Standardization Efforts - EPCglobal

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Abstract

At EPCglobal, end user enterprises and IT enterprises are cooperating to develop technical standards on RFID technologies. The aim is to optimize an entire supply chain using the EPCglobal network, which enables enterprises to share RFID data and provides them with shared view of whereabouts and status of their merchandise flowing through the supply chain.

Since its participation in EPCglobal as the first Japanese IT vendor to take part, NEC has been developing products while contributing to developments of specifications, and has released the RFID platform middleware "RFID Manager" as a product complying with the EPCglobal standards. NEC continues to participate in technical studies and develop products that serve the construction of EPCglobal network systems.

1. Introduction

RFID (Radio Frequency Identification) is a technology for uniquely identifying individual articles by attaching an RFID tag (hereinafter referred to as "the tag") to each article and reading the ID information in the tag by means of wireless communication. The features of RFID make it applicable for example to ski lift tickets, railroad tickets (JR's Suica, etc.), library collection/rental management and cargo sorting at parcel delivery centers.

When the tags were relatively expensive in the past, RFID was mainly used in closed environments such as corporate in-house ones by reusing the tags. However, a recent fall in the tag price has resulted in a significant increase in the scope of application.

Particularly, the distribution industry is advancing attempts at data sharing between partner enterprises in the supply chain by attaching tags to articles and reading the tag data at various points in the process of distribution. This data sharing is expected to bring about various effects including optimization of the inventory level of the whole supply chain, reduction of lead time before delivery, elimination of counterfeit articles and improvements in customer services.

To use RFID in open environments beyond enterprise boundaries, standardization of technologies is required. The scope of standardization includes, for example, methods of wireless communications with tags and interfaces for sharing data between enterprises.

The international standardization organization for RFID, EPCglobal[1] is promoting standardization by proposing the EPCglobal network[2] as a suitable framework for the utilization of RFID. NEC joined EPCglobal as the first Japanese IT vendor in May 2004 and have since been developing compliant products as well as contributing to the creation of standard specifications.

This paper describes the outline of EPCglobal, the mechanism of the EPCglobal network, and the details of NEC's efforts made in support of standardization activities.

2. EPCglobal

2.1 Circumstances of Establishment

The Auto-ID Center, which is centered on MIT, USA, has been conducting R&D into RFID, especially the "networked" RFID systems since about 1999. The networked RFID system is characterized by the arrangement that only the ID numbers are recorded in the tags and the detailed data on the articles carrying the tags are stored in the server that is accessible via the network.

The advantages of the networked RFID system include;
1) The simplification and cost reduction of tags, because these record only the ID numbers;
2) The possibility of data sharing across enterprise boundaries by using the ID numbers as the keys, as data other than

the ID numbers are stored in the server.

The first businesses to notice the advantages of the networked RFID system were the major retailers and consumer goods manufacturers in the USA such as Wal-Mart and P&G. They thought it would be possible to read the data on the tags attached to articles at major points including warehousing and warehouse output locations and let the read data be shared via the network among the partner enterprises in the supply chain.

Data sharing allows enterprises to "view" the flow of articles over a wider area. In other words, the flow of articles, after shipment from the viewpoint of manufacturers or before receiving from the viewpoint of retailers, can be identified as well as articles in house distribution.

Once it is possible to identify the flow of articles over a wider area, enterprises can try to improve efficiency of the entire supply chain as well as of individual in-house tasks. This facility may for example include the optimization of the inventory levels throughout the supply chain.

As a result of a rise in the expectations for the actual use of RFID in the business field, international distribution code standardization organizations including the EAN International (now renamed Global Standards One (GS1)) and the Uniform Code Council (now renamed GS1 US) established EPCglobal by joint investment in November 2003. The purpose of this was to put the results of research at the Auto-ID Center into practical use and promote their international standardizations.

2.2 Organization of EPCglobal, the Process of Standardization

EPCglobal has a Board of Governors as its decision-making body, which appoints the President and other staff for administration purposes (**Fig. 1**). Under the President, there are three steering committees (Business, Technology and Public Policy) with the roles assigned as follows.

(1) Business Steering Committee
End user enterprises that want to use RFID in their businesses usually have various issues and they want to solve them by adopting the EPCglobal standards.

The Business Steering Committee collects the requirements for technical study from the end users and inputs them to the Technology Steering Committee so that the issues of the end users are solved optimally. In addition, it also conducts activities for publicizing the issues encountered in the introduction of RFID systems with actual examples.

EPCglobal aims at establishing technical standards that can meet the needs of various industries in addition to the con-
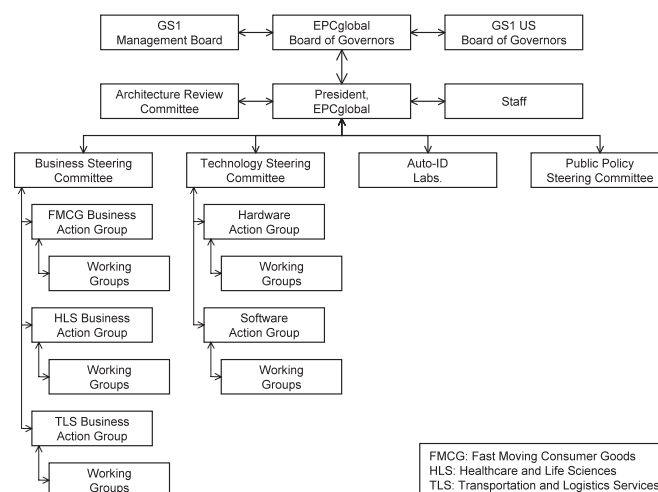

Fig. 1   Organization of EPCglobal.

sumer goods distribution industry. However, these needs vary greatly depending on specific industries. Therefore, actual work is assigned to the Business Action Groups (BAGs) that are established as per industry.

The BAGs currently developing activities include the FMCG (Fast Moving Consumer Goods) BAG handling issues in the commodities distribution industry, the HLS (Healthcare and Life Science) BAG handling those in the pharmaceutical distribution industry, and the TLS (Transportation and Logistics Services) BAG handling those in the distribution industry.

(2) Technology Steering Committee
The main missions of this committee are to input the proposals of problems and needs from the end user enterprises, conduct technical studies for solving problems and meeting their needs, and to compile the study results in the form of standards and specifications.

The action groups include the Hardware Action Group (HAG) handling hardware-related issues and the Software Action Group (SAG) handling software-related issues.

(3) Public Policy Steering Committee
The main missions of this committee are to study the public policy-related issues such as the privacy and environmental loads and publicize them to the governments of various countries as required.

One of the most significant features of the standardization process of EPCglobal is that it is "end user-driven." In other words, it always collects end user needs prior to any standardization work and inputs them as requirements to be considered for standardization.

This flow is not unidirectional, but the details of the technical

study are fed back to the end user enterprises as required. This close linkage between the end user enterprises using the standards and the technology enterprises that are developing them is expected to render standardization more effective and assure orientation toward user needs.

3. EPCglobal Network

In Section 2.1, above, we mentioned that, "enterprises are trying to improve the efficiency of the entire supply chain as well as individual in-house tasks." Now let us see what kind of data is shared in what kind of mechanisms.

An enterprise using RFID can capture the flow of articles in the supply chain by reading the tag every time an operation (attaching of the tag, storage in warehouse, output from warehouse, loading on a palette, loading in a truck, etc.) is executed on articles and record the results as "events." Every event contains four elements of tag ID, time, place and operation executed, representing, when, where and how a merchandise was processed.

For example, when a manufacturer attaches tags to the articles it ships, the manufacturer can identify the situations of the shipped articles (in warehouse, on a shop counter, already sold, etc.) by consulting the event data kept by retailers via the network.

EPCglobal arranged the major functions required for building a system with an inter-enterprise data sharing capability as described above and proposed a framework called the EPCglobal network incorporating them.

Fig. 2 shows an example of configuration of the EPCglobal network. As shown here, the EPCglobal network is composed of "roles" including EPC tags, EPC readers and EPC middleware and the interfaces interconnecting the roles. EPCglobal does not specify the implementation of the roles but simply standardizes the interfaces.

The outlines of the standardized interfaces are as described in the following.

(1) Tag Data Standards
These define the formats for the unique ID numbers (Electronic Product Codes, or EPC) recorded in the tags. These codes currently include the SGTIN (Serialized Global Trade Item Number) based on the numbering system of bar codes and the GID (General Identifier) based on a proposal by the Auto-ID Center.

(2) Air Interface Protocol
This defines a series of interface standards related to wireless communications between the tags and readers, such as the frequencies, modulation systems and communication protocols. UHF Class 0 and Class 1 are mainly used at present, but
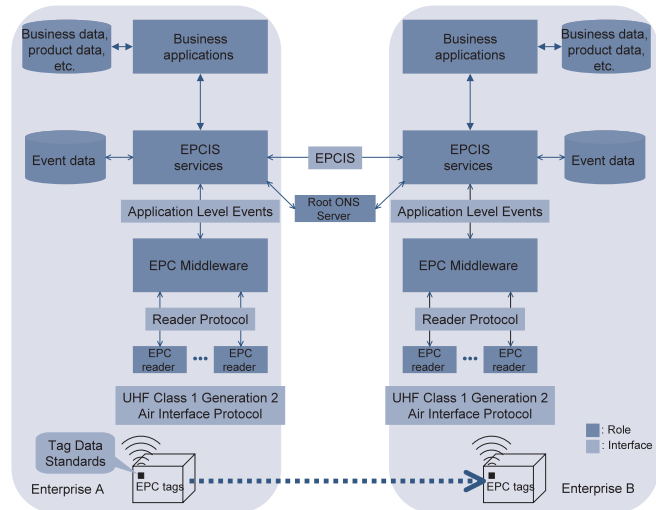

Fig. 2 Configuration example of EPCglobal network.

it is expected that the future mainstream will be UHF Class 1 Generation 2 that can meet the latest end user needs (high-speed tag-reader communication, improved simultaneous read performance, etc.)

(3) Reader Protocol
This defines the command system and data format used in communications between the reader and the higher-level software controlling it. The supported functions are tag data read, tag data write and tag kill (disabling).

(4) Application Level Events (ALE)
In general, data transferred from the reader is sometimes overlapped due to multiple readouts of the same tag or sometimes useless for the higher-level software. ALE defines the interface, which implements the function for filtering and grouping the tag data from multiple readers and notifies the higher-level software only of the necessary data.

(5) EPC Information Services (EPCIS)
These define the interfaces for generating events based on the notified tag data and for allowing inquiry and sharing of recorded events among corporate in-house applications or across enterprise boundaries.

4. NEC's Activities toward EPCglobal

After joining EPCglobal as the first Japanese IT vendor in May 2004, NEC rejoined as an end user member permitted to utilize the EPC technology in its own business operations, in October 2005. We are now not only developing products in

compliance with EPCglobal specifications but are also confidently promoting the introduction of EPC technologies in-house from the standpoint of an end user.

From the standpoint of an IT vendor, we are mainly participating in technical studies in the Software Action Group and have already commercialized EPCglobal-compliant RFID middleware "RFID Manager" (refer to page 97 regarding this issue[3]). The RFID Manager is a software product that offers functions equivalent to EPC middleware in the EPCglobal network, and is compliant with the Tag Data Standards[4] and ALE[5].

The RFID Manager also offers an original interface that can be used together with ALE. The current ALE version does not define the function for writing data in the tags, for example, the original interfaces offer the data write function so that the applications do not have to directly control the read function.

We are also advancing work for achieving compliance with the Reader Protocol that is the interface between the EPC middleware and the EPC reader. When the Reader Protocol-compliant reader is released, it will be usable with the RFID Manager.

For the present, RFID is used mainly in closed environments such as those inside single enterprises. But the true value of the EPCglobal standards lies in the fact that they enable data utilization across multiple enterprises and provide a common view of the articles in a supply chain.

We have previously been focusing efforts on the development of EPC globally compliant RFID middleware, but our activities will not remain exclusively in the field of middleware but will cover the total EPCglobal network system from the above described perspectives.

5. Conclusion

This paper has described the outline of EPCglobal and the EPCglobal network that is an infrastructure for data sharing across enterprise boundaries and introduced the activities directed by NEC toward EPCglobal.

In the future, it is expected that there will be an expansion of the scope of applications of RFID from closed environments to open environments crossing the barriers between enterprises. And the key for realizing this is the implementation of a timely, secure data sharing mechanism. The EPCglobal network offers a strong foundation to support these aims. At NEC, we will continue positive participation in the activities of EPCglobal, while also developing compliant products including products and solutions that can implement inter-enterprise data sharing based on the EPCglobal network.

References

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