Special Issue on i-mode Service
Digital Mova with Micro Browser

For i-mode service, we developed digital mova with micro browser. This mobile portable telephone makes users possible to browse the Web all over the world and send/receive e-mails. To realize this service, we added micro browser and simple protocols to digital mova. In this paper, we described outlines of this new digital mova.

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Introduction

Popularisation of digital cellular phone has enhanced not only voice communication but also data communication. This phenomena is represented by the key word as mobile computing, such as Web access or e-mail etc. Mobile computing is realized by connecting cellular phone and personal computer. With mobile computing, it is available anywhere to have communication that was only possible at limited and fixed place such as home or office. Also it is becoming common to transact short message via cellular phone.

Under these environment, micro browser integrated digital mova [1] is developed to make information communication service available with cellular phone terminal only.

Development Concept and Configuration

There are two types of terminal that has both information function and communication function; communication terminal with information function or information terminal with communication function. Our digital mova corresponds to former type. Latter type is something like PDA (Personal Digital Assistant) with modem. "i-mode" service targets general users who use cellular phone daily basis. So we have focused on telephony function as main feature and developed new cellular phone terminal based on existing digital mova.

This new digital mova appearance is shown in Picture 1. To read information easily, it has larger display than conventional terminals. Also to make user use "i-mode" service with ease, i-mode button was added.

When data communication such as Internet connection is

Picture 1   Digital Mova with Micro Browser

done, normally it is necessary to set up connection destination etc. beforehand. But to let user start "i-mode" service immediately after the subscription, i-mode digital mova does not require pre setup. Table 1 shows features of i-mode digital mova and Figure 1 shows protocol stack. i-mode digital mova follows the same specification as conventional terminals with regards to telephony functions and functions such as weight/volume and call time/standby time etc. Also as "i-mode" service communication method, PDC Packet communication system (PDC-P) is newly applied. With this system, charging is done based on data amount regardless communication time.

In this service, user reads displayed information and transacts data repeatedly. So interactive communication would be the main usage style. Also transacted data amount would be small because of terminal display limitation. This is why data amount base charging mechanism is introduced. There is another advantage of packet communication system. It is to

Table 1　Feature of Digital Mova with Micro Browser

Communication System	PDC/PDC-Packet Communication System
Weight / Volume	About 100g / about 100cc
Call Time / Standby Time	About 120min. / about 200min.
Telephony Function	The Same as Conventional Terminals
Display Size	8 Characters of Full Size Font x 6 Lines (minimum size)
Others	Micro Browser i-mode Communication Protocol (ALP/TLP) Installed

Telephony Function	Micro Browser (Support HTML Subset)
	ALP　(Application Layer Protocol)
	TLP　(Transport Layer Protocol)
PDC	PDC-P

Figure 1　Protocol Stack

reduce negotiation time at the time of network connection. Moreover, to realise "i-mode" specific service feature or to have efficient signal transmission in air section, new functions are installed such as micro browser / ALP (Application Layer Protocol) / TLP (Transport Layer Protocol).

Function Overview

Following text explains functions installed digital mova for "i-mode" service.

■ Micro Browser

Internet Web sites providing information is normally written in HTML (Hyper Text Markup Language). To display the contents written in HTML, special software (HTML support browser software) is necessary. HTML is standard descriptive language in the Internet world and used at many Web sites all over the world. Their specification and generation tools are becoming more common. For this i-mode digital mova, HTML corresponding browser software is mandatory. However, the terminal processing capability or memory size is inferior to PC and its display size and display capability is limited. Including HTML sub set not HTML, functions are minimized. And it became possible to install micro browser which capability is specific to cellular phone. HTML subset incorporates HTML basic element, which is used normally at Web site. Micro browser also supports image data or "i-

mode" service specific icons.

With "i-mode" service, the user can access to "i-mode" service dedicated server and also Internet Web sites all over the world. So if Information Provider tailors HTML file considering HTML subset or display size, it is possible to broadcast information toward i-mode digital mova users as it has been done for PC users. Actually after launching this service, i-mode corresponding company sites or individual sites are increasing. Also this micro browser specifies keys or links of telephony functions and improves user interface.

Followings are major features of micro browser;

① HTML subset support

② Image data

　GIF (Graphics Interchange Format) image support

③ Easy focus function (Figure 2)

　Normally when link selection is performed, focus has to be moved on to the link. However to improve operability, information (accesskey =" ") to specify key of digital mova is described in HTLM file, this made possible to have link selection by just pressing the key.

④ Phone to function (Figure 3)

　By describing telephone number (tel：) in HTML file, call origination is possible with link selection from obtained display.

⑤ Others

　・Bookmark, Cache etc.

　・Access to Internet Web site with direct entry of URL (Uniform Resource Locator)

　・Display memo

　　It is function to store obtained display contents in digital mova. And after communication completion, it is also possible to redisplay it upon necessity.

■ ALP (Application Layer Protocol)

In Internet, HTML file is obtained by HTTP (Hyper Text Transfer Protocol). But for i-mode service, ALP is newly specified based on HTTP, and it reduces data amount and realizes "i-mode" services specific functions. Followings are differences from HTTP.

① Data reduction by not allocating HTTP header, which is not necessary for the service.

② Addition of termination notification signal

③ E-mail transaction with HTTP by converting e-mail into HTTP format

Since ALP format is the same as HTTP format, it is possible to get HTML file directly from i-mode server or Internet Web site.

```
    .
    .
    <A accesskey="1" HREF="http://docomo.ne.jp/cp/page1.htm">1.ニュース/情報</A>
<BR>
    <A accesskey="2" HREF="http://docomo.ne.jp/cp/page2.htm">2.モバイルバンキング</A>
<BR>
    <A accesskey="3" HREF="http://docomo.ne.jp/cp/page3.htm">3.カード/証券/保険</A>
<BR>
    <A accesskey="4" HREF="http://docomo.ne.jp/cp/page4.htm">4.トラベル</A>
<BR>
    <A accesskey="5" HREF="http://docomo.ne.jp/cp/page5.htm">5.チケット/リビング</A>
<BR>
    <A accesskey="6" HREF="http://docomo.ne.jp/cp/page6.htm">6.グルメ/レシピ</A>
<BR>
    <A accesskey="7" HREF="http://docomo.ne.jp/cp/page7.htm">7.エンターテイメント</A>
<BR>
    .
    .
```

Figure 2 Easy Focus Function

```
    .
    .
鈴木物産
<BR>
    <A HREF="tel:0468-00-1111">☎0468-00-1111</A>
<BR>
佐藤商事
<BR>
    <A HREF="tel:0468-00-2222">☎0468-00-2222</A>
<BR>
伊藤運輸
<BR>
    <A HREF="tel:0468-00-3333">☎0468-00-3333</A>
    .
    .
```
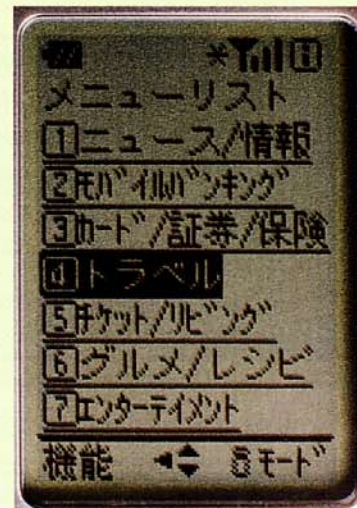
Figure 3 Phone to Function

These protocol functions are described as follows;

(1) Pull type function (Figure 4)

Terminal sends HTTP request signal to the server by selecting link or defining URL. Then by receiving HTTP response signal from the server, terminal gets information (HTML file).
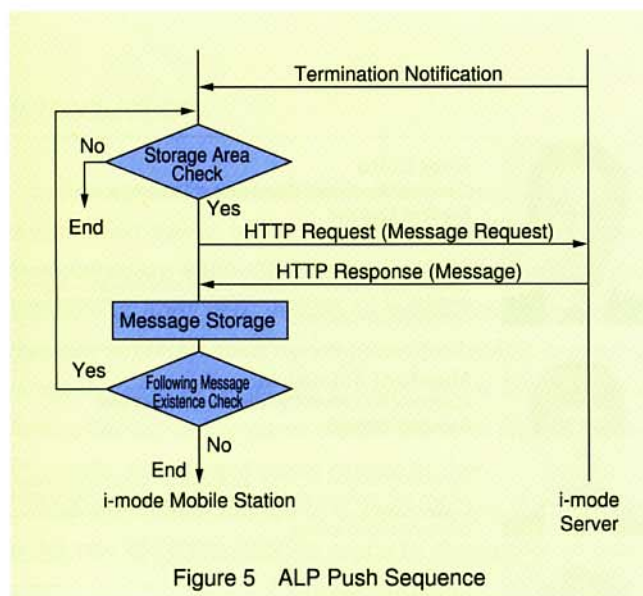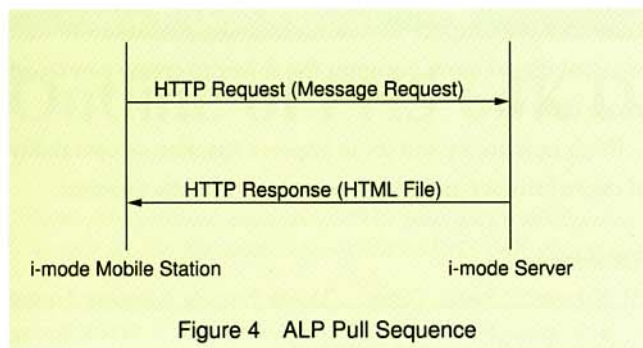
(2) Push type function (Figure 5)

When i-mode server receives e-mail or message from IP (Information Provider), i-mode server sends ALP termination notification signal to the mobile station. When mobile station receives this termination notification signal, it confirms message storage area capacity. And if there is enough storage room, by using pull type function, i-mode terminal sends HTTP request (message request) to i-mode server. Then mobile station receives HTTP response (message). With these procedures push type function is realized. Also HTTP response header tells the terminal the existence of following message. If there is enough storage area, remaining messages in the mail server are delivered in the same way. Since e-mail reception is done by using HTTP request/response, it made possible to reduce signal amount compared to general e-mail reception protocol such as POP. Likewise, mobile station and i-mode server use HTTP request (POST) / HTTP response for e-mail transmission.

■ **TLP (Transport Layer Protocol)**

TLP is a newly specified transport protocol. Normally PPP or TCP/IP are used for Internet connection and data communication is carried out. However to reduce data amount and signal amount transacted in air section, new protocol was developed. This protocol is terminated at M-PGW (Mobile Message-Packet Gateway Module), which is node equipment

Figure 4   ALP Pull Sequence

Figure 5   ALP Push Sequence

Figure 6   TLP Connection Sequence


Figure 7   TLP Connectionless Sequence

of network.

With TLP, connection-oriented communication and connectionless communication are possible. When ALP does HTTP request/response communication, connection-oriented communication is applied. When i-mode server sends termination notification to i-mode digital mova, connectionless communication is used. Check sum function is set up for each TLP signal for error detection. After data is transmitted, confirmation-oriented communication, which waits Acknowledge signal every time, is taken place.

(1)   Connection-oriented communication (Figure 6)

By sending Open Request, connection establishment is started. Open Request is set up with retransmission parameter used by this connection and values related to data size. With the reception of Open Acknowledge, connection establishment and negotiation of each parameter are taken place. After connection is established, confirmation-oriented data communication is performed. And when data transmission is completed, connection is closed with Close Request. In Open Request or Close Request, several data can be incorporated together, it makes possible to reduce number of signals.
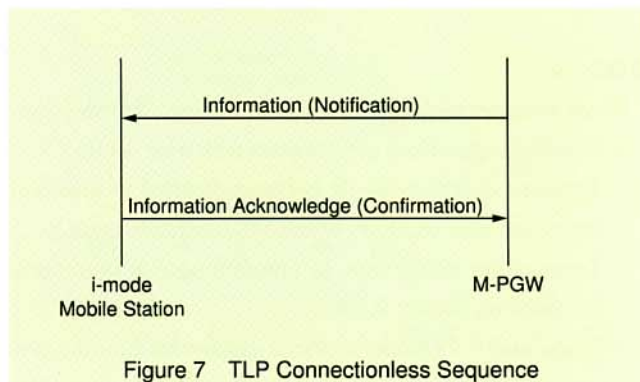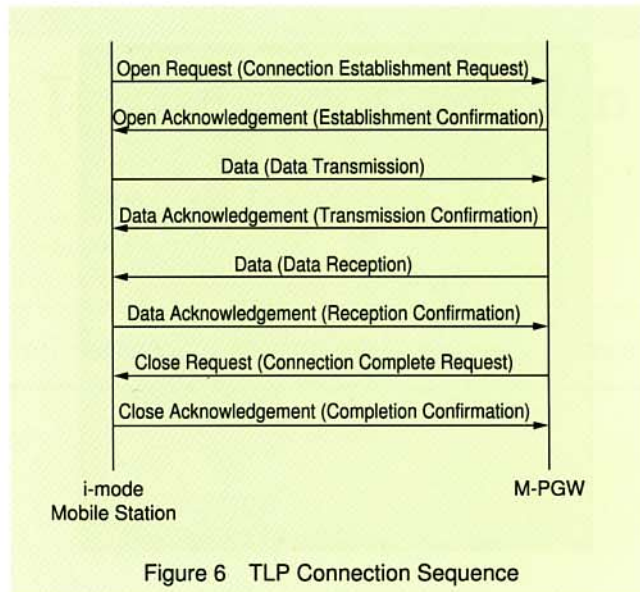
(2)   Connectionless communication (Figure7)

ALP termination notification signal is sent by Information. When Information is received, Information Acknowledge is transmitted. Termination notification is issued irregularly every time i-mode server receives e-mail or message. So during connection-oriented communication, it is possible to receive Information.

■ **Display (Picture 2)**

(1)   Display

To have large display area, large scale LCD panel is used.

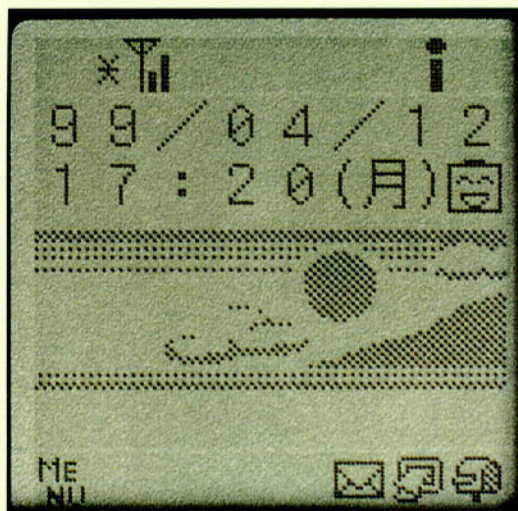(2)   "i" display (up right of display of Picture 2)

"i" display is newly made to indicate "i-mode" service area and communication status.

· "i" is lit : it indicates terminal is in "i-mode" service coverage area

· "i" is flashing : it indicates communication status.

(3)   E-mail / message arrival display

(bottom right of display of Picture 2)

This display indicates there is unread e-mail / message.

Picture 2   Display

accessory. We expect that newly developed micro browser installed digital mova becomes the driver to create new trend in our daily life.

From now on, we will try to improve function or operability of micro browser and create more user friendly terminal.

References

[1] Nakatsuchi, Sasaki, Chiba： "Mobile Portable Telephone Loaded with Micro Browser for PDC Packet System", IEICE Spring Conference B-5-1, 1999.

■**Others**

When voice termination is occurred during "i-mode" service, following operations are available with user set up.

· Termination response (It becomes normal termination status and user can have telephone communication.)

· Termination notification ("i-mode" service continues. Termination history is left.)

· Voice mail ("i-mode" service continues. Leaving termination history, and terminated call is forwarded to voice mail service center.)

· Call forwarding ("i-mode" service continues. Leaving termination history, and terminated call is forwarded to registered forwarding number.)

Conclusion

Everyone always carries cellular phone like watch or