Special Article on IMT-2000 Services (3)
– Launch of FOMA, the Pioneer of the New Mobile Age –

Multi-Access Service

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Accompanied by the introduction of the IMT-2000 Services (FOMA), multi-access service which allows voice communication while browsing in i-mode or transferring data is provided. This article provides an overview of the multi-access service, and feature realization methods of FOMA in the future.

1. Introduction

Multi-access service, a feature service of "Freedom Of Mobile multimedia Access" (FOMA), which makes simultaneous communication of a circuit switching session and a packet switching session possible, has been provided since the start of the trial service in May 2001. With this service, a more flexible communication means is provided, usability is improved, and the area available for mobile communication is expanded.

2. Services

2.1 Feature Overview

With the multi-access service, multiple radio transmission links are simultaneously and independently controlled. That is, each call and its corresponding radio transmission link are separately established and released. Unlike conventional communication in Personal Digital Cellular (PDC) system, where multiple calls employ one radio transmission link to use switching for call-waiting or to use mixing for three-way calling, multi-access service has a new feature which sets up simultaneously and maintains different services for each destination (**Figure 1**).

Even during voice call communication, multi-access allows a user to initiate packet transmission and packet reception with a mobile station or a personal computer, which typically occurs while in i-mode mail. Similarly, even during packet data com-

munication, voice call transmission and reception are possible. Furthermore, a received call can be routed to a voice mail center or can be forwarded during packet data communication by the service setup specified in advance or manually by the user from the receiving mobile station.

2.2 Application Examples

Multi-access is attempting to open up a new type of service for both business and personal use. Specific examples are described in the following.

⑴ Business Use Application Example

In order to perform data searches utilizing i-mode or other operations, the voice call connection had to be disconnected. However, since multi-access allows packet data communication while maintaining a voice call connection, product data search operations can be performed by accessing the corporate local area network (LAN) during voice call communication. Therefore, better real-time customer service can be provided.

⑵ Personal Use Application Example

Multi-access allows mail transfer during voice call communication, which could not be done in the past. Because of this, information such as map data can be sent as an attachment to mail while voice call communication is in progress, thus allowing a new type of communication that has not been available in the past.
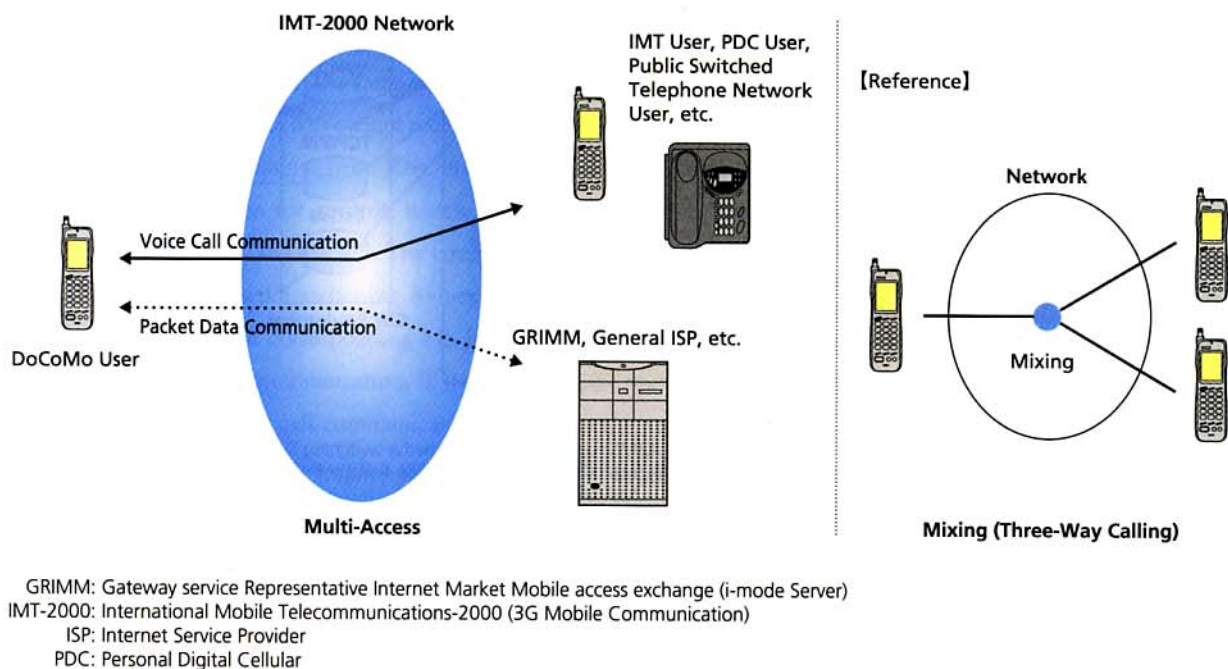

GRIMM: Gateway service Representative Internet Market Mobile access exchange (i-mode Server)
IMT-2000: International Mobile Telecommunications-2000 (3G Mobile Communication)
ISP: Internet Service Provider
PDC: Personal Digital Cellular

Figure 1 Configuration of Multi-Access Features

2.3 Service Terms

Terms of the multi-access service currently provided by DoCoMo are shown in **Table 1**.

3. Network

3.1 Network Connection Configuration

Multi-access service network connection configuration is shown in **Figure 2**. Radio resources are set up for packet data communication and voice call communication independently, and each destination is also controlled independently.

3.2 Connection Sequences

(1) Originating Packet Call During Voice Call Communication

The connection sequence for originating a packet call during voice call communication is shown in **Figure 3**. Since calls are

controlled on a circuit switching session and a packet switching session independently, the packet connection sequence is the same as the originating packet call sequence without voice call communication.

However, only one connection is set up for a Mobile Station (MS) to connect an MS to a Radio Network Controller (RNC) and is used for both voice call communication and packet data communication. Therefore, a service request signal for a packet session from the MS is transmitted through the connection for control that has already been established between the MS and the RNC.

(2) Terminating Packet Call During Voice Call Communication

The connection sequence for the terminating packet call during voice call communication is shown in **Figure 4**. In this case, since the MS is already connected to the network for voice

Table 1 Multi-Access Service Terms

Provided Users	**FOMA Subscribers** (Basic service provided to users who have a charge plan contract that includes voice call communication and packet data communication)
Multi-Access Combination	Simultaneous communication is possible for one voice call switching network link and one packet data link (The number of PDP context, which can be activated by the same mobile station, is 1)

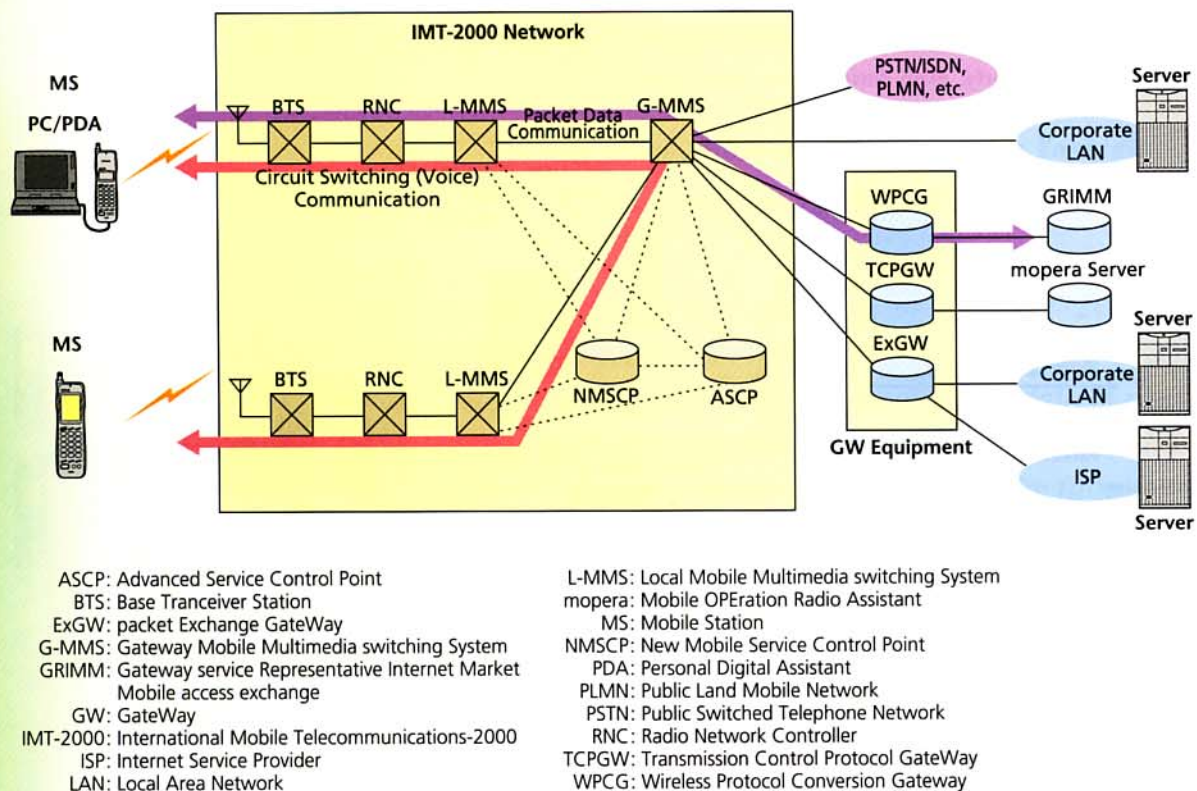FOMA: Freedom Of Mobile multimedia Access
PDP: Packet Data Protocol

ASCP: Advanced Service Control Point
BTS: Base Tranceiver Station
ExGW: packet Exchange GateWay
G-MMS: Gateway Mobile Multimedia switching System
GRIMM: Gateway service Representative Internet Market
      Mobile access exchange
GW: GateWay
IMT-2000: International Mobile Telecommunications-2000
ISP: Internet Service Provider
LAN: Local Area Network

L-MMS: Local Mobile Multimedia switching System
mopera: Mobile OPEration Radio Assistant
MS: Mobile Station
NMSCP: New Mobile Service Control Point
PDA: Personal Digital Assistant
PLMN: Public Land Mobile Network
PSTN: Public Switched Telephone Network
RNC: Radio Network Controller
TCPGW: Transmission Control Protocol GateWay
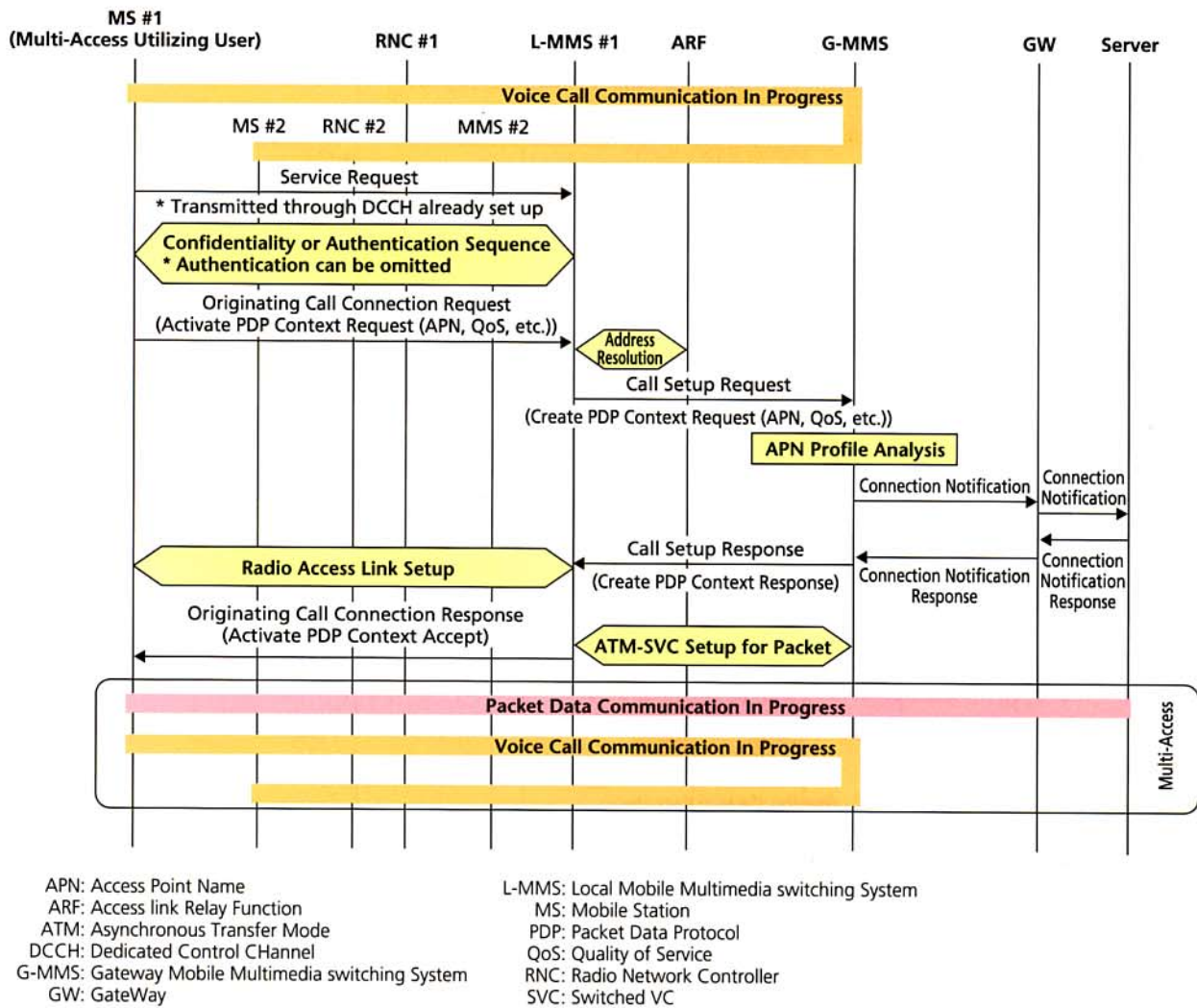WPCG: Wireless Protocol Conversion Gateway

Figure 2 Configuration of Network Connection

Figure 3 Multi-Access Connection Sequence (Originating Packet Processing During Voice Call Communication)

APN: Access Point Name
ARF: Access link Relay Function
ATM: Asynchronous Transfer Mode
DCCH: Dedicated Control CHannel
G-MMS: Gateway Mobile Multimedia switching System
GW: GateWay

L-MMS: Local Mobile Multimedia switching System
MS: Mobile Station
PDP: Packet Data Protocol
QoS: Quality of Service
RNC: Radio Network Controller
SVC: Switched VC

call communication, even if a paging signal is transmitted through the Paging CHannel (PCH) the same way when there is no voice call communication, the MS cannot receive the paging signal. Therefore, the paging signal from RNC must be transmitted through the connection for control, which has already been set up between the RNC and the MS. The terminating side of the Local Mobile Multimedia switching System (L-MMS) determines whether or not the corresponding MS is connected to the network for voice call communication. If the MS is connected to the network for voice call communication, the terminating L-MMS informs the RNC through a paging request that the RNC has to perform search processing. If the MS is not connected to the network for voice communication, the terminating L-MMS informs the RNC that the RNC does not need to perform search processing.

Any sequences other than the above are the same as a terminating packet call when there is no voice call communication.

(3) Originating and Terminating Voice Call Communication During Packet Data Communication

The originating sequence of a voice call during packet data communication is the same as the originating sequence of a voice call when there is no packet data communication which is similar to (1) above, and the terminating sequence includes paging request processing based on evaluation of whether or not voice call communication is in progress, similar to (2) above.

Any sequences other than the above are the same as a terminating voice call sequence when there is no packet communication.

4. Conclusion

This article described an overview of the multi-access service, a feature service of FOMA. This gives rise to a new type of service in which voice call communication and packet data communication can be performed simultaneously. In the future,
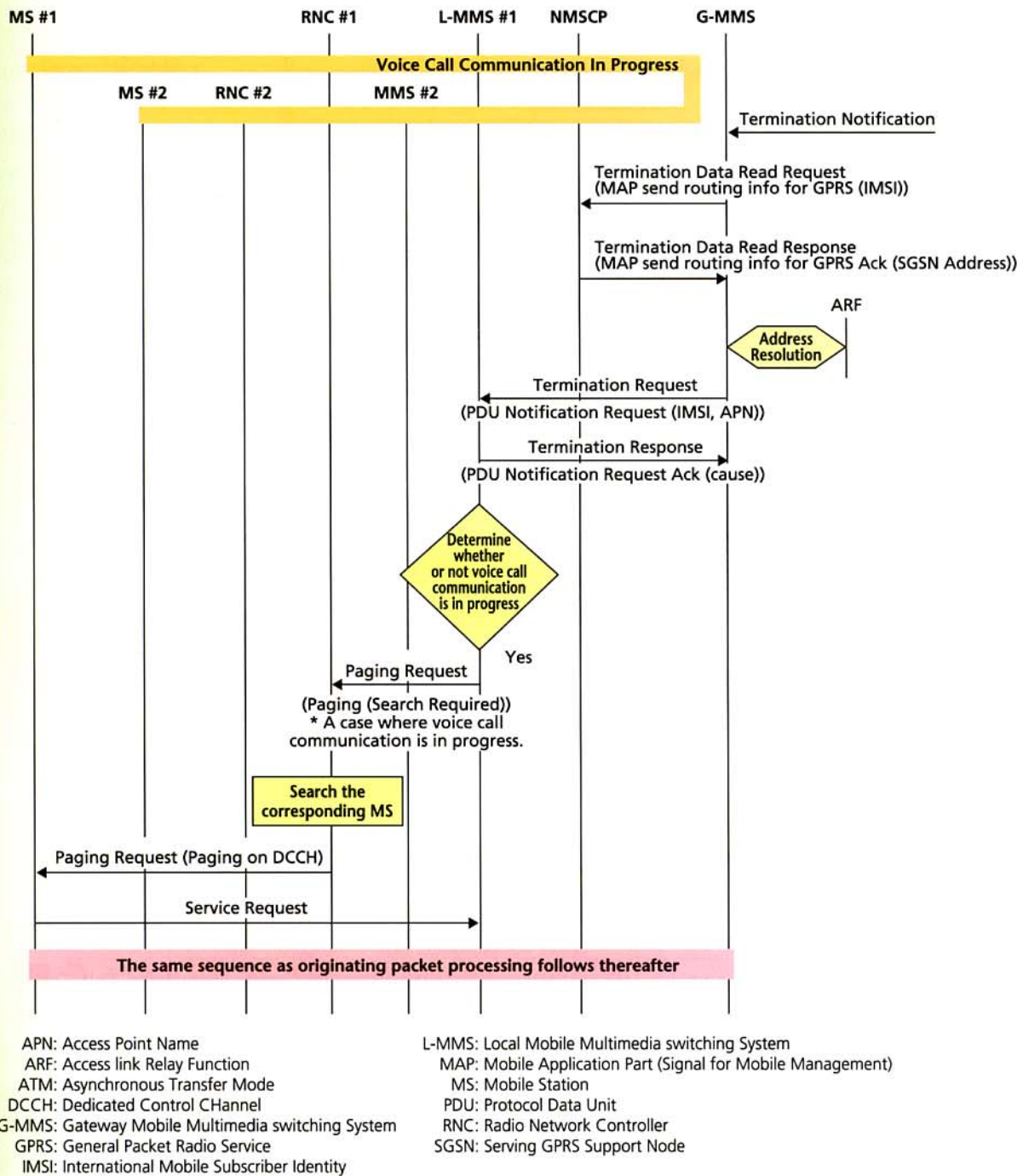
Figure 4 Multi-Access Connection Sequence (Terminating Packet Processing During Voice Call Communication)

we will look into more diversified multimedia service applications by applying multi-access service to packet data communication and an unrestricted circuit switching digital call. At the same time, simultaneous connection of multiple circuit switching calls will be examined.

GLOSSARY

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ExGW: packet Exchange GateWay
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MAP: Mobile Application Part
mopera: Mobile OPEration Radio Assistant
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PCH: Paging CHannel
PDA: Personal Digital Assistant
PDC: Personal Digital Cellular
PDP: Packet Data Protocol
PDU: Protocol Data Unit
PLMN: Public Land Mobile Network
PSTN: Public Switched Telephone Network
QoS: Quality of Service
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SGSN: Serving GPRS Support Node
SVC: Switched VC
TCPGW: Transmission Control Protocol GateWay
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