

# Development of a NICE-based Smart Card System Conforming to the GlobalPlatform Specifications

Sei Ijuin, Takahiro Yamamoto<sup>†</sup>, Shinichi Hirata, Katsuhiko Suzuki, Yoshinori Wada, Takumi Kashiwagi, and Nikkou Kaku

## Abstract

Multi-application smart cards are needed in financial fields, and the use of cards conforming to the GlobalPlatform specifications, which are the *de facto* standard for those fields, is spreading. In response to this need, we have made it possible to operate and manage GlobalPlatform cards with the NICE smart card information sharing platform.

## 1. Development background

In recent years, smart cards have been making inroads in credit and other financial services for purposes such as the prevention of card forgery. If it were possible to install application programs desired by the card user in a smart card, then a single card could handle multiple services, which would be more convenient for users. Such a card is called a multi-application smart card. Since the latter half of the 1990s, there have been standardization efforts with the aim of increasing the mutual compatibility of cards and application programs. In the finance industry, the

GlobalPlatform Consortium [1] was established in 1999, focusing on credit companies, but the NTT Group has also participated in it from the beginning. Progress has resulted in the standardization of a multi-application card architecture and command specifications for installing application programs in smart cards (Fig. 1). As a result, the GlobalPlatform specifications are becoming the *de facto* standard in financial fields. They will also be used in the third-generation cell phone UIM<sup>\*1</sup> and other such areas, so their field of application is broadening.

NTT Service Integration Laboratories has developed NICE (network-based IC card environment), a platform for operating and managing multiple-appli-

<sup>†</sup> NTT Service Integration Laboratories  
Musashino-shi, 180-8585 Japan  
E-mail: yamamoto.takahiro@lab.ntt.co.jp

\*1 UIM: The user identity module of a smart card records subscriber information issued by the cell phone company.

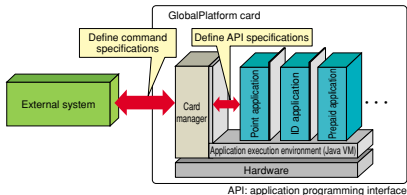


Fig. 1. GlobalPlatform card specifications.

cation smart cards [2], and ELWISE [3], a multi-purpose smart card that has a maximum memory capacity of 1 MB [4], [5]. Both NICE and ELWISE are widely used for the smart card systems of local governments in Japan. By adapting NICE to conform to GlobalPlatform specifications and combining it with ELWISE, we have made a complete system which extends their application fields to the field of finance.

## 2. Special features of NICE for GlobalPlatform card operation and management

NICE [2] is a platform that provides the card holder with functions for secure downloading of applications to multi-application smart cards when needed and secure deletion of applications that have been downloaded (Fig. 2). It has also been adapted to support the GlobalPlatform operation model. A number of other systems for operating and managing GlobalPlatform cards have been announced. The advantages of NICE compared with them are described below.

### (1) Management of smart card memory

The conventional GlobalPlatform card operation and management systems did not know if the smart card had sufficient memory available to store an application until they actually downloaded it to the card. NICE, however, systematically manages smart card memory use on the server side as well as on the cards themselves. Thus, available memory can be confirmed without actually executing the download processing. This makes it possible to accurately display to the card holder the applications that can be installed on the card, and thus eliminate pointless application downloads.

### (2) Operation by personal computer (PC) and the Internet

To perform the following operations, many of the other operation and management systems require special terminals or telecommunication lines. NICE, on the other hand, performs these operations securely with simply a general-purpose personal computer equipped with a card reader/writer, a Web browser, and an Internet connection.

- The card holder can download applications to a GlobalPlatform

form card and personalize<sup>\*2</sup> and delete them.

- The card issuer can stop and reinstate the use of an invalid GlobalPlatform card.

In this way, card holders can easily and securely receive requested services with their own cards, even in their own homes.

- (3) Smart cards other than GlobalPlatform specification cards can be operated and managed at the same time

Each card company has hundreds of thousands of holders of credit cards and cash cards, so it is difficult to change all of the cards at one time. Furthermore, some kinds of applications (for example, credit applications) can only be installed in the smart cards of a particular platform, so it may not be possible to install them in GlobalPlatform cards. Therefore, financial organizations must often operate and manage smart cards of different specifications (multiple types of smart cards) at the same time.

With conventional GlobalPlatform card operation and management systems, it is difficult to operate and manage multiple types of smart cards. NICE, however, has a card plug-in function<sup>\*3</sup> (Fig. 3) and a func-

\*2 Personalization: The setting of an individual's attribute information and service-specific information for a smart card.

\*3 Card plug-in function: A module that executes the processing that is dependent on the smart card specifications (the processing of commands for the smart card, etc.)

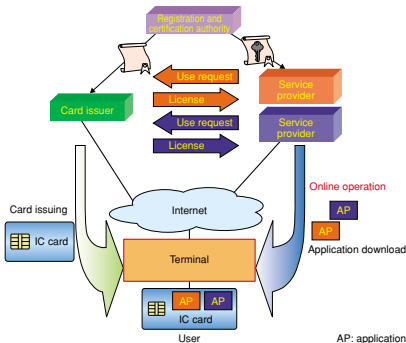


Fig. 2. The NICE concept.

tion for automatically recognizing the type of smart card, which make it possible to operate and manage different kinds of smart cards at the same time with the same system. For example, GlobalPlatform cards, NICE smart cards, and MULTOS<sup>9</sup> cards can all be operated and managed at one time with the same system. This gives the card issuer much more freedom when selecting smart cards. It also makes it unnecessary to construct and operate different operation and management systems for each type of smart card in parallel, so it reduces costs.

(4) Architecture for easy customization according to user requests

NICE comprises a “business operation system (OpS)” module, which provides the operator with an operation interface for issuing cards, stopping their use, and so on, and a “core” module, which executes operations and performs card operation and management. This architecture allows efficient changing of the operation screen according to user requests and customization for creating an interface for importing data from other systems, because only the business OpS needs to be changed.

(5) Low system construction cost

The NICE servers can run on Solaris or Windows. Even when such low-end server machines are used, 100,000 or more cards can be operated and managed. Furthermore, a smart card reader/writer can connect to a general-purpose PC. Thus, a system can be economically constructed.

### 3. Advantages of using ELWISE as a GlobalPlatform card

ELWISE has a card manager (CM) that supports the GlobalPlatform specifications and a Java virtual machine (VM). It provides the features described below [5]. These features have not previously been available with GlobalPlatform cards (Fig. 4).

<sup>9</sup>A MULTOS: Multi-application smart card specifications set by the MAOSCO consortium that serve as the *de facto* standard for the financial industry. <http://www.multos.com/>

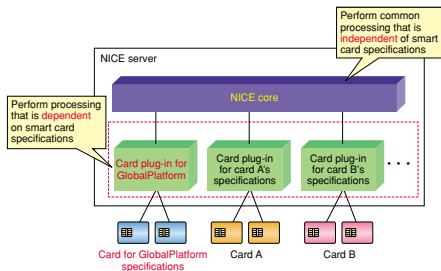


Fig. 3. Smart card management by means of card plug-ins.



Fig. 4. GlobalPlatform card (ELWISE).

- (1) The world's first card recognized as conforming to the GlobalPlatform V2.1 specifications.
- (2) Support for the world's largest memory capacity (1 MB).
- (3) Greatly improved operability for electronic money, etc. through support for contactless interfaces.
- (4) Support for C language programs which achieves wide applicability where a quick response is required, such as electronic tickets and transportation applications.

### 4. Future development

To further increase the convenience and efficiency of GlobalPlatform card operation and management with NICE, we will continue with work on supporting card issuing script specifications, a re-issuing function that can also restore private card holder data, and other such improvements.

## References

- [1] GlobalPlatform, <http://www.globalplatform.org>
- [2] S. Yamamoto, R. Toji, S. Hirata, and E. Niwano, "Smart Card Information Sharing Platform: NICE," NTT Technical Journal (in Japanese), Vol. 13, No. 12, pp. 14-18, 2001.  
R. Toji and Y. Wada, "A Multi-card Architecture for Smart Card Management Systems," NTT Technical Review, Vol. 1, No. 6, pp. 70-75, 2003.
- [3] M. Yoshizawa, H. Unno, T. Fukunaga, and H. Ban, "ELWISE - A Super Multi-purpose Smart Card," NTT Review, Vol. 14, No. 1, pp. 23-27, 2002.
- [4] "First Multi-application Smart Card Recognized as GlobalPlatform Compliant—Dramatically Increases Application and Data Storage to Enable True Multi-application Usage," NTT Technical Review, Vol. 2, No. 1, pp. 98-100, 2004.
- [5] GlobalPlatform Newsletter, Oct. 16, 2003. [http://www.globalplatform.org/uploads/Newsletter\\_Oct2003.pdf](http://www.globalplatform.org/uploads/Newsletter_Oct2003.pdf)

**Sei Ijuin**

Senior Research Engineer, Smartcard Service Promotion Project, NTT Service Integration Laboratories.

He received the B.E. and M.E. degrees in electrical engineering from Waseda University, Tokyo in 1977 and 1979, respectively. In 1979, he joined Nippon Telegraph and Telephone Public Corporation (now NTT), Tokyo, Japan. He is engaged in the development of NICE.

**Yoshinori Wada**

Smartcard Service Promotion Project, NTT Service Integration Laboratories.

He received the B.E. and M.E. degrees in electric power engineering from Musashi Institute of Technology, Tokyo in 1995 and 1997, respectively. In 1997, he joined NTT Software Laboratories, Tokyo, Japan. He is a member of IPSJ.

**Takahiro Yamamoto**

Smartcard Service Promotion Project, NTT Service Integration Laboratories.

He received the B.E. degree in electrical engineering and the M.E. degree in information engineering from Nagoya University, Nagoya in 1983 and 1989. He joined NTT in 1989. He is engaged in the development of NICE.

**Takumi Kashiwagi**

Smartcard Service Promotion Project, NTT Service Integration Laboratories.

He received the B.E. degree in electrical & electronics engineering from Sophia University, Tokyo in 1997 and joined NTT soon after. He is now actively engaged in the development of smart card operating systems.

**Shinichi Hirata**

Smartcard Service Promotion Project, NTT Service Integration Laboratories.

He received the B.E. degree in mathematics from Hokkaido University, Hokkaido in 1990. He joined NTT in 1990. He is engaged in the development of NICE.

**Nikkon Kaku**

Smartcard Service Promotion Project, NTT Service Integration Laboratories.

He received the B.E. and M.E. degrees in industrial and management systems engineering from Waseda University, Tokyo in 1996 and 1998, respectively. He joined NTT in 1998. He is engaged in the development of smart card operating systems.

**Katsuhiko Suzuki**

Research engineer, NTT Service Integration Laboratories.

He joined NTT in 1995 and is engaged in the development of a smart card operating system. He is a member of the Information Processing Society of Japan (IPSJ).