Smartphone ISP sp-mode

Technology Reports

New Services and Functions for Smartphones in 2010 —Service Provision Platform for Smartphones—

*NTT DOCOMO has been making improvements in its mobile phone service environment aiming at expanding the utilization of smartphones, for example, by launching new terminals and integrating flat-rate packet plans. However, the fact that services offered for i-mode capable terminals such as i-mode and i-mode mail cannot be utilized by smartphones has been one of major barriers inhibiting increases in the utilization of smartphones. Against this background, NTT DOCOMO has developed a "Service provision platform for smartphones" which provides services in an integrated manner, including services such as i-mode mail that take advantage of i-mode, together with various services which fit the Internet and which only smartphones can make the best use of. Based on this platform, the company has launched the "sp-mode™ *1" which is an ISP for smartphones.*

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1. Introduction

In recent years, expectations have been growing rapidly regarding smartphones which can more freely make use of the functions and applications that are Internet-friendly. NTT DOCOMO has been strengthening its lineup of smartphones by putting new terminals one after another onto the market that feature OSs such as Android™*2 and Windows Mobile®*3. However, in a survey, half of the users who said they would not buy a smartphone listed as one of the reasons the fact that smartphones cannot access i-mode mail (docomo.ne.jp domain), and this has been a big barrier preventing the increased usage of smartphones.

As a result of this, we have recently developed a service provision platform for smartphones [1] and launched the "sp-mode" service [2] in September 2010 as an ISP for smartphones. This platform enables the provision of services that take advantage of i-mode such as i-mode mail, as well as the features of the smartphones best fit to make use of various services that are Internet-friendly. sp-mode is an ISP that allows the usage of smartphones more conveniently and securely. Furthermore, this service provision platform for smartphones is an integrated platform that can provide various services to smartphones so that it has now become possible to offer smartphones with services that were previously available only to i-mode terminals.

*1 **sp-mode**™: "sp-mode" and "sp-mode" logo are trademarks or registered trademarks of NTT DOCOMO, INC.
*2 **Android**™: A trademark or registered trademark of Google, Inc.
*3 **Windows Mobile**®: A trademark or registered trademark of Microsoft Corp. in the United States and other countries.

In this article, we will mainly describe overviews of the sp-mode service and the functions of the core network/service platform that make possible the sp-mode service. For details of the e-mail service in sp-mode (sp-mode mail), refer to article [3].

2. Overview of sp-mode Service

2.1 Patterns of sp-mode Service Provision

In order to use sp-mode, it is necessary to agree to the "sp-mode contract." By entering this contract, the user can make use of the standard services for smartphones such as Internet connection and sp-mode mail, as well as optional services made available by making optional contracts (**Figure 1**).

The following shows the service patterns of sp-mode:

(1) New contract for sp-mode

(2) Contract changed from i-mode to sp-mode

(3) Contract changed from sp-mode to i-mode

(4) Contracts for i-mode and sp-mode

In the cases of (2) and (3), it is possible to migrate the e-mail address, password and e-mail related setting for the benefit of the user. In the case of (4), the e-mail address, password and e-mail related setting will be kept for each contract and there will be no sharing between the two contracts.

This will enable smooth service transition when changing to a new terminal without causing users' inconvenience.

2.2 Services Provided by sp-mode

The following are the services that become available by subscribing to sp-mode:

1) Internet Connection Service

Protocol free[*4] Internet access taking advantage of the features of smartphones is possible. It supports both PDP-Type=PPP (Point to Point Protocol) and PDP-Type=IP as the packet authentication method. When the smartphone is using the Internet, an Internet Protocol version 4 (IPv4) address is allocated to it. It is to be noted that the platform has been implemented with a view of providing Internet Protocol version 6 (IPv6) addresses in the future.

2) sp-mode mail

The same level of service as that of i-mode mail is made available because of the following functions provided in the smartphone:

- Usage of i-mode mail address (@docomo.ne.jp)
- New e-mail arrival notification to smartphones
- e-mail client capable of using pictograms and Deco-mail

3) Web Access Restriction Service

In order to strengthen users' feeling of ease and safety, it is possible to restrict access to sites falling under certain categories so that juveniles do not access harmful sites inadvertently. It is also possible to change the settings for categories of sites for which access is restricted

4) Content Payment Service

It is possible to consolidate online content shopping charges with the monthly phone bill of the mobile terminal.

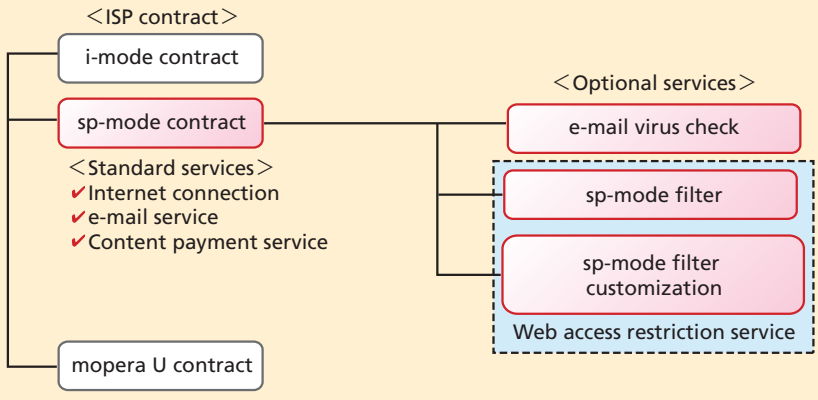

Figure 1 sp-mode service patterns and service provided

2.3 System Configuration

In realizing the sp-mode service we

*4 **Protocol free**: A case where there is no restriction on the protocol to be used.

have adopted the principle of making maximum use of the existing system so that the services can be started quickly and at low cost.

As regards the connection functions including the function to check whether the terminal has a legitimate sp-mode contract and whether it can support sp-mode, these functions were assigned to the core network by expanding the existing functions.

In addition, the platform function which forms the basis of the sp-mode service was realized by adding functions to CiRCUS (treasure Casket of i-mode service, high Reliability platform for CUStomer) and MAPS (Multi-Access Platform System) which are the existing platforms of NTT DOCOMO. MAPS is the platform that provides Internet connection and corporate system connection to various access lines including FOMA.

Figure 2, **Table 1** and **Figure 3** respectively show the sp-mode network configuration, an overview of the functions of each node and smartphone, and an overview of the platform functions (CiRCUS/MAPS).

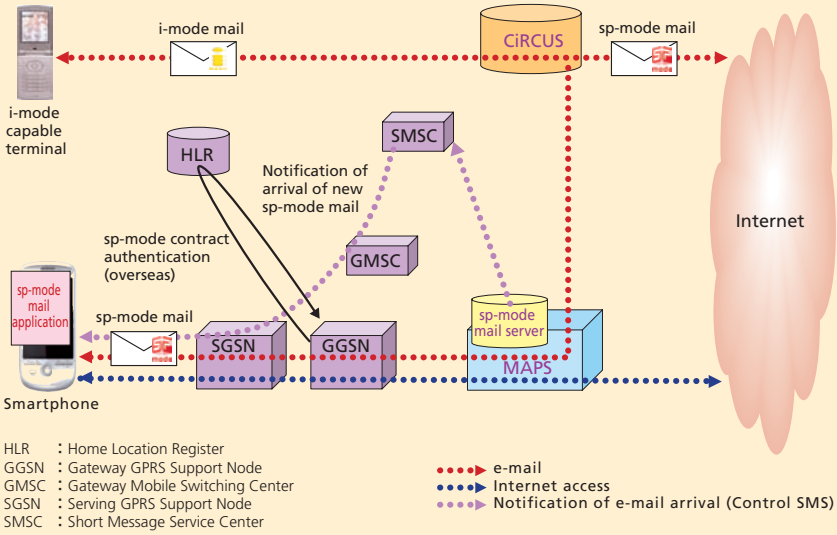

Figure 2 sp-mode network configuration

Table 1 Overview of node and smartphone functions

System name	System functions
CiRCUS	・sp-mode contract management ・User management, address management ・Sorting of e-mail received ・sp-mode mail sending/receiving
MAPS	・sp-mode contract management ・sp-mode mail ・Filtering ・Terminal application authentication platform ・Web customer control function for setting customization
SMSC/GMSC	・SMS control for new e-mail arrival notification
HLR	・sp-mode contract management ・sp-mode mail receiving control
SGSN/GGSN	・sp-mode contract determination ・sp-mode capable terminal determination ・Traffic control
Smartphone	・sp-mode mail ・Application authentication

3. Connecting to Internet

3.1 Process for Connecting Smartphone

1) sp-mode Connection Process

Figure 4 shows the overview of the sp-mode connection process. When connecting the terminal to sp-mode, the core network checks and determines the sp-mode contract status of the user. In addition, in order to provide services only to those terminals that support sp-mode, the core network is equipped with the following functions to check terminal compatibility:

- At the time of requesting location registration, the mobile terminal sends to the core network pieces of information including its IMEISV (International Mobile Equipment

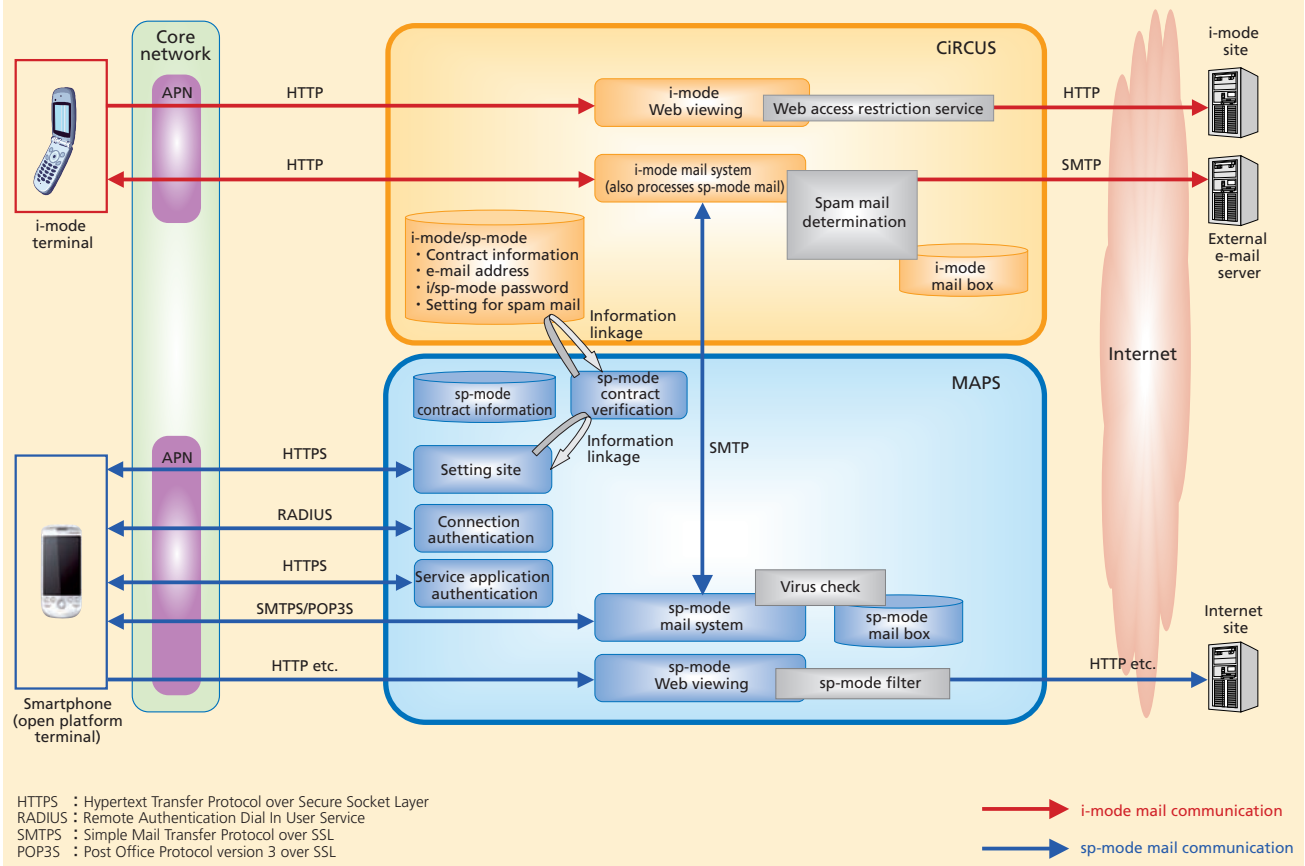

Figure 3 Overview of platform functions (CiRCUS/MAPS)

Identity and Software Version number) and the core network keeps this information for each user. The core network is equipped with a database that allows it to identify whether each mobile terminal is compatible with sp-mode.

- When the mobile terminal starts to connect to sp-mode, the core network refers to the data base and connects only those mobile terminals that are compatible with sp-mode.

2) Simplification of APN Setting

In providing smartphone and

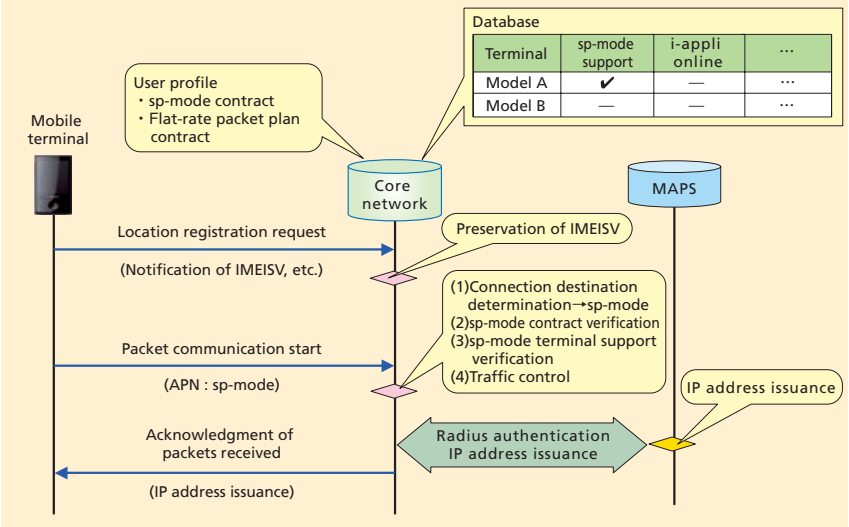

Figure 4 sp-mode connection process

PC data communication services, NTT DOCOMO has been preparing multiple Access Point Names (APNs) corresponding to whether or not the contract includes flat-rate packet plans; for example one APN for measured-rate billing plans and another for flat-rate data plans. Based on these APNs, the core network has been conducting charging controls and connection permissions. Consequently, users had to consciously choose the right APN depending on his/her contract and this was an issue from customer's point of view.

In light of the above, improvements were made in sp-mode so that appropriate services including traffic control and charging can be offered regardless of whether the billing plans are flat or measured-rate, under a unique APN of "spmode.ne.jp" as in the case of i-mode.

3.2 LSN Function

More and more people have now come to believe that the IPv4 addresses used by mobile terminals in accessing the Internet will likely become exhausted in Japan between around early 2011 to mid 2013. Thus, a scheme called Large Scale NAT (LSN) has been introduced in sp-mode for the first time in the world as a method to cope with IPv4 address exhaustion issue.

In a network environment using LSN, private IP addresses[*5] are issued to the smartphones and by locating the LSN on the border between MAPS and the Internet, the same global IP address[*6] can be shared by more than one smartphone. Specifically, it is a scheme to reduce the number of required global IP addresses by sharing global IP addresses and port numbers by a number of private IP addresses (**Figure 5**).

In introducing the LSN, connection tests to major Internet sites were actually conducted so that the appropriate number of ports to be associated with a private IP address in combination with a single global IP address can be calculated. This has enabled a reduction in global IP address usage without affecting user convenience by assigning a single global IP address to multiple private IP addresses.

3.3 Remote Initial Setting/Position Measurement Function

NTT DOCOMO has developed a "Remote initial setting function using Device Management (DM)" and a

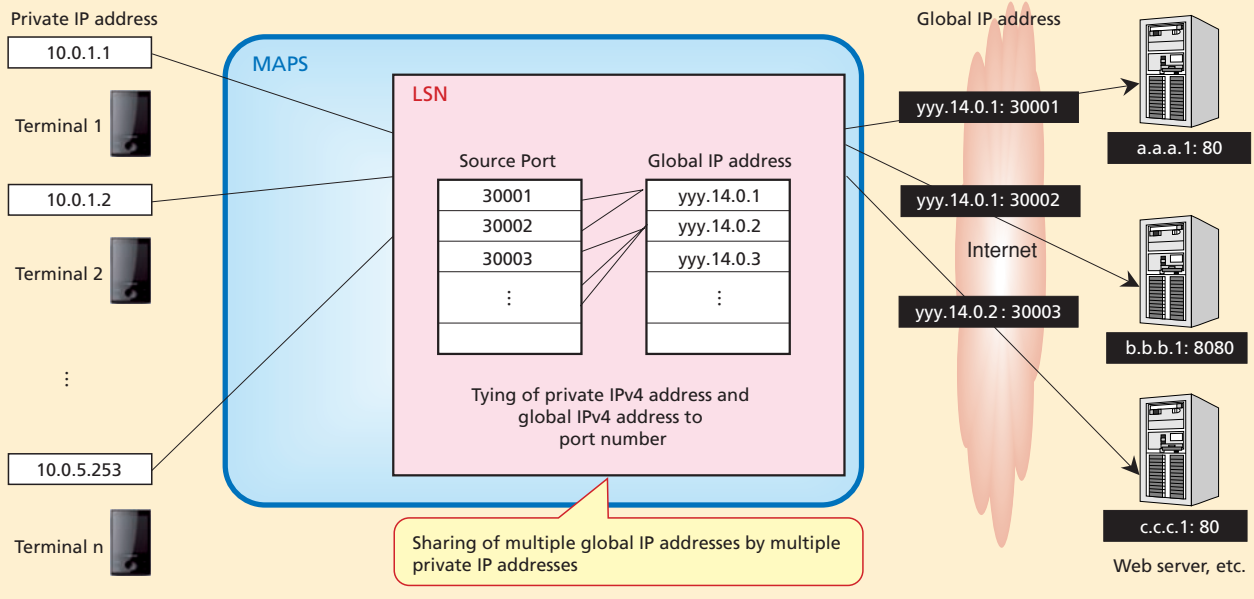

Figure 5 Processing by LSN

*5 **Private IP address**: IP address that can be used in a closed manner in a particular network.
*6 **Global IP address**: IP address assigned uniquely to equipments that can be connected to the Internet.

"Position measurement function using Secure User Place Location (SUPL)" for open platform terminals, and currently provides services such as terminal management and location information using these functions [4]. These services can also be offered in sp-mode based on the smartphone service platform.

The "Device management platform system" and the "SUPL system" of these services are placed in the core network and not in MAPS in order to allow as many users as possible to use the services regardless of their contract details. However, in the case of packet communications in sp-mode, the communication is via MAPS so as to prevent illegal access and to block unnecessary packets from the Internet when using the smartphone.

Thus, we have made it possible for users using sp-mode to receive services without having to manually change APNs by partially modifying the core network so that communication to the two systems only will be directly connected by static routing to the system concerned.

4. Receiving Function for sp-mode mail

In sp-mode mail, it is possible to notify the arrival of e-mail real-time, as in the case of i-mode mail.

To realize the sp-mode mail arrival notification function, existing delivery functions have been utilized. When an e-mail sent by sp-mode mail arrives at the sp-mode mail server, the delivery server of MAPS sends an SMS request (SMS-SUBMIT) to the core network so that it can notify the arrival of the new e-mail. The mail client in the smartphone detects the SMS sent to it via the core network, following which it starts to retrieve the e-mail from the sp-mode mail server.

When an SMS fails to arrive at the smartphone due to reasons such as it being out of range, it is re-transmitted when the core network detects that the terminal is back within range.

5. Web Access Restriction Service

5.1 URL Filtering

For the sake of peace of mind and safety, and based on the "Web access restriction service" already provided in i-mode, a Web access restriction function has been introduced in the sp-mode for smartphones so as to prevent juveniles from accessing harmful sites inadvertently.

In this function, when a user having an sp-mode filtering contract connects to sp-mode, a certain IP address is issued to this user at the time of connection authentication. As a result of this, when the IP packets from the smartphone start to flow through the MAPS network, it becomes possible to route only the Web access traffic to the OPF_Proxy[*7] in MAPS, thereby enabling OPF_Proxy to check whether the destination URL is subject to restriction or not (**Figure 6**). If it is subject to filtering, the OPF_Proxy sends back an "access to this site is restricted" screen to the smartphone, and if not it passes the packets to the Internet. As such, the workload of the OPF_Proxy is reduced by routing to it only the packets coming from users who have an sp-mode filtering contract and then making filtering decisions regarding these packets only.

5.2 Provision of Filtering Setting Site

Customization of filtering in sp-mode is made possible both for the guardian and the individual being protected. Parts of the sites and categories for which access is restricted on the protected person's terminal can be changed by the guardian modifying the setting. First, the contract user (i.e. the protected person) makes a preliminary registration of the sites he/she wishes to view. Next, after the guardian approves the preliminary sites, the viewing of these sites becomes possible.

On the customization screen, an environment by which the user moving from i-mode can intuitively use the screen has been implemented through an authentication procedure which features nearly identical screen transition and the use of the sp-mode password. In addition, a utilization environment the same as that of i-mode has been realized for the authentication by the

*7 **OPF_Proxy**: One of the MAPS servers. It has the function of terminating user HTTP communications, checking the URL and then relaying to the Internet, in order to determine whether access should be restricted.

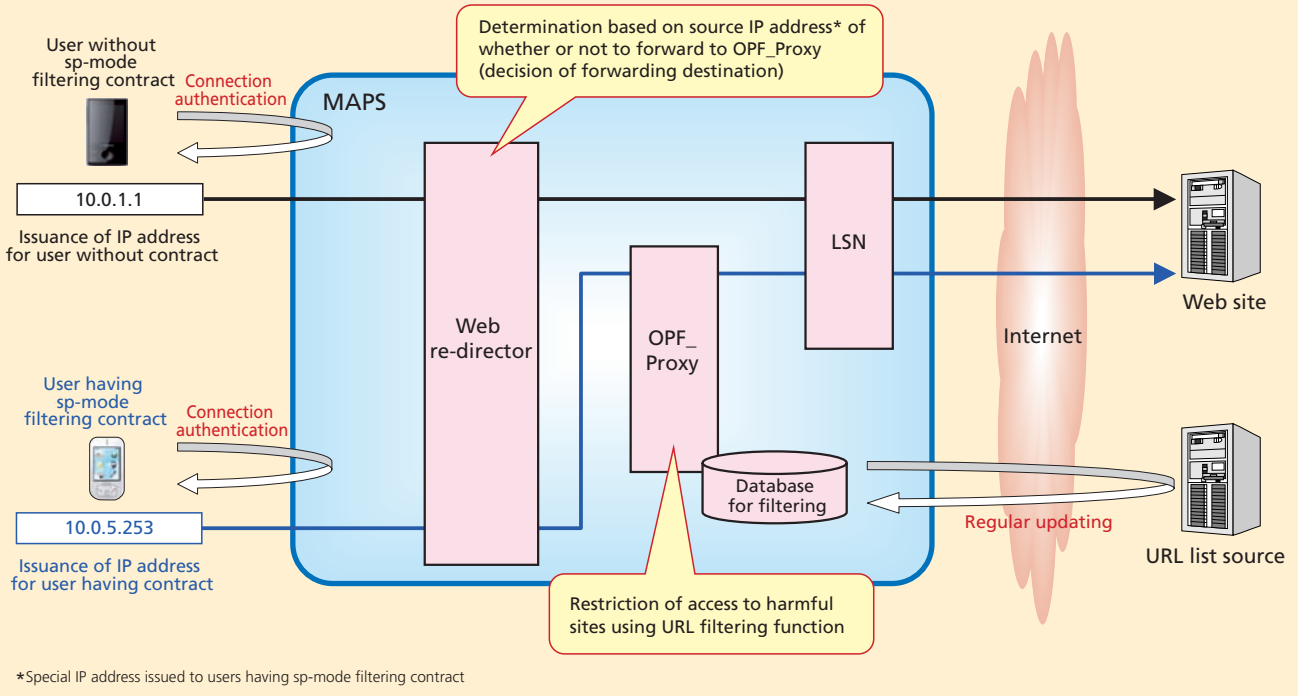

Figure 6 URL filtering

guardian by adopting a "Limit password[*8]" as the authentication method.

6. Provision of Payment Functions for Purchased Contents

The same contents payment function as provided in i-mode has been realized for smartphones in sp-mode. Users can purchase contents just by entering the sp-mode password on the payment screen, and the charge is billed together with the monthly mobile phone charge.

Contents payment by simple user action has been made possible by making use of the authentication information, which is acquired at the time of sp-mode connection, for billing purposes.

7. Conclusion

The service provision platform for smartphones has been developed as an integrated platform to provide a wide range of services to smartphones. When starting a new service in the future, it is necessary only to add a new server in MAPS corresponding to the service, whereby a quick service launch becomes possible.

We have also developed an Internet connection platform using LSN taking account of the potential exhaustion of IPv4 global address. We are preparing to move to IPv6 in the future.

We plan to enhance the features of the platform as necessary so as to provide new services for smartphones.

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*8 **Limit password**: Common six-digit password necessary when raising limit in tariff plans with limit functions and when setting Web access restrictions in customization site and when changing categories.