

Trends in ISO/IEC Standardization of IC Card Technology

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Abstract

This article describes trends in the standardization of technology related to IC cards (cards containing integrated circuits), focusing on ISO/IEC activities (ISO: International Organization for Standardization, IEC: International Engineering Consortium). It also describes NTT's contributions to those activities.

1. Introduction

IC cards, which incorporate IC (integrated circuit) chips, are overtaking and replacing previous cards that used other data storage methods. The card, reader/writer, and terminal that constitute a card system and the software running on those devices are usually supplied by multiple vendors, so maintaining compatibility is indispensable. In recent years, the use of one card for multiple services has gradually increased, so the standardization of technical specifications has become more and more important for interoperability.

2. Relationships among international and Japanese organizations

The standardization organizations concerned with IC card technology are shown in **Fig. 1**. The fields of electronics, non-electronics, and communications are handled by IEC (International Engineering Consortium) [1], ISO (International Organization for Standardization) [2], and ITU (International Telecommunication Union), respectively. IC card technology is categorized as information technology, so a Joint Technical Committee (JTC) that extends across both ISO and IEC has been formed to lead international standardization in that field. 17

subcommittees (SCs) have been formed within ISO/IEC JTC1. Matters related to IC cards are handled by SC17. It comprises eight working groups (WGs) that deal with elemental technology and specific applications. SC17 also cooperates with other relevant committees (e.g., JTC1/SC31 and JTC1/SC37).

In Japan, the Japanese National Committee of SC17 has been established as a counterpart to JTC1/SC17. The subordinate WGs have about the same structure as those of the international organization. They discuss the drafts proposed to JTC1/SC17 by various countries and handle the submission of proposals from Japan to the international standards organizations.

3. International standards and Japanese standards

Under the agreement with WTO/TBT (World Trade Organization, Technical Barriers to Trade), new Japanese specifications should conform to any existing international standard specifications established by ISO, etc. Japanese Industrial Standard (JIS) specifications concerning IC cards are also in principle set to be consistent with ISO/IEC specifications. The process of setting JIS specifications is illustrated in **Fig. 2**. First, the JIS proposal drafting body draws up draft JIS specifications that correspond to ISO/IEC specifications. The draft then goes to the Japanese Standards Association for review and revision, after which it is submitted to the Japanese

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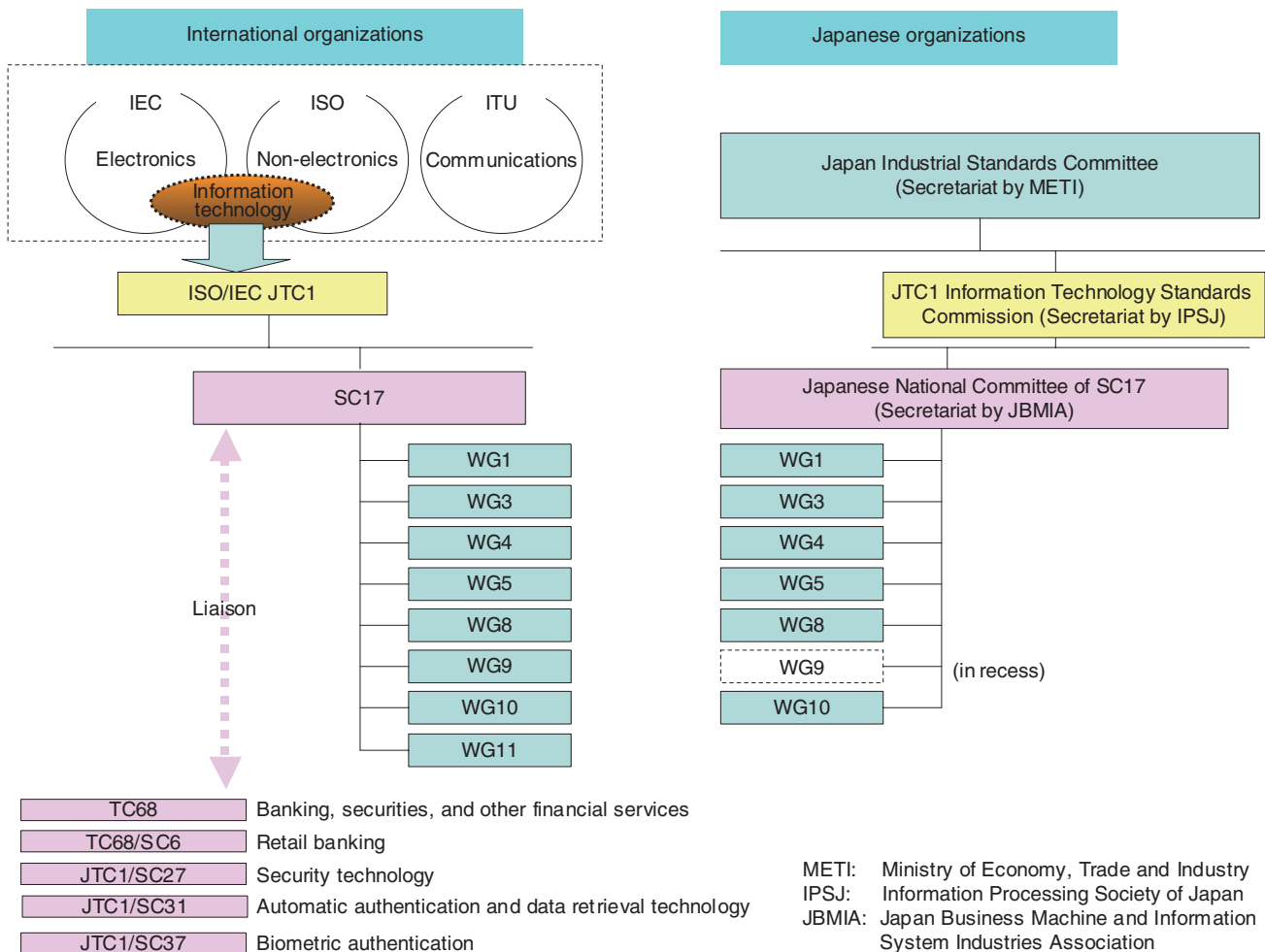


Fig. 1. IC card technology standardization organizations.

Industrial Standards Committee (JISC). Next, the JIS draft is discussed by JISC and sent to the appropriate Ministry for enactment (for IC card technology, this is the Ministry of Economy, Trade and Industry).

The primary leader of IC card system standardization activities in Japan is JICSAP (Japan IC Card System Application Council) [3]. JICSAP not only drafts JIS proposals, but also sets the JICSAP IC card specifications for IC card implementation based on the circumstances of use in Japan. To improve the interoperability of IC cards from different manufacturers, JICSAP drafted a JIS proposal that included the JICSAP IC card specifications and the IC card specifications used in Japan for train passes and other such purposes. In 2005, the proposal was adopted as the JIS X 6319 series.

NTT has greatly contributed to JICSAP activities related to the drafting of JIS proposals and setting of JICSAP IC card specifications by providing

Chairpersons and Editors of the WGs.

The established international standards are, in principle, reviewed every five years. The JIS specifications are also revised accordingly.

4. Overview of SC17 WG activities

The WG topics and international standard specifications are listed in **Table 1** and the activities of each WG are summarized below [4].

WG1 deals with physical characteristics and physical testing methods of identification cards (common to plastic, magnetic, and IC media).

WG3 deliberates on the specifications of machine readable travel documents (referred to as e-passports). The e-passport specifications are based on the specifications established by the ICAO (International Civil Aviation Organization) and have become the international standard.

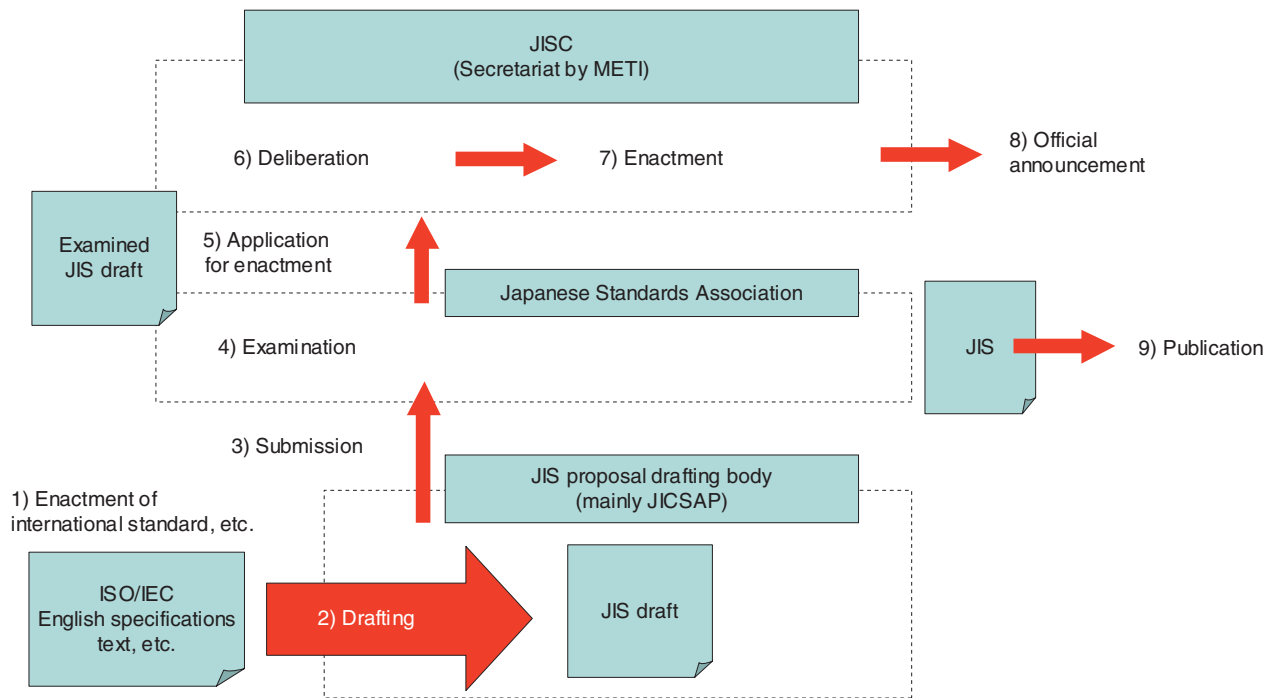


Fig. 2. Process up to JIS enactment (IC card specifications).

Table 1. Main international standards deliberated on by JTC1/SC17.

Working Group	Main topics	ISO/IEC no.
WG1	Physical characteristics and test methods	7810: ID cards
		7811: Recording technique
		10373-1: Identification cards—Test methods (general characteristics tests)
		10373-2: Identification cards—Test methods (magnetic stripe technologies)
		15457: Thin flexible cards
WG3	Machine readable travel documents	7501: Identification cards—Machine readable travel documents
WG4	IC cards with contacts	7816: Identification cards—Integrated circuit cards
		10373-3: Test methods—Integrated circuit cards with contacts and related interface devices
		24727: Integrated circuit card programming interfaces
WG5	Card issuer numbers, etc.	7812: Card issuer numbers for financial transaction cards
WG8	Contactless IC cards	10536: Identification cards—Contactless IC cards (closely coupled cards)
		14443: Identification cards—Contactless IC cards (proximity cards)
		15693: Identification cards—Contactless IC cards (vicinity cards)
		10373-6: Test methods—Proximity cards
		10373-7: Test methods—Vicinity cards
WG9	Optical memory cards	11694: Optical memory cards and devices
		10373-5: Test methods (optical memory cards)
WG10	Motor vehicle drivers licenses and related documents	18013: Identification cards—Motor vehicle drivers licenses
WG11	Biometrics	24787: Personal authentication—On-card matching

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WG 4 deals with the full range of specifications for IC cards that have contacts (pins), from physical specifications such as pin position to upper-layer matters like commands and application downloading.

WG5 handles specifications concerning the number identifying the issuer of financial transaction cards. The central task is revision of existing specifications.

WG8 generally deliberates on the communication specifications of contactless IC cards. Current activities center around reviewing existing specifications.

WG9 deliberates on optical memory card specifications. However, as companies in Japan are cutting back on or ceasing to use optical cards, the domestic committee is in recess.

WG10 deliberates on specifications for the items on the surface of the driver's license, physical characteristics such as surface layout, data structure, and other electronic recording methods, and specifications for encryption, etc.

WG11 studies the application of biometric authentication technology to IC cards. In Japan, the Japanese National Committee of WG 4 deliberates these specifications.

The status of activities of two of these WGs are explained below.

4.1. SC17/WG4 activities

SC17/WG4 studies the physical characteristics, transfer protocols, IC card common command functions (including security functions), biometric authentication, and terminal middleware of IC cards that operate through contacts.

Previously, the ISO/IEC 7816 series was a main subject of deliberation, but recently WG4 has also taken up other topics. Two that deserve particular mention are ISO/IEC 7816-13 IC and ISO/IEC 24727. These cover card application downloading methods for response to the demand in recent years for multi-use IC cards (7816-13) and the interface for terminal applications to access the IC card (24727).

ISO/IEC 7816-13 has become the international standard, with the existing major standards (MULTOS [5], GlobalPlatform [6], and NICSS [7]) having a major effect on specifications concerning commands for managing multiple applications (IC card application download and installation, etc.).

MULTOS is being studied by MAOSCO, an international consortium of companies from various industries formed to promote widespread use of the MULTOS specifications and manage their

development. MAOSCO is operated and managed by the British firm MAOSCO, Ltd. under Master Card International, Inc.

GlobalPlatform is an organization founded on VISA Open Platform technology. The most recent specifications (GlobalPlatform Card specification v2.2) can implement the NICSS and MULTOS systems as well as the previous GlobalPlatform system [8].

NICSS (Next Generation IC Card System Study group) is an organization established to develop and promote a common platform for next-generation IC cards in Japan's public sector. The objectives of NICSS are common specifications for IC cards to be introduced in relevant government ministries and the sharing of information with those ministries. That system has had a major effect on administration projects in Japan.

NTT developed PKI-based multiple application management technology (PKI: public key infrastructure) [9] and has made important contributions to the NICSS-Framework and Reference Specifications, eEurope Smart Card Charter Standard [10], and the most recent GlobalPlatform card specifications (GlobalPlatform Card Specification v2.2) [11] towards the construction of an open IC card system. These activities have affected decisions concerning the ISO/IEC 7816-13 specifications.

An organization that has had a strong influence on the interface specifications under deliberation as the ISO/IEC 24727 series is the National Institute of Standards and Technology (NIST). NIST has set specifications for the Government Smart Card Interoperability Specification (GSC-IS) terminal middleware and has actively participated in deliberations on the ISO/IEC 24727 series, so it has a major influence in this area.

Comité Européen de Normalisation (CEN) [12] is another standardization organization that influences ISO/IEC activities.

The JIS specifications that correspond to the ISO/IEC 7816 series currently have numbers divided according to part, but the plan for the future is to integrate the order according to the final specifications, after revisions have been completed by JTC1, as the JIS X 6320 series (Table 2).

4.2. SC17/WG8 activities

International standards concerning contactless IC cards are categorized into three types according to the distance at which they are operate: closely coupled (about 2 mm between IC card and reader/writer),

Table 2. International standards deliberated on by SC17/WG4.

ISO/IEC no.	Parts (year of the latest publication)	Description	Current state	Corresponding existing JIS specifications (year of the latest publication)	Corresponding existing JIS specifications
					Planned for enactment as JIS X 6320 series
7816	Part-1 (1998)	Physical characteristics	IS	JIS X 6303 (2000)	Planned
	Part-2 (1999)	Dimensions and locations of the contacts	Revised FCD		Planned
	Part-3 (2006)	Electrical interface and transmission protocols	IS	JIS X 6304 (2000)	In progress
	Part-4 (2005)	Organization, security and commands for interchange	IS	JIS X 6306 (1995)	In progress
	Part-5 (2004)	Registration of application providers	IS	Obsolete	Enacted as JIS X 6320-5 (2006)
	Part-6 (2004)	Interindustry data elements for interchange	IS	Obsolete	Enacted as JIS X 6320-6 (2006)
	Part-7 (1999)	Interindustry commands for Structured Card Query Language (SCQL)	IS	None	None
	Part-8 (2004)	Commands for security operations	IS	Obsolete	Enacted as JIS X 6320-8 (2006)
	Part-9 (2004)	Commands for card management	IS	Obsolete	Enacted as JIS X 6320-9 (2006)
	Part-10 (1999)	Electronic signals and answer to reset for synchronous cards	IS	None	None
	Part-11 (2004)	Personal verification through biometric methods	IS	None	In progress
	Part-12 (2005)	USB electrical Interface and operating procedures	IS	None	Planned
	Part-13 (2007)	Commands for application management in a multi-application environment	IS	None	Planned
	Part-15 (2004)	Cryptographic information application	IS	None	Enacted as JIS X 6320-15 (2006)
10373	Part-3 (2001)	Test methods (IC cards with contacts)	IS	JIS X 6305-3 (2002)	
24727	Part-1 (2007)	Architecture	IS	None	
	Part-2	Generic card interface	FCD	None	
	Part-3	Application interface	CD	None	
	Part-4	API administration	CD	None	
	Part-5	Testing procedures	Discussion begun	None	

USB: universal serial bus
 API: application programming interface
 WD: working draft
 CD: committee draft

FCD: final committee draft
 FDIS: final draft of international standard
 IS: international standard

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proximity (about 10 cm), and vicinity (about 70 cm). Of those types, specifications for the proximity type, which is used for the resident card, IC driver's license, and other such applications were set as the ISO/IEC 14443 series in 2001 [13].

As many IC cards and reader/writers complying with ISO/IEC 14443 have been widely deployed, a large demand for their interoperability has arisen. Therefore, the compatibility of IC cards and reader/writers is an important factor in the revision, and the parameters specified in the standard are being revised to allow for a little margin in their values. Test methods for proximity cards are also under revision.

In addition to the existing standards, two other specifications are ready to be deliberated: specifications for high-speed communication at 1.6 Mbit/s or more and specifications for correctly reading multiple IC cards simultaneously, such as when electronic visas attached to e-passports.

The current state of progress in the revision of ISO/IEC specifications by SC17/WG8 is shown in **Table 3**. Revised versions of the corresponding JIS specifications are also planned and will be enacted in parallel with the publishing of the international standards.

Table 3. Status of SC17/WG8 deliberation on proximity IC cards.

ISO/IEC no.	Parts (year of the latest publication)	Description	Current state	Corresponding existing JIS specifications (year of the latest publication)
14443	Part-1 (2000)	Physical characteristics	Revised FCD	JIS X 6322-1 (2001)
	Part-2 (2001)	Radio frequency power and signal interface	Revised CD	JIS X 6322-2 (2001)
	Part-3 (2001)	Initialization and anticollision	Revised CD	JIS X 6322-3 (2001)
	Part-4 (2001)	Transmission protocol	Revised CD	JIS X 6322-4 (2002)
	Part undecided	Ultrahigh bit rates	Discussion begun	None
	Part undecided	Multiple proximity IC cards	Discussion begun	None
10373	Part-6 (2001)	Test methods—Proximity cards	Revision discussion begun	JIS X 6305-6(2001)

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5. Conclusion

We described trends in the standardization of technology related to IC cards and NTT's contribution to that process, focusing on ISO/IEC and related organizations. Through participation in these kinds of standardization activities, NTT is working to realize an information infrastructure that is both open and interoperable to allow anyone the carefree, secure, and easy use of electronic services anywhere in the world.

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