

Launch of Nationwide Interoperable Transport System IC Cards

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Introduction

Back in 1987, at the breakup and privatization of Japanese National Railways (JNR), passengers purchased cardboard tickets that were punched manually by railway staff at ticket wickets before boarding trains. Later, automatic gates were introduced for magnetic tickets, but passengers using commuter season tickets faced extra tasks, like removing tickets from cases, wallets, and purses, passing the ticket through the gate and then putting it away again. In addition to all this, customers had to look up destination fares on fare tables before purchasing tickets and needless to say, all purchases at platform kiosks were cash only.

Some 15 years later, the first appearance of IC cards in greater Tokyo in 2001 radically changed how trains were used and products were purchased. Passengers with IC commuter tickets or IC cards could leave their tickets or cards in the case while they simply touched the automatic gates with the card to ride the transport system without glancing at a fare table. Today, using IC cards like Suica and PASMO for riding trains and buses as well as for purchasing in the many convenience stores and other shops in and out of stations has become second nature for users and the great convenience of these cards has made them indispensable components of our social infrastructure.



IC card in action at automatic gate

(JR East)

The 23 March 2013 launch of the Nationwide Mutual Usage Service for IC cards from 10 operators of transport systems nationwide allows passengers with any single card from these operators to ride all trains and buses in areas participating in the service, as well as to purchase goods using the card as e-money (excluding PiTaPa).

This article discusses the evolution of IC cards from their inception, through the early partial mutual usage service, up to the comprehensive Nationwide Mutual Usage Service.

History of IC Cards in Transport System

Birth of IC cards

The first card to be introduced was Suica, a contactless IC card conceived by East Japan Railway Company (JR East) following the 1987 JNR breakup and privatization. Fundamental R&D continued based on experimental cards developed by three Japanese manufacturers between 1988 and 1989. However, development work with the manufacturers was on the verge of being discontinued at one point.

JR East was planning to automate gates and started introducing a magnetic ticketing system from 1990 with the aim of modernizing station business mainly in Greater Tokyo. Back then, IC card R&D was in the early stages and manufacturers warned that they would stop development because they could not see any practical future as transport tickets because such cards were not part of the introduced automated system. Nevertheless, the department in charge of R&D decided that IC cards had future potential across all fields and continued development in a low-profile manner.

Three field trials were held with many revisions between each trial. Meanwhile, general IC card technology was advancing and good results were being achieved by the third trial in 1997, favouring the possible consideration of actual introduction of an IC card-based system from 1998. By now, 10 years had passed since introduction of the previous magnetic ticketing system, so it was time to upgrade, and a new system incorporating IC card technology was introduced as the next-generation ticketing system, giving birth finally to Suica in November 2001.

Outline of 10 transport system IC cards

More than 10 years have passed since Suica was introduced by JR East in November 2001 and other major cities in Japan have now also successively introduced IC card services.

We have continuously enhanced Suica convenience by extending the usage area, introducing a loyalty programme point service, starting an e-money service, expanding the number of affiliate stores where e-money can be used to enable more users to take advantage of Suica, etc. Likewise, the seamless public transit afforded by the 'touch & go' style of travel has been very well received by the public, who flock to Suica in huge numbers, especially in the greater Tokyo area. As a result, the ratio of IC card users in the Suica area (ratio of IC card use to overall use, including magnetic tickets) exceeds 80%, with the number of Suica cards reaching a staggering 42 million—10 orders of magnitude larger than the 4 million card target set prior to service launch.

The history of the 10 transport system IC cards (Fig. 1) in the Nationwide Mutual Usage Service launched in March 2013 is described below in launch order.

(1) Suica

This prepaid IC card is issued by JR East. Service started in greater Tokyo on 18 November 2001. It was expanded later to accommodate the Sendai and Niigata areas, and the service area in Greater Tokyo was also further extended. JR East launched Mobile Suica using mobile phones with built-in Suica in January 2006.

(2) ICOCA

This IC card is issued by West Japan Railway Company (JR West). Service started in the Kansai area in November 2003, and then spread further across the region, extending out to the Okayama and Hiroshima areas as well as the Takamatsu and Sakaide stations of JR Shikoku.

(3) PiTaPa

This IC card is issued by Surutto Kansai. It is unique in being the only post-paid card among the 10 IC cards featured here. (It adopts a prepaid system when outside PiTaPa areas, such as in the ICOCA area). Service started for the Keihan Electric, Hankyu, and Nose Electric railways in the Kansai area from August 2004. Since then, it has been extended to accommodate public railways in the Kansai area, such as lines run by Osaka Municipal Transportation Bureau and Kinki Nippon Railway, as well as reaching out to lines like Shizuoka Railway in Shizuoka.

(4) TOICA

Central Japan Railway Company (JR Central) launched this IC card for the Nagoya area in November 2006, extending it later to the Shizuoka section of the Tokaido main line, as well as to other district lines such as the Takayama, Iida and Gotemba lines.

(5) PASMO

Issued by PASMO Co., Ltd., this IC card was launched in March 2007 to cover the 23 public and private train services (such as Tokyu, Odakyu, Tokyo Metro and Toei lines) together with 31 bus operators (such as Odakyu and Keio) in Greater Tokyo. In 2009, service was expanded to Kanto Railway and two other companies, further increasing IC card travel on railways and buses.

(6) nimoca

Nishi-Nippon Railroad (Nishitetsu) Co., Ltd., issues this IC card, which was launched on the entire section of Nishitetsu's Tenjin Omuta Line, (including Amagi Line and Dazaifu Line) in the Kyushu region plus one bus service office in the Fukuoka City area from May 2008. Since then, the service area has been expanding mainly in city bus services, reaching the Oita area from December 2010.

(7) Kitaca

Hokkaido Railway Company (JR Hokkaido) launched this IC card for the Sapporo area in October 2008.

(8) SUGOCA

Kyushu Railway Company (JR Kyushu) launched this IC card in March 2009 with services extending out as far as Oita and Kumamoto and to northern Kyushu, with later expansion to the Nagasaki and Kagoshima areas in December last year.

(9) Hayakaken

This IC card is issued by Fukuoka City Transportation Bureau in Kyushu with service starting for all lines and stations on the Fukuoka City Subway system from March 2009.

(10) manaca

This IC card is issued by the Nagoya Transportation Development Organization Co., Ltd., and M.I.C. Corp., with service starting from February 2011 by Nagoya Railroad (Meitetsu), the Nagoya City Transportation Bureau (subways and buses), Toyohashi Railroad (Toyotetsu) and Meitetsu Bus. It is the latest of the 10 transport systems using IC cards.

Figure 1 Card Logomarks and Image of Usage Areas



nimoca



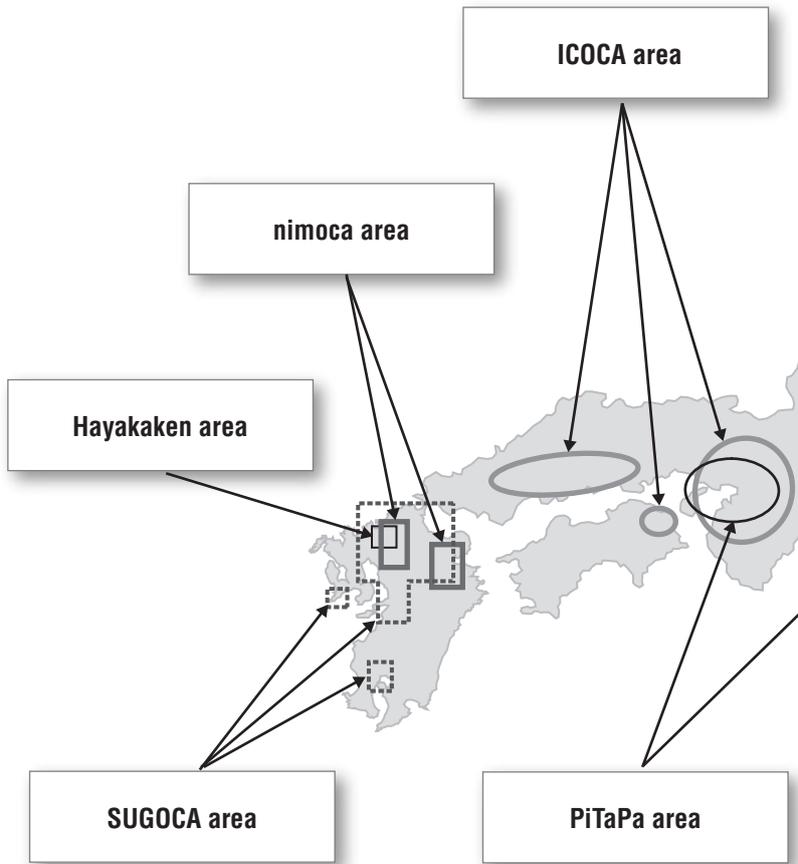
HAYAKAKEN



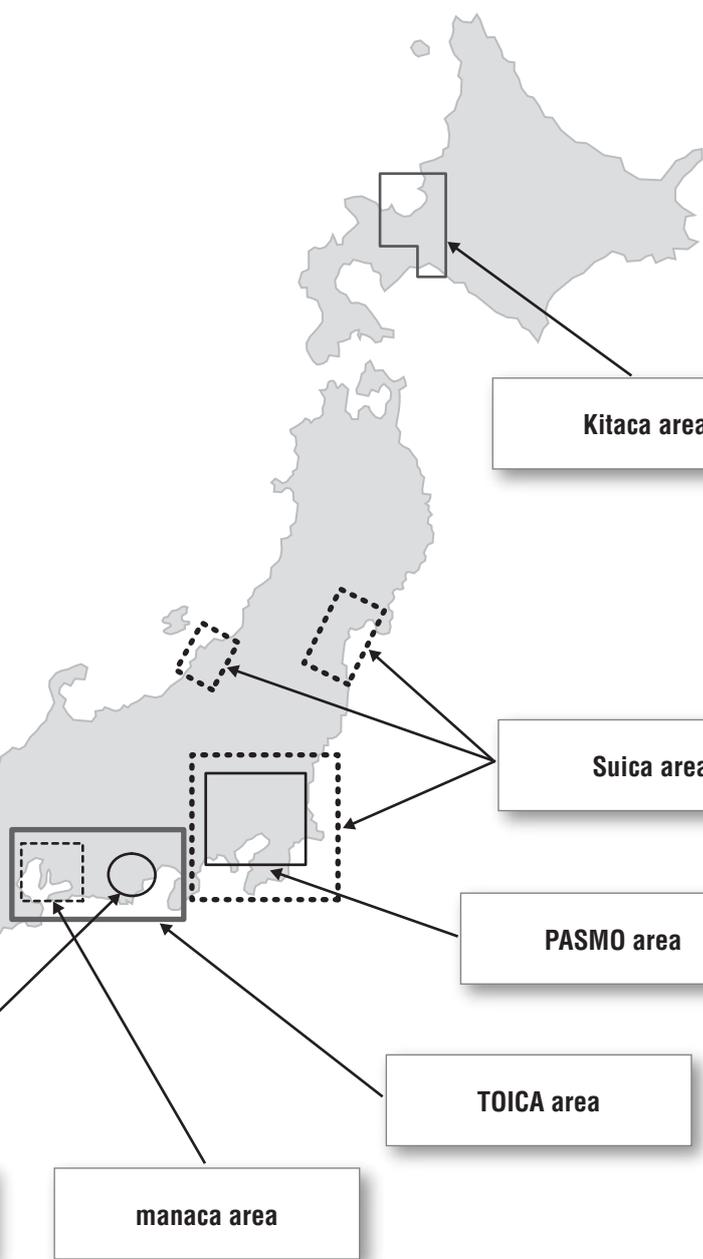
SUGOCA



ICOCA



PiTaPa



Kitaca



Suica



PASMO



TOICA



manaca

Mutual Usage Service

Suica and PASMO in Greater Tokyo

When Suica was being introduced back in 2001, the area was struggling with a complex network of services and payment systems, such as the 'Passnet' prepaid magnetic card for 22 public railway lines, the *Bus-Kyotsu-Card* (multi-bus-card) used by 62 bus operators, and an added complication of some operators running through-services with JR East. With this background, it is no wonder there was increasing demand for a single IC card that could be used seamlessly across the entire complex network of Greater Tokyo.

With JR East's Suica already in use as a common IC card, other public and private railway companies commenced R&D to launch their own IC cards, culminating in PASMO.

To implement a Mutual Usage Service in Greater Tokyo, the line operators had to share equipment specifications for automatic ticket vending machines and gates, as well as fare calculation software. A software program malfunction would have been a disaster, so the operators cooperated in surmounting each problem one-by-one, checking some 1.23 billion fare patterns to test and validate fares, performing different operational tests between machines and systems some 400,000 times, and doing many other R&D tasks.

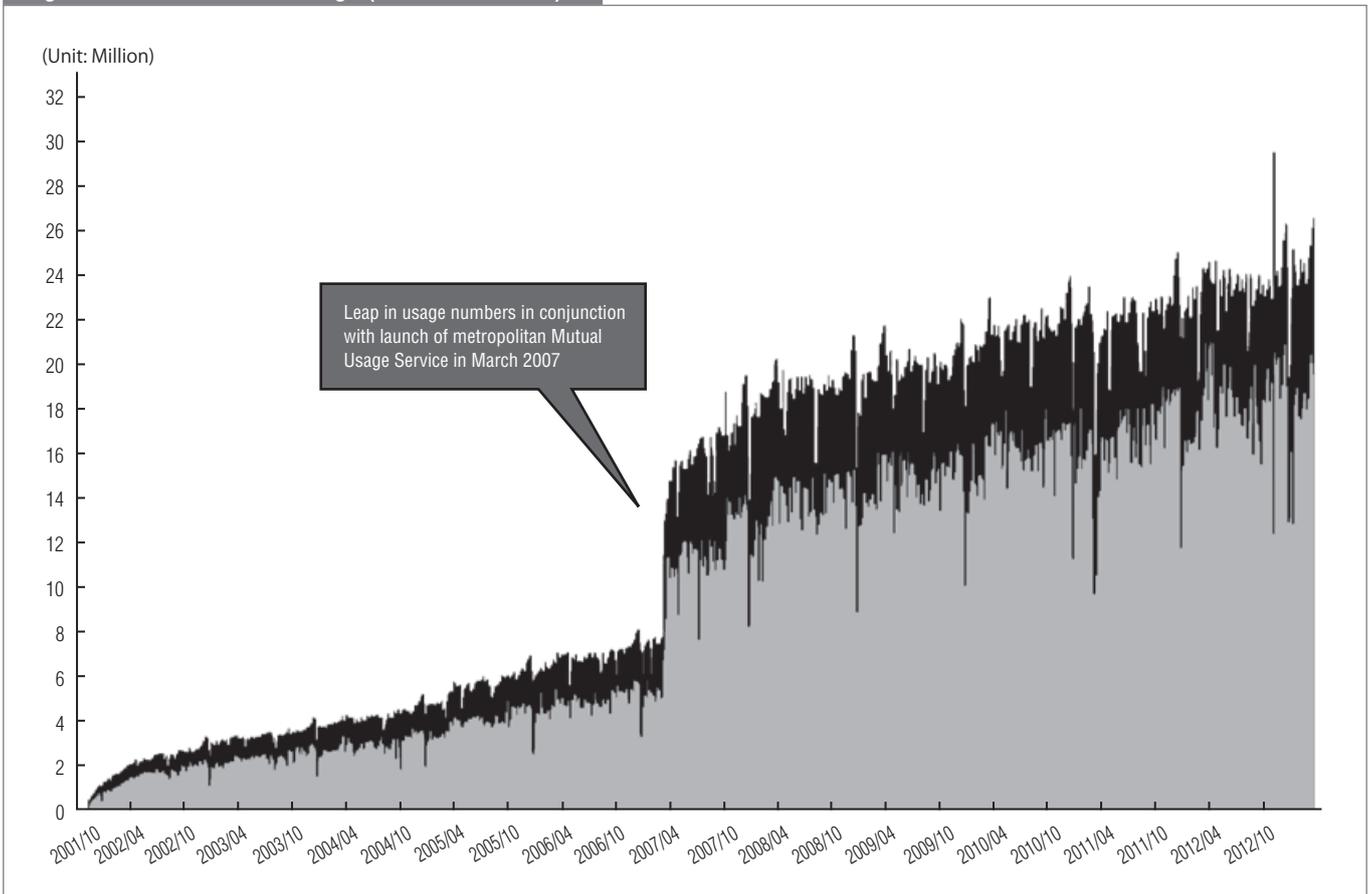
The Suica and PASMO Mutual Usage Service launched on 18 March 2007 with the slogan *shutoken-wo-ichimai-de* (Greater Tokyo on One Card), giving birth to a massive social infrastructure in the area. Henceforth, whatever the transport need—whether commuting to work or school, or some day trip—just one IC card (either Suica or PASMO) allowed passengers to change seamlessly between JR East trains, and other public and private transport and buses. Coupled with the simultaneous launch of a mutual e-money service for IC card shopping, the convenience has accelerated the spread of IC cards.

Other Mutual Usage Services in transport

August 2004 marked the launch of the Mutual Usage Service between Suica (with Greater Tokyo as its main domain) and ICOCA (with the Kansai area as its main domain). It was the first service to be launched in non-adjacent areas, meaning that just one IC card (either Suica or ICOCA) linked the eastern and western metropolises of Tokyo and Osaka.

From there, the network has grown steadily, first with Suica, ICOCA and Nagoya's TOICA linking up in March 2008 to provide service across three major conurbations (Tokyo, Osaka and Nagoya), followed by Suica and Hokkaido's Kitaca coming together in March 2009, then by

Figure 2 Trends in Suica Usage (Transaction Data)



Suica and Kyushu's SUGOCA as well as Hayakaken and nimoca in March 2010, and finally by SUGOCA, TOICA and ICOCA in March 2011.

Nationwide Mutual Usage Service

Issues to overcome

Because IC cards for transport had reached a certain level in each region and within the group of JR companies, the next stage was for the 11 operators with 10 compatible IC cards and systems to discuss combining their cards and systems into a mutual usage system. These discussions started in December 2010.

Regarding the 10 transport systems' IC cards, prior to the introduction of Suica, the Congress of Japan Railway Cybernetics standardized the card medium and interface specifications, and considered how future mutual usage services could be implemented smoothly, meaning that

each operator's system had to be mutually linked, and usage data forwarded between the systems and properly processed. Yet, while the cards have the same standards, each operator's equipment and software specifications was slightly different, so to launch the service it was essential to check in detail all the specifications and make the necessary compatibility adjustments. Furthermore, to verify that the service could be used normally, elaborate checks were performed repeatedly, including nearly 6 months of tests where actual machines, systems and IC cards were used.

Scale of Nationwide Mutual Usage Service

The Nationwide Mutual Usage Service was launched on 23 March 2013, with passengers only needing one of the 10 transport systems' IC cards to be able to use the transport networks and e-money (excluding PiTaPa) to purchase goods from stores affiliated to the operators involved in the Nationwide Mutual Usage Service. The number of issued

Table 1 History of Mutual Usage Service

Year	Topic
2001	<ul style="list-style-type: none"> • Suica service launched (transport usage only, e-money from 2004)
2002	<ul style="list-style-type: none"> • Suica & Monorail Suica Mutual Usage Service launched • Suica & Rinkai Suica Mutual Usage Service launched
2003	<ul style="list-style-type: none"> • ICOCA service launched (transport usage only, e-money from 2005)
2004	<ul style="list-style-type: none"> • Suica & ICOCA Mutual Usage Service launched (transport usage only, e-money from 2008) • PiTaPa service launched
2006	<ul style="list-style-type: none"> • ICOCA & PiTaPa Mutual Usage Service launched • TOICA service launched (transport usage only, e-money from 2010)
2007	<ul style="list-style-type: none"> • PASMO service launched • Suica & PASMO Mutual Usage Service launched (greater Tokyo mutual usage)
2008	<ul style="list-style-type: none"> • Suica, ICOCA & TOICA Mutual Usage Service launched (transport usage only, e-money from 2010) • nimoca service launched • Kitaca service launched (transport usage only, e-money from 2009)
2009	<ul style="list-style-type: none"> • SUGOCA & Hayakaken services launched (transport usage only, e-money from 2010) • Suica & Kitaca Mutual Usage Service launched
2010	<ul style="list-style-type: none"> • Suica, SUGOCA, Hayakaken & nimoca Mutual Usage Service launched
2011	<ul style="list-style-type: none"> • manaca service launched • SUGOCA, ICOCA, TOICA Mutual Usage Service launched
2012	<ul style="list-style-type: none"> • TOICA & manaca Mutual Usage Service launched (transport usage only, e-money from 2013)

Nationwide Mutual Usage Service launched.



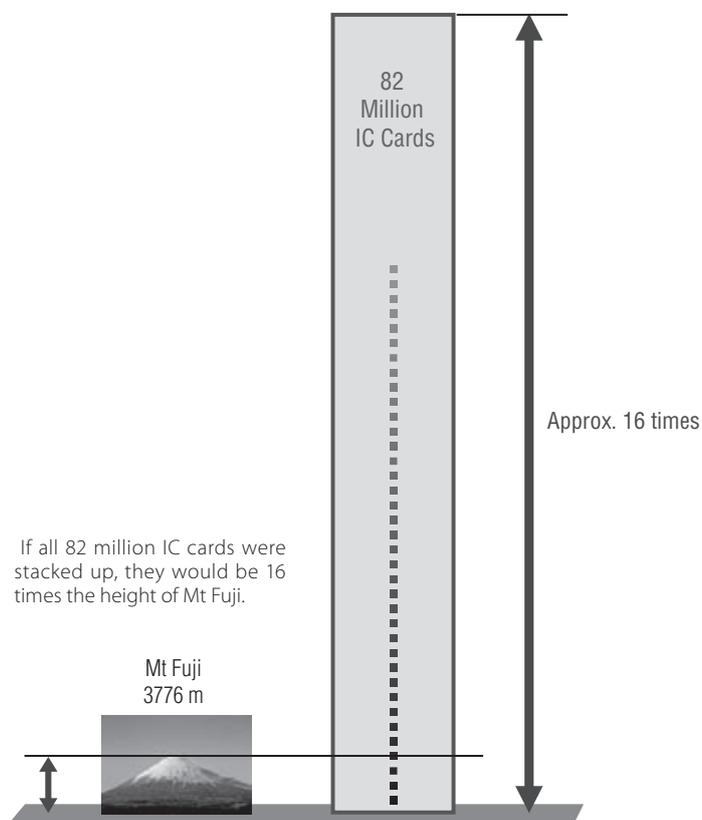
Launch ceremony for Nationwide Mutual Usage Service for IC cards (Tokyo Station, 23 March 2013)

(JR East)

Table 2 Numbers of Issued Cards and Card Holders

IC Card	Number of Issued Cards and Holders
Kitaca	Approx. 460,000
PASMO	Approx. 22,020,000
Suica	Approx. 42,100,000
manaca	Approx. 2,780,000
TOICA	Approx. 1,430,000
PiTaPa	Approx. 2,340,000
ICOCA	Approx. 7,680,000
nimoca	Approx. 1,860,000
Hayakaken	Approx. 460,000
SUGOCA	Approx. 850,000
Total	Approx. 81,980,000

• All figures current at end of February 2013



IC cards has reached about 82 million, and these cards can be used for 150 transport operators across the country, which means 4275 stations (nearly half) of all the 9000 stations in the country now accept IC cards, while the number of people living in 'usage areas' amounts to approximately 100 million (estimate provided by the Ministry of Internal Affairs and Communications' basic resident register for the end of March 2012). In addition, the number of affiliated stores where e-money can be used has grown to about 210,000, making the Nationwide Mutual Usage Service a world-class large-scale IC network (Tables 2 and 3).

All this means a huge leap in customer convenience, because for example, an IC commuter pass normally used for commuting to work can now be used for business and holiday trips, and there is no need to check fare charts even when boarding trains or buses for the first time.

Plan for Logo for Nationwide Mutual Usage Service

In conjunction with the launch of the Nationwide Mutual Usage Service, a logo for the entire Service has been designed, as one measure for enabling users of the 10 transport systems' IC cards to recognize where their cards can be used. The logo is to be rolled out on all equipment, buses and affiliated stores. The logo shown in Fig. 3 is not a brand logo but simply seeks to provide a clear pointer to the service. The fact that the operators, all with their own distinctive brands, have decided to use the same logo is a ground-breaking development in itself.

The logo was designed based on the following concepts.

- An easy-to-recognize, friendly design that anyone can remember.
- Designed on the letters 'IC' with a transport image woven in by incorporating pantograph and wheels.
- Gold expressing high-quality service and red for the passion put into this service make up the colour scheme.

Use Status of E-money

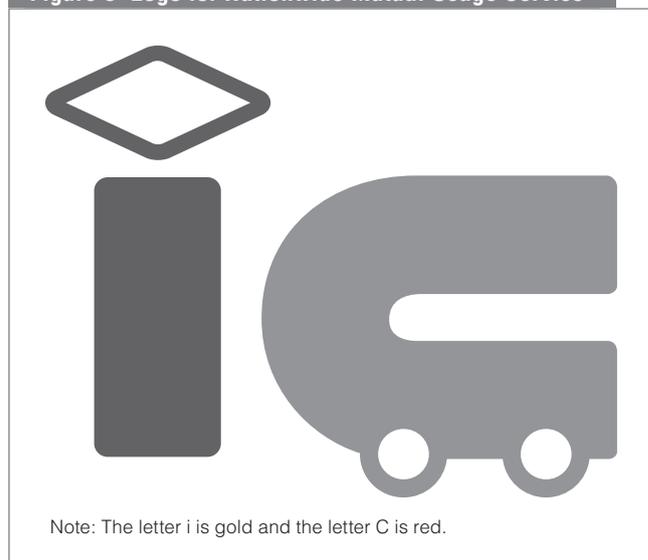
To enhance usage convenience and offer extra added value, each of the operators worked to launch e-money for shopping at the same time or after the launch of IC card

Table 3 Number of Stations and Buses in Nationwide Mutual Usage Service

IC Card Area	Number of Stations and Buses in Service	
	Railway Stations	Buses
Kitaca area	55	—
PASMO area	1212	14,800
Suica area	811	532
manaca area	379	1618
TOICA area	149	—
PiTaPa area	860	1300
ICOCA area	430	—
nimoca area	72	3200
Hayakaken area	35	—
SUGOCA area	272	—
Total	4275	21,450

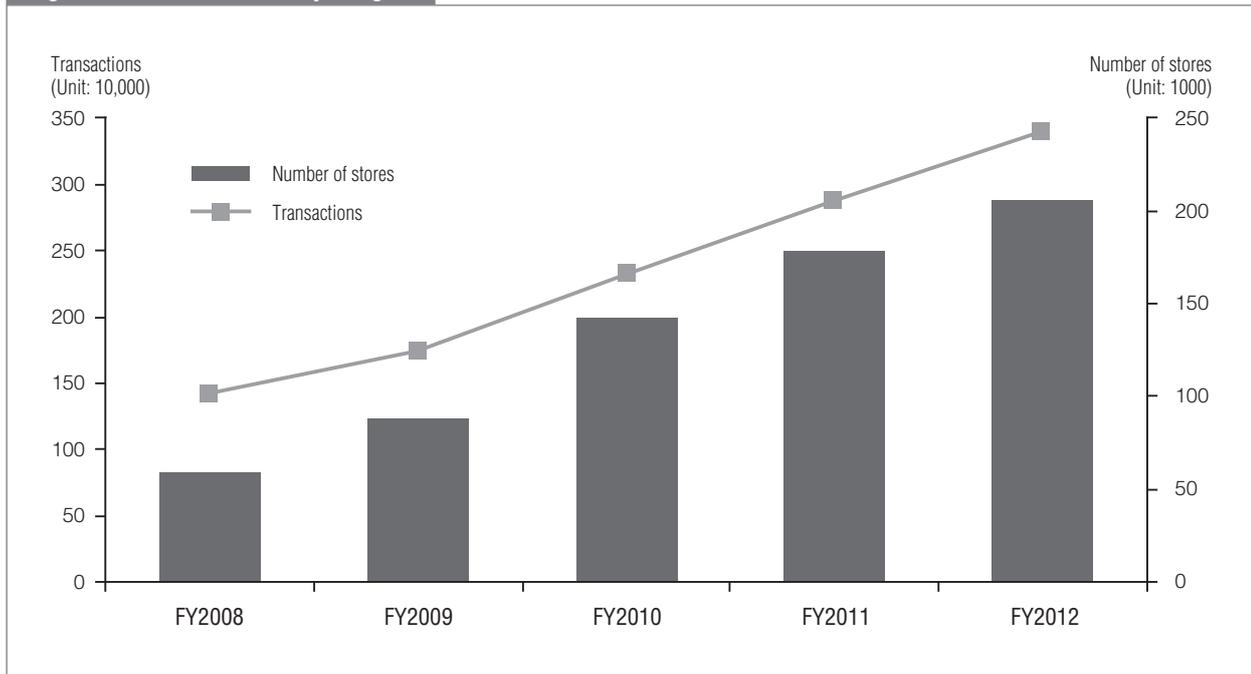
*Railway figures current at 23 March 2013 and bus figures current at 1 December 2012

Figure 3 Logo for Nationwide Mutual Usage Service



services. The overall usage of transport-related e-money—starting with Suica—is expanding rapidly every year. In FY2012, the highest number of e-money transactions in 1

Figure 4 Trends in E-money Usage



day was some 3.4 million, while the number of e-money friendly stores reached approximately 210,000 (Fig. 4).

These are not just limited to stores and drinks vending machines in station premises but now also include an ever-widening diversity of uses, with urban convenience stores of national chains, diners, shopping centres, household electrical appliance stores, taxis and more all offering e-money facilities. In some JR East station stores, more than 50% of payments are made using e-money. Up to now, as with IC travel cards, depending on the card being used, the stores that could be used differed too. However, thanks to the Nationwide Mutual Usage Service, any of the cards (excluding PiTaPa) can be used in any e-money friendly store in any area. So, even if users are travelling or on a business trip, they can shop with e-money just as they usually do in their normal routine with just a single IC card. From stepping out of the house in the morning to returning at night, transport systems and shopping are all available for the entire day without the need to carry cash.

What is more, as a service unique to Suica, the above-described Mobile Suica and Suica Internet Service can now be used to settle internet shopping bills.

Future of E-money

The *JR East Group Management Vision V – Ever Onward* plan announced in October 2012 sets targets that seek to boost e-money business further by aiming to reach maximum daily e-money transactions of 5 million in FY2015 and 8 million by FY2020.

Using the opportunity provided by the current switch to the Nationwide Mutual Usage, we will continue to work with all other operators to stimulate increased use of e-money, while also continuing to seek to achieve a situation where any IC card can be used in e-money friendly stores in any area. We will also increase the number of e-money friendly stores in our area and give impetus to the development of diverse e-money usages to robustly promote the penetration of e-money into daily life. In other words, together with the IC travel card service, we want to elevate the presence of e-money as a social infrastructure.

Conclusion

The launch of the Nationwide Mutual Usage Service using transport systems' IC cards is one step up the ladder, but we are not at the top yet.

Even now, the service is being expanded to go further. For example, coinciding with the start of the Mutual Usage Service, the route buses operated by Niigata Kotsu Co., Ltd., can now accept the 10 transport IC cards, while the Sapporo Municipal Subway and Tram Line operated by the Sapporo City Transportation Bureau as well as the bus company routes running through the Sapporo district joined the service from 22 June 2013.

Nevertheless, there are still a number of issues to be resolved, such as not being able to use an IC card for a single journey through varying areas in Japan. Therefore, we will continue to tackle such issues, further enhancing customer convenience to ensure that the service penetrates



Store transaction (image)

(JR East)



Drinks vending machine transaction (image)

(JR East)

more through society as a social infrastructure essential for daily life.

There is still leeway for massive development of IC cards in fields such as the authentication business using card ID and the information business based on usage history, outside of transport and e-money usage. IC cards are a sector where further growth can be expected. While pushing on with the task of achieving a mega infrastructure that functions stably, we are continuing to meet the challenge presented by the limitless possibilities of IC cards. ■

**Etsuro Ito**

Mr Ito is General Manager of IT&Suica Business Development Headquarters at JR East. He joined the company in 1987, following the privatization of JNR. Prior to his current position, he served as Deputy General Manager of the Finance Department.