Traceability and Identification Solutions for Secure and Comfortable Society

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OVERVIEW: As the ubiquitous information society is truly being realized, the need to identify individuals is increasing in municipal, traffic, financial and administrative services, medical treatment and welfare, education, and other such fields. In conventional authorization by means of credit cards, etc. (confirmation of validity by expiration date, detection of misuse, etc.) and authentication on the Internet (confirming legitimacy over a network by means of entry of a user ID (identification) and password, etc.), confirmation of the identity of the user is indirect. Recently, however, research has been moving closer to solving problems that arise from the inability to directly identify an individual, such as misrepresentation of the producing area and forgery. Hitachi, Ltd. has developed a solution based on traceability that is achieved with ultra-compact, non-contact technology and IC (integrated circuit) chips and a new card standard that combines IC cards and memory. In addition to solving these problems, our objective is a convenient social infrastructure that is comfortable and secure.

INTRODUCTION

PERSONAL identity confirmation in a strict sense and confirmation of the manufacture and distribution history of commercial products have not been practiced in Japan, and no major problems have arisen as a result. Now, however, there is a rapidly increasing need for identification of individuals for authentication, determining production history and establishing legitimacy. One reason is the increasing use of the Internet for various procedures that require on-line commercial transactions and personal authentication. Other reasons include the need to identify the area of production of beef that has been infected with BSE (bovine spongiform encephalopathy), forgery of
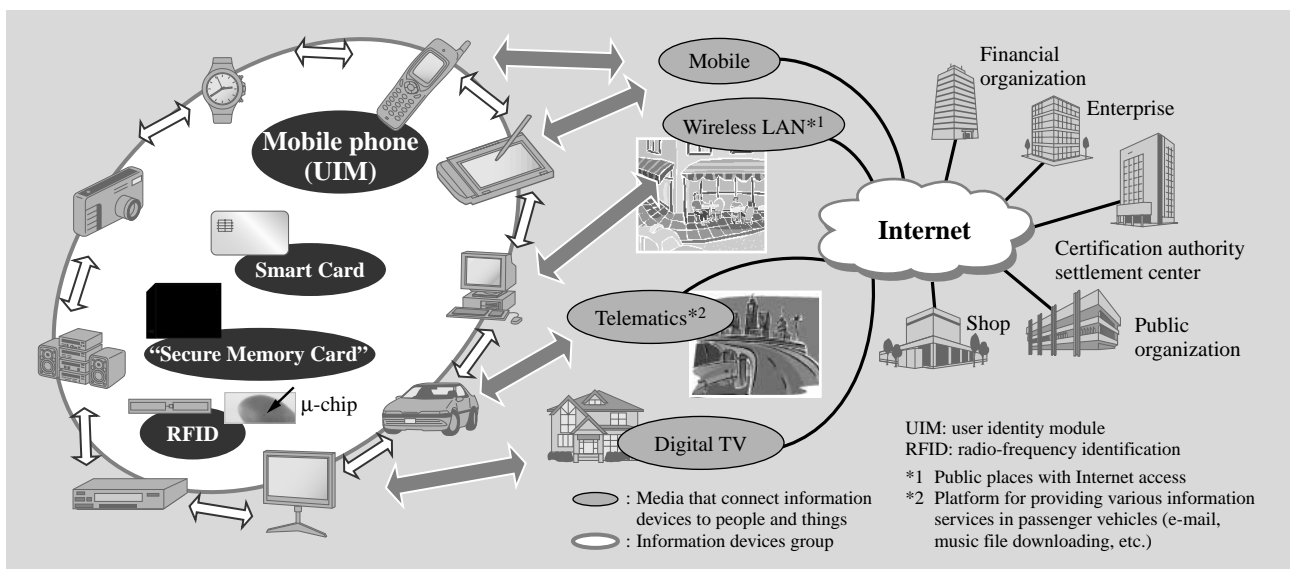

Fig. 1—Outline of Network Society.
The private and public and the real and virtual are connected securely to realize the ubiquitous information society.

branded products, etc. (see Fig. 1).

Here, we discuss the feasibility of using a Secure Memory Card to solve these problems concerning individual authentication. The Secure Memory Card is based on a new standard that combines IC cards and memory to provide traceability with an IC chip.

NEW GOODS MANAGEMENT METHOD
Definition of Traceability

Traceability is defined as "the ability to use IT to follow the movements of goods, thus achieving the application of electronic devices to product life cycle management and the management of transactions and settlement, increased efficiency and functionality of product distribution, rationalization of factory production management, and other such improvements.[1]"

Trend in Traceability

From the viewpoint of the enterprise, efforts to achieve traceability begin with confirmation of the distribution paths and methods of product recycling, and we believe that in the future there will be increasing need for feedback from consumers on products, parts, etc. To address these social concerns, the industry, academia, and government sectors are investigating the possibility of applying traceability in various fields of production management, and we believe there will be further expansion into other diverse fields in the future. Although there is little prospect for any major changes in investment in traceability by various companies in the next few years, a break is expected to occur in about 2007, and the trend toward expansion is predicted to continue after that.[2]

Examples of Traceability
Beef traceability

As a measure against BSE, with the objective of safe distribution of beef, a system is being constructed that makes open the entire beef production process from the cattle breeding history and post-slaughter inspection results to processing, shipment and distribution. The consumer, by inputting the ID written on a seal attached to the product, can now find the information on the Internet, giving a better feeling of safety.

Steel material management and product traceability

In the steel industry, the management needs concerning product distribution are increasing, but conventional bar coding cannot be attached to thin plate and rust or oil may make bar code labels difficult to read. To cope with this kind of situation, Hitachi, Ltd. has developed a system that makes use of a non-contact type IC chip in place of the bar coding. This system is intended to improve the tracing accuracy for materials information and raise the recognition rate for products.[3]

Hitachi's Efforts to Implement Traceability
Technology for implementing traceability
(1) RFID technology

For implementing traceability, we use "electron tagging" as an individual identification medium. This electron tagging is accomplished by using a non-contact type IC chip called RFID.

Hitachi has developed the "μ-chip" as the non-contact IC chip. This ultra-compact (0.4×0.4 mm) IC chip can communicate across distances of up to about 30 cm. It can be used to implement the steel materials and product traceability mentioned above.
(2) Information tracing platform

A common platform for collected information management and tracing information access must maintain a high level of security and durability. In response to those needs, Hitachi plans to develop such a platform on the basis of its experience with the TWX-21 inter-corporate EC (electronic commerce) service.

Scope of project

Hitachi is taking on the challenge of "extra-company traceability" as well as "intra-company traceability" (see Fig. 2). In developing those solutions, we are implementing a system that makes best use of the merits of intra-company traceability and extra-company traceability by maintaining the consistency of the two.

Extra-company traceability refers to the traceability of product information across all types of industry, including producers, distributors, retailers and consumers (and the disposal industry in the case of recycling). Intra-company traceability refers to the capability of tracing product information within an enterprise (plant) in the series of production processes that includes parts procurement, production process, inventory management, and shipping.

Providing solutions

Beginning with introduction consulting, Hitachi provides a total solution that links together electron tagging, reader/writers and other such
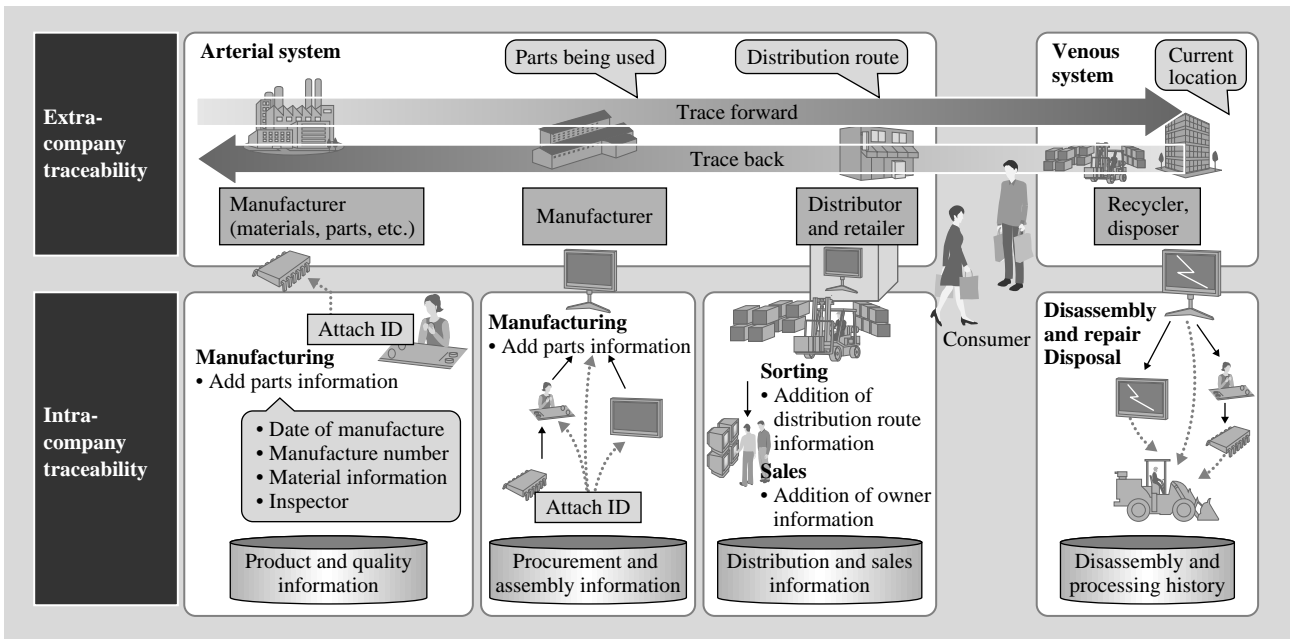
Fig. 2—Types of Traceability.
There is a need for collecting tracing information down to units of parts and production processes in units of
each enterprise in each type of industry in addition to the product distribution routes that span various types
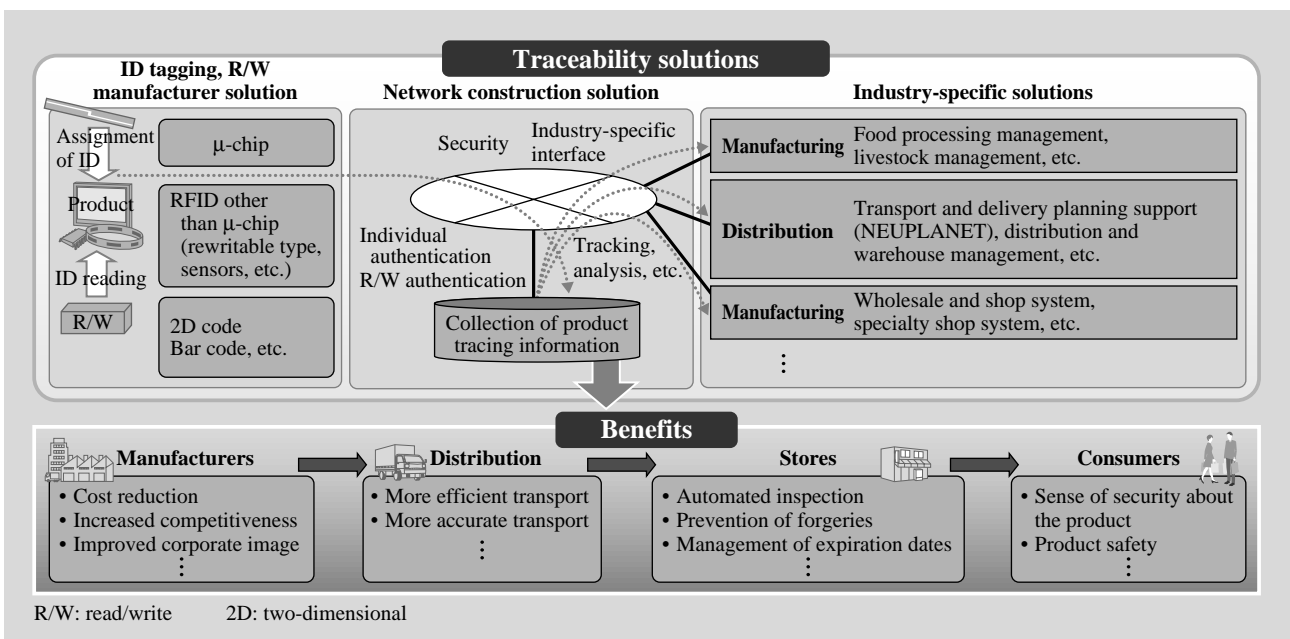*of industry.*

Fig. 3—Overall Picture of Traceability Solutions.
The traceability system provides a total solution that encompasses products, networks, and industry-specific
solutions.

products, network construction, and industry-specific applications. In this way, we have created a new added value based on individual authentication and product information tracking management (see Fig. 3).

For example, the consumer can check on the product manufacturer and the components used with information about the distribution and manufacturing processes published on the Internet. For food products, the freshness expiration date can be checked to give the consumer a high sense of comfort and safety.

Furthermore, enterprises can lower costs in production processes, increase efficiency in inventory and distribution management, and improve marketing to strengthen competitiveness. Companies can also improve their corporate images by promoting product safety.

Future of Traceability

For the future we have planned verification experiments and expect to expand the application range through feedback received from them, technological innovation, and standardization of ID systems. Examples include prevention of counterfeiting paper currency and the prevention of shoplifting at stores.

Furthermore, the media for checking tracing data can be expanded to include mobile phones and portable information terminals, making it possible to construct an environment in which authentication can be accomplished "anytime, anywhere".

FEASIBILITY OF SECURE MEMORY CARD

As a device that will be a key to widespread mobile commerce, Hitachi has developed the Secure Memory Card, a memory card that can safely store multiple application programs.

Overview of Secure Memory Card

The Secure Memory Card has both an IC card function and a memory card function (see Fig. 4). It conforms to the expanded specifications for memory cards used for mobile commerce that were announced by five companies in July 2002 (Matsushita Electric Industrial Co., Ltd., TOSHIBA CORPORATION, Ingentix GmbH & Co. KG/Ltd., SanDisk Corporation and Hitachi, Ltd.) and includes PKI technology.

The IC card function has a multi-application card OS (operating system) and conforms to the "GlobalPlatform*" specifications. That allows the secure installation of multiple independent application programs.

The memory card interface is independent of any particular specification, and can be used for various kinds of memory devices, such as multimedia cards and SD (secure digital) memory cards. That means the IC card function can be used with the memory
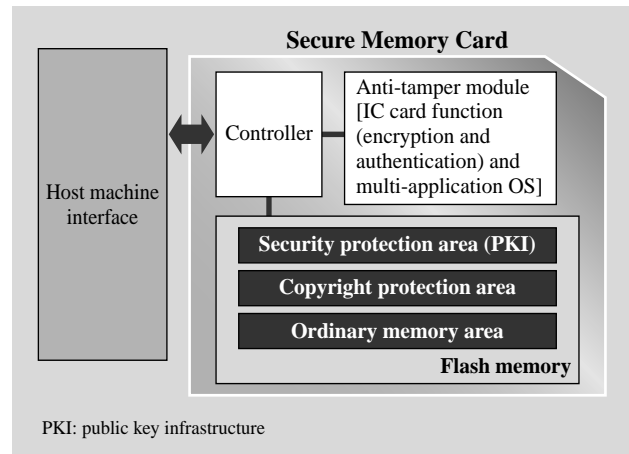
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* GlobalPlatform: A standardization body formed in 1999 by several dozen companies from around the world—joined by card issuers, card vendors, industrial groups, governments and technology enterprises, and other organizations—whose aim is promoting standards for the development of multi-function IC cards. GlobalPlatform is laying down and promoting specifications for so-called open-platform cards—namely, specifications that do not depend on the type of IC card.

Fig. 4—*Internal Structure of Secure Memory Card.*
The Secure Memory Card has PKI technology installed as standard and possesses both IC card and memory card functions.

card slot that various machines are equipped with rather than requiring a conventional dedicated IC card reader/writer. Integrating a large memory capacity and advanced security functions in a single card makes it possible to offer personal authentication as well as content protection. It also allows use with mobile phones, PDA (personal digital assistants), PCs and other such equipment.

Providing Solutions

Hitachi offers Secure Memory Card introduction and operation consultation, system construction and task program development, Secure Memory Card issuing systems and development tools to enterprises that issue Secure Memory Cards and provide services on them.

The applications that could be installed on the Secure Memory Card include
(1) settlement systems (credit cards, pre-paid cards, etc.),
(2) ticket systems (facilities entry, fixed-period tickets, coupons, etc.),
(3) ID systems (corporate, membership, public services, etc.),
(4) entertainment systems (content distribution, drive card, etc.).

In addition to the above applications, we believe that the possibilities for mobile commerce will be expanded by the creation of applications that make use of the advantages offered by the Secure Memory Card combined with individual identification by means of biometric authentication functions, etc.

Activities of MOPASS Consortium

Matsushita, Toshiba and Hitachi established the MOPASS Consortium in August 2002 for the purpose of disclosing Secure Memory Card specifications and studying new service technology that makes use of the Secure Memory Card. The consortium began with 26 member companies, and after two years the number of participants has grown to over 60 and more companies that are actively engaged in the activities.[4]

With Professor Mitsuru Iwamura of Waseda University Graduate School serving as advisor, we are setting up marketing section meetings in which applications and new business models that make use of the Secure Memory Card are studied and technical section meetings in which technology for implementation of systems that use the Secure Memory Card is studied.

Furthermore, there are plans for events and seminars to promote widespread adoption of the Secure Memory Card, and promotion of the "Secure Memory Laboratory," which conducts research on card application program development environment, testing and execution environment, machine rental, and other such activities.

Future Development

In the current situation, PCs and PDAs are gradually being equipped with slots for the Secure Memory Card. We believe that dominance over existing IC cards and the advantage of the compactness of memory cards are the key to future installation in mobile phones.

We also aim for expansion outside of Japan to Europe, Asia, the United States, and other regions.

CONCLUSIONS

We have described Hitachi's efforts toward creating a safer and more comfortable society by overcoming the problems the ubiquitous information society is facing.

In the future, as the ubiquitous information society is maturing, Hitachi will verify the fields in which traceability and the Secure Memory Card are effective, evaluate the effectiveness, and establish specific solutions for those fields. We also intend to maintain leadership in this field.

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