

M1000 and MAPS for Expansion of Business-Oriented Services

(1) FOMA M1000

Toshifumi Mori, Hirobumi Nakayama, Shigeki Naganawa, Katsumi Isogimi, Kazushige Aoyama and Kouichi Hayashi

We have developed “FOMA M1000,” an IMT/GSM dual mobile terminal mainly targeted for the business consumer group that requires advanced functions for mobile terminals. This mobile terminal is equipped not only with basic telephone functions, but also with advanced applications such as a full-fledged Internet browser and an Internet e-mail program, as well as wireless LAN.

● Development Reports ●

1. Introduction

In 2005, we developed FOMA M1000 equipped with advanced Personal Digital Assistant (PDA) functions for the business consumer group.

As a result of the rapid price drop of mobile terminals and PCs since the start of i-mode services in 1999, the diffusion rate of access to the Internet in households (including usage via mobile terminals) has reached approximately 90%.

Against this background, we conducted a market survey to analyze user needs based on the hypothesis that “there must be a demand for being able to use the Internet outside as easily as using PCs at home as well,” and it was found that potential demands at the scale of several million people exist. Based on this result, we launched two concepts: to achieve full-scale Internet access via mobile terminals of the existing size and to level up the entire DoCoMo non-voice traffic by cultivating user groups different from existing i-mode users to widen our overall user base.

Based on the concepts above, we set the following specific goals.

- 1) The primary target will be business consumers in their 30s and 40s (users who always use the Internet via PCs) and corporate system users.

- 2) Provide easy-to-use Internet functions that the users above can use without feeling uncomfortable.
- 3) Provide wireless Local Area Network (LAN) facilities that allows downloading large amounts of data comfortably.
- 4) Provide voice communication functions equivalent to FOMA terminals.
- 5) Implement international roaming functions, which are in high demands among the business user group.
- 6) Launch the products on the market at low prices and as soon as possible in order to form a dedicated market for these products.

In order to satisfy the goals above, we focused on a Motorola's open platform mobile terminal (A1000), which supports International Mobile Telecommunications-2000 (IMT-2000) and is equipped with Internet functions.

We developed M1000 jointly with Motorola using A1000 as the base to shorten the development period. Moreover, we achieved the goals above by newly implementing extra functions required to appeal adequately to the target group.

2. Overview of M1000

Photo 1 shows the external view of M1000 and **Table 1** shows the basic specifications. The external view of M1000 has the following characteristics.

- A stylus/touch panel combination is used as the input method to operate the device.
- The most frequently used buttons, such as initiate call and end call, are only adopted as hardware buttons while other functions are adopted as on-screen software buttons, to make the screen larger.
- The LCD used is much larger than the ones used in normal mobile terminals.



Photo 1 External view of M1000

Table 1 Basic specifications of M1000

Function/characteristics		M1000
Physical dimensions	Design	PDA type
	Size	117 x 59.5 x 21.5 mm
	Weight	168 g
Battery time	Duration of continuous voice phone call	120/280 minutes (FOMA/GSM)
	Duration of continuous video phone call	80 minutes
	Continuous standby time	3G: 200/110 hours (stationary/in transit) 2G: 200 hours
Wireless band	3G	2 GHz
	2G/2.5G	900 MHz, 1800 MHz, 1900 MHz
LCD	Size	Approximately 2.9 inches
	Resolution	208 x 320 pixels
Camera	Back camera effective resolution	Approximately 1,310,000 pixels (CMOS)
	Front camera effective resolution	Approximately 310,000 pixels (CMOS)
Other functions	Wireless LAN	IEEE 802.11b
	Bluetooth ^{*1}	Ver. 1.1
	External memory	Transflash ^{*2}

*1 Bluetooth: A registered trademark of Bluetooth SIG, Inc. in the US.

*2 Transflash: Compact flash memory card for mobile phones developed by SunDisk in the US.

CMOS: Complementary Metal Oxide Semiconductor

LCD: Liquid Crystal Display

As for the built-in software, a full-fledged browser and Internet e-mail program with functions equivalent to PC software are implemented as the main applications. Moreover, the Internet e-mail program is equipped with functions to receive mail reception notifications via Short Message Service (SMS), and to establish communication with a mail server and receive mails automatically. Additionally, M1000 functionality, which was originally as high as that of PCs, has further been upgraded through utilization of Mobile OPERATION Radio Assistant U (mopera U)^{*1}, which is DoCoMo's mobile Internet connection service. The details of the main applications of M1000 are explained in Chapters 3 and 4.

Functions for using the applications above easily and safely are also implemented. Chapter 5 explains functions that allow easy connection to the Internet and Chapter 6 explains security functions for handling virus attacks on the mobile terminals.

Moreover, voice call, video phone, SMS, data communication via Circuit Switching (CS) and packet communication are available as communication services. The services above are available in overseas locations as well. Global System for Mobile communications (GSM)/General Packet Radio Service (GPRS) are also supported, making it possible to use each function of M1000 throughout most parts of the world. Furthermore, wireless LAN, which is becoming very popular lately, is implemented and it is thus possible to download large amounts of data comfortably. Additionally, a Software Development Kit (SDK) is provided to allow creating additional applications for M1000 in order to accommodate specific needs of corporate users in various fields flexibly. Chapter 7 provides some examples of applications using SDK.

Finally, certain functions corresponding to customer systems and functions supplementing the communication services have also been implemented, as explained in Chapter 8.

3. Browser

When using the browsers installed in most of the exiting mobile terminals, it is only possible to view contents that are suited for mobile terminals. M1000, on the other hand, is equipped with a general-purpose full-fledged browser, which makes it possible to view Webpages intended for PCs, given the limited screen size, memory capacity and throughput of mobile terminals. This allows viewing not only mostly text-based Webpages, but also pages with large amounts of contents, such

as image data, on the mobile terminals. However, if a Webpage for PC browsers is displayed as is on the screen of a mobile terminal, horizontal and vertical scrolling becomes necessary; these complicated operations make it inconvenient for the user to view the contents. In order to solve this problem, M1000 is equipped with functions that render the Webpage in three different browser display modes and improve the clarity and operability of the contents display. The display modes of the browser installed in M1000 are explained in the following. **Figure 1** shows screen images displaying the same contents using each of the display modes.

- 1) Zoom mode: Fig. 1 (2), (4), (5), (6)
- 2) Small Screen Rendering (SSR) mode: Fig. 1 (1)
- 3) Mid Screen Rendering (MSR) mode: Fig. 1 (3)

1) Zoom Mode

The Zoom mode scales the Webpage up/down within a zoom range of 20% to 200% and displays it. In addition to this, M1000 is equipped with an AutoZoom mode, which automatically scales the display to a range where horizontal scrolling (moving the display to the left or right to display areas that are not shown on the screen) is not necessary.

When the Zoom mode is used, the entire Webpage, which may contain not only characters but also image data, can be rendered at any scale; it is suited to view both the entire page and individual details.

2) SSR Mode

The SSR mode displays the entire Webpage after rendering so that it can be displayed on the screen of M1000. In order to optimize the display for the screen of M1000, this mode changes the font size (i.e. the specification of shape and size of characters rendered on computer displays), shrinks images according to the screen size, blocks banner advertisements (the most widely used method for Internet advertisement) etc., and automatically renders the page at the size where horizontal scroll is not necessary. Since this mode changes characters to a fixed size and displays images according to the screen size, it is particularly suited for viewing such as news sites.

3) MSR Mode

The MSR mode changes the font size to a size that can be displayed comfortably and renders the page at the size where horizontal scrolling is not necessary while maintaining the Webpage structure before displaying the page. Since the Webpage structure is maintained in the rendering process, it is

*1 mopera U: A trademark of NTT DoCoMo, Inc.

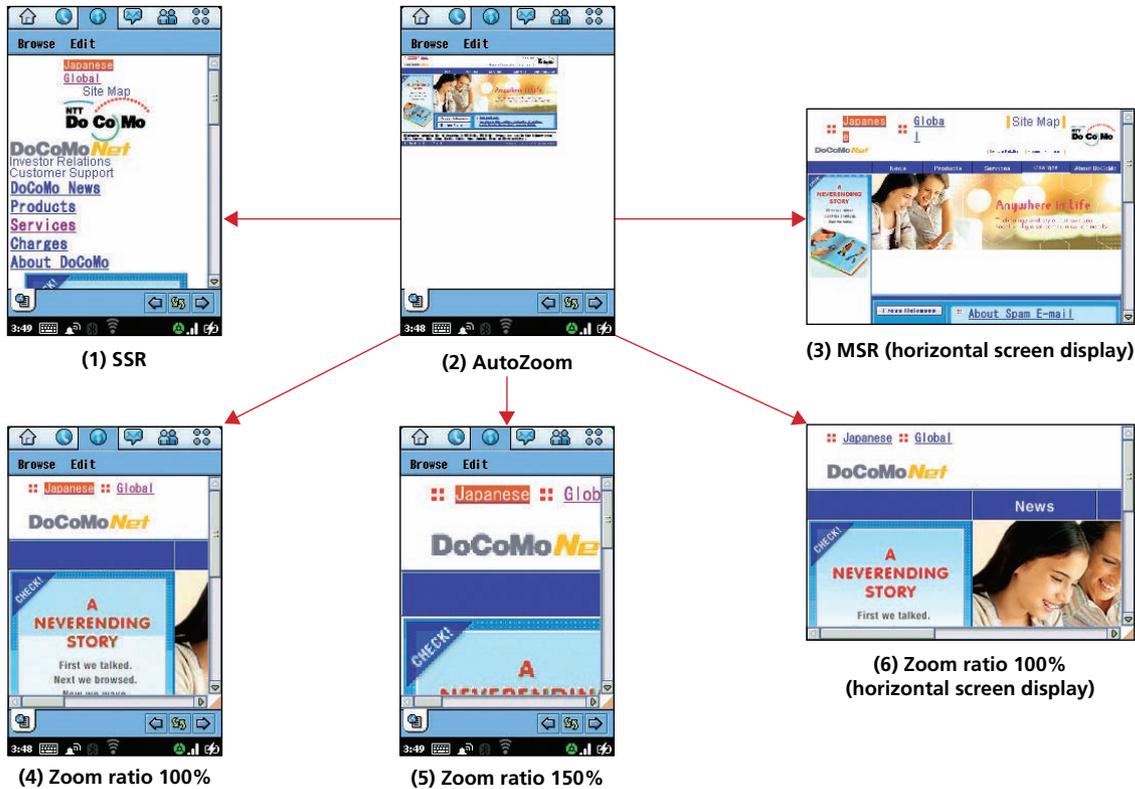


Figure 1 Browser display modes

possible to view it in basically the same way as it would be seen on a PC monitor.

4. Internet Mail Program

M1000 is equipped with an Internet mail program similar to the ones generally used in offices and at home, instead of the i-mode mail functions normally used in mobile terminals. Thus, it is possible to send and receive mails with any types of files. Under normal circumstances, e-mail program for PCs requires users to perform operations to “connect to a line,” “start up e-mail program” and “receive new mails.” M1000, on the other hand, is equipped with functions to receive e-mails sent to the users automatically in the same way as for i-mode mail programs. Moreover, the program makes sure to save the mails efficiently, considering the limited storage capacity; it supports four reception methods, which will be explained below.

The following explains the mechanism for receiving new mails automatically with M1000.

M1000 adopts a method standardized by the Open Mobile Alliance (OMA) as its automatic reception method of new mails. The advantages of adopting the OMA method include that it is possible to use M1000 in overseas locations because it is a standard method used all over the world and that it can be

implemented at low cost and in a short period of time because the basic functionality has already been implemented in A1000. Note that this method is used to receive i-mode mails in overseas locations as well.

Figure 2 shows an overview of automatic mail reception via this method, Figure 3 shows the SMS format used in the automatic mail reception, and Figure 4 shows the automatic mail reception processing flow on the M1000 side. As shown in Fig. 2, when a new mail arrives at the mopera U mail server, the SMS gateway server creates the information necessary for M1000 to receive the new mail automatically and the Message Processing System (MPS) notifies this information to the terminal with a special SMS. M1000 then automatically receives the mail based on the information. The information fields of the Transfer Protocol-User Data Header Indicator (TP-UDHI) shown in Fig. 3 indicate whether the SMS is of the special or normal type. Upon receiving the SMS, M1000 confirms that the SMS is special (processing (1) in Fig. 4) and then confirms that the EMail Notification (EMN) parameters are set in the “Content Type” and “Headers” fields of the Wireless Session Protocol (WSP) headers shown in Fig. 3 (processing (2) in Fig. 4). If it receives an SMS in which the EMN parameters are set, M1000 compares the mail address in the SMS body text and the

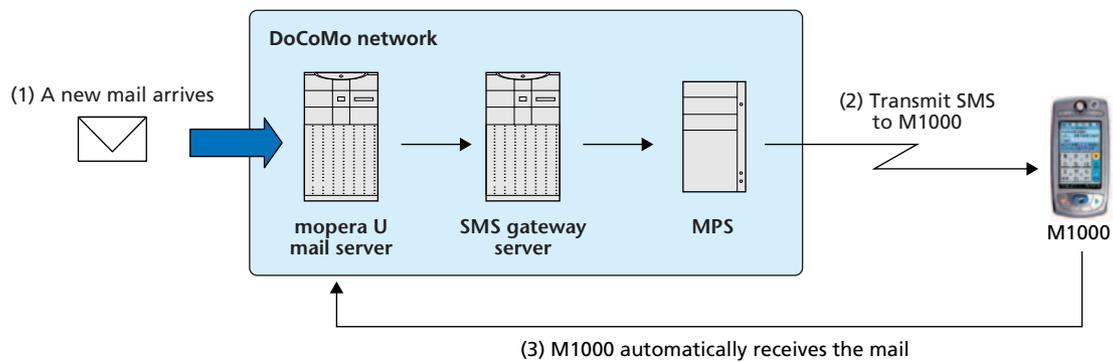


Figure 2 Overview of automatic mail reception

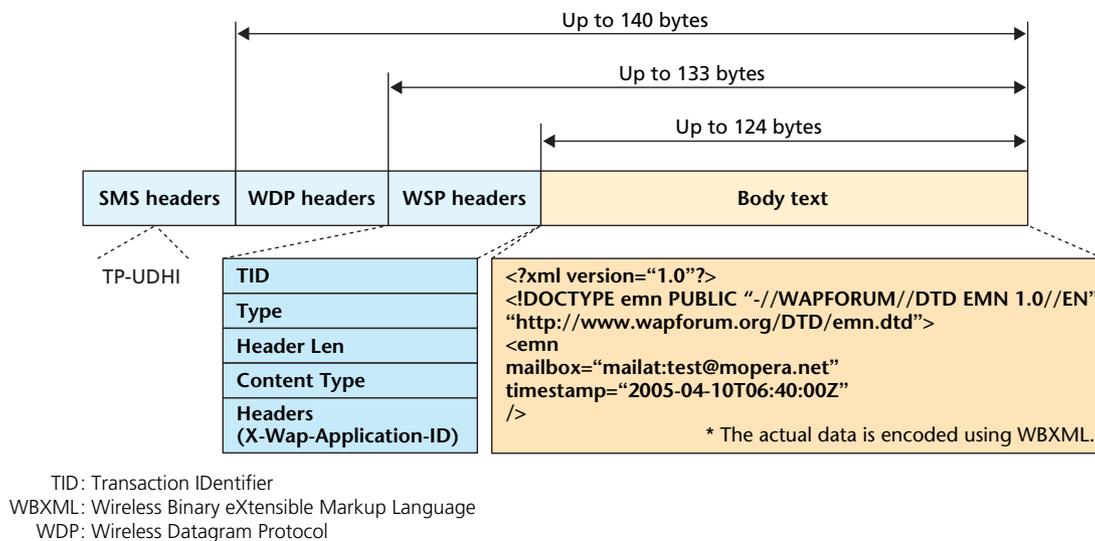


Figure 3 SMS format

mail addresses stored in its memory. If the account setting of a matching mail address is set to automatic reception, M1000 receives the mail automatically (processing (3) in Fig. 4).

The method of receiving mails is as follows.

M1000 supports the following four reception methods in order to use the limited storage capacity effectively.

- 1) No restriction (receive the full text of an e-mail)
- 2) Reception of headers only (address, sender, title, etc. of an e-mail)
- 3) Reception of specified number of lines
- 4) Reception of specified size

Reception of specified number of lines is a method where the user specifies the maximum number of lines in the e-mail body text to be received. The user can then check the part of the mail body text received and get an overview of the contents of the mail. This method is possible only when using Post Office Protocol 3 (POP3).

Reception of specified size is a method where the user specifies the maximum data size per mail to be received. The mail size information managed by the server is used to specify the size and the mail reception method is changed based on this information for each mail. If the size of a mail is larger than the specified file size, only the mail headers are received by M1000. If the size is smaller than the specified file size, the entire mail is received by M1000. Since only the mail headers are received by M1000 in case of large mails, it is thus possible to reduce both the storage capacity and communication fee.

Mails received using “reception of headers only,” “reception of specified number of lines” or “reception of specified size” can be received again as complete mails as far as they are saved in the mopera U server.

5. Simple Internet Connection Setting

To connect to the Internet with M1000, it is necessary to specify environment settings and Internet Service Provider

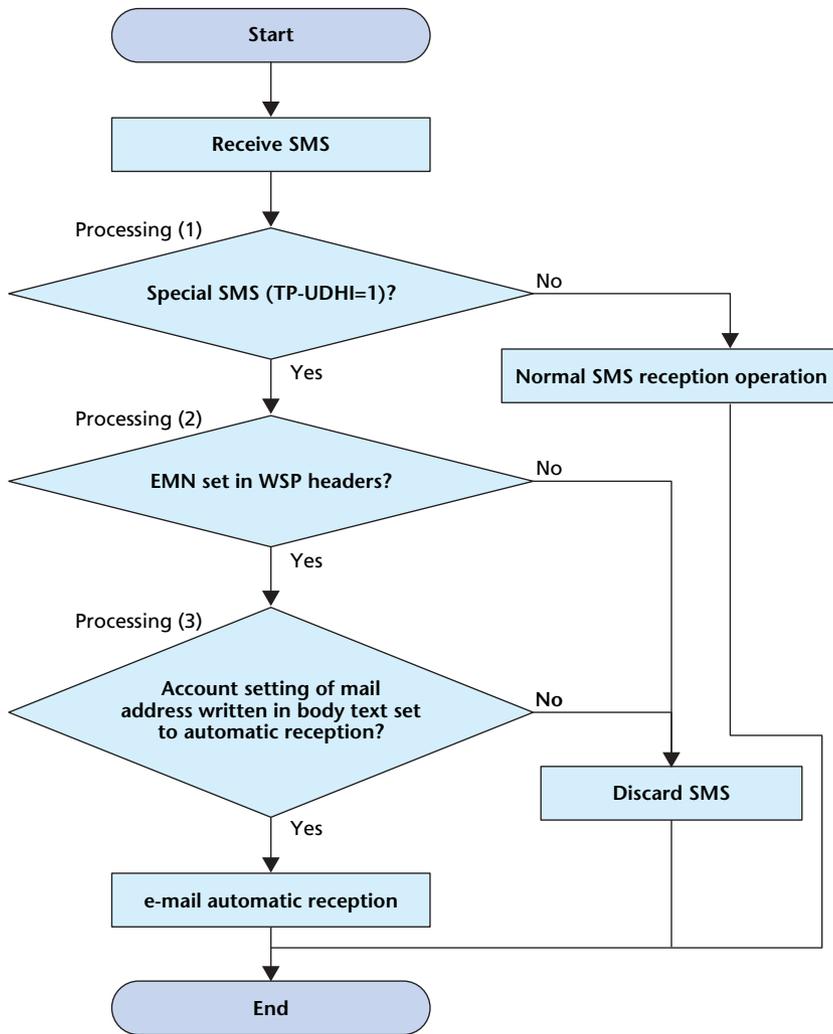


Figure 4 Processing flow of automatic mail reception

(ISP) settings in the same way as for PCs, and it was essential to simplify the operations required for these settings. The methods used to resolve this issue are explained below.

1) Unified Management of Network Profiles

We succeeded in unifying the management of the network profile information necessary for communication using M1000 in a single network setting screen regardless of the communication mode (FOMA circuit switching mode, GSM circuit switching mode, mopera U mode and wireless LAN mode) (Figure 5). This allows users to create new network profiles, edit/delete network profiles and connect to or disconnect from a network in a single setting screen. Moreover, it is possible to call up the list of network settings created using this screen when using the browser, allowing the user to connect to the Internet through a few simple operations.

2) Network Profile Default Settings

Users of M1000 can access the Internet without making any

ISP settings because the mopera U ISP has already been set in M1000.

3) Automatic mopera U Connection Settings

One of the network setting functions installed in M1000 is the automatic settings to access mopera U. This allows accessing a particular site with a single touch of a button from the automatic setting screen and setting and saving mopera U profiles, i.e. user ID and password, along with mopera U mail account information automatically in the M1000 terminal. Furthermore, the users can access mopera U service sites without entering ID and password and use mail services immediately by using the mail account, which is automatically set in a similar manner.

6. Security Functions

Lately, countermeasures against viruses are becoming more and more important on the PC platform and in mobile terminals as well, security scan functions are implemented from the FOMA 901i series launched at the end of 2004 [1]. For

M1000, one of the important goals was the ability to add new applications and taking countermeasures against viruses was therefore an important issue, just the same as PCs. However, it turned out to be impossible to implement the security scan functions of the FOMA 901i series as is due to the differences in the additional application functions between M1000 and the FOMA 901i series. For this reason, we developed a set of functions suited for the characteristics of M1000 while taking advantage of existing technologies to the greatest extent possible. This chapter explains the security scan functions of M1000, by comparing M1000 and the FOMA 901i series.

With the security scan functions of the FOMA 901i series, each application passes data to the scan program when it operates. Additional applications are limited to i-appli (Java^{®2}) and scanning is performed by passing data to the scan program from

*2 Java: Object oriented software environment with particular emphasis on network use, promoted by Sun Microsystems, Inc. in the US.



Figure 5 Network setting screen

the management function that handles adding, deleting and activating applications. M1000, on the other hand, was required to support not only Java applications, but also applications that can be directly executed on Symbian OS^{*3} written in C++ (a programming language) as additional applications. For the latter type of applications, no management function such as the one described above and infection on the file level similar to what can be observed on the PC platform was feared. Therefore, it is necessary to scan all data in case of M1000 and a method where the user manually instructs when to start a scan is adopted. This allows a wide-range scan more similar to the method adopted on PCs.

As discussed, the method to pass data to the scan program was changed, but the technologies accumulated in the FOMA 901i series were utilized as much as possible for technologies

*3 Symbian OS and all trademarks and logos related to Symbian are trademarks or registered trademarks of Symbian Ltd.

that can be shared such as security scan technologies, including memory optimization technologies for scan engines and traffic control technologies for pattern data downloading, and the functions suited to the characteristics of M1000 could be implemented in a shorter period of time as a result.

7. Add-On Applications

M1000 is able to execute C++ and Mobile Information Device Profile (MIDP) 2.0 (Java defined for mobile terminals) applications on Symbian OS environment and it is thus possible to expand the application software functions. **Figure 6** shows the system architecture, i.e. the relationship between the OS and add-on applications. Add-on applications for improving the user convenience and sense of security are provided targeted at the consumer users who make use of M1000 terminals mainly for business purposes, and other add-on applications aimed at improvement of business efficiency by linking with corporate systems and for security measures are provided for corporate users who use M1000 for business operations. These add-on applications are explained below.

1) For Business Consumers

a) Remote lock

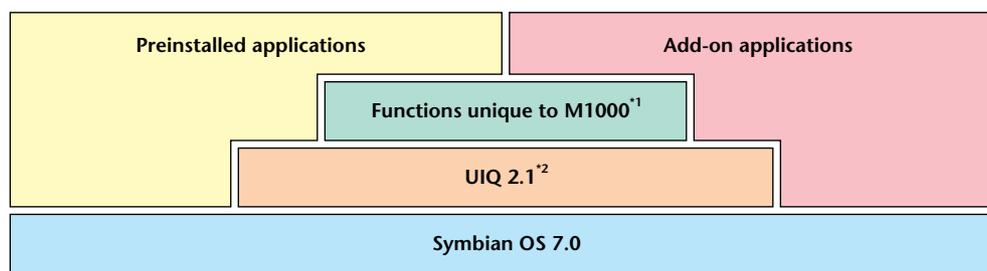
In case of loss or theft of a terminal, it is possible to make a specified number of calls to the terminal from a specific telephone number, whereupon the terminal is locked (invalidating all screen operations) or user data is deleted.

b) Wireless LAN client

This application simplifies wireless LAN settings by downloading the settings via a network and automates ID and password entry in Internet access operations.

It can be used with public wireless LANs such as Mzone and in wireless LAN environments at home and at offices.

c) M1000 application data backup



*1 Functions unique to M1000: Functions based on UIQ that are added or changed for M1000 (e.g. voice functions).

*2 UIQ: Software platform for wireless mobile terminals equipped with touch panel in which unique UI and related functions are implemented on top of Symbian OS. UIQ is a trademark of Symbian Ltd.

Figure 6 M1000 system architecture

This application backs up Personal Information Manager (PIM) data such as schedule information stored in the M1000 terminal on a server via a network and allows viewing and editing of the information via Webpages. It is also possible to synchronize and reflect data edited on a Webpage with/in the M1000 terminal. This function is provided as a part of the mopera U services.

2) For Corporate Users

a) PUSH remote application activation

This application receives an application activation mail triggered by an SMS sent from the company side to a terminal via PUSH and automatically activates a business application on the M1000 terminal according to the commands described in the mail. This application allows real time coordination between business systems on the company side and business applications on M1000 terminals. **Figure 7** provides an overview of the operations.

b) Security monitoring tool

This application maintains a list created on the company side specifying applications that have been approved with respect to access to networks and security policies prescribing methods of handling unapproved applications within M1000. It also checks applications at fixed time intervals to detect illegal applications unrelated to business and unknown applications suspected of being affected by viruses, and prevents them from being activated or even deletes them.

c) Business mopera Access Economy^{*4} client

This application supports the Business mopera Access Economy tunneling protocol to allow remote access to corporate LANs.

8. Other Functions

1) Support for ALADIN

M1000 supports the customer management system ALI Around DoCoMo INFORMATION systems (ALADIN) in order to utilize FOMA networks.

First, ARIB-A connectors provided by the Association of Radio Industries and Businesses (ARIB) are adopted instead of Motorola's standard connectors. This eliminates the need to prepare special conversion connectors etc. when connecting to ALADIN. Moreover, M1000 is equipped with memory copy functions allowing the user to transfer data between terminals at model change and software update functions required in case software problems should occur.

2) Additional Services

M1000 supports almost all services from the standard functions specified by the 3rd Generation Partnership Project (3GPP) including Call Waiting, Call Hold and Call Forward to functions unique to DoCoMo, such as Drive Modes and Call Rejection.

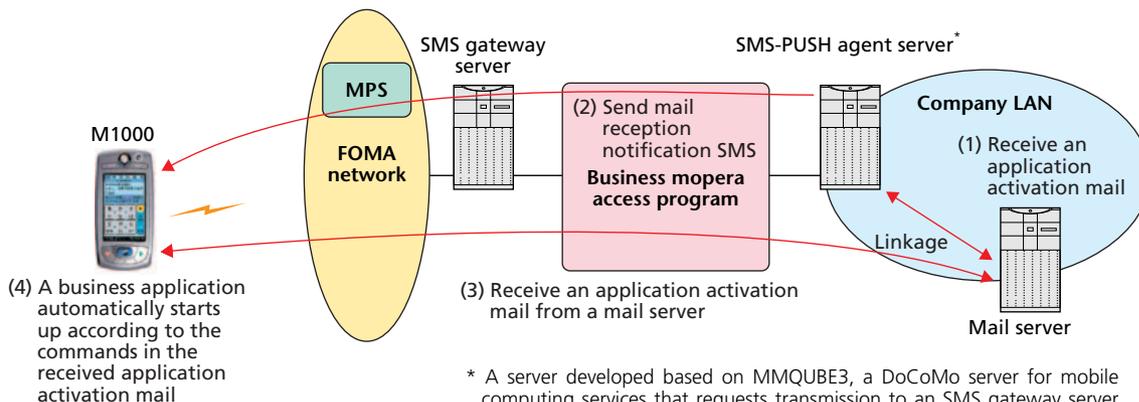
Moreover, additional setting functions for User Supplementary Service Data (USSD)^{*5} are also provided, taking additional services to be added in the future into consideration.

9. Conclusion

M1000 is a mobile terminal based on A1000 and equipped with various additional functions such as automatic new mail reception and wireless LAN in order to develop the business

*4 Business mopera Access Economy is an inexpensive and secure remote access environment for companies proposed by NTT DoCoMo Inc.

*5 USSD: Also called non-structured additional service data. It is signal-type data mainly used to start, stop and confirm settings of various network services including answering machines and telephone redirecting.



* A server developed based on MMQUBE3, a DoCoMo server for mobile computing services that requests transmission to an SMS gateway server when a linked mail server receives an application activation mail and notifies about mail reception to the corresponding terminal via SMS.

Figure 7 Overview of operations of PUSH remote application activation

consumer market promptly. In the future, we intend to enrich functions for the business consumer group as well as implement multimedia functions such as standard equipment of i-mode, and promote development toward reduction in size and weight of new mobile terminals.

REFERENCES

- [1] H. Kobayashi et al.: "Security Scan System Using Wireless Communication," NTT DoCoMo Technical Journal, Vol. 7, No. 1, pp. 26–31, Jun. 2005.

ABBREVIATIONS

3GPP: 3rd Generation Partnership Project
 ALADIN: ALI Around DoCoMo INformation systems
 ARIB: Association of Radio Industries and Businesses
 CMOS: Complementary Metal Oxide Semiconductor
 CS: Circuit Switching
 EMN: EMail Notification
 GPRS: General Packet Radio Service
 GSM: Global System for Mobile communications
 IMT-2000: International Mobile Telecommunications-2000
 ISP: Internet Service Provider
 LAN: Local Area Network
 LCD: Liquid Crystal Display
 MIDP: Mobile Information Device Profile
 mopera U: Mobile OPEration Radio Assistant U
 MPS: Message Processing System

MSR: Mid Screen Rendering
 OMA: Open Mobile Alliance
 PDA: Personal Digital Assistant
 PIM: Personal Information Manager
 POP3: Post Office Protocol 3
 SDK: Software Development Kit
 SMS: Short Message Service
 SSR: Small Screen Rendering
 TID: Transaction Identifier
 TP-UDHI: Transfer Protocol-User Data Header Indicator
 USSD: User Supplementary Service Data
 WBXML: Wireless Binary eXtensible Markup Language
 WDP: Wireless Datagram Protocol
 WSP: Wireless Session Protocol