Position Paper for Ubiquitous WEB

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1. Our Objectives

As various types of digital communication networks including the Internet and mobile phones, have become widespread. There has been not only a rise in demand for broadband networks, such as fiber-optic networks but also an emphasis on the importance of ubiquitous networking that supports our lives sensitively by embedding communication capabilities in devices even smaller and surrounding us.

Therefore, our laboratory aims for establishing infrastructure protocols for communication of the next generation, and its system to achieve a ubiquitous computing environment that supports our lives more sophisticatedly by embedding micro-computers and communication capabilities in all physical objects around us and having them operate on cooperative processing and exchanging information with each other.

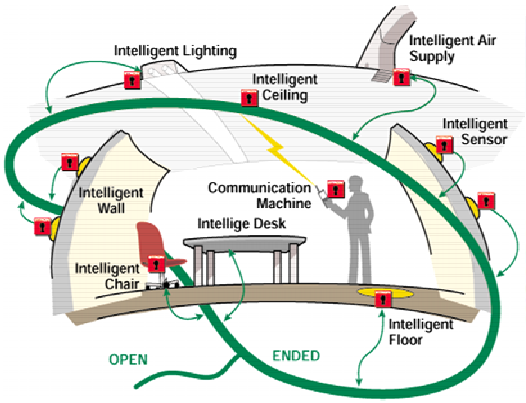

Figure 1: Indoor ubiquitous computing

Figure 2: Outdoor ubiquitous computing

To achieve this aim, we have been developing platform systems in which all hardware, kernels, middleware and various types of application software for the ubiquitous computing environment with the following features.

1. Real-time Communication Protocols
2. Security
3. Ultra Tiny Computers
4. Effortless Operation
5. Human Friendly Interface

6. Calm Computing
7. Cooperative Processing in Ubiquitous Computing Environments

2. Relation Between The Ubiquitous WEB And Our Efforts

In such a platform system, the following features of WWW are important.

1. It is based on social infrastructure for the people by circulation of the presentation data (html, SVG etc.).
2. It interoperates with all information systems with both loose and sloppy coupling.

The presentation data of WWW will achieve general human interface on a tiny computer. A loose interoperability of WWW is an important qualification for wider cooperative processing. We consider the above-mentioned features made WWW succeed. In addition, we believe that it is necessary to apply it to ubiquitous computing.

3. Our Conspicuous Approaches

We are advancing the following three conspicuous approaches concerning ubiquitous WEB. We believe that we take role of significant issues in promotion of ubiquitous WEB.

3.1. Ubiquitous ID architecture that gives new IRI

In ubiquitous ID architecture, various real-world objects are embedded with ubiquitous code tags (ucode tags), made up of RFID elements, sensors, or other components. Basically, only ucodes are stored in these ucode tags. On the other hand, information about physical objects into which ucodes are incorporated is stored in a database over a network. In this way, separating the identification of physical objects from information management makes it possible, for example, to update information on certain physical object in real time, to obtain the latest information on that physical object, and to obtain information on other physical objects related to certain physical object, etc.

Ucode is a sort of identifier by 128bit binary data, and it does not depend on the MAC address etc. Moreover, the ucode doesn't have the meaning in the code itself. Therefore, it can number all things at random if necessity, for it is impossible to enumerate everything beforehand. We are

advancing installation of resolver for the ucode (It is called ucode relation management server). It offers URI(IRI) that relates to each ucode. That is, it has the function like DNS.

3.2. Lower Case Ubiquitous Web Implementation

The configuration of Ubiquitous WEB analogized from XML and Web Services might be shown in figure 3.

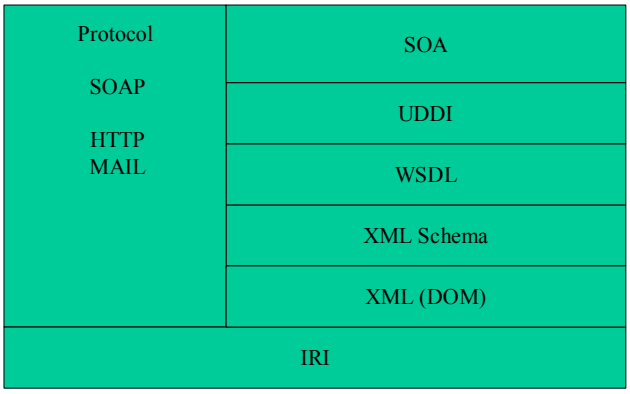

Figure 3: Configuration analogized from WS

However, because these specifications are too complicated, abstract and huge, a general implementation will be large-scale and very difficult. Therefore, in an actual application, a proprietary and special implementation tends to be performed. It might produce the vender lock-in situation in the sleight of hand, though it should be a social infrastructure.

The ubiquitous computing demands further flexibility and implementability for more various and smaller computer environments. It is also necessary to build up not only such heavy platforms, but also light platforms. Moreover, it is necessary to perform concrete implementation. We think that lightweight semantic web is promising on the lightweight platform. It has the following characteristics.

1. Embeddability for general web presentation data
2. Possibility of rudimentary light implementations
3. Possibility of sloppy applications
4. Scalability toward more advanced, stricter systems

The configuration of lightweight semantic web is shown in figure 4.

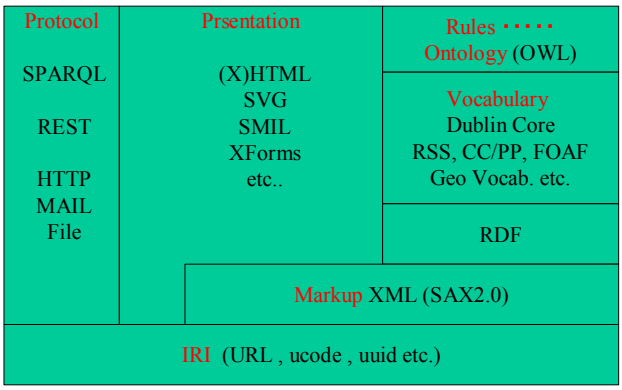

Figure 4: Lower Case Ubiquitous Web Configuration

Therefore, ucode relation management server handles the data that adjusts to RDF. When the data is related to ucode, we call that UCR (UCode Relation).

It might be called Lower Case Ubiquitous Web, likening it to microformats.

3.2.1. Implementation

We are achieving basic implementations now. Implementation on the server side is a resolver called ucode relation management server.

Implementations on the client side by small computers are as follows.

1. XML SAX2.0 parser: 30KB load module. "C"(not C++)
2. RDF/XML parser + Basic RDF query interface: 28KB load module. "C"

This enables the circulation of the RDF/XML data and the processing of the RDF data on both server side and client side, and also enables distributed information system transparently.

3.3. Outdoor Ubiquitous WEB

Features of outdoor computing might be as follows.

1. Existence of various events for real worlds
2. Many physical limitations have been imposed on the information system. (Energy, weight, temperature, vibration, communication etc.)

Thus, the outdoor application is a very good domain to train the ubiquitous WEB, and we applied the ubiquitous computing to GIS

(Geographic Information Systems). At that time, we also introduced the semantic WEB architecture to GIS. We have been developing like the following vocabularies.

1. UCR – Spatial Metadata: Vocabulary for basic spatial metadata based on W3C basic geo vocabulary.
2. UCR – Spatial Network: Vocabulary for the spatial network. It enhances the above-mentioned vocabulary. And it suits with the logical network structure of RDF.
3. UCR – Spatial Accessibility: Vocabulary to express spatial accessibility for mover such as pedestrian, handicapped person, etc.

In addition, SVG is widely regarded as a very important markup language for basic presentation for maps used especially for the outdoor applications rather than text documents, and of course above-mentioned vocabularies can be embedded into SVG.