B
01-008	1	1	MB89R119	Fujitsu Microelectronics Limited	2005.7.7	ISO/IEC15693
01-009	1	1	Mu-Chip RTK101	Hitachi, Ltd.	2005.12.13	
01-010	1	0	μ -Chip Hibiki	Hitachi, Ltd.	2006.11.21	ISO/IEC18000-6 Type C
01-011	1	0	TSL102LC	Lintec Corporation	2007.11.28	ISO15693
01-012	1	1	Large Cast RFtag for Block (TGC2)	TOPPAN PRINTING CO., LTD.	2007.11.28	ISO11784
01-013	1	1	Thin-Laminated RFtag (TGL2)	TOPPAN PRINTING CO., LTD.	2007.11.28	ISO11785
01-014	1	1	IC hologram	TOPPAN PRINTING CO., LTD.	2008.7.16	
02-002	2	1	Local Area Search (LAS) 300	K-ubique ID Corporation	2005.12.13	
02-003	2	0	Info Sign	NEC Engineering, Ltd.	2006.5.17	
02-004	2	0	RFtag03RX	Nomura Engineering Co., Ltd.	2006.10.17	
02-005	2	0	Wireless Marker Active tag	YRP Ubiquitous Networking Laboratory	2006.11.21	

physical objects, and the device in which the ucodes are provided is the ucode tag. In Ubiquitous ID Center, because the usage, characteristics, etc. are different, bar codes, RFIDs, smart cards, active chips, etc. are comprehensively handled as ucode tags. In Ubiquitous ID Center, the certification criteria for these standard ID tags are set for each interface category, and tags that satisfy these criteria are certified as standard ID tags. The basic policy for authorization is, 1. To provide method that enables the acquisition of ucodes, 2. To guarantee the uniqueness of ucodes, 3. To be able to distinguish between ucode tags and non-ucode tags, 4. To clearly mark tags as ucode tags.

Server Technology that Realizes Ubiquitous ID Architecture

ucodes are distributed to companies and organizations and managed based on a space allocation procedure. The ucode resolution servers which provide the "ucode resolution function" for retrieving information from ucodes is realized by a distributed database with a hierarchal structure as its basic component. At present, route node operated by Ubiquitous ID Center and the ucode resolution servers that manage the upper layer in the hierarchical space are working and being used. Each company or organization that receives a ucode

space allocation sets up its ucode resolution server. When companies or organizations notify their ucode resolution servers to Ubiquitous ID Center, the ucode resolution servers can connect to each other. In addition, terminals sequentially search the mutually connected servers, uniformly resolve ucodes issued by each organization, and obtain information associated with the ucodes by using APIs provided in the ucode resolution client library.
On the other hand, the ucode relation database for realizing the ucR (ucode Relation) framework is realized by a normal relational database, a database using Resource Description Framework (RDF) engine that is highly compatible with ucR, and an overlay network. By using these databases, the study and operation of systems that register, search, and manage metadata for creating tourist information associated with places have been promoted.

Ubiquitous Security Technology

Ubiquitous Computing Society and Information Security

In a ubiquitous computing society, a wider range and larger amount of information than in modern information society will spread into every corner of the living environment and information services based on such information will support our lives in a sophisticated manner (Figure 9). An information protection mechanism is necessary to safely and comfortably use "information" that forms such a ubiquitous computing society as one of the important resources to support our lives, just like water, gas and electricity. Information security in a ubiquitous computing society is called "Ubiquitous security." In order to realize ubiquitous security, a wide range of social infrastructures, not only technology but also operation and a legal system, have to be implemented and improved.

eTRON to protect electronic entities

eTRON (entity TRON) is the information security infrastructure architecture to support the above-mentioned "ubiquitous security." eTRON realizes a special form information (electronic entities) which is protected from various threats such as forgery, reproduction and alterations utilizing tamper-resistant hardware, in other words, information with the behavior similar to physical objects which are difficult to forge, reproduce and alter. In modern society, there is a problem that specialists have more knowledge on the

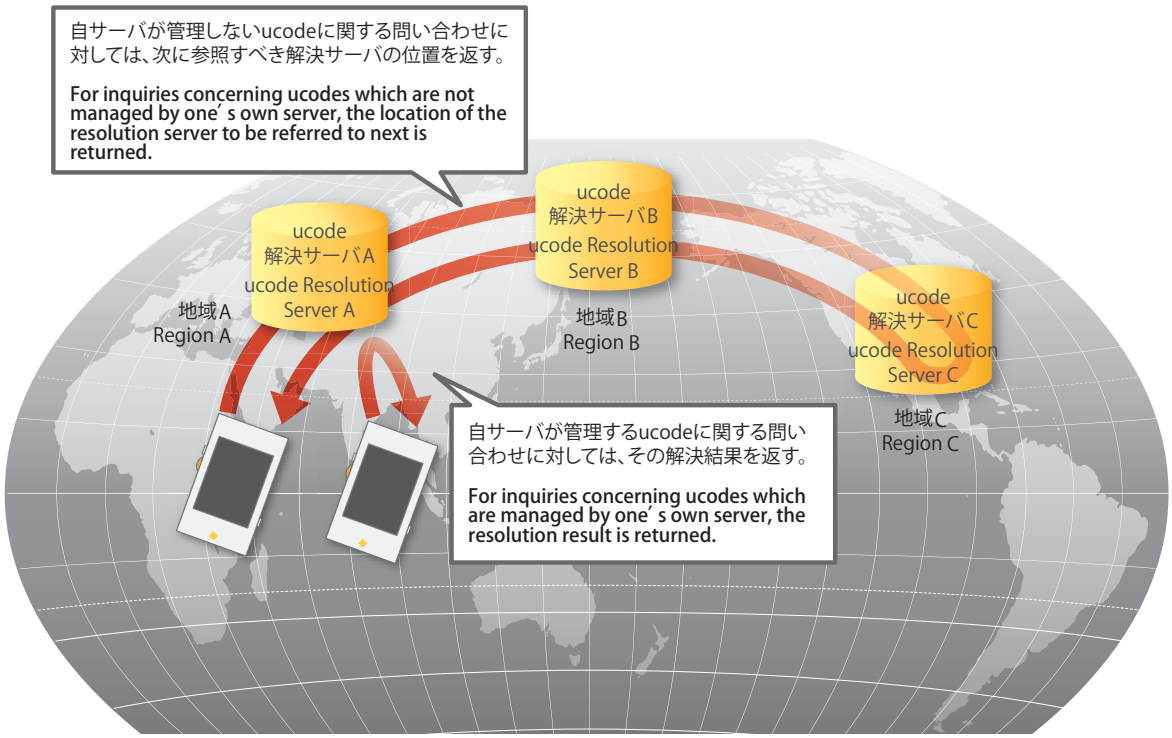


Figure 9: Ubiquitous Computing Society and Security

digital technology and benefit from the technology whereas non-specialists can not benefit from it and, thus, there is a clear disadvantage to the non-specialists. YRP Ubiquitous Networking Laboratory (YRP UNL) tries to solve this issue by "materializing electronic information" with eTRON technology, and making it easier for non-specialists to use the otherwise unapproachable technology, so that the disadvantage due to the unfamiliarity is reduced (Figure 10).
In a ubiquitous computing society, "information" will definitely play an important role. This "information" will be utilized in all scenes of day-to-day life. "Information security technology" that protects "information" to enable us to use information comfortably needs to be designed from a standpoint of universal design so it can be easily used by anyone. However, electronic "information" is invisible. In our approach, "information storage" that robustly stores information and all the means for protecting information routes as "physical objects" (hardware) have been materialized using eTRON technology so that they can be recognized by anyone. YRP UNL would like to establish security in our lives by providing a security device called "eTRON," which is physical object that is visible and touchable so that anyone can use eTRON as they wish to control information in their lives. For example, let's take personal seals and house keys in which are authority information in material forms. We routinely use these without any difficulty. If "eTRON" hardware device is used, it will be possible to use electronic entities as

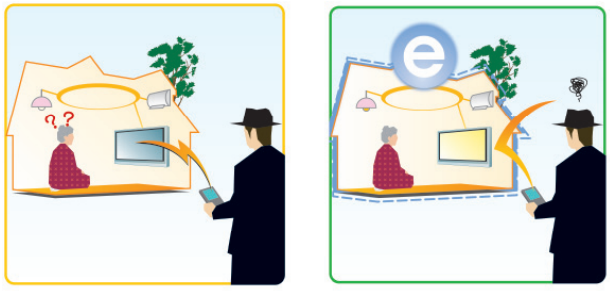


Figure 10: Problem of Asymmetry and Universal Design

easily as seals and house keys.
In this way, information that should be protected with "eTRON" is "electronic entities." These "electronic entities" are stored in the eTRON-specification hardware "eTRON device" that supports information access control mechanisms and is physically and logically tamper-resistant. Additionally, based on a protocol called "eTP (entity Transfer Protocol)," a robust "peer-to-peer" secure communication channel can be established between eTRON nodes and information will be securely transmitted and received in the channel (Figure 11). eTP is a security protocol for eTRON that utilizes various types of cryptographic technology.

eTRON hardware and record of its use

eTRON architecture has various eTRON devices which correspond to each application. The eTRON/8 card is equipped with an 8-bit microcontroller and an ISO/IEC 14443-compliant non-contact interface. This eTRON device is in the same form as a credit card operating with weak inductive current without battery (Photo 1). Also eTRON/16 chip incorporates 16-bit microcontroller. There is a version with a dual-interface, equipped with both ISO/IEC 7816-compliant contact communication interface and ISO/IEC 14443 -compliant non-contact interface. eTRON/16 chip is designed under the assumption that it will be used by embedding into various computer nodes such as T-Engine and ubiquitous communicator. eTRON/16 chip is equipped with advanced instructions to support the development of various applications to deal with previously-mentioned electronic entities. As one of the implementations of eTRON/16 chip, we have UIM-form chip (Photo 2). Moreover as a successive eTRON devices for increased processing speed, larger memory capacity, increased communication speed and multiple functions have been developed. They include "SECURETRON32-B" corresponding to biometric authentication within chip (Photo 3), "UT01" with enhanced PKI function (Photo 4), and “UT03” with a few dozen MB of storage (Photo 5).
eTRON/8 card has been already used by more than 300,000 people at the Expo 2001: Experience the Future held in Kobe city, Hyogo Prefecture in 2001, National Museum of Emerging Science and Innovation (Miraikan) in Koto-ku, Tokyo, which was opened in 2001, and a Digital Museum III exhibit held at the University Museum of the University of Tokyo in 2002. Also as an appliance using eTRON/16 device, "ubinet pass CO," a small device equipped with USB interface (Photo 6) and "ubinet pass AD-L," a small device equipped with ISO/IEC14443-compliant non-contact interface (Photo 7) are being developed. "Ubinet pass AD-L" is adopted as the electronic lock system in some parts of the Hongo campus of the University of Tokyo in 2006. In addition, conversion adaptor, "UT-SCI (Secure Contactless Interface)" (Photo 8) to use contact chip via non-contact interface is provided.

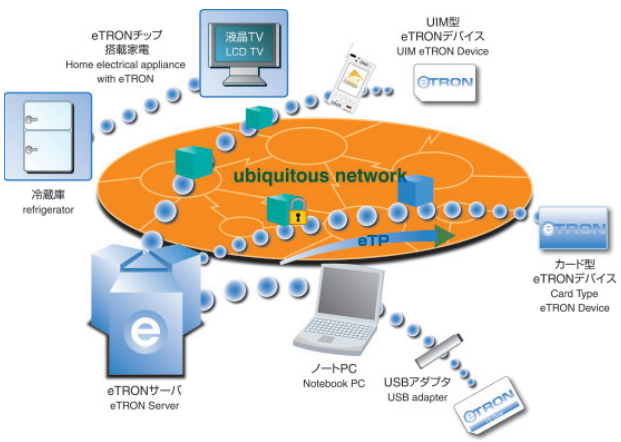


Figure 11: Information Security Pipeline established with eTP

Identification prevention technology

Identification prevention technology is a privacy control mechanism to enable owners of physical objects that are made intelligent using ubiquitous computing technology to utilize them safely and comfortably. Embedding electronic tags such as RFID tags into various physical objects will cause a risk that identification information stored in the tags may be read against the intention of the owners and their behavior maybe tracked by a third party. Such risks can be avoided by using identification prevention technology.
The point of identification prevention technology is that it is an access control mechanism against tag information (including IDs) that may become a clue for tracking behavior. This mechanism enables the owner of a physical object at that moment to control the access to information that may potentially encourage behavior tracking. The core technology to realize this identification prevention technology is an identification

Photo 1: eTRON/8 Card

Photo 2: UIM-type eTRON/16 Dual Device

Photo 3: SECURETRON32-B (picture courtesy of Dai Nippon Printing Co., Ltd.)

Photo 4: UT01 (The University of Tokyo)

Photo 5: UT03

Photo6: UbinetPassCO (picture courtesy of Dai Nippon Printing Co., Ltd.)

Photo 7: UbinetPass AD-L (Dai Nippon Printing Co., Ltd.)

Photo 8: UT-SCI (The University of Tokyo)

prevention air protocol (Figure 12). This protocol allows only proper readers/writers to access tag information. On the other hand, it does not allow other readers/writers to access such information and it does not respond to readers/writers that are not intended by the owner to track behavior. This is because not responding or simply responding with the same encrypted information each time may encourage behavior tracking. The identification prevention air protocol is technology to prevent tags from being identified by readers/writers other than proper ones. Identification prevention technology is used as one of the criteria to be define a ucode tag security class in ubiquitous ID technology infrastructure.

Flexibly Switchable Cryptographic system

A switchable cryptosystem (Figure 13) is a framework for cipher control management to automate smooth and secure cipher switching within devices and to utilize cryptographic algorithm that is the most appropriate for the situation and the environment for the use of cryptographic assets. This system is characterized by a mechanism that selects the most appropriate cipher and encourages the use of the selected module. This mechanism is linked with a cryptographic management server that manages all the cryptographic modules, based on the description of cipher evaluation standards with information on functions, types and attributes of the cryptographic modules.

Devices have a cryptographic control manager that controls, manages and maintains cryptographic assets. This enables upper level systems such as applications and middleware to leave everything from selection and execution of cryptographic modules appropriate for various conditions and environments to updating, switching and maintenance of these modules to this manager. This manager has a highly abstract security API that gives a full control of cipher-switching without influencing the upper level systems. In addition, by operating in collaboration with eTRON devices, the security of cryptographic key management and updating and distribution of ciphers is further strengthened.

Implementing a switchable cryptosystem makes it possible to flexibly deal with, as a total system, various security policies in execution environments and

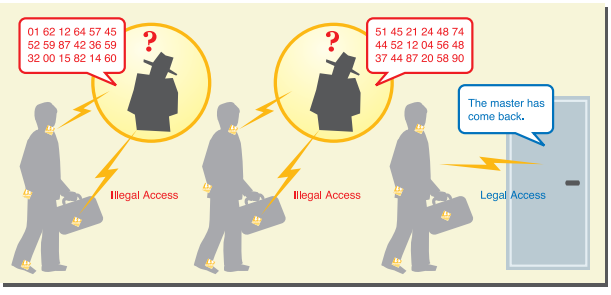


Figure 12: Identification Prevention Air Protocol

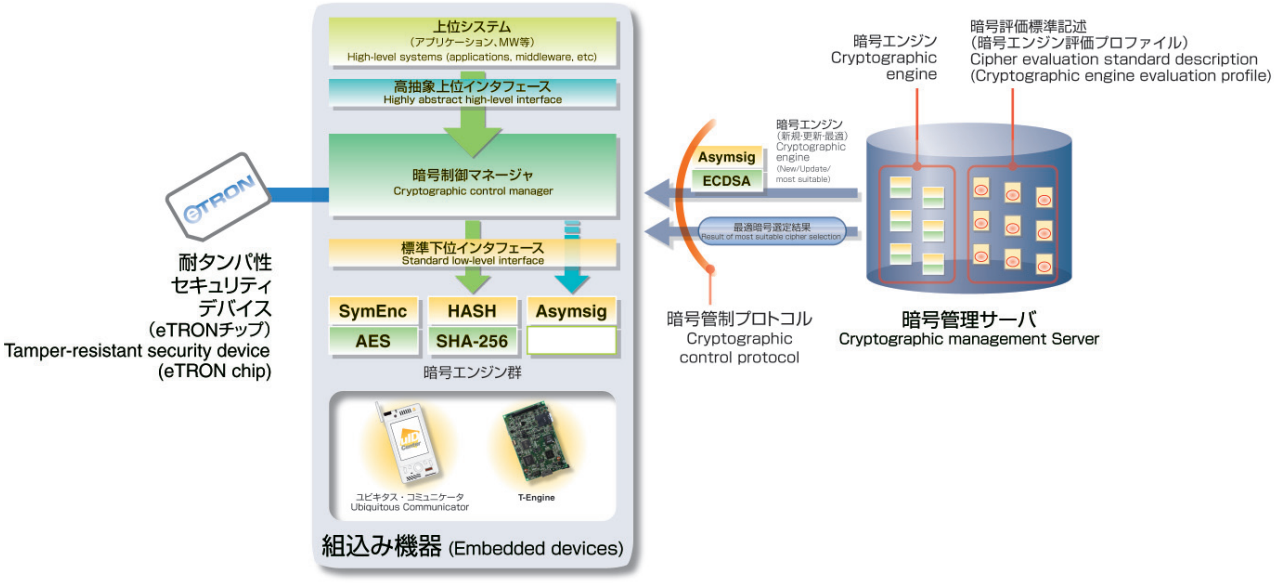


Figure 13: Flexibly Switchable Cryptographic system

dangers that cryptographic technology may be exposed to outside threats.

TRON-DRM

TRON-DRM is a DRM (Digital Rights Management) method that enables contents protection and billing processing. Contents can be decoded without being analyzed from the outside by conducting cryptographic processing and image decoding within the chip using the eTRON compliant tamper-resistant security chip TRON-SMP (Secure Media Processor). Since DRM is not a method for decoding based on software such as conventional method, it is possible to prevent the leakage of keys and decoded contents by illegal analysis. Moreover, for billing processing, it is possible to support not only limited methods such as conventional unrestricted use without conditions or with copy protection to restrict users but also a very flexible billing systems. Note that flexible billing here is methods in which billing can be changed according to the type of use such as one-time viewing, limited term viewing, and adjustment of image quality while viewing according to the performance of the terminal (image display characteristics such as screen size and high-definition televisions). The method that we mentioned above has never been developed before and we expect that the method is adopted by IPTV and VoD (Video on Demand) systems in the future.

Sensor Network Technology

UWB wireless communication with very low-power consumption

UWB (Ultra-Wideband) is a next-generation wireless system that transmits signals in a wide bandwidth of 500 MHz or wider with very low output power and has been attracting attention because it has many advantages. Divided roughly, one is a short-distance and high-speed UWB targeting high-speed data transmission (110Mbps@10m) and the other is an impulse-type UWB with low power consumption for sensor network. The YRP Ubiquitous Networking Laboratory focuses on the latter impulse-type UWB for wireless systems for sensor network.
Our laboratory has developed three types of "Wireless module"; license-free weak radio wave at 315 MHz, long-range radio (ARIB STD T-67) at 429 MHz, and UWB Active Tag at 3-5 GHz band as a pT-Engine-compliant active tag. Among the three, the "UWB Active Tag" is positioned as a flagship device in the sensor network module line-up, and it realizes very low-power consumption (battery life of more than 10 years), highly accurate positioning (within 30 cm) and a

communication capability of 10Mbps@10m and 250kbps@30m. The "UWB Active Tag II" (Photo 9) is the mobile station with the sending/receiving function. The antenna, RF circuit, microcomputer, and temperature sensor are mounted on a single board. Receiving function as well as transmission function allows switching the operation mode by instruction from the base station. Also, using T-Engine platform, a compact base station incorporating all control functions of UWB base station has been developed (Photo 10) so that "UWB Active Tag II" is easy for everyone to use. Through promotion of those features, we will continue to stimulate potential demands of "UWB Active Tag" series in various fields required for high resolution positioning.

Multi-hop wireless communication

Multi-hop wireless communication is a communication method that transmits data via relay nodes, not by direct transmission, when data is transmitted from the source node to the destination node.

Extent of Transmission

Since it uses transmission of data via relay nodes, even device that cannot make a direct communication can receive data from the source node.

Robustness

Highly redundant communication paths make it possible to maintain the network even when a node has trouble or a communication failure occurs.

Photo 9: UWB Active Tag II

Photo10: Compact UWB Base Station

Power saving

The short communication distance results in low transmission power. The transmission power required for communication is proportional to the square of the communication distance, so multi-hop communication that transmits data via relay nodes can reduce the total power consumption.

Scalability

It is possible to reduce wiring cost and build large systems due to minimal wiring construction requirement. Installation cost can be also reduced since connectivity to network is automatically provided with no special work when a new node is added.

Because of the above advantages, multi-hop wireless communication technology is considered as the key technology for sensor network technology. YRP Ubiquitous Networking Laboratory has been developing "Wireless module" which is an ultra tiny active tag that can be used as a sensor network node. Pre-installing μT-Kernel in "Wireless module" has made it easier to implement and change a multi-hop communication protocol stack in "Wireless module." In the future, highly robust multi-hop wireless communication through various types of feasibility study experiments will be designed and examined.

Markers (Active Tags, Infrared Rays)

ucode Marker

There are two kinds of ucode markers that transmit location ucodes. One is the radio wave marker, which transmits ucodes by radio communication, and the

other is the infrared marker, which transmits ucodes with infrared rays. The communication distance for radio wave markers is several dozen meters, and several meters for infrared markers. In this way, radio wave markers are more suitable for usage in wide areas since the communication distance of radio wave markers is longer. On the other hand, infrared markers are more suitable for pinpointing locations in narrow areas. Since the characteristics of communication differ between radio communication and infrared rays, it is necessary to select an appropriate ucode marker according to the environment of a place.
ucode markers have already been installed at many locations such as the Ueno Onshi Zoological Garden, Aomori Museum of Art, and Tokyo Midtown, the venue for this year's TRONSHOW. The specification of infrared markers has been released in the "ucode Container Specification (Category3) Specification of IrDA infrared active tag" on the Free Mobility Assistance Project website.

UC

What is a Ubiquitous Communicator?

A Ubiquitous Communicator (UC) is a new information terminal, which is completely different from a PC or a PDA. The biggest characteristic of a UC is that it is a tool used for the interaction between a ubiquitous computing environment and people, and therefore it is called a "communicator."
There are three patterns of communications, which are "communication with objects," "communication with people," and "communication with the environment," and the ubiquitous communicator can perform those three functions. "Communication with objects" is to obtain information about objects by reading ucode tags, etc. which are embedded in objects in our surrounding. "Communication with people" literally means that a person has a conversation with another person using a UC or other communication infrastructure.
"Communication with the environment" is that when a UC gathers information via a network from sensors installed in the environment and ucode markers attached to places, it becomes aware of the environmental context of the place so that it can control equipment, electric home appliances, etc. based on the context-aware information.

Ubiquitous Communicator for business use

A Ubiquitous Communicator for business use is the ubiquitous communicator developed as a terminal that can endure heavy-duty use at business sites. It is equipped with environmental resistant features such as dust and water-proofing and robustness and incorporates high-speed barcode reader, RFID reader, and ten-key pad. In addition to IEEE802.11b/g wireless LAN, a PHS communication function can be added as an option. It can be used for many applications using ucodes in a wide range of fields.

PDA-type Ubiquitous Communicator

A PDA-type Ubiquitous Communicator has a PDA-type large screen, displays rich content such as movies, still images, multilingual characters, and audio output. It focuses on intuitive operation with touch panel. With a push-style information service, it is an ideal information terminal that can receive signals from wireless markers and infrared light markers attached to places and provide navigation in towns and tourist areas just by user's carrying it.

PDA-type Ubiquitous Communicator

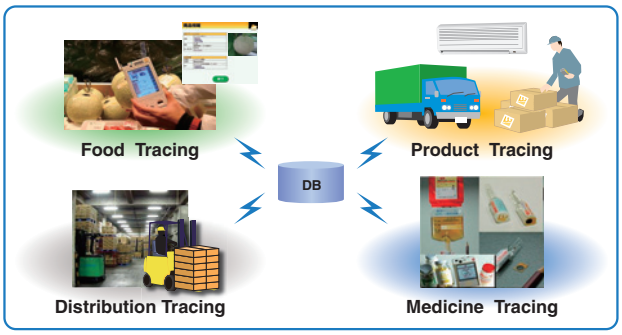
Ubiquitous Communicator for business use

Ubiquitous ID Application （Principle）

Ubiquitous Tracing Platform

"When was a product manufactured, by whom, and where is it now, through which distribution route?" By using the Ubiquitous Tracing Platform (UTP) promoted by YRP Ubiquitous Networking Laboratory, it is possible to efficiently retrieve and immediately display all tracing information at all stages of a product life cycle from production, distribution, sales to consumption. For example, if the UTP is introduced into a production process, the ubiquitous computing technology can support such environment wherein ucodes can be automatically assigned to products. In addition, if the UTP is introduced into each stage of distribution, sales, and consumption, you can register or display the tracing information easily by reading the ucode tag with ubiquitous communicator. Moreover, since the ubiquitous ID architecture is used in the UTP, even if each player introduces the system separately, we can link them with each other later, and ultimately consolidate the tracking information which can be used by anyone.

The first feature of the UTP is to enable the individual item-level management of products by assigning a unique identification number, a ucode, to products. In addition, we can easily handle the issueing of multiple ucodes to objects coming out of an object (one ucode) as in the case of division of lots. We can also handle issueing one new ucode to an object formed by many objects (many ucodes) as in the case of consolidation of lots. These new and old ucodes are related to each other in the information system, enabling us to continuously track items despite the change of the mode of packaging during a distribution process. Thus, by using the UTP, we can track the product from the upstream process to the downstream process consistently. The second feature is the ease of "tracing back," in which the product information is traced back from the consumer side to the producer side in case a problem occurs with the product. On the other hand, it is also easy to execute "tracing forward," in which the product is traced from the producer side to the consumer side.



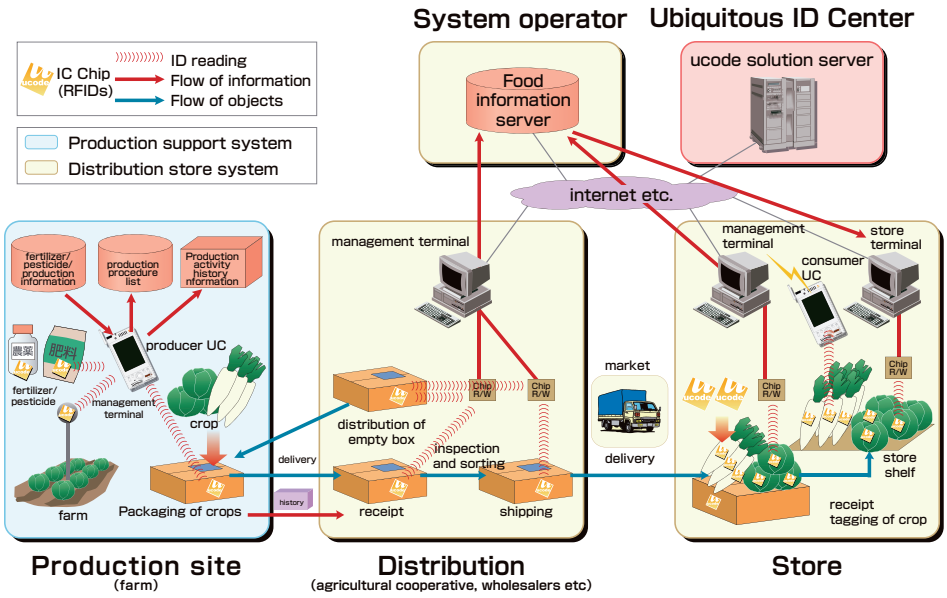
Platform concept

The UTP with such functions is the platform to be the basis of the systems which realize the information management of every "object" and its tracing. This platform covers a wide scope of applications and is not limited to food and industrial products only.

Ubiquitous Food Traceability System

In recent years, a system to comprehend the production and distribution history of foods accurately and to trace the information immediately, called the food traceability system, is in demand due to the frequent occurrence of food accidents, for food safety for consumers, for possible crisis management and prevention of harmful rumors for producers, distributors, and sellers.

The food traceability system provides the mechanism that permits recording information at each stage of production, processing, and distribution, and in case of a problem, immediately identifying the origin of the problem, and extent of the impact from the recorded information. You can trace back the information back to the original plant in which the food is processed from the particular food product, and further find other

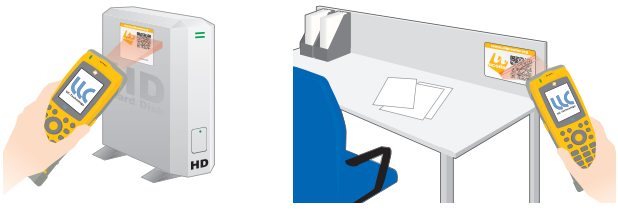


Ubiquitous Food Traceability System

food products processed in the same plant. The introduction of such traceability system can improve the quality of risk management for food accidents and make consumers feel safer and securer. This system has been developed based on the Ubiquitous Tracing Platform (UTP). It was adopted as the infrastructure system for "Food Traceability Systems Development Project of the Ministry of Agriculture, Forestry and Fisheries" which was conducted from FY2003 to 2005 by T-Engine Forum. Moreover, in the feasibility study experiments in FY2006 and 2007, it was used for the system linkage through ucodes by Japan Traceability Association, Japan Fisheries Association/Fishing Boat and System Engineering Association.

Ubiquitous Equipment Management

In our offices, there are many pieces of equipment subject to asset management such as electronic devices including PCs, printers and projectors, as well as fixtures and furniture including chairs and desks. A piece of equipment, which is often moved, may get lost. During inventory taking, the ledger doesn't match the actual number of pieces of equipment due to the misplacement, etc., which is a big problem for administrators. YRP Ubiquitous Networking Laboratory has conducted research and development of "Ubiquitous Equipment Management System." This system assigns ucode to respective items and storage places, based on ubiquitous tracing platform (UTP), and easily manages the equipment and its location for record-keeping purposes. When assigning ucodes to individual object, you can select from various tags including two-dimensional barcode (QR code) and RFID tags, in accordance with the size and material of the object. When purchasing new equipment, you register the ucode of the equipment and ucode of storage place in a server by using ubiquitous communicator. Afterward, you can find the said equipment easily by designating the equipment information to search the storage place during inventory taking. Also, by installing ubiquitous markers using infrared or wireless technology in the storage, it is possible to register the storage place automatically or to guide the user to the specified storage place. By using this system as the front end for existing equipment management system, you can make effective use of the existing system. You can also link it with related administrative processes such as resource management and leasing management.



Use case of Ubiquitous Inventory Traceability System

Ubiquitous ID Application （Places）

Ubiquitous Location Information Infrastructure

Overview

Ubiquitous Location Information Infrastructure associates information with places by assigning unique codes (ucodes) to "places" with various degrees of details from global level to an object level such as a shelf and desk based on ubiquitous ID technology. The infrastructure also provides various information for all sorts of people such as people having no disabilities, the physically-challenged, and people from overseas. The Ubiquitous Location Information Infrastructure was developed for the purpose of building an environment where "anyone" can access information such as "travel routes," "means of transportation," "destination," and "anytime and anywhere" as part of activities toward the realization of a universal society to which everyone in the society will contribute by exerting their potentials to the full extent and supporting each other.
The use of the Ubiquitous Location Information Infrastructure will provide many people, regardless of whether they are physically-challenged or not, with the freedom of action or opportunities to actively participate in society. Furthermore, many applications of the Ubiquitous Location Information Infrastructure such as revitalization of tourist areas and shopping streets as well as disaster management and the management of facilities such as water and gas have been studied. For example, the Ubiquitous Location Information Infrastructure can be used for building a service in which information on bargains that is valid only at a certain date in a certain place is provided in real time. It has been studied to use such a service to attract many tourists and shoppers and to revitalize the community.

System Concept

IC tags and wireless markers are setup in various places such as streets, buildings, parks, shops, and shop windows and provide information associated with the places to people walking around with a terminal. Services provided by the Ubiquitous Location Information Infrastructure are characterized by screening information so that the service offers only piece of information that is appropriate for the attributes of a recipient, such as physical information, preferences, the purpose of traveling, nationality, etc.

Ubiquitous Common Platform

Ubiquitous Common Platform provides the contents based on the Ubiquitous Location Information Infrastructure. By providing standard attribute information on places and contents which can be commonly used and providing API for searching, registering, etc., various kinds of people and groups can register their contents to the ucodes installed at places and use them. Since the contents can be shared reciprocally, information services can be provided in a cross-section manner, not solely by a particular information provider.

From Feasibility Study Experiments to Practical Applications

The Ubiquitous Location Information Infrastructure is used in the feasibility study experiments conducted by the private sector and local governments including the "Free Mobility Assistance Project" of the Ministry of Land, Infrastructure, Transport and Tourism and the "Information Grand Voyage Project" of the Ministry of Economy, Trade and Industry. Building practical systems based on the Ubiquitous Location Information Infrastructure has been also promoted. We furthermore plan to mature the system and improve the quality in the future.

Free Mobility Assistance Project in Many Areas in Japan

The Ministry of Land, Infrastructure, Transport and

Tourism has implemented feasibility study experiments of the Free Mobility Assistance Project in many areas in Japan since FY2004, and various investigations have been carried out.
In FY2008, The Ministry of Land, Infrastructure, Transport and Tourism established and provided infrastructure for the Free Mobility Assistance Project and private companies are now providing services by use of this infrastructure. In addition, the public was invited to participate in feasibility studies conducted in collaboration between the government and private sector for offering the regular services from June to July 2008. In this public participation, infrastructure for IC tags, infrared markers, radio wave markers which use ucodes, and location infrastructure such as ucodeQR and pedestrian space network data including barrier information will be established. In the newly built environment, the services for finding and navigating barrier-free routes with various portable terminals are requested. As a result of this call for public participation, companies including Yokosuka Telecom Research Park, Inc. were selected.

Tokyo Ubiquitous Technology Project

Tokyo Ubiquitous Technology Project

The Tokyo Metropolitan Government and the Ministry of Land, Infrastructure, Transport and Tourism have engaged in feasibility study experiments for the "Tokyo Ubiquitous Technology Project" using state-of-the-art ubiquitous ID technology since FY2005 with the aim of improving the charm and vitality of the city for tourism and commercial promotion as well as the city planning with universal design that allows anyone to enjoy walking throughout Tokyo comfortably. In FY2005, the “Ueno E-navigation Experiment” was held in Ueno-Onshi Park and Ueno Onshi Zoological Garden. This feasibility study proved extremely popular, and an animal information service is now provided throughout the zoo. Since FY2006, the “Tokyo Ubiquitous Technology Project in Ginza” has been carried out in Ginza, which is one of the most well-known downtown areas of Tokyo in Japan, in cooperation with the Ginza Association.

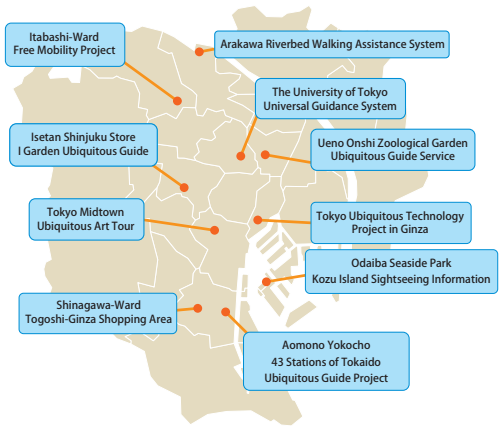
Tokyo Ubiquitous Technology Project in Ginza

By using state-of-the-art technology for city planning

and transmitting outstanding Japanese technology to the world from "Ginza," this project aims at regional, industrial, and tourist promotion, establishment of ubiquitous ID technology, and the linking of the Free Mobility Project to practical use. In FY2008, the ongoing feasibility study carried over from FY2007 with the participation of the private sector has been conducted, and the feasibility study of collaboration between different areas will be conducted between the observation room of the Tokyo Metropolitan Government in the Nishi Shinjuku and the Ginza area. A public study experiment integrating these experiments is scheduled in the period from January to March 2009. Furthermore, the approach of collaboration with the private sector's participation in the demonstration experiment of the Free Mobility Project by the Ministry of Land, Infrastructure, Transport and Tourism will be promoted.

Many ucode Markers within Tokyo

The Tokyo Metropolitan Government has promoted the Tokyo Ubiquitous Technology Project. The project itself has promoted the establishment of infrastructure to increase the variety of situations in which ucodes can be used by disseminating ucode markers to all "places" including Ueno and Ginza. Private companies have installed ucode markers for feasibility study experiments and commercial services.



Feasibility Study Experiments in 2008

Nara

Nara Prefecture is implementing a project for the 1300th anniversary of the capital relocation to Heijo City for the year of 2010. As a part of this event, the Nara Free Mobility Assistance Project has been under way since FY2006. This fiscal year, the Nara City Sightseeing Information Center plans to implement a pilot system for technical verification of a mobile navigation service in Nara Park area and a guide service for sightseeing and store information.

Gifu・Takayama

Takayama City is promoting barrier-free and universal design in city planning, and the offering sightseeing information, etc. in multiple languages to as many as 130,000 foreign tourists who visit the city each year (based on the number of hotel guests in 2007). Furthermore, a pilot system and its feasibility study of the mobile navigation service and sightseeing information guide service in multiple languages is scheduled in the Free Mobility Assistance Project in order to deploy various services with more general features and extendibility from this fiscal year.

Hyogo・Kobe

Kobe City has been engaged in the Free Mobility project since FY2004 and has conducted various feasibility studies. This fiscal year, Kobe plans to provide a seamless mobile navigation service both above and underground in and around the vicinity of Sannomiya station and a guide service for sightseeing and store information in the Nankinmachi area in addition to the feasibility study of technical items, etc.

Aichi・Toyota

Toyota City carried out the Free Mobility Assistance Project feasibility study for the purpose of finding and navigating barrier-free routes using cellular phones in the last fiscal year. The study in collaboration between the government and public sector for the regular service will continue this fiscal year. A pilot system and its feasibility study of an indoor and outdoor seamless mobile navigation service within and around the vicinity of stations and neighboring facilities is scheduled.

Tokyo・Ginza

Various feasibility studies have been carried out in Ginza in collaboration with the "Tokyo Ubiquitous Technology Project" of the Tokyo Metropolitan Government since FY2006. Ginza is one of the most well-known downtown area of Tokyo in Japan and there exist many commercial facilities throughout the area. Many foreign tourists also visit the Ginza area and tourist information in multiple languages is necessary as a result. Furthermore, since there are many underground passages in the Ginza area, smooth route navigation from underground passages to street level roads is also necessary. Therefore, business models and systems which are compatible with these conditions including the technical aspect are scheduled to be verified.

Expanding Application of Ubiquitous Location Information Infrastructure

There are many other application examples that use the ubiquitous location information infrastructure aside from the ones already introduced in earlier sections. There is also an important trend among local governments to prepare a common framework so that they can offer services based on the infrastructure jointly. Here, we introduce the latest topics related to the ubiquitous location information infrastructure and some examples that you can try for yourself.

Information Grand Voyage "Puratto Plat"

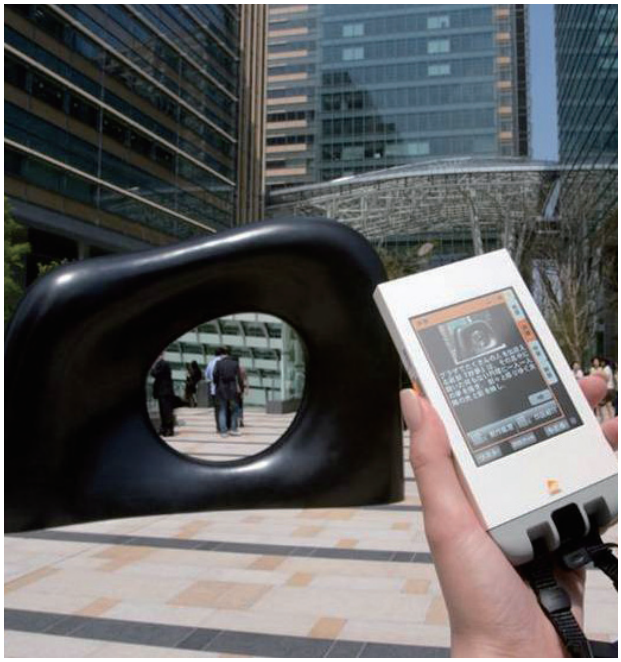
In the Information Grand Voyage Project "Field-Testing of Next Generation Information Retrieval/Analysis," the space with highly added value, called "e-Space" is built using ucode, ucR (ucode Relation), and other technologies. The feasibility study of a system that offers mobile-environment support information "only for now, only for here, and only for you" and triggers action of visitors is performed by building a real pilot system, e-Space service "Puratto Plat." This project develops a database called "e-Space repository" to store and manage information about space and its related information (content) in a unified manner. Using this repository, we will perform feasibility studies in three distinctive areas (Jiyugaoka, Fukuoka, and Matsuyama) by handling the special features and issues of the regions appropriately.

Furusato Foundation

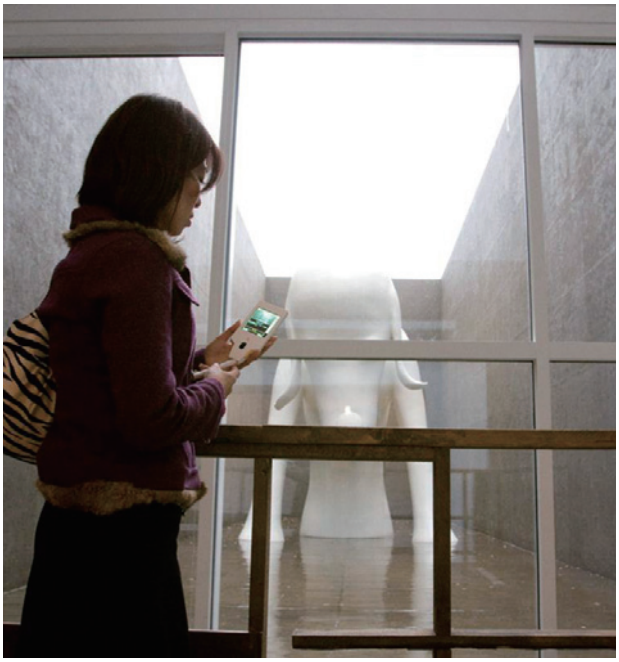
As part of the "e-Regional Resource Utilization Project," Japan Foundation For Regional Vitalization (commonly called Furusato Foundation) consolidates information (content) that each local government or tourist area has. The Foundation also promotes the establishment of the "Ubiquitous Common Platform" to share and publish information on common themes such as literature, history, and hot springs, cooperating with the local community. This fiscal year, we plan to disseminate tourist information in eight regions using this platform. We plan to further expand other application services after the next fiscal year.

Ubiquitous Art Tour®, Tokyo Midtown

Ubiquitous Art Tour, a service to guide visitors to more than 20 works of arts and design on the premises of Tokyo Midtown. About 500 infrared and radio ubiquitous markers are placed indoors and outdoors on the premises. Ubiquitous Communicator (UC) terminal held by the visitor receives ucode emitted by these markers, guides the visitor to the works of arts, and supplies the content such as the explanation, how the work was created, and the interview of the creators.



Tokyo Midtown



Aomori Museum of Art

There are seven tour courses and visitors are guided to the works of arts in the selected course one by one. The supplied contents are available in five languages: Chinese, English, French, Korean and Japanese. If you have a chance to visit Tokyo Midtown, please try the tour.

・Fees

¥1,000 (¥500 for a rental fee and ¥500 for a deposit*)

*It is a reimbursable deposit and paid back when a terminal is returned. For a deposit, we accept only cash, and no payments by credit cards are accepted.
*Please show your ID card(s) (driver's license, passport, health insurance card or student identification card) when renting a terminal ("Ubiquitous Communicator"). A guest without ID card(s) may not be able to rent a terminal.

・Recommended age

Junior high school students or older.*

*Elementally school students or youngers should be accompanied by their parent(s).

・Check-in counter

Tokyo Midtown Tour Counter located within "Tokyo Midtown Design Shop" on 3F of Galleria

・Rental hours

Up to two hours*

*Batteries will exhaust after approximately two hours, the longest assumable tour hours.

・Operating hours

11:00-18:00*

*Guests can rent a terminal until 18:00 and should be returned to the Tour Counter by 20:00.

Aomori Museum of Art : Art Museum Ubiquitous Guide System

"Art Museum Ubiquitous Guide System" service is being provided at Aomori Museum of Art. This system is an integration of infrared indoor location management system SmartLocator® by NEC and NEC Engineering Corporation and Ubiquitous Communicator (UC) terminal. The visitors carry UC rent by the museum to receive ucode transmitted from SmartLocator installed at approximately 70 locations in the museum ceiling to be automatically guided on the route, and to view the contents such as explanation of artworks, authors and museum information.

Isetan

I Garden on the roof of Isetan headquarters in Shinjuku provides a ubiquitous guide for children. UC is lent to general visitors to acquire the information on the environment and plants by attaching it to the IC tag installed throughout the garden. Quizes on plants and the environment are particularly popular among children.

Isetan

Ueno Onshi Zoological Garden

Ueno Onshi Zoological Garden

Ueno Onshi Zoological Garden introduces the guide system for general visitors. Various types of information on animals are being provided with radio wave markers installed in 16 locations and IC tags installed in 140 locations around the premises. Descriptions by General Director Komiya and video of rarely seen animal behavior are popular.

The Kyoto Botanical Garden

The Kyoto Botanical Garden carried out a feasibility study of the guide system that provides information on valuable flowers, plants and trees, facilities, and events in the garden targeting general visitors in the last fiscal year. Plant contents related to the famous novel, “The Tale of Genji,” were added and the system was partially improved this fiscal year with trial operation from October to December. Since the botanical garden guide includes the history and inside story of the botanical garden and detailed description on plants by General Director Matsutani, it is very popular and a wide variety of people from children to seniors use the guide.

Tsuwano Sightseeing Navigation

In Tsuwano, the service to provide sightseeing information or useful tips to tourists is being offered.

Association for Ubiquitous Space Infrastructure Promotion/Feasibility Study in Kobe

The Association for Ubiquitous Space Infrastructure Promotion has engaged in activities aiming to establish infrastructure which can be widely used by companies and consumers by linking information on various "spaces" to various attribute information on the spaces as infrastructure for ubiquitous networking society since FY2006. A study with Kobe City as the testing site was performed to confirm the usability of the 'u-delivery' model for two weeks from February 4, 2008 as a tangible feasibility study in FY2007. A feature of this study is that it is possible to specify delivery conditions and locations in detail such as the floor, room, and place within a company by defining a space code that is more detailed than the current ZIP code and address for the delivered item so that we can deliver the item to a specific place rather than just delivering the item to the reception desk of the specified company in the specified building.
In addition, the feasibility study of “Tebura Kanko (Sightseeing Without Luggage)” is scheduled to be implemented in FY2008. Three major features of “Tebura Kanko“ are: 1) It is possible to deliver items purchased by tourists staying one or more nights in Kobe City to their hotels in Kobe without using delivery slips, 2) It is possible to easily specify the delivery

The Kyoto Botanical Garden

Tsuwano Sightseeing Navigation

location and conditions in the delivery instructions to the hotel such as "I would like to eat this item tonight so I would like it to be placed in the refrigerator in my room.", 3) It is possible to conceal personal information from delivery companies and maintain privacy in 1) and 2) with the cooperation of major hotels, delivery companies, and local shopping areas, and by use of the space codes mentioned earlier.

The University of Tokyo: Universal Guidance System

The demonstration of "Universal Guidance System" was conducted in 2007 as part of 130th anniversary celebration of the University of Tokyo. With this as a start, "Universal Guidance System," which helps the visually-challenged in moving on the campus, was introduced. This system guides the visually-challenged with voice guidance by reading the IC tag embedded in guidance blocks using the sensor mounted at the tip of a white cane or by receiving radio waves from the wireless markers installed in the surrounding area. In addition to the route from the main gate of Hongo Campus to the Yasuda Auditorium, which had been prepared for the anniversary celebration in 2007, the route to Koshiba Hall and Sanjyo conference Hall was newly prepared in 2008. The University of Tokyo is planning to expand the area as part of planned enhancement of barrier-free premises.

Togoshi-Ginza

"The 11th Togoshi-Ginza Ubiquitous Event (Organizer: Masami Kobayashi Laboratory, Meiji University)" was held for two days from August 30 to 31, 2008. This event was held as a feasibility study in order to verify the ideal way for providing information with ucodes and the effect on visitors from the viewpoint of ubiquitous computing technology use in city planning. In detail, ucodeQR was installed throughout the Togoshi-Ginza shopping area in Shinagawa Ward, Tokyo. Points were given to shoppers for finding and reading the ucodeQR with their cellular phones and the shoppers received awards according to the amount points earned. The aim of the organizer was to provide feedback based on the results to public space planning, public facility planning, sign planning, transportation planning, etc. in order to assist city planning. In addition, the organizer is investigating the implementation of a ubiquitous society feasibility study on disaster prevention and crime prevention at Togoshi-Ginza shopping area in the future.

The University of Tokyo "Universal Guidance System"

Togoshi-Ginza

Ubiquitous ID Application （Objects）

"Flashing Tag," Zero Wrong-shipment System of Logistics Center with Active Tag

In logistics warehouses at a drug company, picking, i.e., collecting products out of tens of thousands of items into baskets according to orders from customers is conducted. To gather the products that are picked from large shelves, the products in a basket are put into the appropriate container for each order, which moves on a conveyor. If products in the basket are put into the wrong container, a costly incorrect shipment occurs. The system designed to solve such incorrect shipment is "flashing tag," which uses 429MHz wireless active tag. Immediately after the barcode on the container is read, the tag which is attached to the corresponding target basket flashes by radio signal. Since an operator simply picks up products from the flashing basket and puts them into the correct container, the number of incorrect shipments can be reduced to almost zero.
The leading pharmaceutical wholesaler, Toho Pharmaceutical Co., Ltd. has operated 800 "flashing tags" at the logistics center of the Kanto area since November 2006. Zero incorrect shipment per month was accomplished immediately after the introduction of "flashing tag." The company maintains the accuracy rate of 99.997% with the current shipment system.

Cyber Concrete

Concrete is used for various kinds of structures and required to be sturdy in its performance for a very long period of time. "Cyber concrete" supports long-term quality control and maintenance management by attaching ucodes to concrete itself by means of IC tags. Use of "cyber concrete" allows us to link and consolidate quality information on raw materials, information on concrete quality, manufacturing, transportation, etc., and construction information. Also, it is possible to link the information on design and manufacturing of the structure and later maintenance management by associating the attached IC tag (ucode) with the structure information. Furthermore, multiple usage for various purposes is possible, resulting in improved convenience as a social infrastructure. For example, general information on the surroundings, etc. can be provided under normal circumstances, and disaster and evacuation information can be provided in an emergency.

Information Infrastructure Construction for Thoroughbred Horses

Japan Race Horse Registry which registers

Flashing Tag


Cyber Concrete

* "Flashing tag" system was jointly developed by Toho Pharmaceutical Co., Ltd. and YRP Ubiquitous Networking Laboratory.

Identification Certificate

Reading microchips implanted thoroughbred horses.

thoroughbred horses has started using ucodes to construct the information infrastructure useful for various services, including pedigree management, breeding and transfer management of thoroughbred horses. The electronic tags for animals called microchip are widely used nowadays for pets such as dogs and cats. Implanting a microchip in race horses, which have been born after 2007, has become one of the prerequisites for registering race horses, so microchips are now implanted in thoroughbred horses. Using microchips conforming to ISO11784/ISO11785 is required. Ubiquitous ID Center has defined the ucode domain for ISO11784 so that the microchip identifier can be used as ucodes.

At the horse auction held in July 2008, the feasibility study experiment was conducted. In the experiment, the UC read the microchip and then referred to the Japan Race Horse Registry database based on the obtained ucode of the microchip. This immediately displayed the basic information of the horse on the UC, and verified the horse against the available list. In addition, ucodeQR was printed on identification certificate issued by Japan Race Horse Registry, and it is scheduled to provide the service of physical characteristic drawing of the horses using this.

Traceability Management System of the Housing Components

"Who built this house?, what kind of housing components are used?, who brought these components?, and how did they process, build, and inspect these?" For the purpose of constructing the system to allay those concerns of dwellers and provide appropriate information, YRP Ubiquitous Networking Laboratory has provided the latest technology based on the ubiquitous tracing platform (UTP) to the "Traceability Management System of the Housing Components" of The Center for Better Living. The operation of the Traceability Management System of the Housing Components started in February 2006 with the focus on fire alarm, and approximately 830 thousand certification information controlled by ucode tags are registered with the system as of April 2008. This system has been developed and researched as the basis to realize the policy of "bicentennial house," "longer life of residence which can be used for 100 to 200 years by enhancing the serviceability" which is advocated by the Ministry of Land, Infrastructure, Transport and Tourism. This system can be easily applied to other industries and industrial products that need long life cycle.

Traceability Management System of the Housing Components

Electronic Medication Record

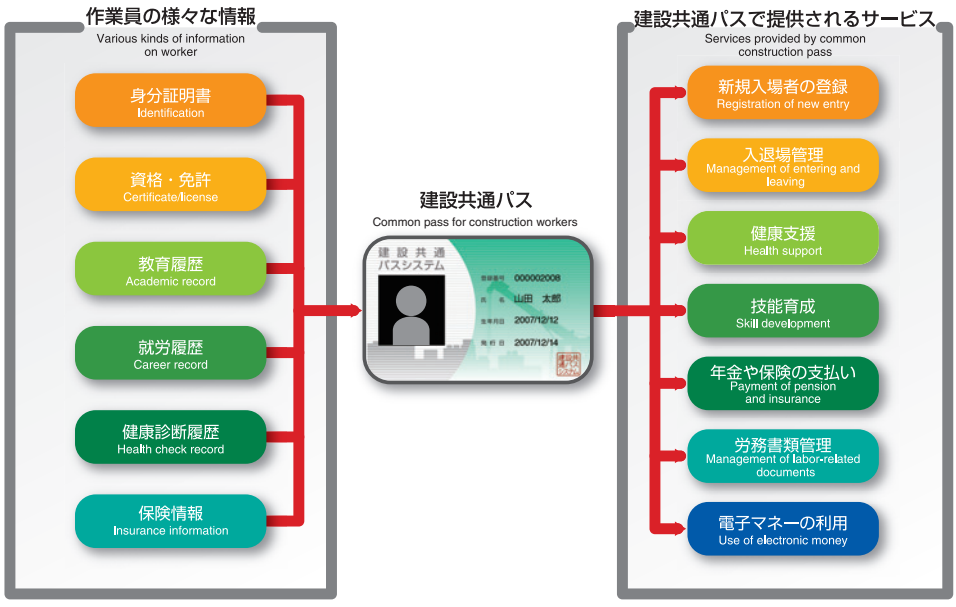
In recent years, the sharing of roles where doctor examines and prescribes, and pharmacist dispenses and administers the prescription is fully functioning. However, accidents due to medication error have not disappeared yet. One of the reasons is the human-inducible causes including doctor's/pharmacist's inappropriate instruction on dosage and administration and the fact that they do not understand patient's information on drug history, allergy, etc. Due to the recent heath food fad, consumers have become more health conscious. Many product ingredients that are not approved under Pharmaceutical Affairs Law have been observed in the market. Serious accidents continue to occur including death accidents from having such ingredients. What can we do?
As a technology to prevent such accidents, YRP Ubiquitous Networking Laboratory is promoting the technical development of electronic medication record. The electronic medication record keeps track of the patient's drug, disease and allergy history and detects harmful combination of drugs, based on the past history to prevent an accident due to harmful prescription. The electronic medication record based on the security architecture, eTRON, protects personal information by storing into it the secure chip. Furthermore, through access right control for data on the network, the system where third party cannot access the sensitive data is being developed.

Common Pass for Construction Workers

Common pass for construction workers is the project which has been implemented by the committee mainly consisting of general contractors, the University of Tokyo, IT vendors and ASP vendors with financial assistance from the Ministry of Land, Infrastructure, Transport and Tourism since 2007. One ucode tag that each construction worker of various companies can use at any construction site, solves the difficult issues including entering and leaving management of the construction site, proper handling of retirement benefits based on correct and comprehensive career record management, improving the efficiency of safety-related document management, and license and traning management. This corner introduces the architecture of the Common pass for construction workers using this ucode.

Play Equipment Information Management with uID by PASCO

PASCO CORPORATION provides the national government and local governments with geospatial information which is combined with additional information such as city plan and road registry data. Pasco combined the ucode concept with geospatial data earlier than any other company and developed many systems to improve the maintenance efficiency of



Play Equipment Information Management System (PASCO)

public structures such as general roads, express highways, and bridges. This time, as an application example of ubiquitous ID technology, Pasco developed "Play Equipment Information Management System" for the purpose of managing the inspection and history information on play equipment in parks, with ucode and Ubiquitous Communicator for business use (UC for business use). In the "Play Equipment Information Management System," UC for business use reads the ucode tags attached to the play equipment to be managed such as swings. Since an inspector checks the items for inspection and manages the check record in accordance with the menu displayed on the UC for business use, there is no missing check item. Therefore, even if the inspector is a beginner, the inspection work can be thoroughly conducted. Also, the collected data can be directly stored in PC for administrative use. This removes the burden for posting and reduce the inadvertent omission, and improve the efficiency of play equipment management. Moreover, Pasco are planning to provide the service of informing the citizens of inspection or defect information on the play equipment using the ucodeQR attached to the play equipment.

Use of ucode for Public Facility Management

In our society, there are numbers of public social infrastructures ranging from electricity, gas, water, and phone to larger-scale physical objects such as bridges, river banks, harbor and airports as well as roads. They must be properly and effectively installed, managed, and maintained. These things constituting public social infrastructures are called public facilities, and their management/maintenance work is called a public facility management. For this public facility management, it is important to understand the installation environment and link the public facility with information on the maintenance/inspection results, etc., and then conduct management. Such knowledge allows a damaged facility to be efficiently recovered. Consequently, we have decided to attach ucodes to the public facilities with RFID and barcode, and systematically link them with management/ maintenance information for effective management work in the future. In FY2007, the University of Tokyo and YRP UNL attached sensor network nodes to the public facilities, such as signs installed on the roads, which automatically detect the damages, etc., for the research sponsored by Japan Construction Information Center. In this research, they used the tilt sensor to detect any damage in case a public facility was tilted or bent due to collision with a vehicle, etc. They also attached ucode markers to public facility ledgers which have not been digitalized in order to improve the efficiency of ledger management. Since 2008, the University of Tokyo has been working fully on these projects for the research sponsored by the Ministry of Land, Infrastructure, Transport and Tourism, and making efforts to develop the technique that can improve the efficiency of public facility management using ucode and ubiquitous ID technology.

Tokyo Metropolitan Central Wholesale Market, Ohta Market - Food Distribution Streamlining/New Technology Utilization Business Model Feasibility Projects

As an application field of ubiquitous computing, the distribution industry has attracted most attention. From February 4 to 20, 2008, "FY2007 Distribution Management Efficiency New Technology Establishment Activity Feasibility Study Experiment" was conducted in Tokyo Metropolitan Central Wholesale Market, Ohta Market. In this experiment, the active tags were placed on the boxes of fresh produce (strawberry, Chinese chive, tomato) and pallets at the places of origin. When they were unloaded from the trucks in Ohta Market, the

delivery of those food items to the market was automatically detected, and this information was sent to the cellular phone of the person in charge of wholesale by e-mail. This experiment confirmed that such system enables us to provide the exact location information of the products during the distribution process from the place of origin to the market and resulted in smooth delivery and receipt of the products.

Yokohama Nanbu Market - Food Distribution Streamlining/New Technology Utilization Business Model Feasibility Projects

T-Engine Forum was selected as the "FY2008 Food Industry Competitiveness Reinforcement/Food Distribution Streamlining/New Technology Utilization Business Model Feasibility Projects," by the Ministry of Agriculture, Forestry and Fisheries. This demonstration project aims to demonstrate such business model wherein ucode active tags are installed at the wholesale market. The location management of returnable containers in which fruits and vegetables and fresh produce are stored is automatically conducted. The project aims at improving the efficiency of distribution process for these fruits and vegetables. In the second half of January 2009, this demonstration project plans to conduct the location management of returnable containers with the focus on Yokohama Nanbu Market according to the following usage cycle: package center – distribution center – logistics center – stores – collection/cleaning center – package center.

JAXA

Japan Aerospace Exploration Agency (JAXA) has developed an ultra-small portable communication terminal that can communicate with engineering test satellite “Kiku No.8,” which was launched on December 18, 2006. "Kiku No.8" is a stationary satellite equipped with large extendable antenna as large as a tennis court. It went into steady phase on the orbit at the longitude of 146 degrees East in January 2007. The body of the ultra-small portable communication

ucode IC tags for residents and ultra small portable communication terminal (UC)

terminal is based on Ubiquitous Communicator (UC) developed by YRP Ubiquitous Networking Laboratory. JAXA participated in the general emergency drill in Tokyo on August 31, 2008, and experimented with communication by using "Kiku No.8" on an assumption that the communication infrastructure on the ground had been disabled. We demonstrated the function to read the ucode IC tag carried by the evacuated residents with ultra small portable communication terminal. The summary was reported to the headquarters immediately for confirming the safety of residents, or for requesting for relief supplies.
Also, in January 2008, a demonstration in Mt. Sakurajima, Kagoshima prefecture was held. In this demonstration, the ultra small portable communication terminal was connected to "Kiku No.8" and an predesignated person entered the data of damage status in the surrounding area and reported to the headquarters to display the damage status on the map immediately. This system using "Kiku No.8" and ultra small portable communication terminal are expected to be practically applied as a communication system which can withstand large-scale disaster, etc.

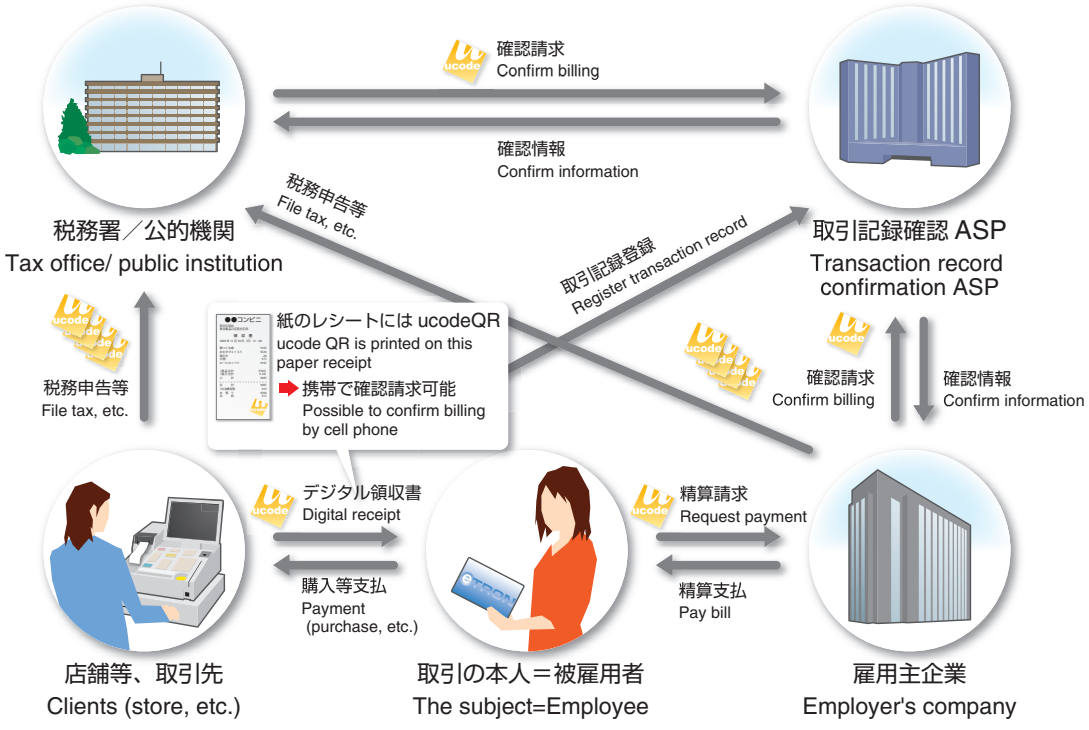
Information Grand Voyage Project “Digital Receipt”

A digital receipt is the subject that the Ministry of Economy, Trade and Industry has worked on as part of the Information Grand Voyage Project (FY2008). The ministry aims at the traceability of economic activities by focusing on transactions and settlements in digital

data and/or with common ID. If a ucode is assigned to each transaction/settlement as a common ID, it will be possible to realize a service in which the validity of each transaction record is assured by managing the transaction record as a digital receipt in as secure IC card and a transaction record confirmation server. Even for paper receipt, we can print ucodeQR with the electronic signature on it. This makes it possible to access the digital receipt stored in the transaction record confirmation server.
This permits preventing misconducts such as cancellation or falsification of transaction, duplicate billing, etc. when reimbursing expenses. The increase of the settlement process efficiency can be also realized. In the future, it is planned to build a transaction record confirmation ASP infrastructure in which the validity of transaction/settlement can be secured by consumers, stores, companies, and public institutions in order to ensure the transparency of economic transactions.

International Distribution Experiment

In recent years, the problems such as mislabeling of production area and tampering during production/ distribution process have occurred. To realize a safe and secure society, it is essential to record the distribution and process history of products and inform consumers of the recoreded information correctly.
YRP Ubiquitous Networking Laboratory launched the pilot project of international distribution traceability, where the international distribution process is traced with ucode, in cooperation with the corporations and universities in Korea, Taiwan, and Thailand.
In the distribution experiment conducted between Korea and Japan, the project launched a virtual shopping mall and implemented the distribution and sales management of products with a ucodeQR as well as the delivery of products to a purchaser by EMS (Express Mail Service). A ucode was attached to each product ordered through the shopping mall, and they checked if the ucode was correct before delivery.
In the distribution experiment conducted between Taiwan and Japan, the project implemented distribution and sales management of products with ucodeQR and provided added-value services to consumers at the real business scene and to visitors at the concert goods shop corner of a concert hall. The purchasers of the concert goods were provided the privilege of "standby screen for cell phone," (featuring celebrity musicians)



Applied Image of Digital Receipt

by reading the ucodeQR attached to the products by using their cell phones.
On the other hand, in the distribution experiment conducted between Thailand and Japan, the distributors recorded the delivery and receipt history of the food items which were imported or exported between Thailand and Japan so that the consumers could view the distribution history. The actual procedure of the experiment is very simple, and consisted of reading ucode tags by terminal and viewing the food information. Also advanced skill was not required for the operation. Therefore, the people particpating in this experiment easily understood the operation and advantage.

Ticket System in Hangzhou Exhibition

UNL/UCT introduced and operated the ticket system with ucodeQR in the exhibition, "Electronics & Information Fair, Hangzhou, China 2008" held in Hangzhou, China from September 3 to 6, 2008.
The visitors of this exhibition entered the information such as names into the reception terminal and received their tickets with ucodeQR printed on them. When the ucodeQR was read by the mobile terminal installed at each exhibition booth, the visit history was recorded. This history provided the visitor with brochures and materials either on the spot or later sent by the exhibitors at the booth.
This system was realized by interconnecting the system used at TRONSHOW2008 and another system developed by a Chinese company.

Extension Course on Food Traceability

The Extension course on Food Traceability intends to develop food traceability experts is aimed at those who in charge of food-related quality control/quality assurance, food security measures, etc. as well as researchers and students. This course is annually held in Kyoto and Tokyo respectively. The course in Kyoto venue is sponsored by Kyoto University, while the Tokyo venue is by the University of Tokyo and T-Engine Forum. The lecturers include food traceability experts, experts on food security measures such as GAP (Good Agricultural Practice), GMP (Good Manufacturing Practice) and HACCP (Hazard Analysis and Critical Control Points), and IT experts who are involved with its application systems. This is one of the best food traceability courses in Japan. One of the course's features is that the method of realizing food traceability system based on the ubiquitous ID technology using ucodes is explained in some detail. In addition, since many actual examples of food traceability systems which were realized using ucodes are introduced, you will find the course highly instructive.

ucode-based Ticket System (Hangzhou, China)


Extension Course on Food Traceability

T-Engine Forum

Who is T-Engine Forum?

T-Engine Forum is an NPO with the activity of international scope to promote the standards to improve the efficiency of real-time embedded systems development and to develop the infrastructure for context-awareness to implement ubiquitous computing environment.

- T-Engine Forum writes the specification of ucode, which is the universal number to identify "objects" and "places" as well as conducts the specification creation, utilization, and promotion of ubiquitous ID architecture, which is an application of ucode.
  - Operates Ubiquitous ID Center, which is in charge of issuing/managing ucode.
  - Conducts standardization activities toward achieving ubiquitous computing environment, and plays a coordinating role among governmental/ international organizations.
- T-Engine Forum conducts the followings: creation of the specification of real-time OS based on open architecture, "T-Kernel," distribution of its open source code, promotion of the distribution of middleware implemented on T-Kernel, and specification creation and publication, promotion of standard development environment T-Engine.

Membership Types for Different Objectives

[1] Vendors or System Integrators that offer embedded system development environment, develop and provide middleware, or manufacture semiconductors

Vendors or System Integrators as key players of embedded systems based on real-time OS or semiconductor devices may consider registering at T-Engine Forum as A-members or Executive Committee members. The user companies developing embedded systems can be involved with the standardization activities of T-Engine/T-Kernel development platform through various playing fields such as Committee Meetings, Working Groups (WGs), or General Meetings for members, etc. They are also among the first to obtain and review prototypes prior to the public release or learn how to use T-Kernel Family such as T-Kernel/μ T-Kernel through the attendances of seminars by T-Engine Forum. For details, please see the section for A-members/Executive Committee members.

[2] Vendors of End User Products

Makers that develop and provide embedded systems now pervading all the places of society such as car navigation system, cellular phone, digital camera, POS terminal, and kiosk terminal for end users may consider registering at T-Engine Forum as B-members. They are among the first to obtain and review prototypes prior to the public release or learn how to use T-Kernel Family such as T-Kernel/μ T-Kernel through the attendances of seminars by T-Engine Forum. For details, please see the section for B-members.

[3] Companies that manufacture RFID tags or develop systems toward the realization of a ubiquitous computing society

Companies that manufacture RFID tags or develop systems using such tags may consider participating in the standardization activities for the ubiquitous computing's future through various playing fields such as Committee Meetings, Working Groups (WGs), or General Meetings for members, etc. as A-members or Executive Committee members. There is "Ubiquitous ID Center" that issues/manages 128-bit unique IDs, "ucodes" under T-Engine Forum. Ubiquitous ID Center has not run only its activities domestically but

internationally, for example, having already established Ubiquitous ID Center, Taipei. The companies can develop various areas of application of ubiquitous computing through the use of ucodes, thus expanding business opportunities. For details, please see the sections for A-members/Executive Committee members.

［4］ User companies that are among the first to make efforts toward the realization of the ubiquitous computing's future

User organizations in every sector such as IT, food, distribution, construction, pharmaceutical, and contents industries, local governments, and government agencies, etc. that are among the first to make efforts toward the realization of the ubiquitous computing's future conduct activities as e-members. They can use the Experimental Activity Procedure (EAP) that supports the realization of various feasibility study experiments using ucodes. We look forward to the active participation of those who consider using ucode, which has gathered international attention, into their business or services. For details, please see the section for e-members.

［5］ Academic members*1

Those who promote the development of embedded systems or the use of ubiquitous ID technology from the academic standpoint may consider taking part in T-Engine Forum as Academic members. You can participate in unit such as university, faculty, department, and individual laboratory. For details, please see the section for Academic members.

［6］ Supporting members

Those who have interests and aspirations of providing financial support for the activities of T-Engine Forum, an NPO may consider participating in T-Engine Forum as Supporting members. For details, please see the section for Supporting members.

Policy

- The specifications created through the Forum activities will be released to the public worldwide in an easy–to–access manner to anyone after review by members. For example, the source code of real-time OS, "T-Kernel" has been downloadable for free since January 2004.

- The Forum does not create just technical specifications but performs the study of intellectual property rights (IPR) system appropriate for the embedded industry. For example, the studies are reflected in the license system such as "T-License" established in consideration of how open and free OS specifications can be utilized in business scene or how the rights of users (companies) can be protected without causing any problems after the use of specifications, etc.

Various Meetings

- Executive Committee
  ［Only Executive Committee members can attend.］
  - Decision-making body of T-Engine Forum consisting of Executive Committee members

- Committee
  ［A- and Executive Committee members can attend.］
  - T-Engine Platform Committee and Ubiquitous Committee are held. This is where the WG activities are reported.

- Working Group
  ［A- and Executive Committee members can attend.］
  - Studying particular topics

- Sub-Working Group
  ［A- and Executive Committee members can attend.］
  - Conducting tasks such as the drafting/reviewing of specifications on particular topics

Activities

［Participation in Seminars］

- Members-only seminars related to T-Engine, T-Kernel, ubiquitous ID technology are held.
  ［available to each membership type］

*1 Individuals are not allowed to apply to join the Forum. You must apply as an organization.

[General Meeting]

- The general meeting is held four times a year to report the Forum activities to members, introduce the products of members, and promote exchanges of information among members. Members can attend a speech by Professor Ken Sakamura, Chair of T-Engine Forum.
  [General meetings for A- and B-members and for A- and e-members are respectively held, which those having respective memberships can attend.]

[Obtaining Information]

- Members will obtain information on T-Engine, T-Kernel, ubiquitous ID technology through the websites and mail magazines.
- Members will obtain the following information at the members-only webpage: (However, available information is different depending on the membership types. Separate contracts or applications may be required for some types of information.)
  - The latest and updated information of T-Kernel, µ T-Kernel, T-Kernel Standard Extension, MP T-Kernel, selectable adaptation patch, tool, etc. prior to the public release
  - Activity reports of general meetings, committees, and selectable WGs
  - Seminar texts or sample codes, etc.
- Members can widely disseminate information on their own products related to T-Engine and/or T-Kernel to the public.

[Cooperation for Various Feasibility Study Experiments]

- T-Engine Forum has participated in the activities of "Free Mobility Assistance Project" across Japan, including "Tokyo Ubiquitous Technology Project in Ginza." It has conducted a variety of preparations and coordination and its staffs have worked together to improve the experiment environments.

The TRON Engineer Certification Examination

- Many problems occur due to the lack of criteria to measure technical skills objectively when development work is outsourced. Such outsourcing happens often due to the scarcity of embedded engineers. To resolve the problems, T-Engine Forum conducts the "TRON Engineer Certification Examination." The purposes of the examination are to objectively measure the technical skills of engineers who use embedded real-time OS such as T-Kernel, ITRON specification OS, etc., in order to improve the status of engineers with high technological skills and to stimulate the entire embedded systems industry.
  - The examination is for embedded real-time systems development engineers in companies that utilize or consider utilizing TRON specification OS such as T-Kernel, ITRON specification OS, etc.

- The examination time is 90 minutes.
- The perfect score is 100 points, and a pass/fail judgment is not made.
- T-Engine Forum members can take the examination at a discount.

Ubiquitous ID Center

- T-Engine Forum operates Ubiquitous ID Center that issues and manages ucodes.
- Developing and certifying the following core technology for ucodes:
  - Data carrier devices to store ucodes (RFIDs, smart cards, active chips, etc.)
  - Devices that communicate with data carrier devices (Ubiquitous Communicators)
  - Communication infrastructure that can retrieve information associated with ucodes
  - Secure wide-area distributed systems for ucodes and information associated with the ucodes
- Supporting overseas branches of Ubiquitous ID Center, which issue and manage ucodes abroad
- Collecting and providing information toward the realization of ubiquitous computing environments
- Conducting standardization activities and coordinating with government agencies or international organizations toward the realization of ubiquitous computing environments

PR Activities

[Exhibit]

- The Forum introduces T-Engine, T-Kernel and ubiquitous ID technologies to the public, hosting TRONSHOW, an annual technology exhibition where the results of TRON Project and related projects are shown, and making presentations at various exhibits.

[Information for the Media]

- The Forum disseminates information on T-Engine, T-Kernel, and ubiquitous ID technology to the press and cooperates with the media for news gathering activities.

T-Engine Forum membership types

• Executive Committee member

- Members can participate in the decision-making processes for policies and strategies of T-Engine Forum.
- Executive Committee members can participate in the executive committee, committees, working groups, general meetings, and seminars.
- Executive Committee members have all the privileges that A-, B-, and e-members have and can browse all of the members-only web pages.

• A-member

- Companies that manufacture hardware, develop various middleware, or provide its development environment in the embedded systems industry can participate in T-Engine Forum. Companies that provide products related to ucode tag such as RFID tags, QR codes, etc. and their reader devices related to ubiquitous ID technology or web services using ucodes can also participate in the Forum.
- Those that develop products using T-Engine and/or T-Kernel and would like to be deeply involved in the specification creation and development of T-Engine and/or T-Kernel find A-member type suitable for their needs.
- Those that develop ubiquitous-related technologies and/or products and would like to be deeply involved in the specification creation and development of ubiquitous ID technology, etc. and provider services find A-member type suitable for their needs.
- A-members can access information of T-Engine, T-Kernel, ubiquitous ID technology, etc. prior to the releases to B-and e-members.
- A-members can participate in committees, working groups, general meetings, and seminars.
- A-members can demonstrate their own products or services related to T-Engine, T-Kernel, and ubiquitous ID technology to other members by showcasing at general meetings.
- A-members enjoy the privileges that B- and e-members have and can browse all of the members-only web pages.

• B-member

- Companies that manufacture hardware, develop various middleware, or provide its development environment in the embedded systems industry can participate in T-Engine Forum.
- Those that consider developing products using T-Engine and/or T-Kernel find B-member type suitable for their needs.
- B-members can access information of T-Engine, T-Kernel, etc. prior to the releases to the public.
- B-members can participate in general meeting for B-members and seminars.
- B-members can browse the B-members-only web page.

• e-member

- Companies that provide products related to ucode tag such as RFID tags, QR codes, etc. and their reader devices related to ubiquitous ID technology or web services using ucodes can participate in the Forum. Furthermore, the users of such products in all industries and public sectors such as food, retail, distribution, construction, and contents industries, local governments, government agencies, etc. can participate.
- Those that use ubiquitous ID technology and eTRON find e-member type suitable for their needs.
- e-members can access information of ubiquitous ID technology prior to the release to the public.
- e-members can conduct various feasibility study experiments using the Experimental Activity Procedure (EAP).
- e-members can participate in general meeting for e-members and seminars.
- e-members can browse the e-members-only web page.

• Academic member

- Academic parties that use T-Engine, T-Kernel, ubiquitous ID technology, and eTRON can participate in the Forum.
- Academic members can participate in unit as university, faculty, department, or individual laboratory.
- Academic members can participate in seminars.
- Academic members can browse the academic members-only web page.

・Supporting members

- For those that provide financial support for the activities of T-Engine Forum.
- Supporting members are not involved in the formulation or approval of Forum standards.
- Supporting members can participate in general meeting and seminars.
- Supporting members can browse the supporting members-only web page.

Membership Type/ Activity contents	Executive Committee members	A-members	B-members	e-members	Academic members	Supporting members
Participation in Executive Committee	○	×	×	×	×	×
Participation in General Meeting	○	○	○	○	×	○
Participation in Committees	○	○	×	×	×	×
Participation in WGs	○	○	×	×	×	×
Participation in Seminars	○	○	○	○	○	○
A-members-only web page	○	○	×	×	×	×
B-members-only web page	○	○	○	×	×	×
e-members-only web page	○	○	×	○	×	×
Academic members-only web page	○	×	×	×	○	×
Supporting members-only web page	○	×	×	×	×	○

【T-Engine Forum Annual Fee and Validity Period of Membership】

T-Engine Forum's activities are held on an annual basis from April 1 to March 31. Irrespective of the timing of participation, the membership is valid only for the applicable year. Only a legally incorporated organization can join in T-Engine Forum.

- Executive Committee members
  A-members that pay 3,000,000 yen or more (please pay three shares or more)
- A-members
  one share 1,000,000 yen/year (please pay one share or more)
- B-members
  one share 100,000 yen/year (please pay one share or more)
- e-members
  one share 100,000 yen/year (please pay one share or more)
- Academic members
  Free/year
- Supporting members
  one share 1,000,000 yen/year (please pay three shares or more)

Application for participation or inquiries

For various inquiries, please contact T-Engine Forum Secretariat.

T-Engine Forum Secretariat
c/o YRP Ubiquitous Networking Laboratory
The 28th Kowa Building, 2-20-1, Nishi-Gotanda,
Shinagawa-ku, Tokyo 141-0031 Japan
Tel : +81-3-5437-0572
Fax: +81-3-5437-2399
mailto: office@t-engine.org
URL: http://www.t-engine.org/index.html

T-Engine Forum®

T-Engine Forum member organization list

Executive Committee members: 23

Aplix Corporation
ColorZip Japan Inc.
DAI NIPPON PRINTING CO., LTD.
DENSO CORPORATION
eSOL Co., Ltd.
FUJITSU LIMITED
Fujitsu Microelectronics Limited
Hitachi, Ltd.
Hitachi ULSI Systems Co., Ltd.
ITOCHU Corporation
NEC Corporation
NEC Electronics Corporation
NEC Soft, Ltd.
Nihon Unisys, Ltd.
NTT DoCoMo, Inc.
Oki Electric Industry Co., Ltd.
Personal Media Corporation
Renesas Technology Corp.
SATO CORPORATION
TOPPAN PRINTING CO., LTD.
TOSHIBA CORPORATION
Yokogawa Digital Computer Corporation
Yokosuka Telecom Research Park, Inc.

A-members: 36

Advanced Driver Information Technology GmbH (Germany)
AISIN AW CO., LTD.
ALGO SYSTEM CO.,LTD.
Alpine Electronics, Inc.
Aplix Corporation
ColorZip Japan Inc.
Computex Co., Ltd.
CORE CORPORATION
DAI NIPPON PRINTING CO., LTD.
DENSO CORPORATION
eSOL Co., Ltd.
Fuji Electric Advanced Technology Co., Ltd.
FUJITSU ELECTRONICS INC.
FUJITSU LIMITED
Fujitsu Microelectronics Limited.
GAIA System Solutions Inc.
Hitachi Information & Control Solutions, Ltd.
Hitachi, Ltd.
Hitachi Software Engineering Co., Ltd.
Hitachi ULSI Systems Co., Ltd.
ITOCHU Corporation.
Japan Traceability Association
Kyoto Micro Computer Co., Ltd.
MEIDENSHA CORPORATION
Microsoft Corporation (USA)
MITSUBISHI ELECTRIC CORPORATION
NEC Corporation
NEC Electronics Corporation
NEC Soft, Ltd.
Nihon Unisys, Ltd.
NIPPON TELEGRAPH AND TELEPHONE CORPORATION
Nomura Research Institute, Ltd.
NTT DoCoMo, Inc.
Oki Electric Industry Co., Ltd.
OMRON SOFTWARE Co., Ltd
Oracle Asia Research & Development Center
PASCO CORPORATION
Personal Media Corporation
Renesas Technology Corp.
Saxa Inc.
SATO CORPORATION
SHARP CORPORATION
The Nippon Signal Co., Ltd.
TOPPAN FORMS CO., LTD.
TOPPAN PRINTING CO., LTD.
TOSHIBA CORPORATION
Toshiba Information Systems (Japan) Corporation
Toshiba Solutions Corporation
TOSTEM CORPORATION
TOYOTA TECHNICAL DEVELOPMENT CORPORATION
Ubiquitous Computing Technology Corporation
UNIADEX, Ltd.
UNION MACHINERY CO.,LTD

Xilinx, Inc.
Yagi Antenna Inc.
YAMAHA CORPORATION
YAZAKI CORPORATION
Yokogawa Digital Computer Corporation
Yokosuka Telecom Research Park, Inc.

B-members: 143

Advanced Telecommunications Research Institute International
A.I. CORPORATION
Altera Corporation (USA)
ALTIMA CORPORATION
ANIMO LIMITED.
ARM Ltd..
AXELL CORPORATION
BIP SYSTEMS CORPORATION
Blaupunkt GmbH (Germany)
Brother Industries, Ltd.
Casio Computer Co., Ltd.
China Household Electric Appliance Research Institute
Chuo Engineering Co.,Ltd.
Communication And Technology Systems, Inc.
Computer Management
Connect Technologies Corp.
Cosmos Scientific Systems, Inc.
CSI co., Ltd.
Dalian uComSoft Co., Ltd (China)
Dalian uLoong C&S Co.,Ltd (China)
DENSO CREATE INC.
DENSOTECHNO CO., Ltd.
E2Publishing Corporation
Elektrobit Automotive GmbH (Germany)
ELMIC WESCOM, INC.
Firmware Systems, Inc.
Forestec Co.,Ltd.
FreeBit Co., Ltd.
From Orient Corp.
Fuji Electric Systems Co., Ltd.
Fuji IT Co., Ltd.
FUJI FILM CO., LTD.
Fuji Xerox Co., Ltd.
Fujitsu Computer Technologies Limited
FUJITSU HOKURIKU SYSTEMS LIMITED
Fujitsu LSI Technology Ltd.
Fujitsu Microelectronics Solutions Limited
Fujitsu Software Technologies Limited
GAIO TECHNOLOGY CO., LTD.
Genetec corporation
Geographical Survey Institute
Global Engineering,. Inc.
Grape Systems Inc.
HAGIWARA ELECTRIC CO., LTD.
HASHIBA GRAND CO., LTD
Hitachi Advanced Digital, Inc.
Hitachi Industrial Equipment Systems Co., Ltd.
Honda R&D Co.,Ltd
iAnywhere Solutions K.K.
ITTO SOFTWARE INC
Japan Radio Co., Ltd.
JRC ENGINEERING CO., LTD.
JTEC Corporation
JTS (Janome Tec Systems Co., Ltd.)
JUSTSYSTEM Corporation
KASHIWAZAKI SILVER SEIKO LTD.
Koyo System Corporation
KYB Corporation
Kyoto Software Research, Inc.
Kyushu Ten Co., Ltd.
LG TeleCom (Korea)
MATO Corporation
Matsutame Co.,Ltd.
MIPS Technologies, Inc.
MITSUBISHI HEAVY INDUSTRIES, LTD.
MITSUI-SOKO CO.,LTD.
MITSUI ZOSEN SYSTEMS RESEARCH INC.
MontaVista Software, Inc. (USA)
Murata Manufacturing Co., Ltd.
Naito Densei Machida Mfg. Co., Ltd.
Nebit Co., ltd.
NEC Aerospace Systems,LTD.
NEC Communication Systems, Ltd.
NEC Engineering, Ltd.
NEC Soft (Jinan) Co., Ltd. (China)
NEC Software Hokuriku, Ltd.
NEC System Technologies, Ltd.
NEC TOSHIBA Space Systems, Ltd.
NIHON DYNAMIC SYSTEM CO. LTD.
Nippon Information Development Co., Ltd.
Niscom Inc.
NISSAN MOTOR CO., LTD.
Nissin Systems Co., Ltd.
NTT COMWARE CORPORATION
NUMATA CORPORATION
OMRON Corporation
Panasonic Electric Works System Solutions Co., Ltd.

Peking Ubiquitous IC Tag Technology Co., Ltd. (China)
PIONEER CORPORATION
Planners Land Co., Ltd.
Reed Exhibitions
Renesas Northern Japan Semiconductor, Inc.
Renesas Technology Corp. (Singapore)
RICOH Co., Ltd.
RIGEL. CO. LTD
RISO KAGAKU CORPORATION
SANEI CO., LTD.
Sanritz Automation Co., Ltd.
Seiko Epson Corporation
Seiko Instruments Inc.
SEIKO Precision Inc.
Semiconductor Energy Laboratory
Semiconductor Technology Academic Research Center
Sennet, Inc.
Shanghai CORE Information Technology Co., Ltd.
SHIMAFUJI ELECTRIC CO., LTD.
SHINKO ELECTRIC INDUSTRIES CO., LTD.
Shinko Shoji Co., Ltd.
SILVER ELECTRONIC RESEARCH Co.,Ltd
SMSC Japan
SoftBrain Inc.
SoftSirius Co., Ltd.
Sony Corporation
Sophia Systems Co., Ltd.
SORUN CORPORATION
SystemPro Co., Ltd.
System Science Laboratory Company
Taiyo Yuden Co. Ltd.
TAKASAKI KYODO COMPUTING CENTER Co., LTD
TAKIGEN MFG.CO., LTD
TANBAC Co., Ltd.
Tateno Dennou, Inc.
T.D.I. CO., LTD.
TechMatrix Corporation
TEMPSTAFF TECHNOLOGIES CO., LTD.
TEPCO UQUEST, LTD.
TOKO, Inc.
TOPCON CORPORATION
TOSHIBA MACHINE CO., LTD
TOSHIBA MICROELECTRONICS CORPORATION
Toshiba System Technology Corporation
TOSHIBA TEC CORPORATION
TOSHIN ELECTRIC CO.,LTD
TOTANI CORPORATION
TOYO KANETSU SOLUTIONS K.K.
UNICO TECHNOS CO., LTD.
UNITEC CO., LTD.
Upwind Technology, Inc.
VASDAQ Security Co.,Ltd
Viometrix Private Limited
Virtutech Inc.
Vitec System Engineering Inc.
YAPPA Corporation

e-members: 117

AISIN AW CO., LTD.
AJIS CO., LTD.
Alpine Electronics, Inc.
AMADA CO., LTD.
AOMORI PREFECTURAL GOVERNMENT
Aplix Corporation
Autonics co., ltd.
BIP SYSTEMS CORPORATION
BF Co., LTD.
Brain Forum, Inc.
CASTNET TOKYO Corporation.
CENTERT FOR BETTER LIVING.
Central Research Institute of Electric Power Industry
CHODAI CO., LTD.
CNS CO., Ltd.
ColorZip Japan Inc.
COMPUTEX CO., LTD.
CORE CORPORATION
CTI Engineering Co., Ltd.
DAIFUKU CO., LTD.
DAI NIPPON PRINTING CO., LTD.
Daiwa House Industry Co., Ltd.
Datacard Japan LTD.
DENSO CORPORATION
E&E Solution Inc.
eSOL Co., Ltd.
Faith, Inc.
Fishing Boat and System Engineering Association
Fugaku Express Ltd.
Fuji Electric Retail Systems Co., Ltd.
FUJITSU ELECTRONICS INC.
FUJITSU LIMITED
Fujitsu Microelectronics Limited
Fuji Seal, INC.
Fuji Xerox Co., Ltd.
GAIA System Solutions Inc.
Geographical Survey Institute
GOV CO.,LTD

Hangzhou Homewell Intelligence Control Co.,Ltd. (China)
Hanshin Department Store
HASHIBA GRAND CO., LTD
Hashimoto Sogyo co., Ltd.
Hewlet-Packard Japan, Ltd.
Hitachi, Ltd.
Hitachi Chemical Co., Ltd.
Hitachi Distribution Software Co., Ltd.
Hitachi Information & Control Solutions, Ltd.
Hitachi Information Systems, Ltd.
Hitachi Plant Technology, LTD.
Hitachi Software Engineering Co., Ltd.
Humeia Corporation
IDTechEx Ltd. (UK)
Institute of Social Environment Systems , Inc.
Ishida Co., Ltd.
ITOCHU Corporation
ITOKI CORPORATION
ITT Cannon Ltd.
JAPAN BUSINESS COMPUTER CORPORATION
Japan Department Stores Association
Japan Logistic Systems Corp.
JAPAN RACE HORSE REGISTRY
Japan Traceability Association
jig.jp co.,ltd.
JTEC Corporation
Kanazawa Institute of Technology
KDDI R&D Laboratories Inc.
Keyware Solutions, Inc.
KIKUKAWA KOGYO CO., LTD.
Kobayashi Create Co., Ltd.
Kobayashi Woven Labels Co., Ltd.
Kobayashi Create Co., Ltd.
Koishikawa System Design, Inc.
KONOIKE TRANSPORTATION CO., LTD
K-ubique ID Corporation
KYOSEMI CORPORATION
Kyoto egg and chicken safety promotion conference
Kyoto Micro Computer Co., Ltd.
LG TeleCom (Korea)
LINCREA corp.
MARS TECHNO SCIENCE CORP.
MARUEI CONCRETE INDUSTRY CO., LTD
MEIDENSHA CORPORATION
MENOX Co,Ltd.
MIPS Technologies, Inc.
Mitsubishi Corporation
MITSUBISHI ELECTRIC CORPORATION
Mitsubishi Tanabe Pharma
Mitsui Fudosan Co., Ltd.
MITSUKOSHI, LTD.
Monohakobi Technology Institute Co., Ltd.
MUSASINO WING Inc.
Nanjing Chengzhi Softech Co., Ltd. (China)
NEC Corporation
NEC Electronics Corporation
NEC Engineering, Ltd.
NEC Soft, Ltd.
NEC TOKIN Corporation
NEWJEC Inc.
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Nihon Unisys, Ltd.
NIPPON FRUEHAUF COMPANY, LTD.
NIPPON MEAT PACKERS, INC.
Nippon Paper Industries
NIPPON TELEGRAPH AND TELEPHONE CORPORATION
NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION
NIPPON TELEGRAPH AND TELEPHONE WEST CORPORATION
NISSIN UNYU KOGYO CO., LTD.
Nomura Research Institute, Ltd.
NTT Communications Corporation
NTT COMWARE CORPORATION
NTT DATA CCS CORPORATION
NTT DoCoMo, Inc.
NTT Software Corporation
NXP Semiconductors Japan Ltd
Ohtomi Inc.
OKAMURA CORPORATION
Oki Electric Industry Co., Ltd.
OMRON SOFTWARE Co., Ltd
Oracle Asia Research & Development Center
OSAKA SEALING PRINTING Co., LTD.
Peking Ubiquitous IC Tag Technology Co., Ltd. (China)
Personal Media Corporation
Renesas Technology Corp.
RISO KAGAKU CORPORATION
SANDEN Corporation
SATO CORPORATION
Saxa Inc.
Sealex Corporation
SEKONIC CORPORATION
SHARP CORPORATION
SHINKO ELECTRIC INDUSTRIES CO., LTD.
Shochiku Co.
SOFEL CO., LTD.
Software Consultant Corporation
SOFTBANK TELECOM CO., LTD.
SORUN CORPORATION

SUMITOMO FORESTRY CO., LTD.
Sumitomo Mitsui Card Company, Limited
Sumitomo Osaka Cement Co., Ltd
Sunstar Inc.
SYSTEM INTEGRATION,Inc.
TAD Co., Ltd.
TAIHEIYO CEMENT CORPORATION
Taiyo Yuden Co. Ltd.
TAMURA Corporation
TECHNOLOGY CENTER HERMIA Oy (Finland)
Tekes-Finnish Funding Agency for Technology and Innovation (Finland)
The Nippon Signal Co., Ltd.
The Pack Corporation
Tokyo Cable Network Inc.
TOPCON CORPORATION
TOPPAN FORMS CO., LTD.
TOPPAN PRINTING CO., LTD.
TORAY INTERNATIONAL, INC.
TOSHIBA CORPORATION
Toshiba Information Systems (Japan) Corporation
Toshiba Solutions Corporation
TOSTEM CORPORATION
Toyo Seikan Kaisha, Ltd.
TOYOTA TECHNICAL DEVELOPMENT CORPORATION
TSUBAKIMOTO CHAIN CO.
Ubiquitous Computing Technology Corporation
UNIADEX, Ltd.
UNION MACHINERY CO.,LTD
Yagi Antenna Inc.
YAMAHA CORPORATION
Yamato Packing Co., LTD
YAZAKI CORPORATION
YAZAKI RESOURCES CO.,LTD
Yokosuka Telecom Research Park, Inc..
ZENSHO CO., LTD

Supporting members: 1

Panasonic Corporation

Academic members: 71

Araki Laboratory, Department of Electronics and Photonic Systems Engineering, Faculty of Engineering, Hiroshima Institute of Technology
Aso Business Computer College
Centre for High Performance Embedded Systems, Nanyang Technological University, Singapore (Singapore)
Cybermedia Center, Osaka University
Dalian Martime University (China)
Department of Civil Engineering, HanYang University
Department of Computer Science, University of Yamanashi
Department of Electrical and Electronics Engineering, Kokushikan University
Department of Information Science, Osaka Institute of Technology
Department of Information Science and Technology, National Agricultural Research Center
Electronics Design Lab., Hanoi University of Technology (Vietnam)
Faculty of Information Technology, Ho Chi Minh City University of Technology (Vietnam)
Fukuyama University
Graduate School of Bionics, Computer and Media Sciences
Graduate School,Gunma University,Shiraishi Laboratory
Hiroshima City University
HOSHI Lab., TOKAI Univ.
Hunan University,School of Computer and Communication, Embedded System&Laboratory (China)
Inaba-Inamura laboratory, Dept. of Mechano-Informatics, Faculty of Engineering, the University of Tokyo
Industrial Technology Research Institute/Identification and Security Technology Center (ISTC) (Taiwan)
Information-technology Promotion Agency, Japan
Inha University (Korea)
Institute for Information Industry (Taiwan)
Institute for Infocomm Research(Singapore)
Integrated System Design Lab. (IMAI Lab.), Osaka University
Intelligent robot laboratory, University of Tsukuba
International Cooperation Department, Institute of Software, Chinese Academy of Sciences (China)
International Institute of Information Technology (India)
Japan Electronics College (Nihon Densi Senmon Gakko)
Kanagawa Prefectual Fujisawa Vocational Trainning School
Koshizuka Laboratory, the University of Tokyo
Kuninaka Labo, Institute of Space and Astronautical Science
Kyung-Pook National Univ. (Korea)
Minoru KUBOTA Laboratory, Chiba Institute of Technology
Miyanaga Lab., Tokyo University of Science MOT
Mizuno Labo, Institute of Space and Astronautical Science
Mizusawa Laboratory, Aoyama Gakuin University
Nagoya University
National Institute of Advanced Industrial Science and Technology (AIST)

Nishihara Laboratory, Department of Welfare Systems Engineering, Kanagawa
Oporto University-Faculty of Science (Portugal)
Oya Laboratory, Information Science, Shonan Institute of Technology
Peking University & Renesas T-Engine Joint Lab (China)
Pukyong National University (Korea)
Republic Polytechnic (Singapore)
Research Institute of Computer Applications, South China University of Technology (China)
Reseach Institute of Management and Information Sciendce, Shikoku University
RFID CENTER in Ajou University (Korea)
RFID Center, Head of the Business Informations Systems Institute, Haute Ecole Valaisanne (Switzerland)
Ryukoku University, Faculty of Science and Technology, Department of Media Informatics
Semyung University (Korea)
Sakamura Laboratory, the University of Tokyo
School of Computer Science and Information Systems, Birkbeck College (UK)
School of Computing University of Tasmania, Australia (Australia)
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Ubiquitous ID Technologies 2009

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