Type-B Smart Card Mobile Phone Production Activities

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Abstract

In close collaboration with NTT DoCoMo, the NTT Department III Smart Card Business Producer Team and NTT Service Integration Laboratories are making excellent progress in developing a miniSD-format smart card that complies with the ISO 14443 Type-B standard and a mobile phone that supports this card. This article introduces the Type-B smart card mobile phone and outlines production and marketing activities as we approach the commercial launch of this new product.

1. Position of the Type-B smart card mobile phone

The primary mission of the Smart Card Business Producer Team is to support the expansion of the NTT Group's smart card business by utilizing the ISO 14443 Type-B standard compliant dual-interface multipurpose smart card ELWISE [1] and network-based platform for multipurpose smart cards NICE (network-based IC card environment) [2] developed by NTT Laboratories. Because ELWISE and NICE have already secured the predominant share of the government market, production targets have been shifted to the consumer market such as financial, transport, and employee-ID applications.

Building on a close collaboration between NTT (NTT Department III Smart Card Business Producer Team and NTT Service Integration Laboratories) with its Type-B standard compliant contactless smart card and smart card platform technologies and NTT DoCoMo with the largest share of the mobile phone market in Japan, this project aims to create new profit opportunities for the NTT Group with the launch of a highly innovative new product.

2. Type-B chip-embedded smart card mobile phone

The key features of the Type-B smart card mobile phone are shown in **Fig. 1**. This phone consists of a miniSD-format smart card [3] with a dual-interface computer chip (a Type-B standard compliant contactless type interface and a contact type interface enabling communication with the mobile phone via the miniSD controller) and a mobile phone with built-in antenna and a slot to accommodate the miniSD card (SD: secure digital).

This marriage of a contactless smart card inserted into a mobile phone has advantages for both elements: the contents of the smart card can be accessed via the display and keyboard on the mobile phone, and applications and/or data can be downloaded to the smart card practically anywhere by connecting the mobile phone to the i-mode network. Meanwhile, the mobile phone benefits from the smart card, which opens up many additional real-world convenient applications through the proximity wireless interface and the ability of the computer chip to securely store data such as encryption keys in the tamper-proof memory part of the chip.

The computer chip embedded in the new miniSD smart card that is now under development is NTT's own ELWISE chip, so this smart card will inherit the superior performance of the ELWISE smart card, including a large (1 MB) tamper-proof flash memory, dynamic application loading/deleting functions after card issuance, and strong security functions based on public-key encryption.

Finally, the fact that the miniSD smart card can be readily inserted into and removed from the mobile phone means that data can be easily transferred or

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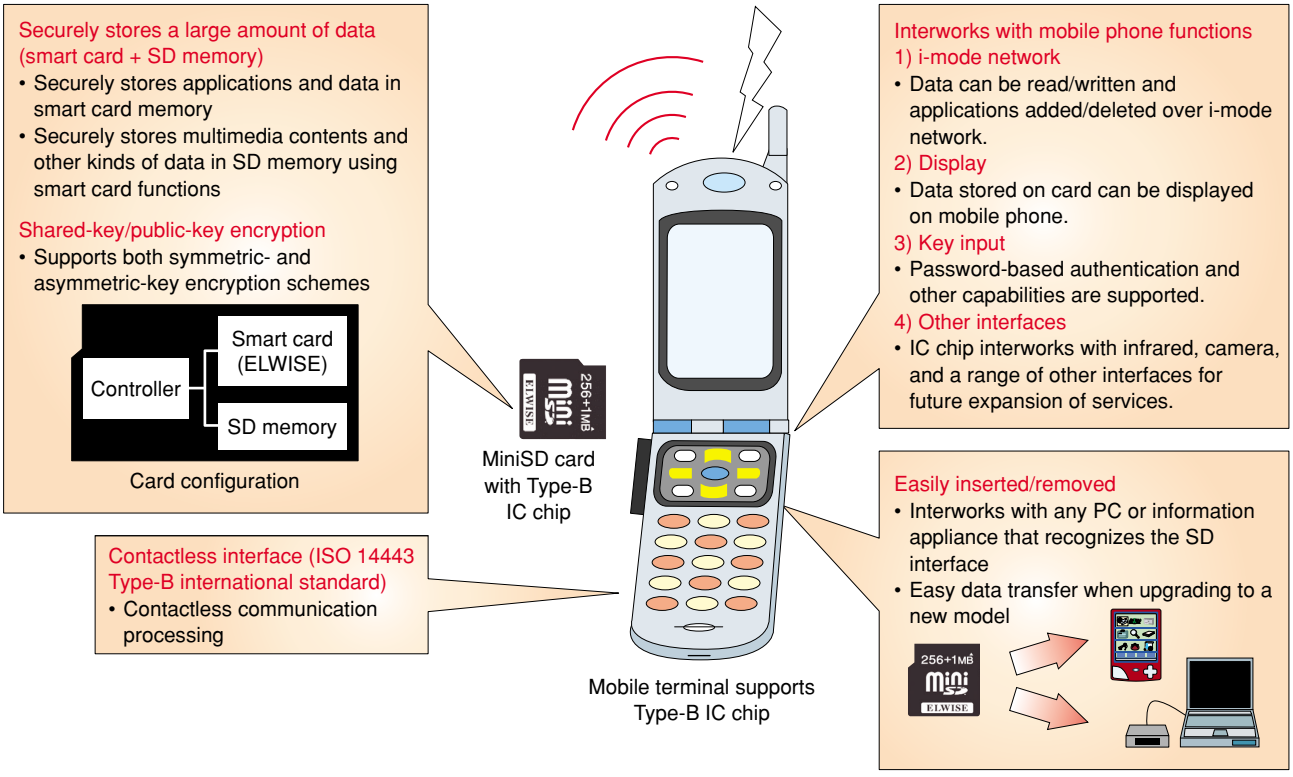

Fig. 1. Key features of Type-B smart card mobile phone.

exchanged between the mobile phone and a PC or an information appliance as long as the PC or the device is also equipped with an SD card slot supporting the Mobile Commerce Extension Specification.

3. Differences between the Type-B and the i-mode FeliCa mobile phone

A similar product to the Type-B smart card mobile phone is the i-mode FeliCa mobile phone [4] that was launched by NTT DoCoMo in July 2004. **Table 1** compares these two mobile phones. The main differences are in the computer chips and how the chips interface with the mobile phones.

The computer chip used by the i-mode FeliCa mobile phone is limited to a proprietary FeliCa-based chip for mobile phones developed by Sony, while as noted in Section 2, the Type-B smart card mobile phone will be able to use any miniSD smart card with an embedded Type-B standard computer chip. Note that this latter type of card is advocated by the MOPASS Consortium [5], and Matsushita Electric Industrial Co. is also developing a miniSD-format smart card of this type called “smartSD” now. The fact that all aspects of the smart cards used in i-mode FeliCa mobile phone are limited to the proprietary FeliCa scheme—the amount of nonvolatile memory, the OS of the card, the encryption scheme, and so on—ensured smooth deployment, which enabled the i-mode FeliCa mobile phone service to be introduced to the market very quickly. In contrast, the Type-B smart card mobile phone is more flexible in allowing service providers and system vendors to choose any standards-compliant computer chip and implementation tailored to the particular service that they want to offer.

Another major difference between the two mobile phones is in the way the computer chips are implemented in the mobile phones. The chip is permanently mounted on a board inside the i-mode FeliCa mobile phone, while a chip-embedded miniSD smart card is inserted into a miniSD slot on the Type-B smart card mobile phone. There are advantages associated with both of these approaches. The onboard chip approach provides better throughput performance and is better optimized for transport systems, convenience store payment systems, and other services where speed is a high priority. On the other hand, the miniSD slot approach makes it much easier to migrate applications and data when upgrading to a

Table 1. Comparison between the Type-B smart card mobile phone and i-mode FeliCa mobile phone.

	Type-B smart card mobile phone	i-mode FeliCa mobile phone
Mounting method	Removable miniSD card with embedded computer chip is inserted into slot in the mobile terminal.	Computer chip is permanently mounted onto a board installed in the mobile terminal.
Computer chip	Dual-interface ELWISE chip tailored for miniSD smart cards (now under development by NTT)	FeliCa-based chip for mobile devices
Communication standards	ISO 7816 contact-type smart card standard and ISO 14443 Type-B contactless-type smart card standard	ISO/IEC 18092 inter-device communication standard
Card operating systems	JavaCard (program type), JICSAP (file type), native OS, etc.	FeliCa OS (file type)
Card platforms	GlobalPlatform and NICE	FeliCa-specific
Security	Symmetric-key and asymmetric-key encryption	Symmetric-key encryption
Nonvolatile memory capacity	32 KB to 1 MB (depending on the chip)	5 KB

JICSAP: a file-type smart card OS standardized by Japan IC Card System Application Council

new model, will support an ever expanding range of new services linked to SD memory and computer chips, and will interwork with PCs and information appliances equipped with SD slots in the future.

4. Production activities

As mentioned earlier, this project is not simply a case of commercially deploying an existing technology or product of NTT Laboratories, but rather an initiative to produce an innovative commercial product that can create new business opportunities by combining the technologies and products of both NTT DoCoMo and NTT.

4.1 Project planning and technology assessment

Production activities on the Type-B smart card mobile phone began in April 2003 with a collaborative service feasibility study involving the producers and the NTT DoCoMo i-mode Planning Department. NTT DoCoMo was already committed to the i-mode FeliCa service project at the time, but based on a market survey by an independent survey firm and other data indicating the future market potential of Type-B standards-based smart card mobile phone services, we began development work on the Type-B smart card mobile phone. Once a target date for commercialization was decided, plans were laid for technology assessment, prototype development, and field trials. Meanwhile, the general features of the new service—FOMA [4], the slot approach, the miniSD interface, and so on—were decided in discussions between the two companies.

A collaborative research group consisting of NTT DoCoMo Customer Equipment Development Department and NTT Service Integration Laboratories was formed, and work began in September 2003 to develop a first prototype FOMA terminal with a built-in antenna and prototype ELWISE chip board for feasibility assessment.

4.2 Prototype development

Both participants achieved their target objectives in 2003 and the feasibility assessment results were favorable, so in 2004 we developed a prototype FOMA terminal, ELWISE-embedded miniSD smart card, and a platform for issuing and managing the smart cards for field trials. To estimate the commercial-level specifications in field trials, the prototypes were based on specifications that closely approximated the actual commercial-level specifications.

Because the Type-B smart card mobile phone is a kind of service platform supporting a diverse range of services, it was important for us to envision the full range of potential services—how the mobile phone might be used—and make the specifications as open-ended, flexible, and unrestricting as possible. The NTT Laboratories research team and the producers approached this task by analyzing usage scenarios for e-money, tickets, and other envisioned services using use-case analysis methods, defining the functional requirements of the Type-B smart card mobile phone, and then investigating the mobile terminal and ELWISE-embedded miniSD smart card in terms of how the specifications and functional requirements could best be implemented.

While these efforts were in progress, the producers analyzed functional requirements and evaluated the appropriateness of basic specifications from the smart card business perspective in cooperation with

NTT Communications, which is expanding its smart card business based on ELWISE and NICE. The requirements that existing ELWISE card applications and terminals be capable of being shared, for example, were dictated from a business point of view.

Once a draft proposal for these functional requirements and key specifications was worked out, the scope of prototype implementation was determined considering the time needed to implement the prototypes and relative priorities.

4.3 Commercial deployment study

While developing the prototypes, we also began studying commercialization prospects in 2004. Thinking in terms of commercial deployment, we considered what new services might be opened up by the Type-B smart card mobile phone and what their market prospects might be. NTT Communications joined us for this study because they are planning a new solution business and a platform business using the Type-B smart card mobile phone.

Based on a market analysis focusing on market scale, potential of the Type-B smart card approach, potential business expansion of NTT Group companies, and ability to interwork with PCs and other information appliances, we identified four key service areas where we believe the Type-B smart card mobile phone will have a major impact. These are credit cards, various government applications, workplace-related applications, and contents distribution. We are continuing to explore potential uses and markets for the Type-B smart card mobile phone focusing on these four key areas. Although we have not started to investigate the contents distribution area, we have received numerous requests for consideration and testing from government agencies and from service providers regarding the other key service areas.

An important part of making people aware of new services is to promote them at trade shows and exhibitions. The photograph in **Fig. 2** shows the ELWISE chip-embedded miniSD smart card and mobile phone being exhibited at CEATEC (Combined Exhibition of Advanced Technologies) JAPAN in October 2004 at the booths of both the NTT Group and NTT DoCoMo. They generated an enormous amount of interest among visitors and received considerable coverage by the media.

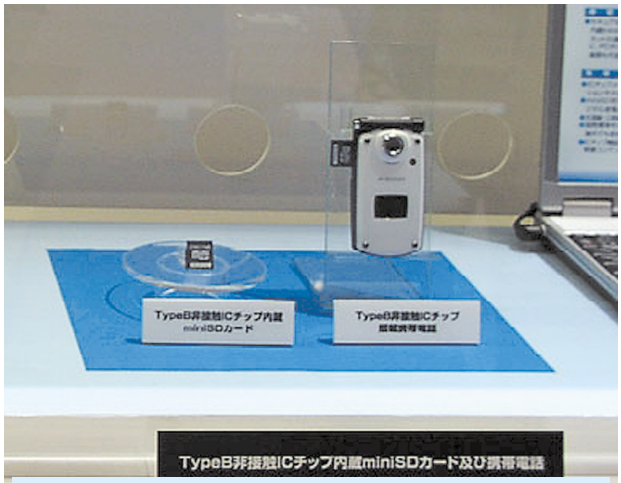

Fig. 2. Exhibit at CEATEC JAPAN 2004.

5. Current status and future issues

Development of the prototypes is proceeding smoothly on the whole, and a number of demonstrations and field trials are planned for 2005 in cooperation with government agencies and service providers. Meanwhile, we are also giving careful consideration to the timing of commercial deployment and business arrangements to ensure the deployment goes smoothly. Commercialization hinges on two key issues.

(1) Scheme for issuing/managing the chip-embedded miniSD cards

Typically, the ownership of smart cards is retained by the card issuer and the cards with operating programs and applications are essentially lent to users. In contrast, conventional memory cards are sold as commodities, and the purchaser can use the storage on the card however he or she wants. The computer chip-embedded miniSD cards are fundamentally different because they combine both computer chip and memory on the same card. Schemes for issuing and managing the new smart cards have yet to be worked out.

(2) Killer service for Type-B smart card mobile phone

Since the Type-B smart card mobile phones are being positioned as a kind of multipurpose device that can support a host of different services, it would be very desirable if we could come up with a “killer service” that would have immediate and widespread appeal that would open up and drive a mass consumer market. Considering the four key service areas, we believe that the content storage capability of the SD memory connected with security functions of the computer chip and the ability to interwork with PCs and information appliances has the greatest potential for fueling mass consumer demand for the Type-B smart card mobile phones.

Since the start of this project, there has been a growing awareness of the great convenience of computer chip-embedded smart card mobile phones in Japan as people have become familiar with the i-mode FeliCa mobile phone service. Meanwhile, developments in the MOPASS camp—an announcement by Hitachi Ltd. and Matsushita Electric Industrial Co. of a computer chip-embedded memory card, the announcement by Vodaphone of a prototype Type-B smart card mobile phone, and so on— have also paved the way and increased the likelihood of a successful commercial launch of the Type-B smart card mobile phone. We are now continuing to refine and test the ELWISE-based miniSD smart card and mobile phone and assess the market potential as we approach a commercial launch for the new service.

References

[1] 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.

[2] R. Toji, Y. Wada, S. Hirata, and K. Suzuki, "NICE —A Network-based Platform for Multi-application Smart Cards," NTT REVIEW, Vol. 14, No. 1, pp. 13-19, 2002.

[3] http://www.sdcard.com/

[4] http://www.nttdocomo.co.jp/english/p_s/service/index.html

[5] http://www.mopass.info/english/index.html

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