

Special Issue on i-mode Service

i-mode Server

Our aim of i-mode server is to provide “receiving information” and “sending and receiving mail” services, just by a click of an i-mode terminal.

This paper outlines i-mode server, which connects the PDC-P network and IP in i-mode service.

Toshiyasu Yabe

Introduction

With i-mode cellular phone it makes possible to receive information from IP (Information Provider) and to transact i-mode mail with easy operation. And with i-mode service introduction it is assumed to expand mobile computing by leaps and bounds.

Following text describes i-mode server, which realises this phenomenon.

In this paper, sometimes i-mode server is referred as GRIMM (Gateway Service Representative Internet Market Mobile Access Exchange).

Purpose of i-mode Server Introduction

In i-mode service, it becomes necessary to have i-mode server as a relay server between M-PGW (Message-Packet Gateway Module), which is termination point of PDC-P network, and IP or PC in the Internet. Followings are major functions;

- ① Gateway function to relay i-mode cellular phone (in PDC-P network) and Internet (including leased line) for information distribution or mail transaction
- ② Mail storage function to store mails when they are not delivered
- ③ User management function of i-mode subscriber and IP management function
- ④ Information charging function

i-mode Server Configuration

In “i-mode” service, i-mode server functions as gateway server which connects i-mode cellular phone and Internet.

Figure 1 shows i-mode server configuration.

i-mode server is connected to M-PGW to have connection with PDC-P network. And also it is connected to customer center and itemisation center, which are in-house system, IP (including PC) via leased line and internet, and maintenance terminal (monitoring terminal, operation terminal) to maintain system.

Table 1 shows connection destination and function outline. i-mode server consists of B-MAX (Business-Mobile Access Exchange), C-MAX (Contents-Mobile Access Exchange), D-MAX (Database-Mobile Access Exchange), I-MAX (Interface-Mobile Access Exchange), M-MAX (Mail-Mobile Access Exchange), N-MAX (Name-Mobile Access Exchange), U-MAX (User-Mobile Access Exchange), W-MAX (Web-Mobile Access Exchange). I-MAX has n+1 configuration and others have redundant configuration.

Each piece of equipment has own responsible i-mode service function. The basic concept of responsibility sharing is as follows;

- ① To guarantee throughput (to have good response)
- ② To increase reliability by load distribution
- ③ To have function base scalability

Service Function

■ Site Connection Service

Table 3 shows i-mode service menu list.

There are two types of site connection service. One is “Pull type”, which i-mode cellular phone requests information and gets response immediately. The other type is “Push type”, which user has to register conditions beforehand and later user receives information fulfilling criteria.

- (1) “Pull type” service

About information request, by using menu of i-mode serv-

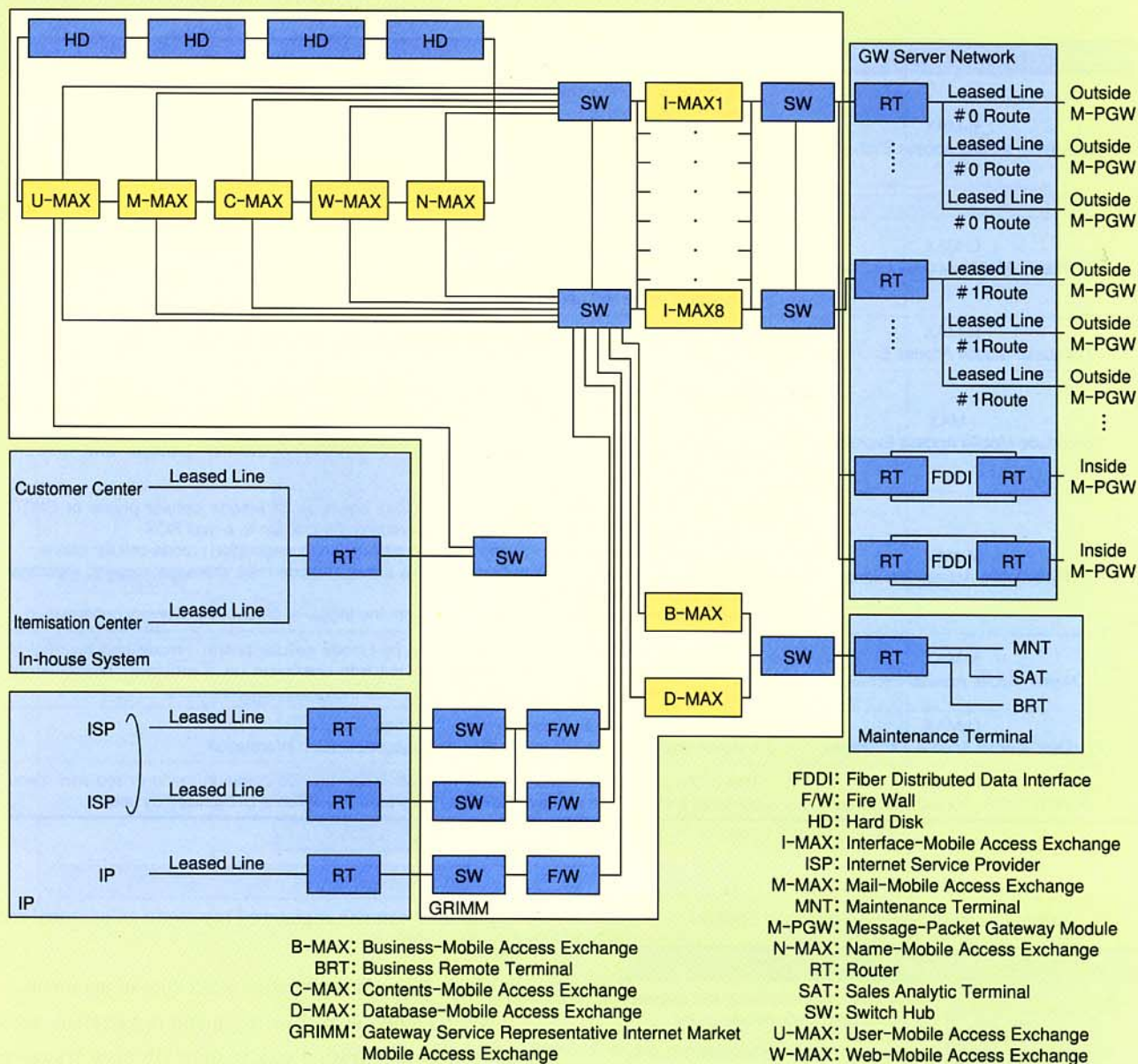


Figure 1 GRIMM Network Architecture

Table 1 Outline of Network Connection at GRIMM

Network Connection	Function Outline
M-PGW (Message-Packet Gateway Module)	Network management. i-mode server communicates with M-PGW by using user information transfer protocol, and connects to PDC-P network. i-mode cellular phone receives various information via PDC-P network.
In-house System	i-mode server communicates with customer center and itemisation center with DoCoMo standard FTP. i-mode user information and IP (Information Provider) contract information is available from customer center. i-mode server sends bill of i-mode information charging to itemisation center through this network.
IP (Information Provider)	There are two routes to connect with IP. One is via Internet and the other is via leased line. E-mail transaction with PC through Internet is carried out.
Maintenance Terminal	Through this terminal necessary information are presented to monitor and maintain each server (MAX) within GRIMM (Gateway Service Representative Internet Market Mobile Access Exchange). SAT (Sales Analytic Terminal), MNT (Maintenance Terminal), BRT (Business Remote Terminal) in GRIMM are processed via this route.

Table 2 Equipments and their Functions of GRIMM

Equipment (Server)	Function Outline
B-MAX (Business-Mobile Access Exchange)	This is the server to control terminals within GRIMM (Gateway Service Representative Internet Market Mobile Access Exchange). SAT (Sales Analytic Terminal), MNT (Maintenance Terminal), BRT (Business Remote Terminal) are connected through this server. It has office data which are integrated and managed within GRIMM.
C-MAX (Contents-Mobile Access Exchange)	This server receives information from IP (Information Provider) and performs write in process into subscriber message. To reduce IP message process load, there is a message called distribution request. This message enables us to ask multiple subscribers message service with one message. When C-MAX receives this message, it can write in message BOX of multiple subscribers with short period of time.
D-MAX (Database-Mobile Access Exchange)	It has functions to collect and analyze marketing data of i-mode service using GRIMM.
I-MAX (Interface-Mobile Access Exchange)	It connects M-PGW (Message-Packet Gateway Module) and other MAXs of GRIMM. When connection to other MAX is made, it tries to distribute load evenly as much as possible, so round robin is used for connection. When it connects to M-PGW it uses user information transfer protocol and network management.
M-MAX (Mail-Mobile Access Exchange)	This server receives e-mail transmitted by mail operation of i-mode cellular phone or SMTP protocol of outside domain. And it also stores received e-mails in to e-mail BOX. At the time of the reception, it sends receiving notification to destination i-mode cellular phone. There are 3 types of BOX maintained by this server, i-mode mail, message request, message free for each cellular phone. Stored each mail (message) will be deleted with the trigger of timer out or delivery confirmation.
N-MAX (Name-Mobile Access Exchange)	It manages i-mode mail account name used by i-mode cellular phone. i-mode mail account of GRIMM is normally cellular phone number, but with user's set up, it provides "prohibition of i-mode mail usage, account using pin code, i-mode mail using different name" .
U-MAX (User-Mobile Access Exchange)	This is the database of i-mode service subscriber. It stores basic subscriber's information and user application information.
W-MAX (Web-Mobile Access Exchange)	This is the content server built up in GRIMM. It can provide common menu or regional menu contents and also has display function as "My Menu" , which is customised by user.

Table 3 List of i-mode Service at GRIMM

i-mode Service	Function Outline
Site Connection Service	Service to requests information and receives information with i-mode cellular phone
i-mode Mail Service (message service)	Service to provide mail via Internet and inter i-mode cellular phones
Internet Connection	Service to provide access to Web site on Internet

er, when arbitrary IP site (menu) is selected, connection with IP server is established.

Followings are Pull type service features.

① My menu registration

i-mode service has bookmark installed in cellular phone terminal. i-mode server has a function of automatic registration and list reordering for the user to browse his or her subscribed information.

Followings can be registered in "my menu" ;

- chargeable site subscription
- Push type site registration
- Frequently using site

The user can use registered my menu as personal menu list.

Figure 2 shows registration procedure of my menu.

When i-mode user does my menu registration, according to the registration guidance of IP, once transaction goes through "W-MAX" to authenticate subscriber's password held in "U-MAX" . In case of normal, registration completion is notified to cellular phone. Also authentication completion is notified to IP server. The order of site list of my menu has learning capability, so the lately used site appears on top of the list.

② Contents length limitation

Pull type contents aim to provide simple contents. Therefore if the contents become more than about 5 kbyte, exceeding portion is discarded within i-mode cellular phone.

③ Menu expansion

i-mode server is planning to provide region-based contents menu or to use i-mode cellular phone terminal location information for menu provision.

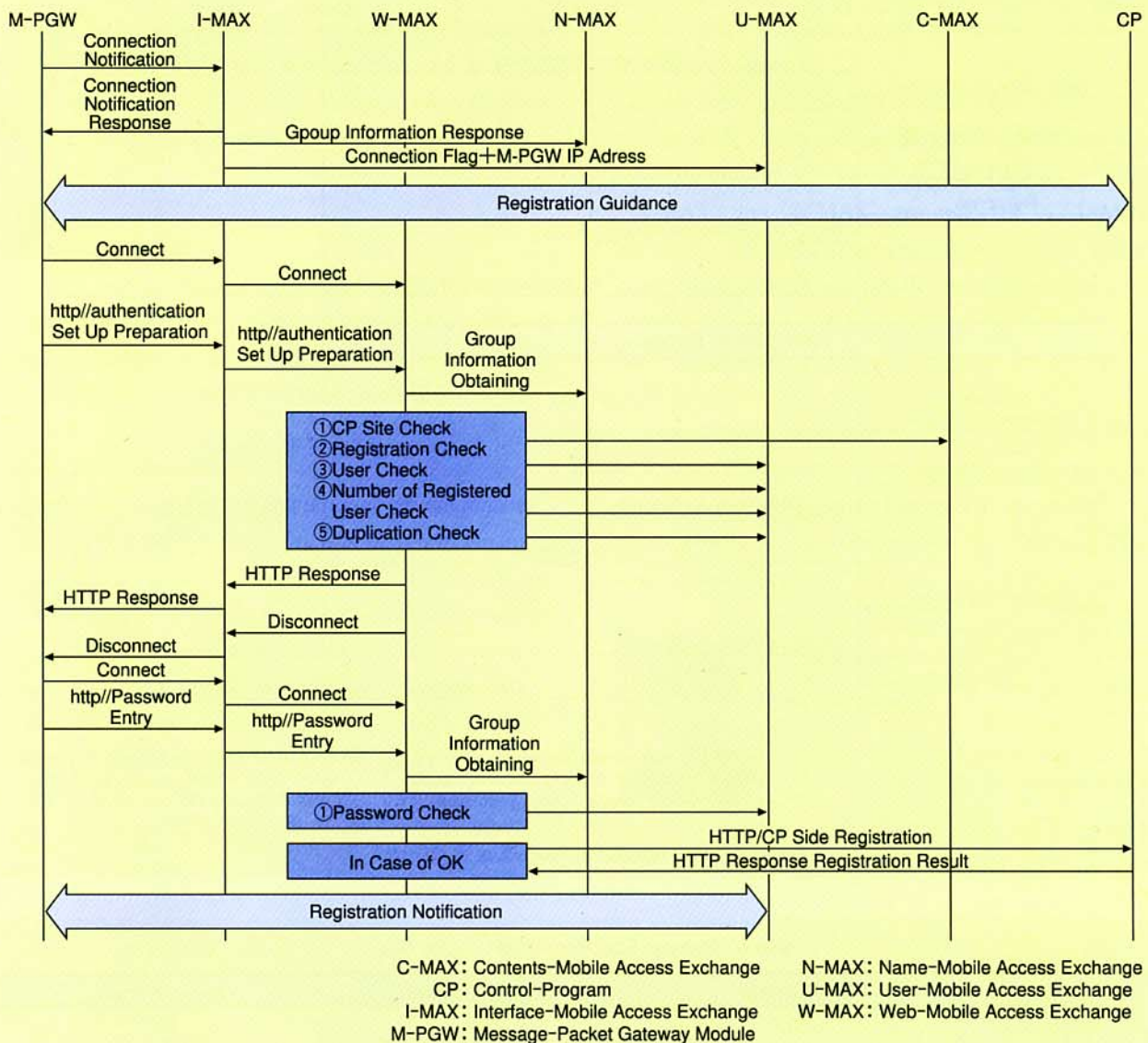


Figure 2 My Menu Update Procedure for GRIMM

(2) Push type service

This is not the service, which let user to look for information. This function is equipped for IP to open information and to provide new information to users.

Push type information distribution is the service to send customised information from IP to user based on user's pre-registered condition.

IP sends push information with specified format. "C-MAX" refers this information with customer information of i-mode server and delivers it as message to i-mode cellular phone. There are two types of Push type service, "Message request", which the user does site registration (including condition set up) and "Message free", which operator side selects users to send information.

■ Mail Service

i-mode mail is able to have e-mail transaction via Internet or inter i-mode cellular phone mail exchange.

i-mode mail is charged packet amount base. So it is necessary to have simpler process than ordinary mail reception process and discard unnecessary packets. To realize this, "M-MAX" is established. Figure 3 shows mail receiving procedure at GRIMM. This procedure is the same as Push type delivery service. All i-mode service mails are stored at "M-MAX" temporarily, and after termination notification is sent to i-mode cellular phone, when i-mode cellular phone is reception available status, mail is automatically delivered. When delivery is performed, mail is sent from old one consecutively and by the amount that i-mode cellular phone can handle. When i-mode cellular phone receives mail, it sends

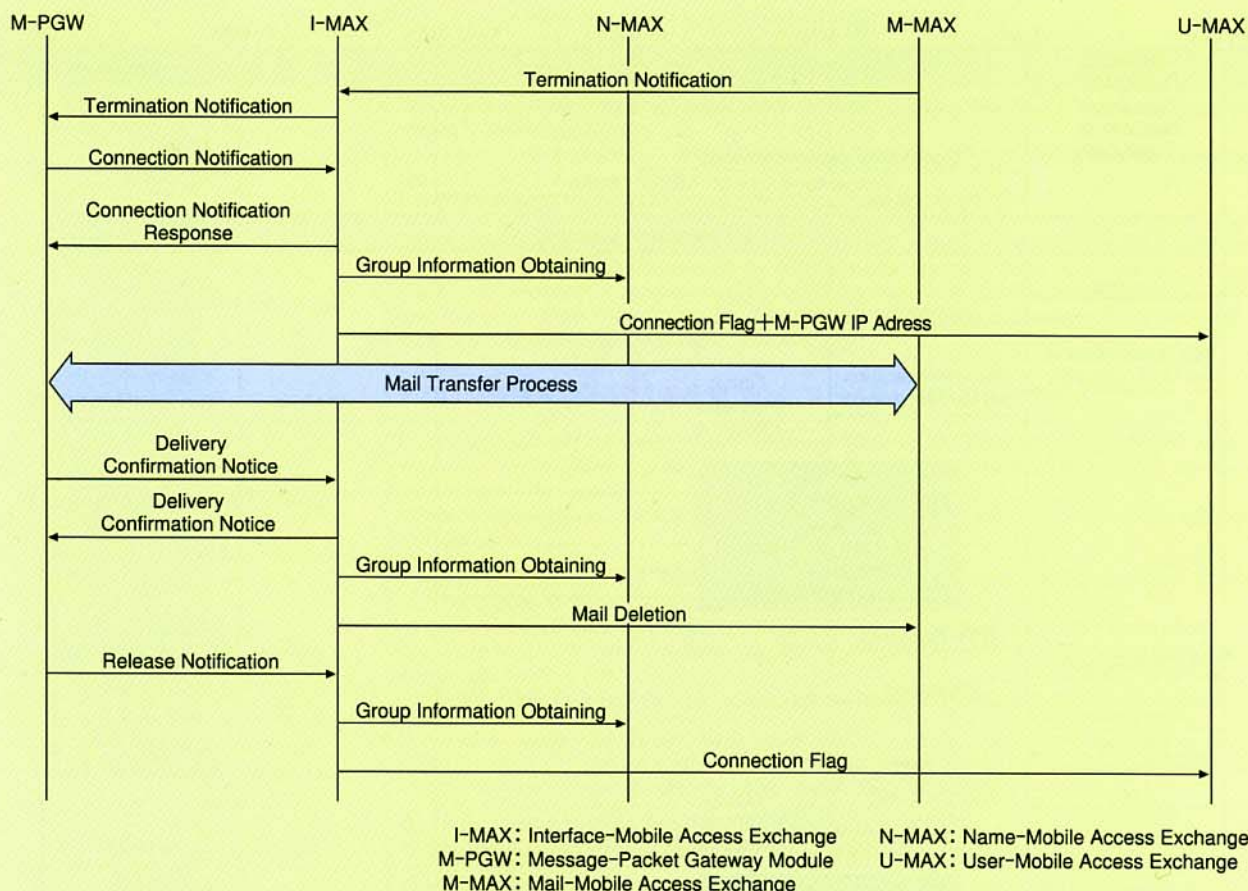


Figure 3 Mail Receiving Procedure at GRIMM

Table 4 Storage Specification of i-mode Mail

Item	Received Mail	Message Request	Message Free
No. of Storage	50	50	20
Storage Period	30days	3days	3days
Deletion timing	<ul style="list-style-type: none"> When transmission to i-mode terminal is completed After storage period time over 	The same as left	The same as left
Reception more than Storage Capability	Mail is returned to sender. When sender is unknown, it is deleted.	Overwrite the mail with older stored date	The same as left

delivery confirmation to i-mode server. i-mode server deletes stored mail at the time of delivery notification reception. When i-mode server does not receive delivery confirmation because i-mode cellular phone can not receive mail, it stores mail at "M-MAX" and deliver it once again when there is delivery request.

Followings are i-mode mail features.

① Mail address

We assume most of the users of i-mode service do not care mail address. To spread mail usage, cellular phone number is automatically allocated as e-mail address at the

time of subscription. If the user does not want to use cellular phone number as mail address, we are planning to provide online service for the user to change mail address. "N-MAX" manages these processes.

② Center query function

i-mode cellular phone requests reception of mail or message stored in "M-MAX".

③ Storage and deletion of mail

Table 4 shows storage specification of mail reception, message request, and message free for i-mode cellular phone.

④ Length of mail text

i-mode mail requires quicker response than Internet e-mail. So one mail length (the same as message) is limited to 500 bytes. In case of e-mail via Internet, exceeding portion over 500 bytes are discarded and attachment file is also discarded.

■ Internet Connection

This is the service to make it possible to access to Internet Web site, which does not have contract with DoCoMo. By supporting standard Internet protocol, i-mode cellular phone can directly send URL and net surfing is available.

■ Accompanied Functions

(1) i-mode user management and IP management function

i-mode service information, which is stored in customer center, is sent to "U-MAX" once a day. "U-MAX" does necessary registration for i-mode service. Customer information is going to be used as foundation to provide customised information including my menu registration.

(2) Charging function of information

IP menu contract is made between IP and i-mode user. i-mode server acts as charging fee collector on behalf of IP. So

"U-MAX" holds site contract/cancel information from i-mode cellular phone and send this information once a day to itemisation center.

(3) Marketing information collection function

"D-MAX" has a role to analyze i-mode service usage status. Operation log information of "I-MAX", "U-MAX", "W-MAX" and "N-MAX" are collected to "D-MAX" and necessary information for analysis are stored and used as basic information of new i-mode service provision.

Conclusion

New service development and new technology application is assumed for future of i-mode service. i-mode server will contribute to service expansion by fulfilling market demands, together with i-mode cellular phone terminal and PDC-P network development.