

ucode

Real-world Identification Scheme for
"Internet of the Things and Places"

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Introduction

What is “ubiquitous”?



- It is still ambiguous, “what is ubiquitous?”.
- Popular answer is “information services in *anytime*, at *anywhere*, and for *anyone*”.
- However, “anytime, anywhere, and anyone” is not a new concept. The ultimate goal of information system has always been “anytime, anywhere, and anyone”.

Context-awareness



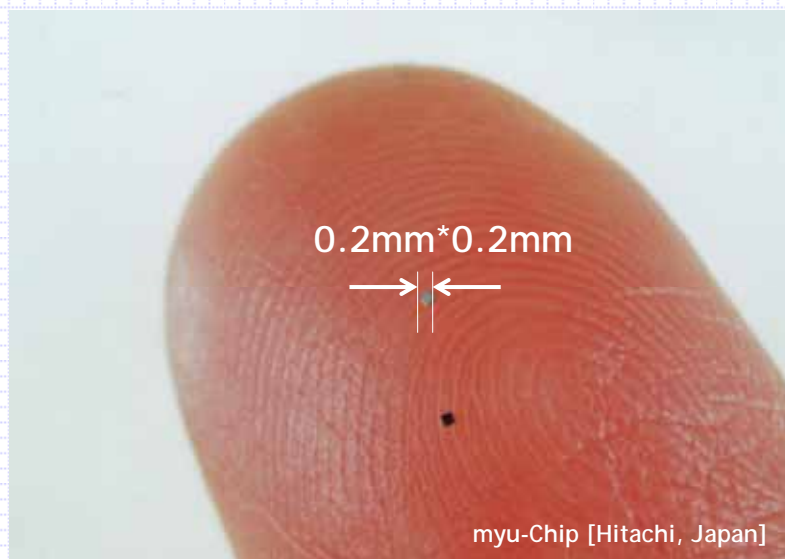
Ubiquitous computing aims
“*context-aware*” and “*proactive*”
information services.

Key issues of "ubiquitous"

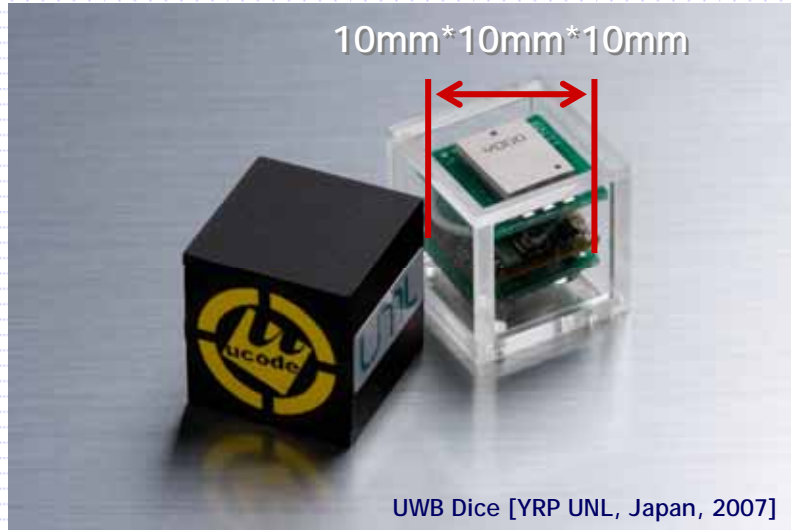


- Ubiquitous computing is featured by new key technologies
- ↓
- Ultra tiny devices
...such as RFIDs and ubiquitous sensor network nodes
- Automatic identification technologies
...such as RFIDs, barcodes, 2D barcodes, IR beacon, ...
- Smart mobile terminals such as smart mobile phones
- Proliferation of public wireless communication services

Ultra-tiny devices (Passive RFID)



Ultra-tiny devices (Sensor Network Nodes)



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Automatic Identification...context-awareness



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Smart Mobile Terminal



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Agenda



1. Technology: Ubiquitous ID Architecture
 - Overview
 - **u**code: ubiquitous code
 - UCR Model
 - ucode Resolution
2. Applications
 - Food Information Tracking with **u**code
 - Location-aware information services with **u**code
 - Ex. 1: Tokyo Midtown in Roppongi
 - Ex. 2: Tokyo Ubiquitous Technology Project in Ginza
3. Standardization Activity
 - Ubiquitous ID Center
 - ITU-T SG16

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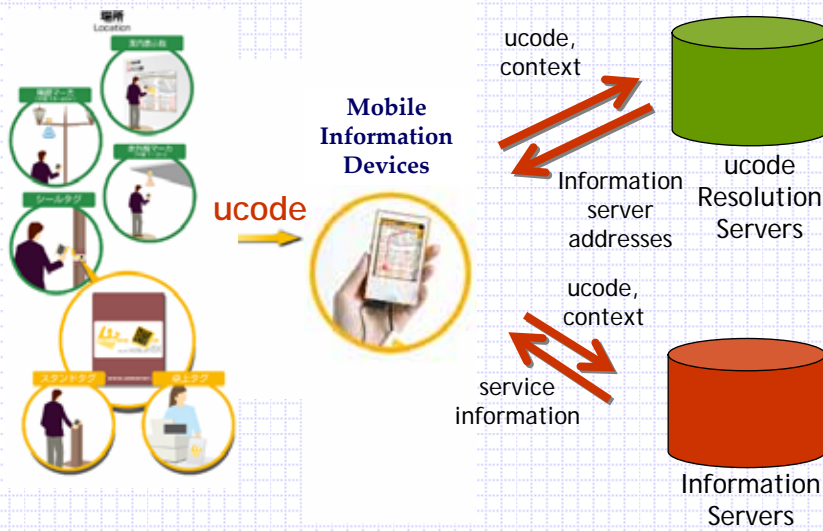
Ubiquitous ID Architecture

System architecture for Internet of the Things and Places

Goals of Ubiquitous ID Architecture

- Users can access digital information from several **real-world entities** such as **objects and places** via their electronic devices equipped with communication facilities and a **tag R/W**.
- Features
 1. Tag-based identifications = identifier is stored in a tag such as RFID, smart card, IR tag, barcode, 2D barcode
 2. Services are automatically triggered by obtaining the identifier in a tag
 3. Information comes from networks.

Overview of Ubiquitous ID Architecture

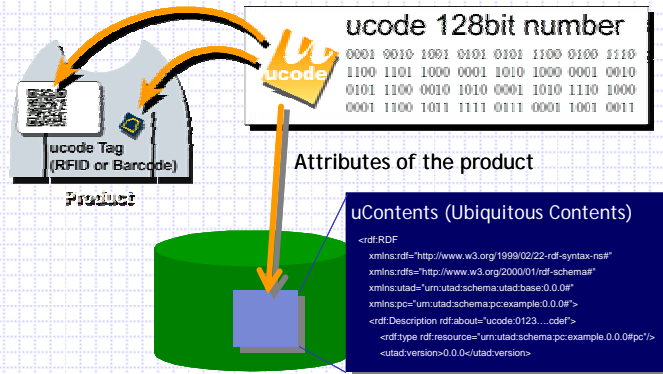


ucode ubiquitous code

ucode: Definition



- **ucode** is a 128 bits number used for identification of real-world entities.
- We embed these numbers in **ucode** tags for identification purposes.
- Semantic information is stored in remote databases via network.



ucode: Features



1. **ucode** is a general identifier system which identifies real-world entities such as objects and places.
 - Using ucode, we can manage objects and places in the same framework.
2. **ucode** includes **no semantic information** of the objects and places.
 - Attributes and meanings will be stored remote database via networks.
3. **ucode** is a fix length number with 128 bits.
 - It's very easy for computers to deal with ucode.
 - It is **suitable for storing in small tags** such as RFID, IR tags, barcodes, and 2D barcodes.
4. **ucode** is used to define real-world contexts
 - We have a framework called **UCR Model (UCode Relation Model)** on the basis of the ucode.
5. **ucode** enables context-aware information retrievals through computer networks
 - We call this retrieval as **ucode resolution**.

ucode Tags Attached to Objects and Places

ucode tags (1)



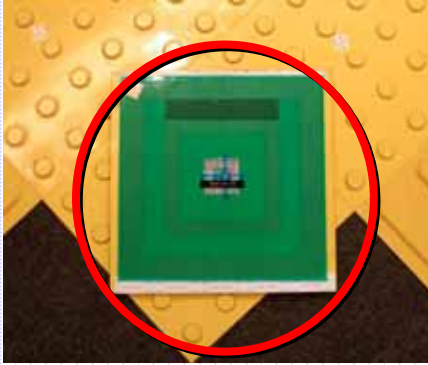
ucode Tags (2)



ucode Tags (3)



ucode Tags (4)



ucode Tags (5)



UCR Model

ucode Relation Model

A description model of real-world contexts

Prose description of UCR

- The basic concept of UCR (ucode relation) Model



- We assign an identifier to every object and place in the real-world.
- We can describe the real-world situation by the relationship between identifiers or between the identifier and another information.

ucode and atom



■ Three types of ucode

- Physical ucode
 - identifies physical entities in the real-world
 - Usually, physical ucode is stored in a physical small tag.
- Logical ucode
 - identifies logical objects such as digital contents, and concepts which are meaningful for human being.
- Relation ucode
 - identifies the relationship between two ucodes. (A part of logical ucode)

■ atom

- Data such as character strings, URL, and numbers which are not associated with ucode.



- ### ■ UCR Model represents real-world semantics using the combination of the three types of ucodes and atoms.

Definition: UCR unit

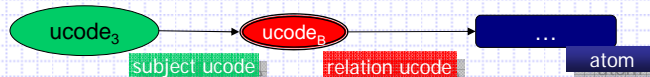


■ UCR unit is defined as the following triple

- A triple of ucodes
= (subject ucode , relation ucode , object ucode)

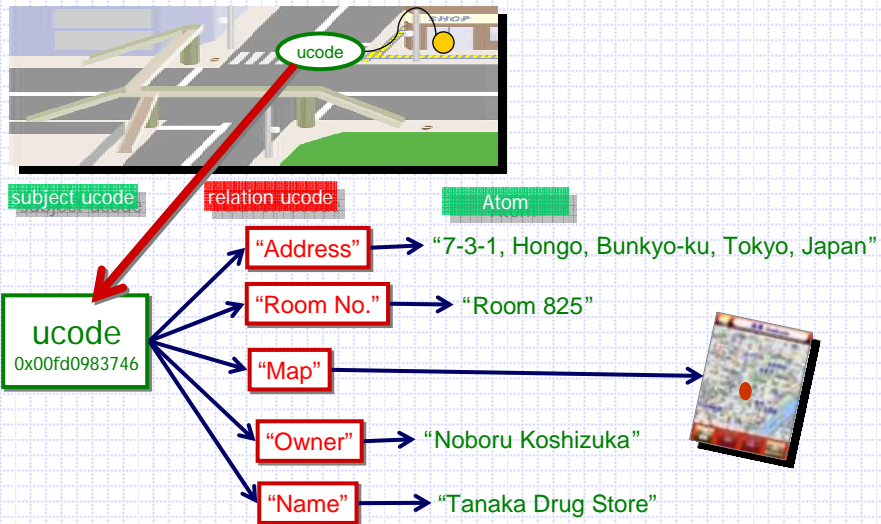


- A pair of ucodes and an atom
= (subject ucode , relation ucode , atom)



- ### ■ UCR unit is the basic unit for describing real-world context information.

Ex.: Database for location-based information services using UCR



uicode Resolution

~Context-aware Information Retrieval Using uicode~

ucode Resolution



- Retrieving information associated with obtained ucode from the networked databases
- Examples
 - Web pages in HTML
 - Maps in SVG
 - Image/pictures in JPEG
 - Animation/movies in MPEG
 - Interactive contents in Ajax

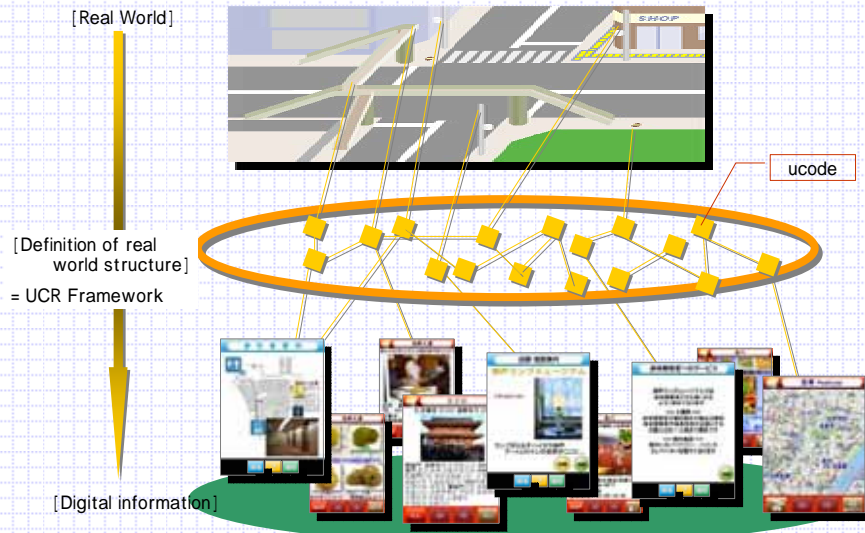


ucode Resolution Query Commands



1. Normal Resolution (`ures_ucd`)
 - `ures_ucd` returns UCR Units which contains specified subject ucode and relation ucode.
2. UCR Graph Query (`ubld_ucr`)
 - `ubld_ucr` specifies a subject ucode, and it returns the UCR sub-graphs whose root node is the subject ucode.
3. Pattern Match Query (`umch_ucr`)
 - `umch_ucr` returns UCR sub-graphs which match the specified UCR expressions.

Bridging the gap between Real and Virtual



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Food Traceability Systems with **ucode**

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Food Safety in Japan



- In these years, we had several troubles and accidents which threat our food safety.



- In 2008, we had an outbreak of food poisoning in Japan that has been linked to Chinese made dumplings.
- About 10 people had fallen ill after eating frozen dumplings, almost 4,000 people complained of feeling unwell in the past few days after eating the dumplings.



Food Traceability Systems



- Food safety is one of the major concerns of Japanese people today.



- Food Traceability is one of the solutions of these problems.
 - Food Traceability is the ability to follow the movement of food through specified stage of production, processing and distribution.
 - For realizing food traceability, we can use ubiquitous computing technology as a strong tools.
- For example, ...
 - We have applied the RFID for the distribution of fresh vegetables and fruits (about 200 items).
 - We also put the active sensor tags with temperature sensor into the container box and pallets.
- Then..
 - If food trouble occurs, we can soon track the information and find the cause of the trouble immediately.
 - The consumers can confirm every information about the food.

Food Information Tracking for Food Safety



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Information collection at farms



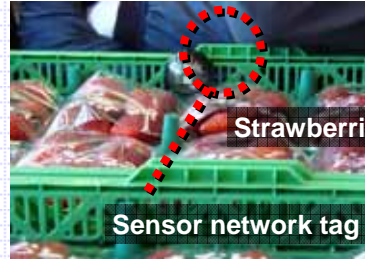
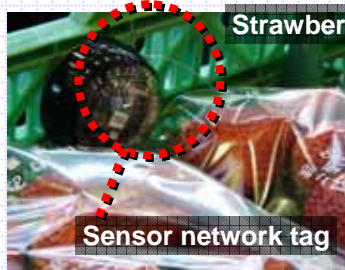
agricultural
chemicals

"Lettuces"
are shipped
with RFID

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Measuring temperature of food



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Showing food information to consumers



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Ubiquitous Location-based Information Services with **u**code

Pedestrian Navigation



Sight-seeing Support (1)



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Sight-seeing Support (2): @Gift Shop



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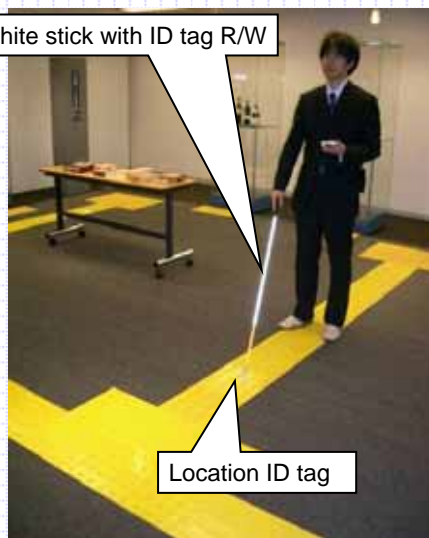
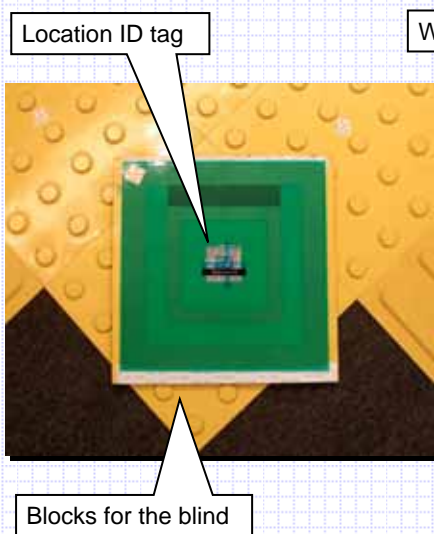
Education



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Supporting the Physically Disabled (1)



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Supporting the Physically Disabled (2) ...even in sick snow



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Ex.1: Ubiquitous Art Tour in "Roppongi Tokyo Midtown"

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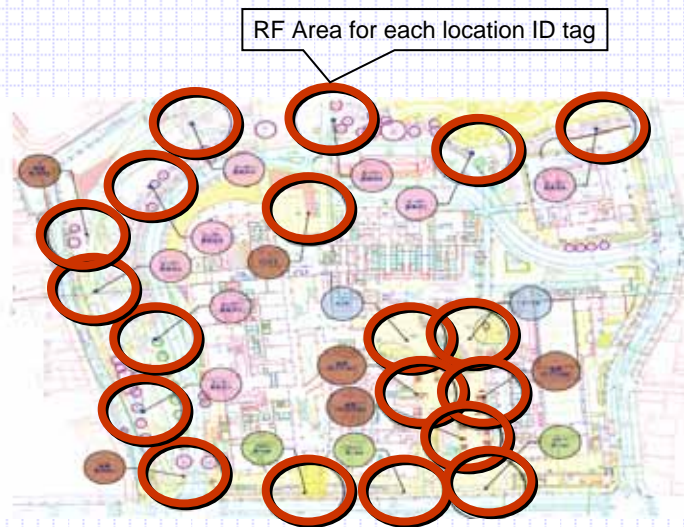
Tokyo Midtown, in Roppongi Tokyo
Established in May 2007



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A few Hundreds of ucode "Tags" are deployed in
Tokyo Midtown.



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Active RFID for Outdoor



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Infrared ID Maker for Indoor



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Ubiquitous Art Tour in Roppongi "Tokyo Midtown"



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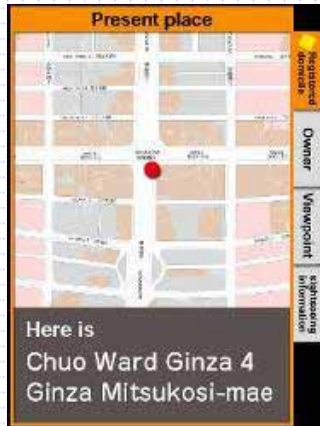


Ex. 2: Tokyo Ubiquitous Technology Project in Ginza

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Service (1): Showing the current place



Showing using a digital map

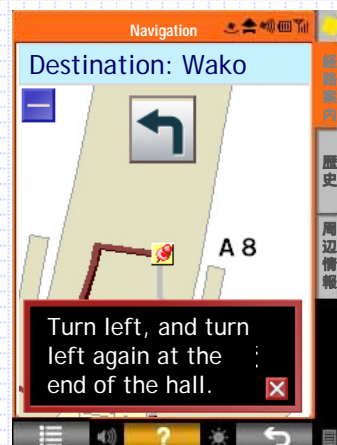


Showing using a 3D panorama view

Service (2): Pedestrian Navigation



- Navigation with maps and speech
- Even, in the underground and buildings
- Flexible navigation suitable for specific situations
 - Nearest bathroom
 - Go underground when it rains
 - Pedestrian zones on Sundays



Service (3): Emergency information



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Service (4): Advertisement information by shops and stores



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Service (5): Other information services



Mobile bulletin board service

Weather information



Standardization Activities Related to the Ubiquitous ID Technology

Standardization Activities of Ubiquitous Information Services



- Industry-based SDOs
 - Ubiquitous ID Center
- International de-jour SDOs
 - NID (Networked aspects of identification systems including RFIDs and USN), SG16 in ITU-T



Ubiquitous ID Center



Ubiquitous ID Center



- Ubiquitous ID Center is a standardization organization of ubiquitous computing technologies.
- Our activity is based on the joint work with many partners from all over the world.
 - companies, academia, industry consortium, government agency, etc.
- About 450 members are supporting our center.
- Established in June 2002



Standardization activity in SG16, ITU-T

**Multimedia information delivery
services and applications triggered by
tag-based identification**

Standardization in SG16, ITU-T



■ Scope

- In SG16, we are working the standardization of "Multimedia information delivering services and applications triggered by tag-based identification"

■ Working Program

- [F.mid] "Recommendation on **service descriptions and requirements** for multimedia information services triggered by tag-based identification"
- [H.mid] "Recommendation on **architecture** of multimedia information services triggered by tag-based identification"
- "Recommendation on **ID code**"
- "Recommendation on **ID Resolution Protocol**"

...

For More Information...



Ubiquitous ID Center

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