

EPC vs. IPv6 mapping mechanism

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Abstract- *This paper related to a method and apparatus for producing the IPv6 Mapped EPC code. The electronic product code is used in the RFID (Radio Frequency Identification) system to identify products. But the code is not accessible using Internet Address because EPC Code is just object identifier such as bar code. This paper suggests that the mechanism producing IPv6 Mapped EPC address to communicate with between objects. This paper is comprised of the step to ready the EPC code from the electronic tag and to assemble the network prefix address with EPC code.*

I. INTRODUCTION

RFID is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennas. Passive tags require no internal power source, whereas active tags require a power source.

Radio frequency identification (RFID) technology is growing rapidly as an alternative to barcode equipment. It uses non-contact readers to activate small radio transponders that emit a unique ID code or other information in its memory. Ubiquitous computing environment consists of various computing devices, e.g. mobile and embedded tiny devices. One of the goals of ubiquitous computing is to enable devices to sense changes in their environment and to automatically adapt and act based on these changes based on user needs and preferences.

In the u-sensor network environment, the RFID is the core technology for automatically recognizing a location and information content of all sorts of things by using the wireless identification technique. To identify objects, Electronic Product Code (EPC) was made by the MIT Auto-ID Center, a consortium of over 120 global corporations and university labs. At this time, the code specification published version 1.1 [1]. For example, RFID tags store a unique EPC on a chip and transmit this code via an antenna to RFID readers.

In an EPC global network environment, a reader reads the EPC code in the objects and it transmits to the object naming system (Object Name System: ONS) server. By querying in the EPC-information service (EPC Information Service) server using the EPC code, the ONS server can obtain the detailed information (for example, the production day, the distribution route, the state information) about a thing.

The EPC-IS server has the problem that the location of a thing can be indirectly chased by recording the information of a reader in a server from a reader whenever it has the request about a thing. However, it is difficult that the real-time information with a thing is obtained.

Therefore, the communications through an object and internet need to be performed in order to obtain the real-time information of the object.

Whereas the EPC code puts a foundation in 64 bit, and the product numbering system of 96 bit or 256 bit to the manufacturer center, the IPv6 of internet address standard service provider (ISP) center is the IPv6 address system of 128 bit-based. Of the system about the use about each and use are different. Therefore, it is necessary to have the mapping mechanism between IPv6 [2], [3] and the EPC code.

In RFID Systems, EPC code that has been developed by MIT autoID Center instead of bar code embedded with products to identify their information. At this time, the code's current version is specification 1.1.

The EPC Network consists of three major components, which are the Savant, the EPC Information Server (EPCIS) and the Object Name Service (ONS).

The Savant is a middleware system located between a reader and the applications in RFID systems. That Savant passes requests from the applications to the reader and receives unique tag identifiers and passes that information to the applications.[4] The code information that was read on the reader is transmitted with the ONS (Object Name System) server to get products information. For example, the production day of a product, the distribution route, and the state information. EPC Information Server database that stored the data between the EPC code and products detailed information.

EPC Information Server can trace objects location because it records the reader's information such as IP address whenever it was requested. But, there are many difficult to get real-time information the objects embedded with EPC code.

Therefore, we have been required that mapping method between EPC code and network address to get real-time information

EPC code created by Manufacture Company based on products number scheme such as 64 bit, 96 bit and 256 bits. Whereas the IPv6 network address consists of 128 bits. To mapping between the codes, we suggest that mapped EPC-IPv6 mechanism.

II. RELATED WORKS

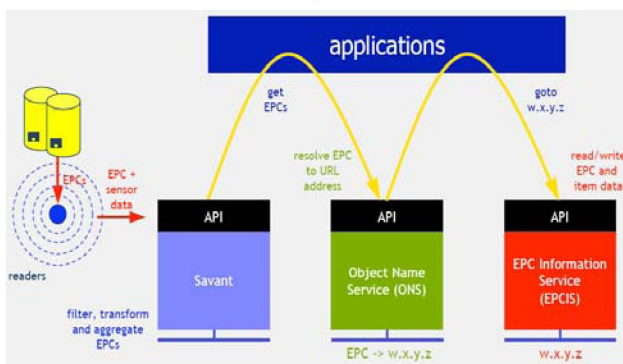
IPv6, a next generation network address protocol, provides a set of auto configuration mechanisms for routers and hosts, so that even today it is possible to simply "plug and play" on a home network.

Based on IPv6 advantages, we propose that the technology which produce Object's IPv6 internet address using its embedded EPC code. Therefore, we can get real-time information for an object's status through communicate using generated IPv6 addressing in the RFID system.

III. EPC-IPv6 MAPPED MECHANISM.

1. EPC elementary operation process.

Figure 1 is showing that general operation process of the EPC network proposed by MIT AutoID center.



<Figure 1> EPC basic operation

(1) The object has an EPC identifier value to express its contents in a RFID system. The EPC code system is similar to bar code. Though bar code value is identical same kinds of products, all kinds of objects with EPC code have different code values.

(2) The reader that can be read the object's EPC code using Radio Frequency collecting EPC code information

and sending that codes to the Savant. The savant which connected to Internet is middleware system located between a reader and the application in RFID system.

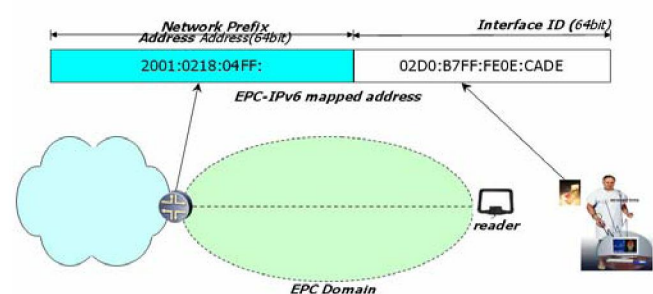
(3)The Savant transmits a query to the ONS (for example, the DNS system similar to on Internet) in order to find the location having the EPC code value and then returned the EPC-IS server address (w.x.y.z) to Savant.

The EPC Information Server has some data such as EPC code with the products name, the term of validity, the product date. Also it records the location where the reader read the products during delivery. Therefore, we can retrieve the distribution route of the products based on the EPC-IS server information.

2. The mechanism to be proposed.

It is comprised of the tag in which embedded EPC code and the reader with TCP/IP stack. By using radio frequency communications the object in which the tag including the EPC code is adhered, a reader can bring about the EPC code information of the object. Also, the reader has the function of transmitting the EPC code. Because it was connected via Internet, the EPC code can be accessible using its code trough the reader. Therefore between object and Internet can be possible for bidirectional communication using proposed EPC-IPv6 mapping mechanism. We can trace the object status in real-time. It could be very helpful online diagnosis a patient such as has a heart disease patient to mange.

(1) Mapped EPC-IPv6 address generation method.



<Figure 2> Process of EPC vs. IPv6 code mapping

IPv6 address is comprised of the network prefix (64bits) and EUI-64 part which is designed to be unique to make 128 bit address space. EUI-64 was made by expanding network MAC (48bits) address. (i.e., EUI stands for Extended Unique Identifier).

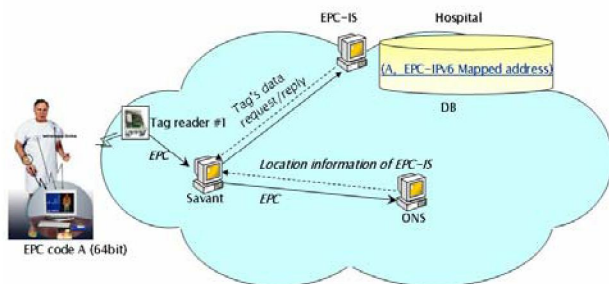
Generally, the node at the IPv6 network environment receives the RA (Router Advertisement) message from a router and produces its own address. But in a mapped

EPC-IPv6 code mapping mechanism, the EUI-64 portion of the network prefix will be replaced by the EPC (64 bit) code value to make mapped EPC-IPv6 address.

(2) Process for record mapped EPC-IPv6 address

In a reader, the process for making the IPv6 internet address from the RFID tag 1) generate its mapped EPC-IPv6 address using IPv6 Prefix address and EPC code. Figure 2 shows the process of making mapped EPC-IPv6 address 2) the reader keeping the record mapped EPC-IPv6 addresses which are produced by using EPC code of the tag and EPC code value. If the reader receives request messages whose destination address is equal to the EPC-IPv6 address pools, the reader read from the tag using mapping table on prefix pool and produces the message fitting for the request of an opponent and transmits.

Figure 3 showing that for example using the EPC-IPv6 code mapping mechanism 3) these kinds of mechanism can be applied to a tiny node and if necessary the sensor node without TCP/IP stack node.



<Figure 3> A patient with a heart disease in RFID networks.

Figure 3 showing the mapped EPC-IPv6 usage, a doctor attached the tag embedded EPC code to the patient having the cardiac disease in the hospital called "A". The tag has a sensor to record the heartbeat number. In the hospital, the heart rate can be measured as follows method.

(1) Through a reader in a home network make its mapped EPC-IPv6 address using tag's EPC code of the patient.

(2) A reader transmits a query to the ONS server in order to know where this EPC code information stored. And then the ONS server will return its EPC-IS server address. i.e, EPC-IS server address at hospital of "A".

(3) The reader will register the mapped EPC-IPv6 address to the EPC-IS database using matched EPC code record. Therefore we can communicate with the patient via the registered mapped EPC-IPv6 address.

(4) By using the IPv6 address recorded in the EPC-IS server in order to know the heart rate of a patient, the

hospital requests to get the information for the patient's heart rate.

(5) Since a reader has the IPv6 address mapped in its own address pool of a form about the heart rate request, it finds the sensor having from its own local with EPC with the address recorded in EPC-IS and records the heart rate information corresponding to that and replies to the hospital.

(6) Through above the process, we can interactively communicate with the tag having the EPC code.

IV. CONCLUSION.

RFID is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. Presently, it has the structure of 64 / 96 bit type. As to the EPC spec 1.0, it is comprised of header, the EPC Manager, the Object Class, the Serial Number, and etc. There are the IPv6 address structure and the limit that the EPC (Electronic Product Code) structure can use in the side called a structure since the area which it uses which having with the analogical deep fade but having this definitely is different at all. Therefore, in this paper, we propose the mapping mechanism for converting into the IPv6 address form for connecting the EPC code on the tag of a object to an internet. That is, the code of the EPC-64 bit type and IPv6 prefix information the mapping method was used and the connectivity through an internet could be received in ubiquitous sensors with support. This mechanism will be applied t that communications between the light sensor nodes which does not support the TCP / IP network stack.

[References]

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