Model Systems for Business Solutions

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FOMA's broadband communication capabilities and various multimedia services are expected to be used in a variety of applications demanded in the business market.
This article describes the model system outlines which definitely shows the business solutions utilizing FOMA services.

1. Introduction

In the world of Internet, diversified and advanced IT solutions are about to come in line with increasing use of broadband communications and higher performance of notebook computers and Personal Digital Assistants (PDAs). To offer equivalent services through a mobile communications system, it is necessary to enhance the mobile phone's transmission rate and improve multimedia capabilities. FOMA (Freedom Of Mobile multimedia Access), the third-generation mobile communications service which began in October 2001, supports a wide variety of business applications by 1) allowing high-speed, best-effort packet switched connections that provide a maximum uplink rate of 64 kbit/s and a maximum downlink rate of 384 kbit/s, 2) allowing multi-access that provides voice and data communications simultaneously, and 3) implementing high-speed data communications and multimedia functions that are represented, for instance, by "XWave," which easily allows multiple user connections to a Local Area Network (LAN) or other networks from mobile devices. To show how these functions can be applied to real business applications, DoCoMo has developed the following two model systems:

① Sales/maintenance support system based on multi-access service

② Mobile camera monitoring system based on XWave

This article summarizes the above two model systems.

2. Sales/Maintenance Support System Based on Multi-Access Service

2.1 Overview

The multi-access service is one of the basic FOMA services which provides voice communications and packet-based data communications simultaneously, making it easy to understand and explain complicated information. The following sections describe the model system that makes effective use of the above feature to provide sales/maintenance support (this model system is hereinafter referred to as the System).

The System enables the field sales/maintenance personnel and the operator on the corporate LAN to use a multi-access function to exchange or manipulate figures, design drawings, and other items of image information by means of packet communications while maintaining voice communications. Therefore, information explanations and opinion exchanges can be completed on the spot. **Figure 1** shows the usage image and configureaion of the system.

2.2 Features

The System offers the following three features:

① Shares real-time bidirectional information by offering a simultaneous voice/data communications capability.

② Permits high-speed, large-volume data downloading at a packet communications downlink rate of 384 kbit/s at the maximum.

③ Assures secure access by offering "Category 1 Leased Line Connection Service."

2.3 System Configuration

The system configuration is shown in Figure 1. The APplication (AP) server and file server are installed on the corporate LAN to control the System. The connection between the corporate LAN and FOMA network is established by "Category 1 Leased Line Connection Service." The field sales/maintenance personnel use a multi-access compatible FOMA terminal and notebook computer. The field personnel and the operator connected to the corporate LAN use the System's client application software to display, edit, enlarge, or otherwise manipulate images. For voice communications purposes, it is possible for the operator to use a local telephone network.

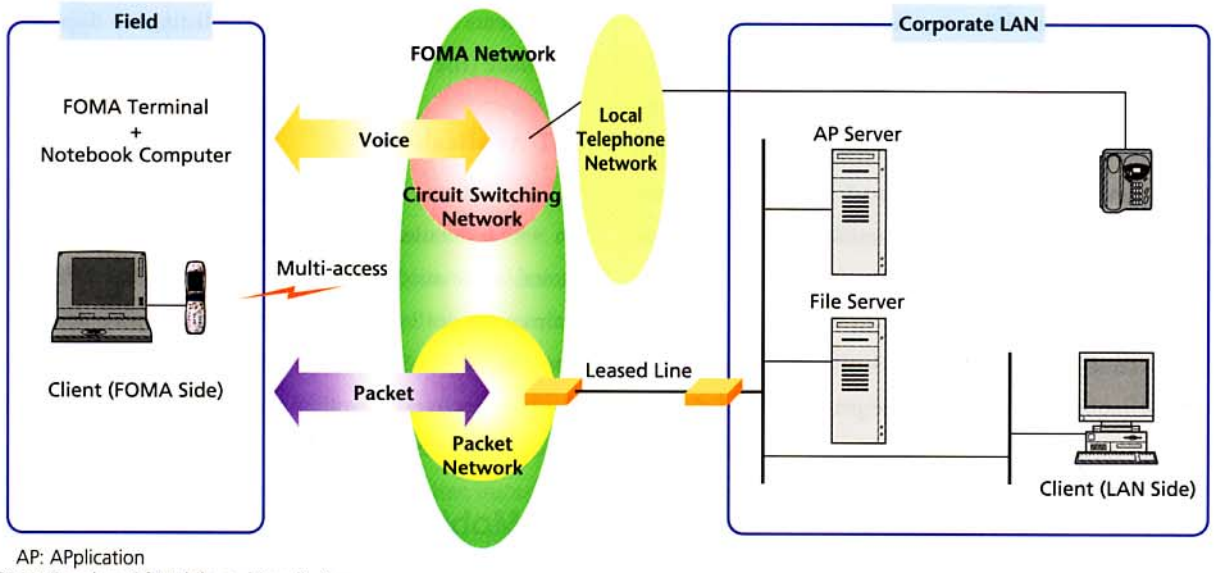
The specifications for the System are established so that a number of users can log simultaneously into the AP server, select a remote user to share images with, and establish one-to-one communication. Client application software is developed with Java★1 so as to provide multi-platform support and allow flexible functionality expansion.

2.4 Client Application Functions

The client application software has the following functions:

(1) AP Server Login/Logout Function

★1 Java: Object-oriented development environments specialized for the network proposed by Sun Microsystems, USA.



AP: APplication
FOMA: Freedom Of Mobile multimedia Access
LAN: Local Area Network

Figure 1 Schematic of System Use and Configuration

Allows you to set the IP (Internet Protocol) address, login ID, password, and other necessary information about the AP server installed on the corporate LAN and enables you to login and logout.

(2) Remote User Selection Function

The System permits image sharing on a one-to-one basis. The user can therefore select a remote user to share image information with while maintaining voice communications.

(3) Control Transfer Function

Image editing and target file opening operations can be performed only in one direction at a time. Control can be transferred as needed for redirection of the operations.

(4) File Acquisition Function

The image files for editing operations can be downloaded from the file server.

(5) File Selection Function

The image file to be shared can be specified so as to direct a remote user to download that file from the file server.

(6) File Display Function

The names of the downloaded files can be listed, the file to be shared can be displayed. JPEG (Joint Photographic Experts Group) or GIF (Graphic Interchange Format) files can be displayed.

(7) Picture Drawing Function

Images can be enlarged or reduced, arrow marks and other simple figures can be written in a selected color and shape.

2.5 AP Server Functions

The AP server has the following functions:

(1) Login Authentication Management Function

Users attempting to connect to the AP server will be prompted to input a user ID and password for authentication purposes. Logged in users will be listed for management purposes and the resulting list will be transmitted to client application software.

(2) Data Exchange Control Function

The connection between selected clients will be managed. When a client requests a file, it will be acquired from the file server. The file specified by a client will be transferred from the file server via the AP server. The file transfer process is described in Section 2.6.

(3) Image Editing Relay Function

The AP server manages the permission to edit the image and gives it to either one of the clients. When a client having permission to edit the image makes a request for image enlargement/reduction or drawing write, the AP server relays such request to the other client. The associated processes are encoded to reduce the volume of data to be transmitted/received.

2.6 File Transfer Process Overview

To allow image sharing between clients using FOMA terminals, the AP server provides a relay function. The contents of a file can be downloaded by employing a high-speed packet communications function that provides a maximum downlink rate of 384 kbit/s. The volume of uplink data transmission is minimized.

Figure 2 shows the file transfer process.

① Client A downloads files via the AP server and chooses the file to share.

② Only the name of the file to be shared is transmitted from Client A to the AP server to request for transmission to Client B (file transfer request).

③ The requested file is acquired from the file server and the contents of the file are transmitted to Client B (file content acquisition and transfer).

④ Client B acquires the contents of the file transmitted from the AP server (file content acquisition).

⑤ Client B transmits the result of the reception process to the AP server (file acquisition status).

⑥ The AP server transmits the file acquisition status to Client A (remote user file acquisition status).

⑦ If Client A issues an abort request during file transfer, the AP server aborts the transfer process (file transfer abort).

⑧ Clients A and B update the file listings to display the file to share (file display).

2.7 Applicability

It is conceivable that the System is applicable to operations in which detailed image information is needed in addition to voice information. The System can be used as a support tool for sales activities in field presentations, real-time drawing modifications, on-site maintenance on precision equipment, and for disaster recovery or other operations where promptness and accuracy are demanded.

3. Mobile Camera Monitoring System Based on XWave

The "Mobile Camera Monitoring System" (referred to as the System) is an XWave-based model system that offers a new ser-

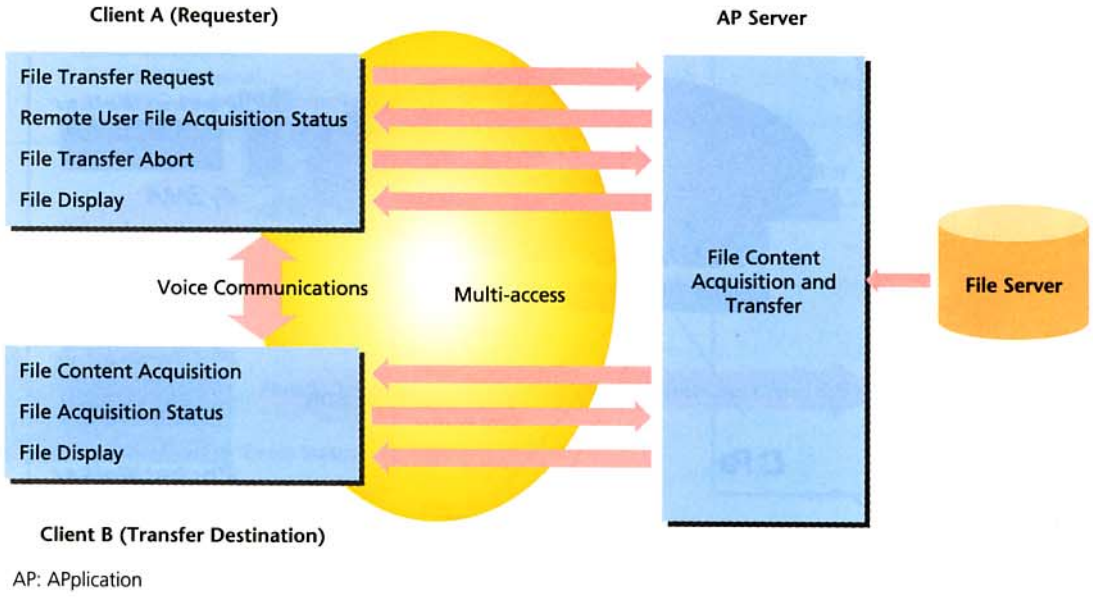


Figure 2 Overview of File Transfer Process

vice for connecting DoCoMo's packet communications network to a corporate in-house network (hereinafter referred to as a corporate LAN).

The following sections outline the System.

3.1 XWave Overview

For remote access to a corporate LAN, the connection is generally established by circuit switched communications. However, in order to make use of the circuit switched method, it is necessary to arrange the same number of access lines as the maximum number of simultaneous connections. Therefore, the use of the circuit switched network causes a facility efficiency problem. The packet communications service named "DoPa," which is provided by DoCoMo as its Personal Digital Cellular (PDC) system, allows multiple user connections to a single connection line, solves the above-mentioned problem. However, it is necessary for this service to connect a corporate LAN to DoCoMo's switching equipment via a leased line.

Under the above circumstances, "XWave" has been developed as a simple implementation method for allowing remote access to a corporate LAN from DoPa and FOMA packet communications and without using a leased line.

The XWave service provides a Virtual Private Network (VPN)[★2] connection, which uses a general public line instead of a leased line, for permitting remote access to a corporate LAN regardless of the means of connection (DoPa and FOMA packet communications). Commercial XWave service began in October 2001.

Figure 3 shows the XWave service.

The XWave service enables to use the following lines to connect a DoPa or FOMA mobile phone to a corporate LAN:

① Integrated Services Digital Network (ISDN) (1B/2B)
② Internet
③ Frame relay
④ FOMA packet communications

The communication between a DoPa/FOMA terminal and corporate LAN is made possible at a best-effort rate. However, when an ISDN, frame relay, or Internet is used, the resulting maximum data transmission rate is 128 kbit/s. The transmission rate achieved during a FOMA session depends on the network's traffic conditions.

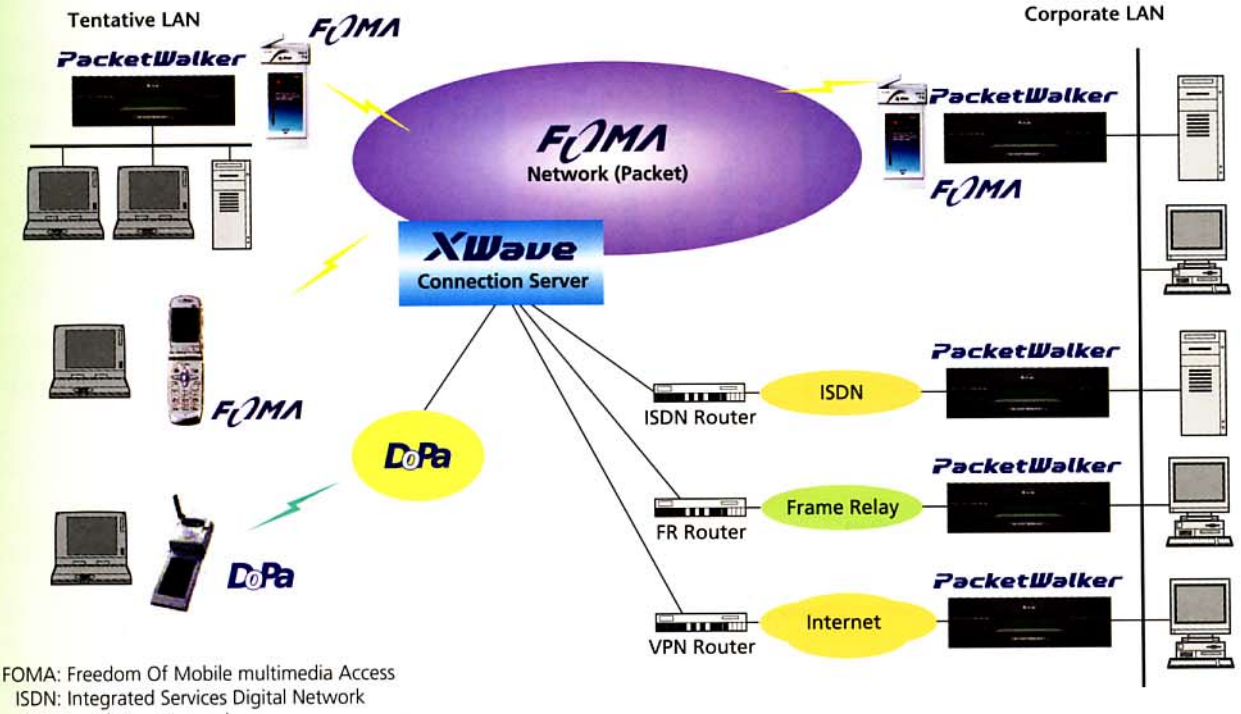
For XWave service, the corporate LAN needs to be equipped with "XWave Connection Protocol" compliant connection equipment. As the connection equipment, PacketWalker 302T is offered by DoCoMo. PacketWalker incorporates a FOMA-compliant interface. XWave can use this interface to establish FOMA's high-speed packet communications session with the corporate LAN.

3.2 Mobile Camera Monitoring System

(1) System Overview

The "Mobile Camera Monitoring System" is a model system that makes effective use of FOMA's high-speed packet

★2 VPN: Technology for establishing secure communication by using the Internet or other public network. XWave uses its unique "XWave Connection Protocol." Further, IPSec (RFC2405) is used for encrypting the information within the Internet.



FOMA: Freedom Of Mobile multimedia Access
ISDN: Integrated Services Digital Network
LAN: Local Area Network
VPN: Virtual Private Network

Figure 3 XWave Service Overview

communications capabilities and XWave features, and can easily monitor the status of a remote location by periodically transmitting still pictures picked up by a camera mounted, for instance, in a vehicle, and the location information acquired by a Global Positioning System (GPS) to a server at a monitoring center.

With previously offered services requiring a dedicated leased line, establishing a mobile packet communications environment was complicated especially at the site of public event monitoring center, disaster relief center, or other temporary installation. However, the System using XWave makes it possible to promptly set up a temporary monitoring center at such sites and obtain the latest visual information from the remote locations.

(2) System Configuration

Figure 4 shows the configuration of the System.

Each monitoring point of an event site or other target sites is equipped with a Charge Coupled Device (CCD) camera and a control terminal connected to a FOMA terminal. A monitoring center is equipped with a monitoring server and monitoring client terminal. These hardware items incorporate software implementing the following functions:

① Control terminal

Equipment control function: The visual information and location information are acquired respectively from a connected CCD camera and GPS equipment and transmitted over an XWave connection to an image server via a FOMA terminal. Some features offered by this function make it possible to change the camera angle or convey messages to the monitoring center.

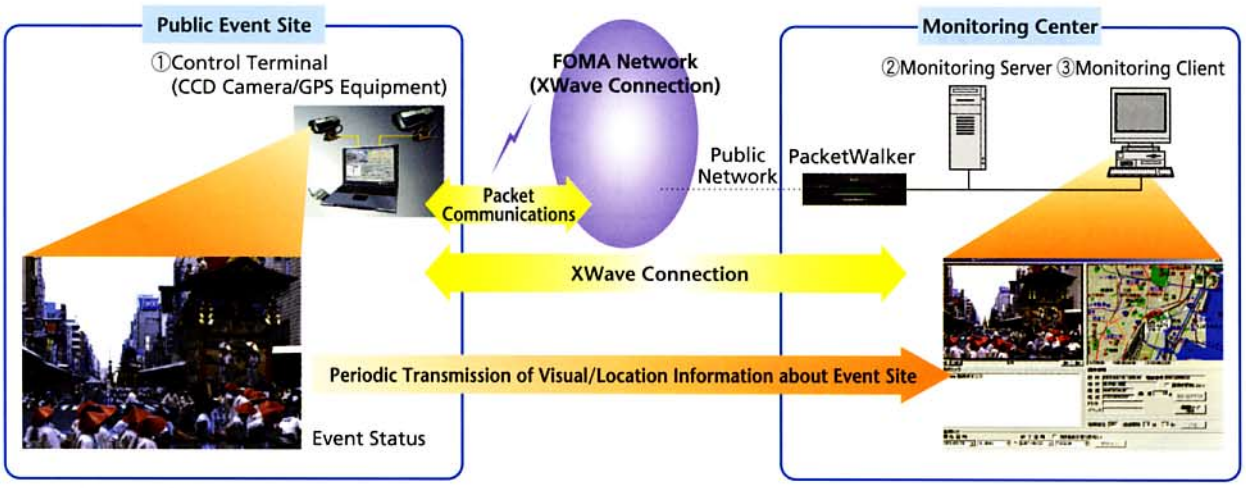
② Monitoring server

Communication server function: This function establishes connections between the server and the control terminal for equipment control. It also acts as an intermediary for the exchange of messages (latest image acquisition, vehicle operation status notification, etc.) between the equipment control function and monitoring client function.

Image server function: The visual information and location information transmitted from the control terminal are forwarded to the monitoring client function and stored in an image database. Upon request from the monitoring client function, the requested visual information in the database is retrieved and returned.

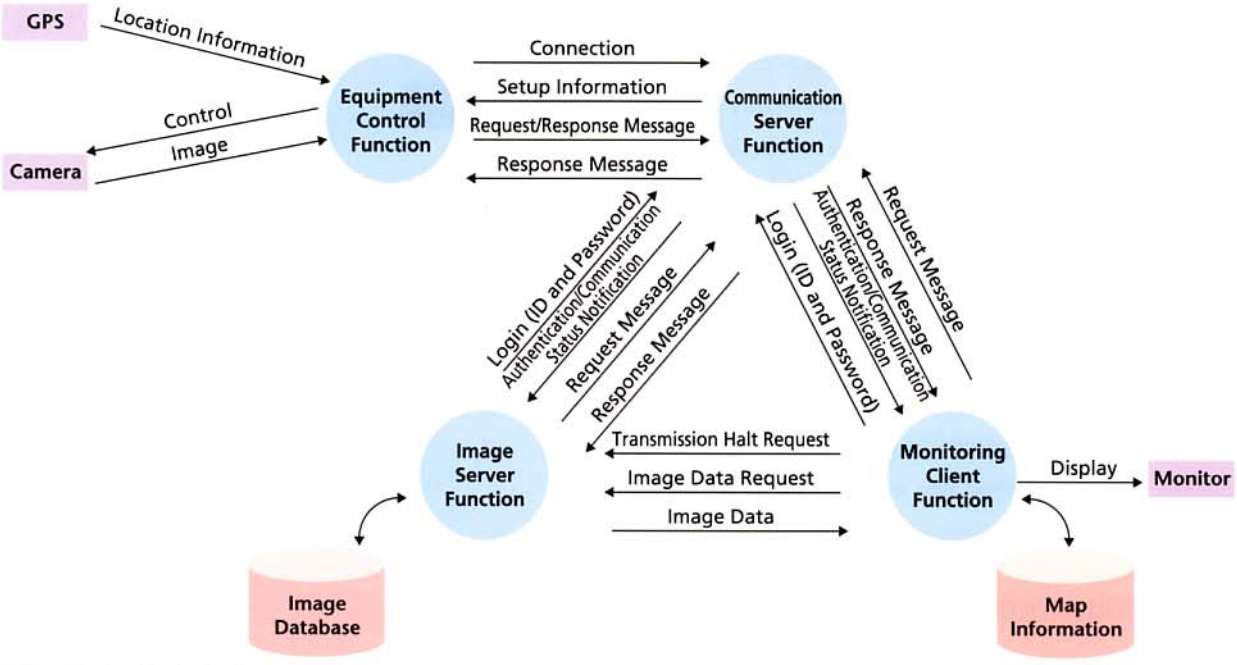
③ Monitoring client

Monitoring client function: The visual information and location information received from the image server function can be displayed on the monitoring client's screen at a remote location. The log of stored images can also be displayed. Some features



CCD: Charge Coupled Device
FOMA: Freedom Of Mobile multimedia Access
GPS: Global Positioning System

Figure 4 Diagram of Mobile Camera Monitoring System



GPS: Global Positioning System

Figure 5 Processing Flow of Mobile Camera Monitoring System

offered by this function make it possible to change the camera angle or issue instructions for the latest image acquisition.

Figure 5 shows the overall system processing flow.

As shown in the figure, the System enables the monitoring center to obtain the latest visual information, as needed, location information, and other incidental information about each monitoring point.

4. Conclusion

The model systems are described above to show the business solutions that can be obtained by using high-speed data communication services and mobile multimedia functions implemented by FOMA. From now on, it is expected that business solutions based on FOMA services will be proposed according to these model systems to promote the FOMA services and create new mobile solutions in the business market.

GLOSSARY

AP: APplication
CCD: Charge Coupled Device
FOMA: Freedom Of Mobile multimedia Access
GIF: Graphic Interchange Format
GPS: Global Positioning System
IP: Internet Protocol
ISDN: Integrated Services Digital Network
JPEG: Joint Photographic Experts Group
LAN: Local Area Network
PDA: Parsonal Digital Assistant
PDC: Personal Digital Cellular
VPN: Virtual Private Network