第 XXV 部

Auto-ID とインターネット

第 25 部
Auto-ID とインターネット

第 1 章　はじめに

Auto-ID WG は、2002 年 12 月に WG として承認されたが、具体的に WG として活動を開始したのは、2003 年 3 月の合宿からである。

WIDE では、SPEARS WG が RFID タグを扱ってきており、ある程度の研究による蓄積があるものの、Auto-ID が対象としている物流管理（Supply Chain Management）を代表とした応用例については、経験がない。

また、Auto-ID Center での研究に実際に携わっている者もいるものの、成果についての共有が不足しているなど、具体的なディスカッションをするためには、前提となる知識の共有ができていなかった。

このため Auto-ID WG は、当初 BoF 形式での勉強会という形で、2003 年 11 月ごろまで活動を行い、続いて、よりシステムについての検討を進めるため、実験システムを立ち上げようとしている（2004 年 1 月現在）。つまり、本年度のアクティビティは、主には情報の共有とディスカッション、およびホワイトペーパー 2 本という形にとどまっている。

本報告では、第 2 章でこれまでの Auto-ID WG の活動履歴をまとめ、第 3 章と第 4 章に、Auto-ID Center Japan（現 Auto-ID Labs Japan）Lab 発行のホワイトペーパーを収録する。

2 本のホワイトペーパーは、“A Field Experiment Report: Publishing of an Auto-ID Enabled Book”、“Internet and Auto-ID Architecture” と題され、「出版物の実証実験報告」および「Auto-ID をインターネット的視点で考察した提案」について述べている。

“A Field Experiment Report: Publishing of an Auto-ID Enabled Book” では、3.1 で既存の実証実験ついての紹介、3.2 で日本の出版業界の紹介、3.3 で実証実験の概要、3.4 で書籍へのタグの取り付け方法、3.5 で日本の商習慣下で懸念される問題、3.6 で実験で行ったインフォームドコンセントについて述べ、3.7 でまとめを述べている。

“Internet and Auto-ID Architecture” では、4.1 でネットワーク的視点、ユビキタスコンピューティング的視点から見た実空間での情報について考察し、4.2 で Auto-ID をインターネット上で扱うときに必要となる新しいアーキテクチャについて述べ、4.3 でその際に必要となる ID 空間管理について議論し、4.4 で未解決の問題点について議論し、4.5 でまとめを述べている。

さらに、Auto-ID は、非常に動きの激しいエリアだが、その情報共有の過程でまとめられた資料を、Auto-ID 周辺技術（スライド）と、用語集という形で付録に収録している。用語集については、今後順次拡充してゆく予定である。

第 2 章　Auto-ID WG 活動履歴

この章では、半年間のミーティングで共有された情報の整理と、現在準備中の実験システムについてのディスカッションについてまとめる。

また、研究を進める上での情報を用語集としてまとめていこうとしている。現時点での版は付録として収録した。

- 2003/3
  3/4: WIDE 春合宿にてミーティング
  - Auto-ID Center と国内関連動向について、情報共有
  - Auto-ID Center の提案するアーキテクチャについての情報共有
  - ブレインストーミング
  - WG の今後について、ディスカッション
- 2003/4
  4/8: 本格的なミーティングを開催開始
  - Auto-ID Center の提案するアーキテクチャについての情報共有
  - タグベンダによるプレゼンテーションとデモ等

－RFID の問題点などについての情報共有

- 2003/5

 5/30: 5 月研究会にてミーティング開催

 －Rivest の blocker tag について

 －RFID の問題点などについての情報共有

- 2003/6

 6/9: ミーティング

 －Auto-ID システムを用いたアプリケーションと、それを支えるシステム像についてディスカッション

- 2003/7

 7/2 E-JapanII 発表

 －2005 年までに、国産牛は 100%消費者がインターネットで情報を取得できるようにとの目標が示された

 7/15 Meeting

 －ONS に議論の焦点が徐々に移り始めた

 －各種 ONS 実装モデルの検討

- 2003/8

 8/7 Meeting

 －ONS における問題点を共有

 －ネットワーク的な攻撃に関する話をまとめる。DNS に対するアタックはだいたい ONS に当てはまる

 －ネットワーク運用に関するホワイトペーパー化に関する議論。アタックも含めて、WIDE 合宿 BoF 等での議論の必要性を確認

- 2003/9

 WIDE 合宿

 －SPEARS WG との関係に関する議論がなされた

 －Recharter

 －EPC 付き書籍の実物が示された

 9/15

 －MIT で EPC シンポジウムが開催された

 －その中で、ISO 18006 850–950 MHz を承認していくという合意が取れた

 9/29

 －六本木ヒルズで RFID と携帯を使った R-クリックサービス開始

- 2003/10

 10/7 Meeting

 －SPEARS との関係の確認

 SPEARS は目的指向であり、インフラに依存せず、Auto-ID 技術にはこだわらない。一方、Auto-ID WG は、Auto-ID に comment をするのが目的である。SPEARS とはスタンスが違うことが確認できた。

 10/21 Meeting

 －EPC の割り当てについて

 EPC の番号割り振りは、EAN/UCC の流儀について検討

 －Auto-ID Center の新体制についての報告

 －ONS 1.0 についての検討

- 2003/11

 11/01

 －EPC Global 発足

 11/04 Meeting

 －Auto-ID WG の Recharter に関する議論がなされた

 －用語集編纂開始

- 2003/12

 12 月 WIDE 研究会

 －Recharter についてのディスカッション

 －用語編纂についての調整

 －実装グループについての相談

 12/26 Meeting（実装）

 －実装に興味あるものでミーティングを行い、1 月以降の活動について相談

第 3 章　A Field Experiment Report: Publishing of an Auto-ID Enabled Book

3.1 Introduction

On the 49th story of the Roppongi Hills building, there is a brand new library for scholars in this central part of the big city. Among the attracting unique features and systems of the library including its location, sparsely spaced layout of the bookshelf, and its 24 hrs of operation, the fact that the books are maintained by the attached 13.56 MHz RFID tags is one of the hidden unique features.

A very strong experiment of RFID on the retail shop model of a book store has been a strong demand from the industries. This is because very advanced marketing system is being employed in Japan as well as the negative fact that book stores are special retail shops where the number of shoplifting is relatively high. The experimental activities reported by Ishikawa et al.[138] is one of the leading examples for such a demand.

There are a lot of important areas for the publishing experiments and a lot more process and function/industries should be involved on the actual publishing business. In order to increase the chances to learn from the experiences for the future Auto-ID deployment, this experiments reported in this paper, gathers experiences through publishing of an book with a certain scale, and being involved with the actual players of this kind of book.

Auto ID center Japan therefore decided to be involved on the project to attach an EPC tags to a book delivered in the real market, and tried to examine various problems on the process.

3.2 RFID and the Publication Industry

The publication industry in Japan has shown strong interests in attaching RFID to a book. In the publication industry, item-level management by RFID is proposed in order to reduce stockpile, prevent theft, and control rental goods.

Since the damage caused by theft at bookstore is on the rise, the introduction of a RFID system to prevent theft is a pressing issue for the Publication Industry Organization.

In the past few years, several field trials were carried out, but their objective is merely to measure the reading rate of tagged books, and the anti-collision performance of simultaneous reading.

"Resale Price Maintenance System" is in the system of distribution, which is employed in few industries in Japan such as books and cosmetics. In this system, retailers are not allowed to discount products. In return for such restriction, retailers can return products to producers. In the case of the publishing industry, returned books are re-distributed as if it were "new books". This re-production is a responsibility of the publisher. Therefore it is publishing companies responsibility to fix and refurbish various parts of returned books. Now, the examination of the attached

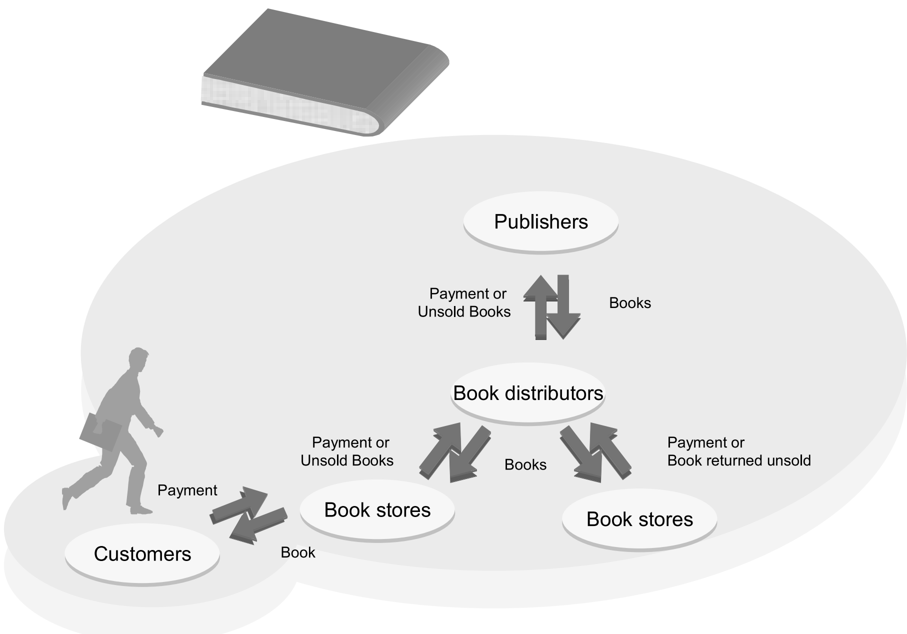

Fig. 3.1. System flow of book supply chain. In Japan, book keeps its price by "re-sell price management system".

RFID, regeneration of the same ID, and refurnish of the new ID are all the publisher ' s new role. This delay the entire process of resale price control system and therefore carefully has to be examined.

3.3 Field Trial Overview

The purpose of our field trial is to explore the technical and social problems when attaching RFID tags to books in the real world.

6000 RFID tags (2.45 GHz band Auto-ID EPC. compliant tag produced by Alien Technology) were attached to all the book published so far.

These books are produced, distributed, and sold in exactly the same manner as normal books in the real market. Thus, it is to clarify various problems of books with RFID.

End-users are able to participate in events in the website, using EPC. The events will be held to enable end-users to meet, cooperate and achieve a goal in the real world.

Our field test also focuses on examining the effect of products with RFID in a distribution process.

The following section discusses the several problems when RFID is attached to products in the real world, and also examines how to solve these problems.

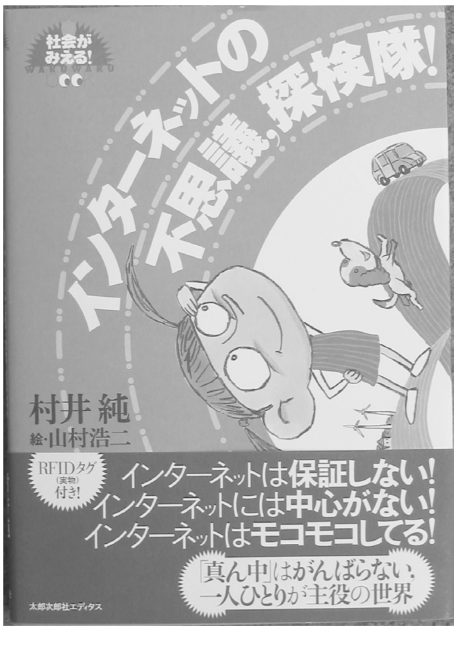

Fig. 3.2. "Internet no Fushigi Hakken-tai" book written by Jun Murai on our trial material.

3.4 Tag Installation on a Book

There are a lot of alternative ways to process the actual implementation of a book with a RFID tag. The robustness of a tag is one of the big issues since the weight of piled books can be extremely heavy. The redistribution processes caused from the resale price control system is another big issue. The work described here on the 7000 book production was a very good lesson for the scalability of the production process in many senses.

3.4.1 Locating a Tag in a Book

Publishing industry is one of the industries who shows the strongest interests on the RFID technologies. The requirement always starts from embedding a tag into a book. Tag location issue is very important and most people seem to locate a tag at spine of the book. But the process of making books, spine of the book is easy to be damaged when packing, sorting, and other operation even though a spine is known as the most durable place of a book.

Also, a cover or a back cover can be considered as a place to attach a tag. In this case, it is necessary to have the structure which releases a pressure from other books. In the preliminary experiment, when a tag was attached inside of the cover, all tags were damaged with pressure when books are piled up. The advantage of locating a tag in a cover is a big room. Any tags with larger antenna part can be accommodated in a cover. Multiple or alternative tags installation also is possible.

Therefore, in order to protect a tag from the piled pressure, we have decided to add a protector on a back cover to install a tag. This also benefit replacing role at the publisher when a book is returned by the resale price control system.

Fig. 3.3. Tag is implemented at inside of back cover.

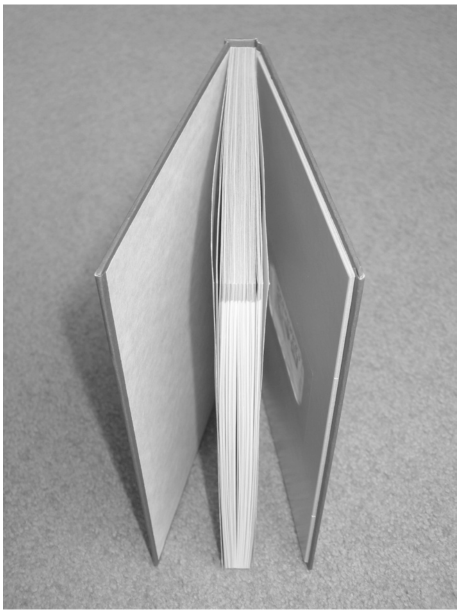

Fig. 3.4. Back cover is twice as thick as front cover to protect a tag.

3.4.2 Tag Implementation and its Procedure

The book used for this experiment is a book for children, and the one objective of attaching a tag is to educate the RFID technology with real material (tag). Therefore, the EPC tag should be viewed even it is installed inside the cover with the use of a transparent film.

At this experiment, most of all operations are done by manual labor. Procedure of implementation is described as below.

Stick a RFID tag on a transparent seal and make it label form. The EPC number and its check-sum are printed with digits on the seal at this time. This is a way for a user who does not have RFID-reader but who want to entry the code manually for the various testing event. These written numbers also are used for proof of the data when EPC tag is broken.

EPC number is burned to the EPC tag using the interrogator.

A pair of cardboards is used to protect a tag. One cardboard has a hole to insert a tag and protect it. Another cardboard is worked as a base. A tag is located at the center of hole and pasted up to the base. The tag is sealed over a transparent film to protect from touching.

The cardboard with EPC tag is binding at back cover of the book.

After bookbinding, every book is checked again.

3.5 After Bookbinding, Every Book is Checked Again and practices

Under the Resale Price Maintenance System, books are sold at fixed price, which benefits publishing companies. In return, publishing companies need to accept the returning of books which are not sold at book stores without any penalty on bookstores.

Returned books are re-distributed as if it were "new books". For instance, publishing companies often refurbish various parts of books.

Under the system, once an RFID is attached to a book, that RFID should be examined whether it works or not when returned to publishing companies. If RFID does not work, the company should be responsible for attaching new RFID. Thus, RFID on books must be easily removed once needed.

3.6 Messages to try to build an "Informed Consent" of the Experiment

Even when RFID tags are embedded in products, there is no visible response expected. Without proper messages explicitly state the fact that a product is with RFID, it is difficult for end-users to use or disable the embedded RFID tag in the product.

Therefore, we tried our best to provide the consumers about the information that the product is with an RFID tag, explanation of it with the reasons, and instructions how to disable it.

Also, the end-users have the right to know whether the product they purchase is with or without tags, and also the right to know what information is stored on the tag. End-users can judge if they should use RFID tags attached to products or not, after comparing the merit and the demerit of RFID tags.

In our field trial, we provide end-users with the information about RFID in the following ways.

- Messages of explanations in front and back side of sleeve
- Inserted paper of instruction how to disable the tag and its information
- Interactive questions and answers on the web site of the publisher
- Since the book is about technology, one of the column inside of the story.

Also, the tag is installed in a visible way: the reader can transparently see the existence of the tag and its contents.

In the future, it is necessary to provide end-users with the information about what kind of RFID is attached to products, and what information is exchanged between RFID and reader. We should continue to examine further as to what information should be informed.

In the case of portable goods like books, there is a possibility that the data on RFID tags is destroyed by a reader. Since the reader does not exist very much on the time of the field test, it was impossible to kill tags in future expected places like bookstores.

Consequently, we inform end-users of the three ways to kill tags.

- Wrap tags with aluminum foil

  This method is aims to avoid the radio-wave from the interrogator. It is easy to make a foil to jacketstyle. Therefore this method is most suggested way to protect the tag from anonymous interrogators.
- Send a book to the publishing company and ask them to kill tag

  The EPC tags could be killed by an interrogator. If the user wants to kill the tag as functionally, this method is applied but it has much time to wait. Because, interrogator is not prepared at the bookstore but at the publish company. Therefore, this method is not suggested to all people.
- Remove the tag.

  This is most easy way to disable the tag, but it is not recoverable way and the shape of the book is destructed. This method is written, but it is not suggested way to all people.

3.7 Conclusion

In our field trial, EPC tags were attached to books exactly when they were produced on the ‘source tagging’ model. It was proved that it is necessary to protect RFID tags when attached to books. In addition, it was made clear that RFID tags on the scroop of books are quite possible. Various ways to disclose the fact of the existence of the RFID on the book and various educational procedures have been proposed.

The experiment achieves:

- Scale of 7000 copies of books,
- Involvement of the real players; publishers, commissioners, distributors, retailers and customers,
- The resale price control system consistency, and 4) education to control the tags by the consumers.

Acknowledgment

We thank Toppan Printing and Toppan forms for their brave challenges on their process of a book. We also thank Toray International and Alien technology offering tags expertise and their products. And the most of all, the publisher Taro-Jiro publishing company who worked with a lot of extra processes for challenging for the future role on the publishing company is very much appreciated.

第 4 章　Internet and Auto-ID Architecture

4.1 Introduction ID management on the Internet and real world

From the networking and ubiquitous computing point of view, every single information object can be properly accessed and shared in the future information space. Here the information object can be either a logical object which is a collection of digital information (such as two digits, '12'), the logical object with a name attached to it (such as 'temp=' and '12'), or even a physical object with a lot of attributes attached to the logical object (such as a thermometer in a particular location has a value of 'temp=' and '12'). This new information space is achieved by the consequence of carefully merged result of logical information technology and physical object.

The Internet has been constructing a logical space where digitized information can freely be exchanged and shared; sometimes called 'cyber space'. The production of this space is achieved by computer elements and networks connecting them. The protocols and their software handle the data recognized by the computers.

This Internet space has been evolving very rapidly, especially because of the evolution of its elements. A computer has been built-in to a non-computer looking object and has started to behave as an element object of the Internet. A camera, for example, consists of CCD and protocol software so that it is behaving as an autonomous object on the Internet now. A digital appliance without such a sophisticated protocol software even behaves as an autonomous object with the help of a near-by computer's software which behaves as a proxy of the original object. A (dumb) printer connected to a computer has been living such a life on the network for a long time already; a software on the computer creates an illusion that the printer is an autonomous Internet object with proper identifier and protocol software to the Internet space (but actually it does not have such a function on its own system).

These examples of a camera, being an input device to a computer, and a printer, which of course is an output device from a computer, both are bridges from the Internet space to the real space. As the value of information handled with such devices, we care very much about their attributes on the real world. Location is one of the primary real attribute to be attached to such an object. We do care about the location where a picture is taken and the location where the printer physically locates. Such a 'non-computer' object is now accessible and handled over the global network, even though its identifiers and its autonomous interactions are largely supported by a neighbor computer.

Any physical object with a tiny IC chip can be tagged with an identifier, communicating over radio waves with RFID technologies. A reader and possibly RFID writer and the software around it can create a new 'illusion' of every single object being recognized and accessed by others. This discussion leads us to the design of RFID being a new element of the ubiquitous computing space using the real space Internetworking technology where the scalability and mobility are not a big issue for communication on the global space.

The real space Internet employs Internet Protocol version 6 (IPv6)[54] where scalability, mobility and autonomy of an element are supported. Security, stability and privacy are the common area of such technologies, so that should be challenged as a whole system. A RFID-equipped object can be abstracted into an autonomous element on the real space network with some neighboring software. In this architecture of the network the RFID can be a dumb ID because the rest of the functions are an independent autonomous element supported by external software, and also the RFID can be a super intelligent and powerful computing element which by itself can be an autonomous object in the space.

This view is totally consistent with the classified plan of an Auto-ID Center's definition of the future evolution of an Auto-ID tag, although the application concept is somewhat the network-to-Auto-ID view rather than the Auto-ID-to-network approach of the original Auto-ID Center's approach. This paper intentionally discusses the way approaching the Auto-ID architectural design from the advanced Internet design point of view.

In our view, it is most probable that various technologies proposed by the Auto-ID Center will make it possible to connect RFID-tagged objects in the real space with the associated data in cyber space. The concept of the Auto-ID Center is that RFID-tagged objects have their own ID, and the ID is able to point various data associated with the tagged objects in the cyber space. Both the relationship between the object ID and data, and the relationship between object itself and the ID will be useful to address the "real-space oriented networking"

On the assumption that this premise is accepted, the attributes and metrics of the object and any data which related to the object are processed and manipulated in the cyber-space indirectly.

The currently available RFID tag has only a static ID. However, there are a lot of attempts being made for a RFID chip to become more intelligent, having sensing facilities, and owning dynamic ID. For example, there are researches of an ID chip, which changes its own response according to its environment and access situation[239]. The design of the networking system accommodating the Auto-ID has to be consistent with such a future with a sophisticated architecture.

4.2 The new Internet architecture for auto-id

A virtual space that spreads on the computer network is sometimes called "cyber-space", which is a logical space for information and digital data. For the past decades, this concept has represented the space created by the Internet pretty well. Though the very much deployed Internet has become a real communication media with real activities on it. This change introduces the merging of cyber space with real space where we physically live.

Understanding the Internet itself is important in discussing the relationship between cyber-space and real-space. This section attempts to describe the current and future of the Internet to represent perception of Internet area.

4.2.1 Internet Architecture

The Internet can be defined as a platform to exchange information. This information is generated and stored in various places. The cyber space consists of the information, and it is sustained by interactions of own information.

In the near future, as far as they are encoded to bit strings, such as all contents video, audio and broadcasting can be exchanged via the Internet. In addition, since the broadband infrastructure can make network available anywhere, various devices which process digital data can be connected to the Internet, for example existing electronic devices, such a television, mobile and PSTN phone and others, as shown in figure 4.1.

Since all devices in the real world, such as refrigerators, lightings, switches, air conditioners, thermometers and some other home appliances, potentially interact with these environments, the connection between these devices and the Internet would reinforce the relationship with the real and cyberspace. In such environment, these devices communicate with each other and generate more value-added information.

4.2.2 Direction of the Internet Evolution

In the 1990s, the Internet established the status of a practical infrastructure. Now, the Internet is widely used in the office and at home. Many people use broadband connectivity over 10 Mbps (by

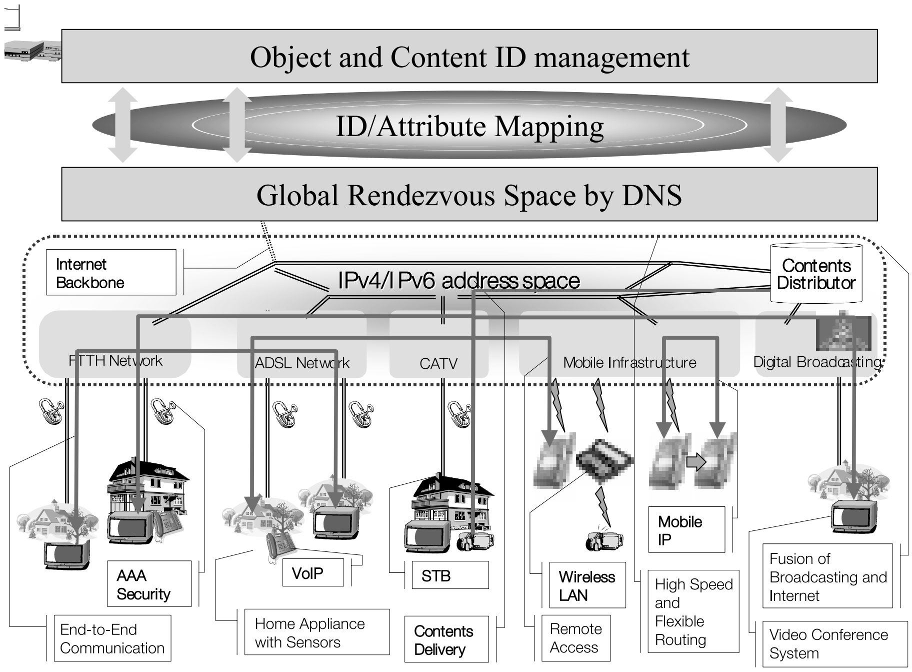

Fig. 4.1. Shows the communication model of the Internet

the ADSL and FTTH connection). In addition, various technologies have been improved in the Internet. The Internet Protocol version 6 (IPv6) is the good example of these improvements.

4.2.2.1 Internet Protocol Version 6 (IPv6)

IPv6 is the successor of IPv4 (the current protocol of the Internet) and it applied the latest research experience to its protocol design. IPv6 has almost infinite address space (128 bit length) and some efficient function extensions, such as extensional header structure, effective routing control, auto configuration and security support.

Of course, the IPv6 would contribute to ubiquitous computing and some real space applications. The large address space enables the connection of various devices to the Internet and the end-to-end communication. The IPv6 architecture will help to handle a large amount of devices in the real space.

The deployment and transition ofIPv6 network has already been started in Asia, Europe and US area. For example, the Japanese government has supported IPv6 deployment since 1999. Currently many ISPs are able to provide IPv6 connectivity. If a RF reader can handle the IPv6 protocol, such a RF reader can be accessible by a global IP address. Many consumer electric appliance companies have developed the consumer electric products which can connected to the Internet, such as an Internet refrigerator.

4.2.2.2 Home Environment for the RF Readers and Sensors

Recently, new possibilities of Real Space Networking have been arising. Broadband connectivity has been introduced to home and offices, and home products are proposed and developed on the assumption that every home has the Internet connectivity. There are two ways to deploy these devices as candidates for the RF readers and sensors.

The first approach is to connect the existing home electronics to the Internet and enhance their computation power. This is generally called the “Home network environment”. Many electronic makers have proposed concept model of such products, for example the Internet refrigerator. In some proposals, a video camera or

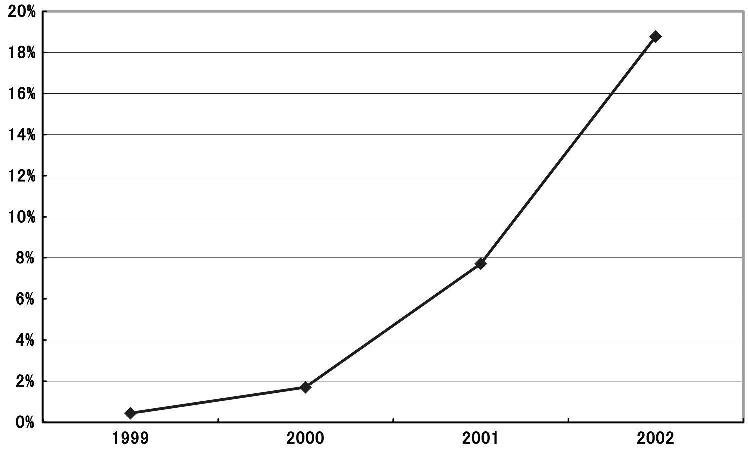

Fig. 4.2. The percentage of the broadband connectivity contracts in the total number of households in Japan.

a bar code reader is installed on the refrigerator and receives information within the equipment. With the introduction of Auto-ID in the near future, RFID will be attached on many products in SCM field. Furthermore, a refrigerator could have a RFID reader and would be integrated in the Auto-ID architecture. Not only a refrigerator, but also other home electronics, which are related to tagged products, such as microwave oven or audio equipments, will be integrated into Auto-ID architecture.

The other approach is to install Internet connectivity to various inexpensive devices with small capability at home, and make it work as a RFID reader. Most Auto-ID applications assume many RFID readers within a house or an office. BAS (Building Automation System) platform research proposes a specification such as EMIT (Embedded Micro Internetworking Technology), where lightings and plug outlets to have IP connectivity. These devices exist densely in a space, and when they work as RFID reader, they play an important role for Auto-ID architecture.

4.2.2.3 Current Status of Broadband Networks in Japan

In Japan, the situation of the broadband Internet was dramatically changed in those a few years. Figure 4.2 shows the increasing number of home with the broadband Internet connectivity.

In 2003, about 20% of household (about 9 million home) in Japan has the broadband Internet connectivity. The capacity for the broadband Internet connectivity is about 74 million for home. The capacity means the number of perpetrated facilities to connect broadband Internet to a home at the Internet service providers. The broadband Internet connectivity is provided by Optical Fiber, ADSL, cable TV and FWA (Fixed Wireless Access). Those technologies do not provide only broadband connectivity, but most bandwidth is consumed in Internet purpose. Many public spaces, coffee shops, train stations, airports, hotel lobbies and so forth, support Wi-Fi hot spot services.

Figure 4.3 shows the ratio of the office connectivity. Now, over 90% of the offices have Internet connectivity.

4.3 ID space management

Thorough our operation on the Internet, a lot of experiences has been accumulated on the ID space related issues, design, implementation and management, thorough actual operation in the Internet. Generally, among them, name space and identification are hard to discuss. Furthermore, management of ID space and ID system has other difficulties because there are so many issues to be

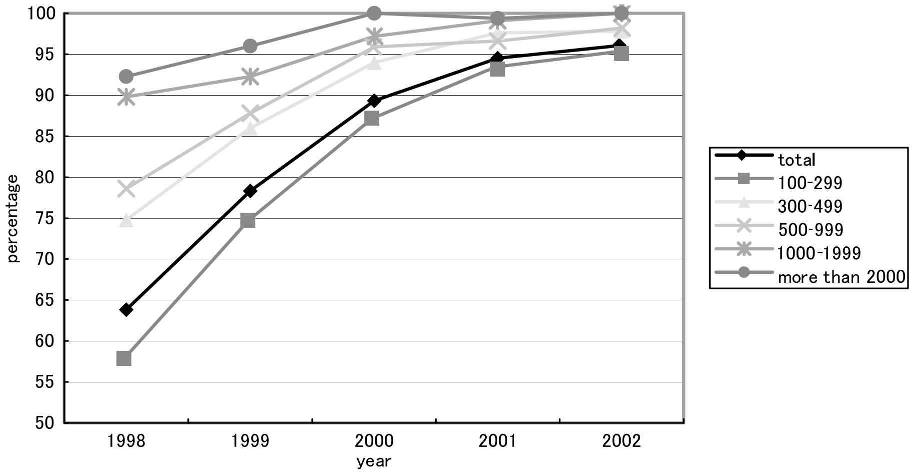

Fig. 4.3. Transition of Company Connected to the Internet (according to employee scale)

resolved.

This section looks at the point of discussion about the ID space management, referring to our experience in Internet.

4.3.1 Naming Architecture of the Internet

The Internet consists of many nodes which are identified by its own IP addresses. Each node using Internet Protocol use IP address to identify communicate-peer, and every IP packet include IP addresses to specify source node and destination node(s). In other words, IP address space is "native" name space in the Internet, because IP address is the identifier for communications.

As you know, there are many kinds of name spaces that are observed on the current Internet. For example, URL (Uniform Resource Identifier), E-mail address, domain name and VoIP phone number is used for various applications on the Internet. These name space are independent from the IP address name space, but the name space mapping mechanism enables to use these different addresses in the Internet. All of these name spaces are finally mapped to IP address when communication peer is established. Therefore, the Internet can manage miscellaneous devices and objects that would have different name space consistently by introducing the mapping mechanisms between name spaces, for example the IP address space and domain name spaces.

4.3.1.1 General Name Space Mapping

The idea of inter-name space mapping is used everywhere on the Internet. Generally, most network models are designed as layering models. In this model, name space mapping mechanisms between layers is introduced to acquire its transparency and independency between conjunction layers. It is also useful for clear implementation.

Particularly, Domain Name Service (DNS) is the global directory service, which is designed and managed in order to map a domain name (FQDN) to IP addresses. The DNS serves scalable mapping service using distributed, tree-structured, delegation base information architecture. Because the DNS is a great success, we cannot imagine the Internet without it. In addition, between data-link layer (L2) and network layer (L3), there are mapping mechanism that exchange IP address and L2 address, for example MAC address of Ethernet, VCI/VPI of ATM or label stack of MPLS. Communication transparency can be realized not by using node ID directly, but by using abstract name (e.g. domain name) and naming system (e.g. DNS) for the exchange from domain name to node ID. In other words, as far as there is a dynamic mapping system, users can communicate by acquiring new node ID from domain name, even if node ID changes.

4.3.1.2 Domain Name Service/System

Figure 4.4 shows DNS conceptual diagram. DNS is the naming system mapping from key entity that can be represented as FQDN form like a host name or mail address to IP address or pointers to other name space such as URI.

The DNS is designed as a system to manage mapping between IP addresses and domain names dynamically using distributed lazy-sync database architecture. The DNS specifications are originally defined as RFC1034, RFC1035 and RFC1123, and continuous effort are made to extend various functions such as security extension and new resource record definition.

DNS performs name space mapping which uses FQDN as the key. Mapped objects are called Resource Recode (RR). Currently many kinds of RR are specified and used, for example, A RR for declare IPv4 address, MX RR for Mail eXchanger, CNAME RR for aliasing name. If someone recognize the needs of to add the new resource record to DNS specification, the IETF[128] start to discuss the feasibility and reasonability of it. In these days, AAAA RR for IPv6 address, NAPTR (Name authority PTR)[175, 176, 177, 178] and some others are defined.

4.3.2 Issues of Name Space and Naming System Design

We have to give careful consideration as to the requirements and use cases of its name space before designing a naming system, because name space structure and its naming system are firmly linked.

This section shows our experience of several naming system designs and large scale name space management in the Internet, to give some points to start the discussion about these issues.

4.3.2.1 Scalability and Expendability

Since the Internet domain space is very large and the naming system must be scalable, the DNS takes tree hierarchical structure and the sub-tree delegation mechanism. This is an example showing a name space structure and naming systems are inseparably related to each other.

Name space expendability and scalability are almost the same but metric of expansion is different. DNS obtains name space extensibility and scalability through using techniques in order to restrict the query key format to FQDN (Fully Qualified Domain Name) format, to use sub-tree delegation mechanism and to allow the multiple-stage resolve mechanism, for example a FQDN to CNAME to CNAME to A; this is a resolving sequence of a FQDN to a IPv4 address with 2 aliases mappings. In addition, the DNS is able to treat other name space mapped the FQDN format, such as IP address. For example, the PTR RR, the pointer to another name space, is used as reverse mapping from the IP address space (IN-ADDR.ARPA.) to the domain name space.

If the key entry to search in name space is structured, the name lookup model could remain

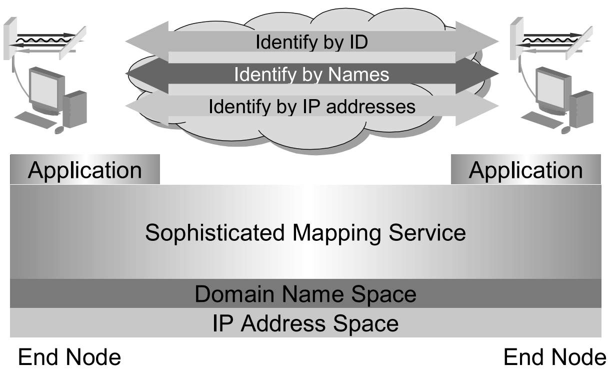

Fig. 4.4. DNS conceptual diagram

simple. The well structured name space. Furthermore, it has some inflexibility for new reference requirement digressing from basic design. When someone designs a name space, he or she needs to understand these advantage and disadvantage, without a blind belief in the success of DNS.

Followings are the issues that should be taken into account for name space design: relationship between name spaces of mapping targets, granularity of query and response operation and name space structure.

4.3.2.2 Security, Privacy and Access Control

Security, Privacy and Access control are all important issues on the naming system mapping among name spaces.

Since DNS was designed to reflect the Internet usage pattern in those days, it has a structure with the following features.

- to equalize every access(non access control)
- to use the plain text for query/response(non security and/or privacy)
- to have no certification for the communication between server/clients.

Since the preference and purpose of Internet usage have been changed with widely spread of the Internet, several attacks to the DNS infrastructure have occurred in recent years. Especially, some types of zone hijacking and a DNS ID spoofing attack are serious problem because of the possibly that they spoil Internet integrity. Of course, the cyber squatting and DoS attack to DNS servers are also harmful. The IFTF, ICANN[289] and RIRs[236] are discussing to make the DNS protocols more resident, such as to apply some AAA (Authentication, Authorization and Accounting) functions to DNS[108].

4.3.2.3 Other Issues

Moreover, the following additional issues exist on the naming system designing:

- System stability
- Integrity, such as intermediate entities that support transmits mapping data, authentication, authorization of origin of mapping information and other system behavior.
- Efficiently of system performance such as “data retrieve time”.
- Data flooding time, if the system is using distributed data model.

4.3.3 Discussions About Naming System Architecture

Followings are important point to discuss and make decisions of name space and naming space design.

4.3.3.1 Centralize Model vs. Distributed Model

DNS is a naming system based distributed database model. The management model of data, such as centralize or distribute, provide important point of its architecture. This models will affects the scalability, management model, access model and some other characteristics of the naming system.

4.3.3.2 Well-organized Structure vs. Amorphous-like Structure

The precision of naming system behavior, such as database synchronization and reflection periods of data updates, is a one of the metrics of naming system measurements. The requirement for the precision of name space mapping

These metrics are affected by the database structure of naming system. As a matter of fact, well-organized structure, which is optimized for database update has good performance but it would be low performance of scalability. In contrast, DNS is one of lazy synchronous type database which using cache and it allows quite long-term synchronization delay, rather than the good characteristics of scalability.

4.3.3.3 Anonymous of Information that is Served

The characteristics of handled information, especially the anonymity of this information, also affect the naming system design. Since the issue regarding anonymousness may affect the scope of naming system. It should be discussed further along with the issue of the naming system architecture.

Please note that this story does not discuss about the privacy issues at all. This just to discuss how the technology can work.

4.4 Auto-ID as the real space tagging system on the world

As mentioned in the previous section, information in cyber-space is manipulated as independent objects such as Web pages or host applications. The information becomes “knowledge” by communicating and getting relationship among these objects. In the cyber-space, no piece of information has a direct relationship with real objects. The relationship between the information and real object is defined by pointers such as a logical name of the objects. RFID technology is able to realize new relationship with real object in the cyber-space. The real object tagged by the RFID has a direct link into the cyber-space. In the near future, several memories and sensors will be integrated in order to store information, and the RFID tag will get more intelligence. In this circumstance, we assume that the tagged object with RFID technology will be a cyber-space object and it will be a real-space object at the same time. In this model, the tagged object with ID is treated by a proxy entity which is bound to the ID.

Following is an example of a situation using above concept at a hospital.

In the morning, a nurse prepares medicine for patients in a pharmacy as her daily work. The nurse puts medicine on a tray for each of her patients. At that time, when two doses of medicine were put on the same tray, they warned the nurse that they should no be prescribed at the same time, because it may cause a harmful effect. The nurse can avoid combination errors thanks to the warning by “intelligent” medicine. The nurse moves from the pharmacy towards one of a patient room with medicine trays. Entering the room, the nurse put the medicine tray on a bedside. The bed and the medicine tray communicate with each other as usual. However something is different usual on that day, an empty bottle of whiskey is under the bed. The patient was drunk last night. His old friend visited him with a bottle of whiskey. The bed has detected that whiskey bottle underneath it. And then the bed talks with the medicine tray about the relationship with alcohol and the medicine. The nurse can protect the patient from the undetectable error with the help of the real-space networking.

Each object acts as an autonomous system depending on its own environment parameter, such as location and time. As show as this case study, the concept of inter-object communication directly will extend our environment.

4.4.1 Global Object

The Auto-ID system constitutes parts of the real-space network. In the Auto-ID system, real objects are identified by EPCs, and the information of the real object is managed by proxy entity, called as PML object. In the first place, the Auto-ID system will be applied to the supply chain management area

Before the Internet’s advent, many application systems were developed with own networking capabilities. The information of online reservation systems for airline tickets, the banking systems, the stock trading systems was limited within the system, and we needed to maintain several terminals in our office in order to access to each information. However, the Internet enabled us to access to almost all information as global sense.

The current situation of RFID technology-based system is similar to the situation where there was no Internet. For example, several railway companies in Japan have applied RFID technologies to their commuter passes. However, commuters have to possess several commuter passes in their wallets, because each railroad company adopted different standards of RFID technologies, and there are no negotiations with exchanging the commuter pass information. This case shows two issues we should consider for real-space networking. One is the standard of the RFID technologies and the other is global information exchange mechanisms.

Everyone agrees that a certain standard for RFID technology is a must, such as shared band of the radio frequency and common protocols between tags and readers. Even though we agree that there should be certain standards on these matters, we believe that such standards are not sufficient. RF technologies are growing continuously, and we do not need to stop such growth. The real-space network will be able to handle the real-space objects that are linked with real objects by the different RFID technologies. In the previous example of rail pass, if users are identified by some kind of technology in real-space networking, the user can pass the station gate without the commuter pass. This means that, in the real-space networking, the information should be accessed as global manner. This is important rather than the standardization of media layer technologies, For example, there are several media layer technologies exists in the Internet such as the Ethernet and optical fiber, however the basement of communication identifier is the IP address. It is the same as this example, in the real-space networking; every real-space object should be handled as global manner, and should communicate each other.

4.4.2 Design Issue of Name Service for Real space Networking

There are many methods for designing the name space, name service and naming system for the Auto-ID architecture. For example, the naming system will be constructed as a part of DNS (Domain Name System). Using DNS as a base system, there are two implementation methods. The first one constructs the naming system as adding the new RR (Resource Recode) for handling Auto-ID related resources. The other operates the whole naming hierarchy and systems for them rather than current naming hierarchy maintained as alternate naming tree.

We should design and implement the real-space naming system consistent with the architectural concept of the Internet. Previous works identify the following issues:

- Name space structure
- Name space management
- Name Space Resolution
- Scalability/bottleneck
- Diversity/stability
- Flexibility of resolution methods
- ID structure

Current specification of Auto-ID naming system is based on DNS NAPTR mechanism. This is the first step for constructing naming system for the Auto-ID architecture. There are several limitations for using DNS system, such as single management authority for the single resource. But this approach is suitable for current demands and use case of Auto-ID applications, such as supply chain management support. To realize the real-space network environment, we should work for above research items further.

4.5 Summary

Research and development experiences of Internet name space will contribute to discuss and design new name space of real world objects. This white paper indicates some issues of name space design, from the point of view of Internet technologies as the start point of discussion.

付録 A　RFID 関連用語集

本 WG では、議論における前提知識として用語集を作成している。

単なる用語集ではなく、関連した団体についての情報も盛り込む形で、いろいろな情報へのリンク集

としてもまとめたいと考えている。今後の公開方法については、検討中である。以下、報告書編集時点のスナップショットをまとめる。進展が早い領域であるため用語の意味の揺らぎや現在の定義としては適切でなはない項目も存在する。

AG（エージー）
正式名称:　Action Group
単語の分野:　組織名/Auto-ID
用語解説:　EPCglobal の ITF（Implementation Task Force）内に設置されている研究グループ。研究領域ごとに設置される。
備考:　現在は HAG/SAG の 2 つがある。PSAG は（実質的に）活動中断中

AIDC（エーアイディーシー）
正式名称:　Automatic Identification and Data Capture
単語の分野:　その他
用語解説:　自動認識技術全般をさす

Air Protocol（エアプロトコル）
正式名称:　Air Protocol
単語の分野:　ハードウェア技術/タグ技術
用語解説:　RFID とリーダーライター間の通信プロトコル一般を指す。

Alien technology（エイリアンテクノロジー）
正式名称:　Alien technology
単語の分野:　会社名/Auto-ID
用語解説:　RFID タグを作っているメーカー。

Amplet（アンプレット）
正式名称:　Amplet
単語の分野:　会社名
用語解説:　RFID 機器の製造・販売を行っている。

Auto-ID（オートアイディー）
正式名称:　Auto-ID
単語の分野:　その他
用語解説:　Auto-ID が提供しているシステム、組織名、その他 Auto-ID センターの成果物に関係するものを指す語。Auto-ID センター自体も指す。

Auto-ID Center（オートアイディーセンター）
正式名称:　Auto-ID Center
単語の分野:　組織名/Auto-ID
用語解説:　MIT を中心に 1997 年から 2003 年 10 月まで組織されていた Auto-ID 技術の検討・標準化組織。2003 年 11 月より EPC-global と Auto-IDLab に分離された。
関連 URI:　http://www.autoidcenter.org/
備考:　URL はすでに存在しない

Auto-ID Inc.（オートアイディインク）
正式名称:　Auto-ID Inc.
単語の分野:　組織名/Auto-ID
用語解説:　Auto-ID Center から普及活動を引き受けるために一時的に組織された会社組織。最終的に EPCglobal に改名された。

Auto-ID WG（オートアイディーワーキンググループ）
正式名称:　Auto-ID Working Group
単語の分野:　WIDE/分科会
用語解説:　WIDE の分科会の一つ。WIDE における Auto-ID に関する議論・研究などをサポート。

C0V1（シーゼロブィワン）
正式名称:　C0V1
単語の分野:　ハードウェア技術/タグ技術
用語解説:　EPC タグ規格 Class0 に沿ったもののうち現在公開されているもの。Matrics 社の提案したものが採用されている。

C1V1（シーワンブイワン）
正式名称:　C1V1
単語の分野:　ハードウェア技術/タグ技術
用語解説:　EPC タグ規格 Class1 に沿ったもののうち現在公開されているもの。13.56 MHz ではフィリップス社、UHF 帯では alien 社の提案したものが採用されている。

C1V2（シーワンヴイツー）
正式名称:　C1V2
単語の分野:　ハードウェア技術/タグ技術
用語解説:　EPC タグ規格 Class1 に沿ったもののうち策定がすすめられている次世代バージョンのもの（Version2）。ベンダ間の互換性、地域による電波法の差の吸収、Version1 以上の性能を目指している。

CA（シーエー）
正式名称:　Certificate Authority:認証局
単語の分野:　ソフトウェア技術/セキュリティ
用語解説:　公開鍵の正当性を保障する機関。

Class (Auto-ID Tag class)
正式名称:　Class (Auto-ID Tag class)
単語の分野:　ハードウェア技術/Auto-ID
用語解説:　Auto-ID Center ではタグの機能をクラスという形で分類している。たとえば Class1

の場合、EPCが読み書き可能なタグである。

DCC（ディーシーシー）
正式名称: Distribution Code Center
単語の分野: 組織名
用語解説: JANコードの登録、管理などを行う組織。財団法人流通システム開発センターの下部組織。
関連URI: http://www.dsri-dcc.jp/

DHT（ディエイチティ）
正式名称: Distributed Hash Table
単語の分野: ソフトウェア技術/アルゴリズム
用語解説: データ分散配置技術の一つ。分散ハッシュテーブルとも呼ばれる。

DNS（ディーエヌエス）
正式名称: Domain Name System
単語の分野: ソフトウェア技術/名前システム
用語解説: インターネットのホスト名（FQDN）からIPアドレスなどに写像するための分散サービス技術およびそのプロトコル。RFC1034, RFC1035などで規定されている。

DoD（ディオーディ）
正式名称: Department of Defense
単語の分野: 組織名
用語解説: アメリカ国防総省

EAN（イアン）
正式名称: European Article Number
単語の分野: コード体系
用語解説: ヨーロッパを中心として策定された統一商品コード

EAN International（イアンインターナショナル）
正式名称: EAN International
単語の分野: 組織名/Auto-ID
用語解説: ヨーロッパを中心として策定された統一商品コードを維持管理する団体。
関連URI: http://www.ean-int.org/

EMS（イーエムエス）
正式名称: Event Management System
単語の分野: ソフトウェア技術/Auto-ID
用語解説: Auto-ID Savantの内部構造の1つ。Edge Savantがリーダーライターからのタグ検出イベントを管理する機能を提供する。

ENUM Style
正式名称: ENUM Style
単語の分野: ソフトウェア技術/名前システム
用語解説: DNSのENUM RRで用いられている番号空間マッピングの方法。長い番号空間を短い部分空間に分割してDNSで扱いやすくするために用いられる。

EPC（イーピーシー）
正式名称: Electronic Product Code
単語の分野: コード体系
用語解説: EPCglobalによるEPC Networkでの識別子。
備考: 64 bit、96 bit、256 bitなどのバリエーションが現在ある。

EPC Global（イーピーシーグローバル）
正式名称: EPC Global
単語の分野: 組織名/Auto-ID
用語解説: 旧Auto-ID Inc. EAN/UCCが50%づつ出資して設立されたNPO。EPC Network技術の普及などを行う。
関連URI: http://www.epcglobalinc.org/
備考: 2003/11/1発足

EPC Network（イーピーシーネットワーク）
正式名称: EPC Network
単語の分野: Auto-ID技術
用語解説: EPCを利用する技術の総称。

EPC Symposium（イーピーシーシンポジウム）
正式名称: EPC Symposium
単語の分野: イベント
用語解説: EPC技術の普及を目指して年に1回開催されているカンファレンス。2003年は10月にシカゴで開催された。

EPC-IS（イーピーシーアイエス）
正式名称: EPC-Information Service
単語の分野: ソフトウェア技術/Auto-ID
用語解説: EPCに関連するサービスを提供するエンティティ、およびそのサービスが属するソフトウェア的レイヤ。

ES（イーエス）
正式名称: Edge Savant
単語の分野: ソフトウェア技術/Auto-ID
用語解説: Savant階層のうちリーダと直接接続するSavant。

Edge Savant（エッジサバント）
正式名称: Edge Savant
単語の分野: ソフトウェア技術/Auto-ID
用語解説: Savantの階層構造の内、末端に位置するSavant。

FSA（エフエスエー）
正式名称: Fluidic Self Assembly
単語の分野: ハードウェア技術/実装技術
用語解説: 微小エンボスフィルムに NanoBlock チップを液体中で実装する技術。Alien テクノロジによるもの。

Felica
正式名称: Felica
単語の分野: 製品名/IC カード
用語解説: Sony によって開発された IC カード技術。

GLI（グリ）
正式名称: Global Location Information
単語の分野: ソフトウェア技術/WIDE
用語解説: 地理的位置情報を扱うシステム。

GLN（ジーエルエヌ）
正式名称: Global Location Number
単語の分野: コード体系
用語解説: 世界統一の事業所の場所を示すコード。GS1 コード体系の 1 つ。
関連 URI: http://www.dsri-dcc.jp/company/gln/gln1.htm

GTIN（ジーティン）
正式名称: Global Trade Item Number
単語の分野: コード体系
用語解説: 商品に関連する世界的に一意な識別子。製造元、製品コードなどを含む。GS1 コード体系の 1 つ。

HAG（ハグ）
正式名称: Hardware Action Group
単語の分野: EPCglobal/組織名
用語解説: EPCglobal ITF の下部組織。ハードウェアに関する議論、研究、標準化を行う。

IS（アイエス）
正式名称: Internal Savant
単語の分野: ソフトウェア技術/Auto-ID
用語解説: Savant の階層構造における中間層。

ISBN（アイエスビーエヌ）
正式名称: International Standard Book Number
単語の分野: コード体系
用語解説: 書籍の商品識別子。出版社、書籍コードが含まれる。現在は雑誌は別の雑誌コードを用いているが 2005 年に ISBN に統合予定。

ISM **バンド**（アイエスエムバンド）
正式名称: ISM バンド
単語の分野: ハードウェア技術/周波数帯
用語解説: Industrial Science Medical の頭文字をとったもので、ある規定に従えば特別な免許なしに利用できる周波数帯域。

ITF（アイティーエフ）
正式名称: Interleaved 2 of 5
単語の分野: コード技術
用語解説: バーコード用の符号化方式。ITF14/ITF16 などがよく用いられている
備考: 物流管理のため、段ボールなどの集合包装に表示するバーコード。

JAN（ジャン）
正式名称: Japanese Article Number
単語の分野: コード体系
用語解説: 日本の統一商品コード。EAN コードに基づいている。

MIT（エムアイティー）
正式名称: Massachusetts Institute of Technology
単語の分野: 組織名/Auto-ID
用語解説: Auto-ID Lab に加盟している大学の一つ。

Marks and Spencer（マークスアンドスペンサー）
正式名称: Marks and Spencer
単語の分野: 会社名/実証実験
用語解説: 英国の百貨店の名称。マークスアンドスペンサーの実証実験と称されることも。略称 M&S。

Matrics
正式名称: Matrics
単語の分野: 会社名/Auto-ID
用語解説: RFID タグを作っているメーカー

Metro（メトロ）
正式名称: Metro
単語の分野: 会社名/実証実験
用語解説: ドイツのスーパーマーケットの名称。Metro の実証実験と称されることも。

NAPTR（エヌエーピィティアール）
正式名称: Name Authority Pointer
単語の分野: ソフトウェア技術/名前システム
用語解説: DNS の RR（Resouce Record）の 1 つ。ONS1.0 では EPCIS を指定するために NAPTR を用いる。

NS（エヌエス）
正式名称: Number System Code
単語の分野: コード体系

用語解説:　UPCは、最初の一文字が業界別、用途別に管理されており、これをNSと呼ぶ。

Nominum
正式名称:　Nominum
単語の分野:　会社名/SAG
用語解説:　商業利用可能なDNS基盤の研究・開発・サポートを行っている会社。SAG ONS-WGに参加している。

ONS（オーエヌエス）
正式名称:　Object Name Service
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　EPCからそのEPCに関連するサービス（情報を保持サービスなど）を提供するエンティティを検索する機構。ONS1.0はDNS基盤を用いる。

ONS **リゾルバ**（オーエヌエスリゾルバ）
正式名称:　Object Name Service Resolver
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　アプリケーションからONSを利用するときに使用するAPI。

PKI（ピーケーアイ）
正式名称:　Public Key Infrastructure:公開鍵基盤
単語の分野:　ソフトウェア技術/セキュリティ
用語解説:　公開鍵暗号方式を利用した、認証基盤。

PML（ピーエムエル）
正式名称:　Physical Markup Language
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　EPCが付いている製品の情報を記述するためのマークアップ言語。Product Markup Languageと呼ばれることもある。

PML Core（ピーエムエルコア）
正式名称:　PML Core
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　PMLのうち、どのPMLにも必ず含まれていなければならない部分を指す。

PML Extension（ピーエムエルエクステンション）
正式名称:　PML Extension
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　PMLのうち、PML Core以外の拡張可能である部分を指す。

PML **サービス**
正式名称:　PMLサービス
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　PMLを保持しているサービスのこと。後にEPC-ISへと改称された。

RFID（アールエフアイディー）
正式名称:　Radio Frequency IDentification
単語の分野:　ハードウェア技術/概念
用語解説:　電波を利用した個体識別技術の総称。

RFID Privacy Workshop
正式名称:　RFID Privacy Workshop
単語の分野:　イベント/MIT
用語解説:　MITで2003年12月に開催された研究ワークショップ。
関連URI:　http://www.rfidprivacy.org/

RPC（アールピーシー）
正式名称:　Remote Procedure Call
単語の分野:　ソフトウェア技術/分散システム
用語解説:　ネットワーク上に存在するノードで動作しているプログラムを遠隔から呼び出すこと、またはそのような遠隔呼び出しを行うためのインタフェース。

RSA（アールエスエー）
正式名称:　RSAアルゴリズム
単語の分野:　ソフトウェア技術/セキュリティ
用語解説:　公開鍵暗号の一つ。Ronald Rivest、Adi Shamir、Len Adlemanによって開発された。

Radio Frequency（レディオフレークエンシー）
正式名称:　Radio Frequency
単語の分野:　ハードウェア技術/電波
用語解説:　無線および無線周波数のこと。

SAG（サグ）
正式名称:　Software Action Group
単語の分野:　EPCglobal/組織名
用語解説:　EPCglobal ITFの下部組織。ソフトウェアに関する議論、研究、標準化を行う。

SCM（エスシーエム）
正式名称:　Supply Chain Management
単語の分野:　概念
用語解説:　流通の管理を示す用語。

SPEARS WG（スピアズ）
正式名称:　SPEARS
単語の分野:　WIDE/分科会
用語解説:　WIDEの分科会の一つ。Real-Space Networkというキーワードの元で研究を進めている。

SSCC（エスエスシーシー）
正式名称:　Serial Shipping Container Code
単語の分野:　コード体系
用語解説:　コンテナに付けるコード。GS1 コード体系の 1 つ。
関連 URI:　http://www.ainix.co.jp/barcode/d_03.shtml

Savant（サバント）
正式名称:　Savant
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　Auto-ID EPC ネットワーク内でアプリケーションとリーダ間に必要な機能を提供するためのソフトウェアパッケージの総称。

Suica
正式名称:　Suica
単語の分野:　製品名/IC カード
用語解説:　Sony Felica を用いた JR 東日本による自動改札システムに用いられるカード。電子マネーとしての展開も構想されている。

TMS（ティーエムエス）
正式名称:　Task Management System
単語の分野:　ソフトウェア技術/Auto-ID
用語解説:　タスクを管理する Savant 内機能。

Tesco（テスコ）
正式名称:　Tesco
単語の分野:　会社名/実証実験
用語解説:　Tesco Co., Ltd. 米国のスーパーマーケットの名称。テスコの実証実験と称されることも。

UAG（ユーエージー）
正式名称:　User Action Group
単語の分野:　EPCglobal/組織名
用語解説:　EPCglobal ITF の下部組織。EPC を利用するための利用例などの検討、HAG/SAG へのフィードバックなどを目的としたグループ。

UCC（ユーシーシー）
正式名称:　Uniform Code Council
単語の分野:　組織名
用語解説:　アメリカ・カナダの商品コード管理機関。
備考:　コード体系的には UPC。

UPC（ユーピーシー）
正式名称:　Universal Product Code
単語の分野:　コード体系
用語解説:　UCC における製品コード体系。

URI（ユーアールアイ）
正式名称:　Uniform Resource Identifiers
単語の分野:　ソフトウェア技術/インターネット
用語解説:　ネットワーク上のリソースを識別するための手段。

University of Adelaide（アデレード）
正式名称:　University of Adelaide
単語の分野:　組織名/Auto-ID
用語解説:　Auto-ID Lab に加盟している大学の一つ。

University of Cambridge（ケンブリッジ）
正式名称:　University of Cambridge
単語の分野:　組織名/Auto-ID
用語解説:　Auto-ID Lab に加盟している大学の一つ。

University of St. Gallen（セントガレン）
正式名称:　University of St. Gallen
単語の分野:　組織名/Auto-ID
用語解説:　Auto-ID Lab に加盟している大学の一つ。

VIN（ブイアイエヌ）
正式名称:　Vehicle Identification Number
単語の分野:　コード体系
用語解説:　米国で販売される車すべてにつけられている ID。17 桁の記号+番号で構成され、必ずバーコードも併記される。

VeriSign（ベリサイン）
正式名称:　VeriSign
単語の分野:　会社名/SAG
用語解説:　インターネットにおけるセキュリティ関連システムの開発運用、ドメイン空間管理などを行っている会社。SAG に参加している。

WG（ダブリュージー）
正式名称:　Working Group
単語の分野:　EPCglobal/組織名
用語解説:　ITF の各 AG 内に設置されるミッションオリエンテッドな研究グループ。

XML-RPC（エックスエムエル　アールピーシー）
正式名称:　XML-RPC
単語の分野:　ソフトウェア技術/XML 技術
用語解説:　XML を用いて RPC 通信を表現・カプセル化するための技術。

XPointer（エックスポインター）
正式名称:　XPointer
単語の分野:　ソフトウェア技術/XML 技術
用語解説:　XML 構造中の部分構造を参照するために用いられる技術。

アクティブタグ（アクティブタグ）
正式名称: アクティブタグ
単語の分野: ハードウェア技術/タグ技術
用語解説: タグ内部に電源を内蔵し、回路を駆動するタイプのRFIDタグ。ある一定間隔あるいは外部からのトリガーにより電波を出す。

アパレル実証実験（物産）
正式名称: アパレル実証実験（物産）
単語の分野: 実証実験/アパレル
用語解説: 某ヨーロッパ系有名ブランド店舗および倉庫を実際につかって行われたアパレル実証実験。三井物産、トッパン、BSI、インターネットイニシアティブ（IIJ）が参加。

アンテナマップ
正式名称: アンテナマップ
単語の分野: ハードウェア技術/電波
用語解説: アンテナからの伝達特性を示した図のこと。フットプリントともいう。

オンメタル型 RFID タグ
正式名称: オンメタル型RFIDタグ
単語の分野: ハードウェア技術/タグ技術
用語解説: 金属のような電導体表面に添付することを想定したRFIDタグ。

パッシブタグ（パッシブタグ）
正式名称: パッシブタグ
単語の分野: ハードウェア技術/タグ技術
用語解説: タグ内部に電源を内蔵せず、インテロゲータからの電波を用いて回路を駆動するタイプのRFIDタグ。

フットプリント
正式名称: フットプリント
単語の分野: ハードウェア技術/電波
用語解説: アンテナマップのこと。

リテールテック
正式名称: RETAIL TECH
単語の分野: イベント/日本
用語解説: 日本経済新聞社が主催する小売業者むけのテクノロジーショー。2004年に20回目を迎える。

響プロジェクト
正式名称: 響プロジェクト
単語の分野: 組織名
用語解説: 経済産業省が主導する、国産低価格RFIDタグの開発を目的としたプロジェクト。

慶應義塾大学（ケイオウギジュク）
正式名称: 慶應義塾大学
単語の分野: 組織名/Auto-ID
用語解説: Auto-ID Labに加盟している大学の一つ。

電波特性
正式名称: 電波特性
単語の分野: ハードウェア技術/タグ技術
用語解説: 電波の特性。

復旦大学（フダン）
正式名称: Fudan University
単語の分野: 組織名/Auto-ID
用語解説: Auto-ID Labに加盟している大学の一つ。

偏波面（ヘンパメン）
正式名称: 偏波面
単語の分野: ハードウェア技術/電波
用語解説: 電波が振動する面のこと。偏波には円偏波や垂直偏波などがある。

無線 ID
正式名称: 無線ID
単語の分野: ハードウェア技術/タグ技術
用語解説: RFIDの日本語訳　他にICタグ、無線タグ、無線ICタグなどが使われている。

付録B　Auto-ID システムの概略

- 自動認識技術とAuto-IDシステム
- Auto-ID関連組織と実証実験
- Auto-ID関連サーベイ～電波行政～
- Auto-ID関連サーベイ～RFIDとプライバシ（2003）～

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