Latest Trends in Remote SIM Provisioning Technology

1. Introduction

Subscriber Identity Module (SIM) cards inserted in various telecommunication devices such as smartphones contain identification information including that necessary for identifying the mobile network operator (MNO) providing the service as well as information necessary for decryption, and thus play a crucial role in the provision of services by the MNO. They serve as certificates and their importance for an MNO can be compared to that of passports for a country's citizens. In recent years, certain technology that enables the rewriting of SIM card information via wireless network has been commercialized and is now gradually becoming popular in machine-to-machine (M2M) and consumeroriented markets. This article introduces the latest trends in such Remote SIM Provisioning (RSP) technology.

It should be noted that this technology may often generally be called Embedded SIM (eSIM) in media such as newspapers or magazines because the rewriting takes place while the SIM card is embedded in the device (i.e. the card cannot be detached). However, the definition adopted by the GSM Association (GSMA) which is responsible for its standardization, is officially worded "Remote SIM Provisioning (RSP)" and so the title of this article adopts this wording.

2. History of RSP technology standardization

Attention was first drawn to RSP technology when the content of a patent applied for by a North American smartphone manufacturer was revealed in 2010. This patent relates to the scenario where an equipment manufacturer itself plays the role of a Mobile Virtual Network Operator (MVNO) by switching the MNO service in the terminal, thereby providing optimum service that meets each user's requirements and usage conditions depending on the location of the user (country and/or area). Alongside the publication of the patent, this smartphone manufacturer submitted a proposal to the European Telecommunication Standards Institute (ETSI) to standardize the substance of this patent. Originally, ETSI was involved in standardizing the shape (form factor) of soldered-type SIMs, but the proposal to standardize a technology to rewrite the SIM from a remote place - a technology not conceived by any MNO previously - came as a shock to the mobile communication industry both in the US and Europe, although, in the end, the technology that was standardized was not quite the same as the manufacturer had imagined at the outset.

In response to this development, a working group to discuss the feasibility of the technology and its operating rules was set Munefumi Tsurusawa Deputy General Manager Technology Innovation Strategy Department Technical Planning Division KDDI Corporation



up in GSMA, an industry body composed of MNOs and the relevant system vendors, under the leadership of major US and European MNOs. In the initial stage, discussions focused on issues relating to the broad perspective, such as the future of the mobile communication industry when this technology is widely deployed. However, as demands from the car industry grew and the complicated nature of the mechanism and the system when it is applied to the smartphones was understood, it was agreed among the member companies that they should first deal with the M2M specifications for embedded equipment, and then deal with specifications for consumer-oriented devices. There were voices in favor of the standardization work for RSP technology being carried out by ETSI - European body in charge of standardizing form factors - because the GSMA which is the industry body focused on studying operation guidelines such as roaming and their solutions, is not a standards development body. Taking this into account, collaboration between GSMA and ETSI was initially sought but in the end the GSMA carried out the work by itself. The working group started out in 2011 as a small one with around ten companies that were mainly MNOs and SIM vendors. However, the recent wide proliferation of smartphones and tablets has resulted in the number increasing to around 100 including major MNOs worldwide and device/system vendors. The group currently continues to work on expanding the functions of RSP technology and in effect is creating a large business ecosystem.

3. RSP standard specifications

The word "SIM" refers to a function in a cellular network and the hardware is called "Universal IC Card (UICC)." UICCs are categorized according to size and shape, and in ordinary smartphones or feature phones, removable SIM cards such as mini-SIMs (2 Form Factor: 2FF), micro-SIMs (3FF) or nano-SIMs (4FF) are used. There is also another type of SIM called Machine-to-Machine Form Factor (MFF) where the SIM is soldered directly onto the circuit board inside the equipment (5mm x 6mm). It is called an Embedded UICC (eUICC) because it is embedded on a board and cannot be removed. However, RSP specifications developed by GSMA cover all types of SIM cards including removable SIM cards as targets for remote rewriting. Thus the application categories affected by RSP technology now covers a wide area, ranging from M2M equipment to consumeroriented devices.

RSP-related specifications established by the GSMA can be categorized as follows: (1) requirement specifications describing requirements by MNOs (architecture); (2) technical specifications

Figure 1: Standardization history of GSMA RSP technology

For M2M devices		For consumer-oriented devices
Standardization of RSP specifications for M2M starts in GSMA RSP specs. SGP.02 v1.0 for M2M completed RSP specs. SGP.02 v2.0 for M2M completed RSP specs. SGP.02 v3.0 for M2M completed (Unification of profile format, etc.) RSP specs. SGP.02 v3.1 for M2M completed (Ensuring of profile interoperability)	2011 2013 Dec. 2014 Nov. Dec. 2015 May Sept. 2016 Jan. May Autumn	Requirements for consumer-oriented devices drafted based on M2M specs. Solutions for consumer-oriented devices proposed to GSMA by several device/system vendors MNOs, device and system vendors agree to jointly develop specs. for consumer-oriented devices; intensified work started RSP specs. SGP.22 v1.0 for consumer completed RSP specs. SGP.22 v1.1 for consumer completed RSP specs. SGP.22 v2.0 for consumer planned for completion

necessary to meet such requirements; and (3) testing specifications verifying whether the implemented hardware and software comply with the standards.

As a result there is a set of these three types of specifications for both M2M and consumer-oriented devices. Figure 1 shows a timeline of the milestones in the standardization of RSP technology.

As described earlier, the standardization of specifications for M2M device started first and GSMA SGP.01 (requirement specifications) and SGP.02 (technical specifications) were published in December 2013, enabling the implementation of commercial products to begin. SGP.02 continued to be updated and currently, as of May 2016, SGP.02 version 3.1 is the latest version. Alongside the updating of the technical specifications, standardization of test specifications also moved forward and version 3.1 of GSMA SGP.11 was published in May 2016. I was involved in formulating the specifications from January 2014 to May 2016 as the chairperson of a sub-working group in charge of these test specifications.

After the first version of the RSP specifications for M2M devices was completed, discussions relating to customer oriented devices started in around March following the Mobile World Congress (MWC) 2014, with analysis of the differences between M2M and consumer-oriented devices, e.g. what would be missing if M2M specifications were to be applied to consumer-oriented devices and what other aspects needed to be standardized. These discussions were in full swing in May 2014, and the applications of RSP to smartphones and tablets were studied considering

usage scenarios such as connecting new subscribers, changing subscriptions or replacing devices under the same subscription. Based on the technical specifications that reflected the results of these discussions, some demonstrations complying with prestandards were made by certain companies during MWC2015. GSMA also issued a press release announcing its intention to accelerate RSP standardization and listing the names of the supporting companies. From the summer of that year, studies of the specifications started began with the holding of a fiveday-meeting every other week, and versions 1.0 of SGP.21 (requirement specifications) and SGP.22 (technical specifications), which are for consumer-oriented devices, were released in January 2016. As for SGP.22, a revised version (version 1.1) was published in June. SGP.21 (requirement specifications) was also updated to version 2.0 in August 2016. SGP.22 (technical specifications) is also expected to be further revised (to version 2.0) in the autumn of 2016. The differences between version 1.0 and version 2.0 will be described later in this article.

4. Differences between RSP technologies for M2M and consumer-oriented devices

The outcome that an MNO profile is rewritten using RSP technology is the same for both M2M and consumer-oriented devices. However, there are differences in the specifications due to the fundamental differences in the use cases. The biggest difference depends on whether the rewriting is made from the network side (MNO) or from the device side (user). Figure 2 illustrates this difference simply.



Figure 2: Differences between RSP technologies for M2M and for consumer-oriented devices

In the case of M2M services, there are usually service providers between the MNO and the users, making the relationship between the MNO and the service provider equivalent to that in the case of business-to-business (B2B). For instance, in the case of embedding SIM in a car or a smart-meter together with the communication function, a multi-year contract is usually signed between the MNO and the service provider. If, upon termination of a five-year contract, the service provider opts to switch MNO, it would be a huge and practically impossible task to rewrite manually all the SIM cards fitted in the hundreds of thousands or even millions of devices in the field. If it is possible to remotely rewrite the MNO profile using RSP technology, this would dramatically simplify the work. In this case, it is envisaged that the request to rewrite the contract information is sent simultaneously (or within approximately the same period of time) from the network and that it is not the user devices making requests individually. Therefore, in the case of specifications for M2M devices, a mechanism enabling the command from the network side to switch contracts is indispensable. On the other hand, in the case of consumer-oriented services, the relationship between the MNO and the end-user is basically a business-toconsumer (B2C) -type one, where modifying or adding contracts with the MNO is initiated by the user. Therefore, it is envisaged in this case that the request for a new contract or modification comes from the device side.

The procedures of downloading and installing information between the server (that maintains the MNO profile as an electronic file) and the eUICC (mounted on the device) are the same in both cases. However, due to the different use cases, the functional blocks necessary for implementation using M2M RSP technology and consumer-oriented RSP technology are different. In the GSMA Standardization Work Group, there are future plans to develop and standardize an integrated architecture for the two technologies.

Updating RSP specifications for M2M used to mainly consist of expanding functions and ensuring interoperability. However, in the case of versions 1.0 and 2.0 of consumer-oriented RSP specifications, the use case itself has changed. Figure 3 describes the differences between the two versions simply. Version 1.0 specifications assume a case where a user, already in possession of a smartphone and a subscription, is initiating contract application procedures for his/her newly purchased device by connecting it to his/her smartphone via Bluetooth and thereby to the MNO. Version 2.0 specifications have been created to enable, by using RSP technology, the writing of a variety of contracts such as registration of new contracts, switching of MNOs by replacing of SIM card, and changing devices under the same contract. Note that these formalities are currently possible if the customer uses a removable SIM. By implementing version 2.0 specifications, it will be possible to realize the contract procedures and utilization modes that are currently in common use with SIM lock-free terminals. However, the technical specifications and operating rules for features such as remote control functions for customer care and delegation of control functions for business usage have not been decided yet, and further discussions and revisions of specifications are expected to follow.



Figure 3: Differences between versions of RSP technology for consumer-oriented devices

5. Non-standard technology similar to RSP

Here I would like to deviate slightly from the main theme of this article - introduction of RSP technology - and take a look at similar technologies, which are not standardized. As of August 2016, I am aware of five companies - Simgo (Israel), Cellbuddy (Israel), iQsim (France), TAISYS (Taiwan) and GLOCALNET (China) - which offer technologies that enable remote rewriting of SIM information or enable the utilization of a local MNO network in a foreign country by using SIM information contained in a remote server. Although the details of each technology will not be covered here, there is quite a large demand for such services from the business sector especially from global companies whose members are traveling worldwide. Such technologies are welcomed by some MNOs desiring a niche market and there is definitely a market for such services. Each of these companies calls its technology "Virtual SIM" and there are also other technical terms being used, such as 'Software SIM' (also called 'Soft SIM') to describe such technologies. However, there is a clear distinction between these technologies and the other categories of SIM technology. Namely, in RSP technology and the Virtual SIM technology standardized by GMSA, the security domain that contains the MNO profile is basically isolated at the hardware level (i.e. segregated in the memory area); technologies that do not have such a segregated area for the profile information but contain it in the same memory area with other applications are called Soft SIM. Although software technologies that enable the protection of certain pieces of information are making progress, there are still worries from security point of view about deploying Soft

SIM in commercial products because of fears regarding security. However, if it were to be possible to realize the same level of security in authentication functions without the need of setting up a special hardware security domain, such technologies might find wide application in industrial and consumer-oriented equipment. Accordingly the future development of such features in software technologies is anticipated in the not too distant future.

6. Commercialization of RSP technology for M2M

The demand for RSP technologies in M2M business fields is high among manufacturers that run global businesses. In particular, demand from the automobile industry has been conspicuous since the early days for two reasons. The first one is based on logistical considerations as shown in Figure 4. Currently, in order to install a mobile device in a car at the time of manufacturing, the manufacturer has to either install a specific SIM card for a specific MNO depending on where the car will be shipped, or to install the SIM card upon arrival of the car in the country where it is to be sold. RSP technology was greatly touted as a means of eliminating such time consuming requirements. The automobile manufacturers made it clear that they wanted to simplify their manufacturing processes by introducing RSP technology. This would enable them to manufacture cars to a single set of specifications. Accordingly, a newly manufactured car arriving in country A would have its SIM card written with the profile for the local MNO (MNO-A,) which would be different from the profile for the SIM card in a car arriving in country B.

Such a demand is not unique to the car industry but common to all global manufacturers who provide cellular connectivity as one of their services. Especially, right now in Europe, there are high expectations regarding RSP technology in order to meet the "eCall" (automobile emergency calling system) which will become mandatory for all newly sold cars after 2018. With this emergency calling system, when a car is involved in an accident, communication equipment mounted on the car will, on the driver's behalf, automatically report the location and the travelling direction, thereby making it possible for the police and ambulance to rush to the scene. The characteristics of the shielding for such car mounted communication equipment are strictly regulated in order to protect it from the impact of crashes, especially flames, and it will be practically impossible to carry out disassembly or reassembly work at dealers in the country it is imported to. The technology issues mentioned above like rewriting, etc. will be solved if the MNO profile can be written using RSP technology without disassembling the communication equipment.

The second reason the car industry is obsessed with the merits of RSP technology is not connected with the need to reduce costs by simplifying the logistics as explained above, but the industry's desire to establish a long-lasting relationship with its customers using their products. Up to now, when a car owner sells his/her car, which has been equipped with communication systems, the services involving its car-mounted communication devices will cease, and there was little possibility that the next



Figure 5: Basic global application of RSP technology in global and continental second-hand car market



Table 1: Announcements containing references to RSP technology by major car makers (based on their corporate press releases)

Car Manufacturer	Reference to RSP technology	Year
Aston Martin	Demonstration of provision of racing-car-mounted device at IoT event (Silicon Valley) in corporation with Spirent, and usage plan in World Endurance Championship 2016	2016
General Motors	Announcement of intent to adopt GSMA RSP technology in car mounted devices for OnStar (connected service) starting 2015	2015
Jaguar Land Rover	Statement 'Adoption of RSP technology to car mounted devices will simplify car manufacturing' and display of actual vehicle at GSMA booth in Mobile World Congress 2016	2016
Renault Nissan	Statement 'It is a scheme very beneficial for global automobile manufacturer, and will introduce it into every car in future'	2016
Scania	Presentations made at several events aimed at improving customer value through separation of service and manufacturing	2016
Audi/Volkwagen	Announcement of intent to provide connected service in Europe by mounting eUICC and using RSP technology	2016
Daimler	Announcement of intent to mount eUICC on Mercedes Benz E-class	2016
BMW	Announcement of intent to mount eUICC on all newly sold cars in USA	2015

user will disassemble the communication device from the car to replace the mounted SIM card and then start using a new communication service with a different MNO. However, if the car-mounted communication devices conform to RSP specifications, it will be possible to conclude a new contract whereby service providing MNO is switched in the same country, as shown in Figure 5. Furthermore, if the car is sold in another country as a secondhand car, it will be possible to conclude a new contract with a local MNO that can provide services to this car model. In such a way, relationship between the manufacturer and the secondhand car owners and even the subsequent owners can last for the life-span of the car. Under this scheme, it will also be possible for a car owner driving from country to country to switch the MNO as he/she arrives in a new country. From now on, it is foreseen that the percentage of cars equipped with car communications equipment will increase as the connected-car services and automated driving become more widespread, thus making RSP technology even more common. According to a press release issued by GSMA in February 2016 for the automotive sector, several automobile manufacturers together with 22 of the world's major MNOs have agreed to implement RSP technology conforming to GSMA specifications. Although each automobile manufacturer has its own name for its services and it is rare that the term 'RSP' or 'eSIM' is used, RSP technology is starting to be used extensively by European automobile manufacturers for cars with communications capability. For reference purposes, Table 1

contains a list of press releases issued by automobile manufacturers in various conferences together with some of their comments.

7. Background to promotion of consumeroriented RSP technology

Being involved in the standardization of RSP technology, I am often asked by people in and outside of Japan "why does a mobile communication operator promote standardization of RSP technology which can make it very easy for customers to switch to another operator?" or "what kind of monetization scheme do MNOs envisage using this mechanism?" In order to answer these questions, I will briefly describe the mobile communication environment and MNO strategies in Europe which are quite different from those in Japan.

In introducing RSP technology, European MNOs develop their business strategies in terms of three segments: (1) SIM lockfree terminal market, (2) service to incoming foreign visitors, and (3) benefits to travelers traveling outside their home country (or benefits to MNO's subscribers traveling abroad).

(1) SIM lock-free terminal market

In the European market, about 50 % of the smartphones sold are said to be SIM lock-free, even in the shops of MNOs. In addition, depending on the regulations in each country, SIMlock can be released after 90 days in many countries and it is therefore estimated that about 70% of the smartphones circulating in Europe are SIM lock-free. This fact has a lot to do with the geographical and cultural background of Europe. In Europe, many countries share common borders and many people commute between countries or go shopping over the border. Naturally, they also wish to pay the lowest possible communication charges even when they are on the other side of a border. There are also many people who leave their country for winter and summer vacations overseas that total several weeks of the year. For these people, purchasing a SIM lock-free smartphone to avoid paying expensive roaming charges makes economic sense even if the terminal cost may be a bit more expensive. Accordingly, in the future, it is expected that the percentage of SIM lock-free terminals will increase in the light of the growing number of wearable devices, different home-oriented devices and diversification of sales channels. As such, users themselves are becoming accustomed to switching MNOs as they wish, and MNOs, while allowing free selection by users, are seeing that SIM lock-free terminals, not yet tied to any MNO, will become a new opportunity to increase their customer numbers. These are the motivations behind the promotion of RSP technology development.

(2) Foreign visitors

Table 2 shows the countries, extracted from such statistics, which accept foreign visitors outnumbering 50% of each country's population, in descending order, together with their population. As can be seen in this table, of the 45 countries that make up Europe, 16 countries, corresponding to more than 30% of

them, accept a large number of foreign visitors, as tourists or business travelers, which is equivalent to more than half of their populations. Eleven countries from Austria, in first place, down to the Czech Republic in 11th place, have a total number of foreign visitors that actually outnumbers their own population (Visitor/ Population ratio>100 %). In fact, all European countries except Croatia, Ireland and UK are signatories of the Schengen Treaty which means there are not even passport checks at their border. This means that if border crossing by land is included, far more people are actually moving between these countries. Germany whose ratio is only around 40 % and is therefore not listed in the Table has around 33 million foreign visitors. In Europe, there is of course a ranking of MNOs competing in terms of incremental number of subscriptions. While these MNOs are currently competing in saturated domestic markets for new subscriptions that number only tens to hundreds of thousands, these large number of foreign visitors open up a potential market of millions of subscriptions a month.

When seen from the perspective of offering services to potential numbers of customers that are as big as the population of a country, and also taking into account the limitations on SIM marketing channels as well as abolition of roaming charges in EU starting June 2017, RSP technology enabling service implementation via wireless networks without having to establish the logistics for selling SIM cards is definitely one of the most prospective service marketing channels. Therefore, MNOs see the need to be prepared for RSP technology.

Table 2: Countries with Visitors/Population ratio exceeding 50%

Country	Population (in 1,000)	Foreign visitors (in 1,000)	Visitors/ Population (%)	Remark
Austria	8,510	25,290	297.2	
Croatia	4,240	11,780	277.8	Not a signatory to Schengen Treaty
Greece	10,990	22,030	200.5	
Ireland	4,610	8,260	179.2	Not a signatory to Schengen Treaty
Denmark	5,620	8,560	152.3	
Spain	46,460	65,000	139.9	
France	63,920	83,700	130.9	
Hungary	9,880	12,140	122.9	
Switzerland	8,140	9,160	112.5	
Sweden	9,750	10,750	110.3	
Czech Republic	10,510	10,620	101.0	
Portugal	10,390	9,320	89.7	
The Netherlands	16,860	13,930	82.6	
Italy	59,960	48,580	81.0	
Belgium	11,200	8,040	71.8	
UK	64,510	32,610	50.6	Not a signatory to Schengen Treaty

According to statistical data, there were about 20 million foreign visitors in Japan in 2015 and this figure corresponds to about 16 % of its population. The Japanese government is also promoting system reforms with the view of establishing a framework that can accommodate 40 million foreign visitors by the Tokyo Olympics in 2020. Most foreign visitors come to Japan for sightseeing and since it is thought that they are also looking for cheap communication tariffs, it is natural that the demands of temporary foreign visitors will become more and more important even in Japan.

(3) Travelers traveling outside their home country (or benefits to MNO's subscribers traveling abroad)

Statistics say that 65% of Europeans travel abroad more than once a year including the travel related to commuting and shopping mentioned earlier (10% in case of Asia). When these people travel abroad they search for cheap local services with their SIM lock-free terminals in hand. Such demand for communication services will increase as more and more people travel abroad. It is not yet known how quickly RSP-capable terminals will proliferate in the future. However, if one considers the case where a customer is given the opportunity to choose between an MNO that enables getting cheap communication tariff when traveling abroad and an MNO that does not, it is obvious that the former will be chosen, and therefore it is natural that an MNO should feel the need to offer benefits to its customers by adopting RSP technology and aligning itself with global and standardized systems.

Although the environment in which European MNOs operate is quite different from that in Japan, it must be said that Japanese operators and device manufacturers now need to study use cases in the Japanese market taking into account how global terminals conforming to RSP technology will evolve in the near future.

8. Commercialization of customer-oriented RSP technology

As described above, the requirement specifications as well as the technical specifications were issued in January 2016 and immediately after MWC2016, in which there were demonstrations by major European MNOs and SIM vendors, commercial services conforming to version 1.0 specifications started. At MWC2016, the provision of a service for version 1.0-based smartwatch was demonstrated in a panel session (Photo 1); this was immediately followed by the RSP service for

Photo 1: Panel discussion on consumer-oriented RSP technology at MWC2016



Vodafone (UK), Telefonica (Spain), Orange (France), KDDI (Japan), Deutsche Telekom AG (Germany), AT&T (US)



Photo 2: Demonstration by Telia (Sweden) of how to set up smartwatch

smartwatches by Vodafone Germany on March 11, 2016, and now major MNOs such as O2 (UK), Telia (Norway, Estonia), Swisscom (Switzerland), Orange (France), T-Mobile (Germany) and Telecom Italia Mobile (Italy) have also started selling products and providing RSP services. Moreover, in early September, a next generation smartwatch was announced by a Korean manufacturer at IFA 2016 held in Germany, and in this product too, GSMAbased RSP technology is used.

Readers may be surprised to learn that products and services conforming to SGP.21/22 version 1.0 standards were commercially introduced within two months of their release. However, those MNOs providing services and the vendors selling products were deeply involved in the standardization work from the beginning and promoted development and implementation in parallel with their standardization work. It is still unclear whether smartwatches will sell well in the future but it is anticipated that their usefulness will improve with the advent of RSP-capable products, for example, smartphones and tablets conforming to version 2.0 specifications expected to be issued in the autumn of 2016. It is expected that these products in combination with the new services provided by MNOs will further increase the proliferation as a result of the synergy between the two trends.

9. Challenges facing introduction of RSP technology in smartphones

Technical challenges involved in the introduction of RSP technology have already been identified, but the challenges relating to regulatory issues in each country still need more study. Currently, in many countries, including Japan, personal authentication, by the presentation of certain personal identity documents issued by public authorities, is necessary as a crime prevention measure when purchasing a SIM card that is capable of voice communication. In the case of the smartwatch mentioned above, voice communication will be made possible after concluding the contract using RSP technology. However, this is permitted because user identification has already been made via a smartphone that already has a user contract. Furthermore, North American manufacturers currently provide services to their tablet customers using similar schemes to that of RSP technology. These schemes enable their customers to freely select service providers of their choice in many countries around the world when they are traveling but they are permitted to do this because they are offered pre-paid type data-only communication. There is not yet a clear answer to the question about whether a user having a SIM lock-free terminal conforming to RSP technology should be allowed to subscribe to voice communication using RSP technology outside his/her home and/or at places he/she visits. In the case of the roaming services available to users abroad, they can make use of both voice and data communication as usual, provided the communication charges are acceptable. This is because in this case, there is the 'roaming agreement' between the MNO that issued the SIM card in the subscriber's country and the MNO in the foreign country. The simple explanation is that there is an agreement between the two MNOs so that the foreign MNO places confidence in a SIM card user who has been authenticated by his/her home MNO, and there is the assumption that there is an automatic mechanism to check the SIM issuing MNO regarding the authenticity of the user. Signing a voice communication contract in such a way would not bring about any technical problems but it is necessary to take into account the contractual procedures requiring compliance with the regulations in both countries. Meanwhile, voice communication is actually becoming easier nowadays with Voice over IP technology combined with certain application software increasing in number, and being offered by service providers. Therefore, in view of the increasing bandwidth for cellular services and proliferation of the Wi-Fi environment, those users who are satisfied with the use of IP voice service over data communication when abroad may not be so interested in RSP technology.

10. New business areas targeted by RSP technology

It is not just conventional MNO business where RSP technology can be applied. If the current logistics supporting the distribution of SIM cards - for example, the delivery system starting from card manufacturing to finishing with promotion and sales activities in dealer shops - can be eliminated by the use of RSP technology, it may bring about various changes just like what happened in the Compact Disc (CD) market which originally had to be bought in shops but were replaced by downloadable music files. There are countless scenarios where merits can be gained from the elimination of the logistics of SIM cards which would make manual mounting/removing of SIM cards unnecessary. For instance, the merits to be gained in the management of Internet of Things (IoT) devices that are expected to increase so dramatically in the future, are immeasurable. Almost every MNO can see the advantages of mounting SIM cards remotely and simultaneously by the million or even billion. In addition, for an MVNO which sells SIM cards issued by the hosting MNO through an independent sales channel, the merits of RSP technology are comparatively large and there are quite a number of MVNOs who have already announced the implementation plan of RSP services. In reality, it would require certain investment in order to introduce RSP technology and therefore it is not so easy to judge from profitability viewpoint. However, it would surely enable simplification of distribution flow. Not only the simplification of current business styles, but new services with innovative ideas are expected to be created by combining new technologies with RSP technology.

11. Conclusion

This article has offered an outline of the RSP technology specified by GSMA and its status regarding commercialization which has been led by the USA and Europe. It is foreseen that the commercialization of this technology, supported by MNOs and device/system manufacturers, will become more and more widespread. The RSP mechanism is not only determined by purely technical and implementational factors but is also influenced by regulatory issues relating to user contracts in each country. Furthermore, there are possibilities that new services not even conceived at present, will emerge with new devices and systems as new ideas appear. RSP technology is placed on the border between technology and business, involving difficult and delicate matters. In the end, the most important thing is that the Japanese mobile-phone users as well as foreign visitors coming to Japan can make use of communication services safely, securely and comfortably. In order to achieve this goal, it is important to review global standards, regulations in each country and implementation technology from a wide angle. It is also important not only to widen the range of RSP compatible devices but also to create and provide attractive and useful services for users.

Cover Art =



Shokoku meisho hyakkei, Gion sairei (Gion Festival in Kyoto, from the series a hundred view of famous places in various provinces)

Utagawa Hiroshige II (1826-1869) Collection of the Art Research Center (ARC), Ritsumeikan University Object number: arcUP2016