DoCoMo Location Platform (DLP) Service

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Location-based service is one of the promising service fields expected to expand in the future. In November 2001, NTT DoCoMo launched a new location-based service targeting businesses and Application Service Providers (ASPs) called DoCoMo Location Platform (DLP) Service as a type-2 telecommunication business service.
This article describes the overview of this DLP Service.

New Technology Report

1. Introduction

Location-based services are infrastructure services with the potential to generate a wide range of businesses harnessing the characteristics of mobile communications, which are expected to grow in the future.

In July 1999, NTT DoCoMo hammered out the "DLP concept," aimed at implementing a common platform with a unified interface for location-based services called the DoCoMo Location Platform (DLP), in order to improve user convenience and expand and stimulate the location information market. Based on the DLP Concept, NTT DoCoMo has conducted demonstrations and experiments on location-based services with Location Agent, Inc. (in which NTT DoCoMo is an investor) and other corporate partners. In November 2001, it launched a location-based service targeting businesses and ASPs called the DLP Service.

This article describes the overview of the DLP Service.

2. Service Overview

The construction of existing user systems utilizing location information required the construction of positioning systems, the development of applications using location information and the manufacturing of compatible terminals separately for each user system. A location information platform that can share positioning systems and compatible terminals would make it possible to develop user systems efficiently.

In consideration of this, the DLP Service offers a location information platform in which positioning systems and compatible terminals can be shared by businesses and ASPs who wish to develop user systems efficiently utilizing location information. Two functions are offered by the DLP Service: the Location Information Provisioning Function, which takes general use into consideration, and the ASP Support Function, which supports the production of applications.

(1) Location Information Provisioning Function

The Location Information Provisioning Function offers the following four basic functions to enable the general use of location information.

① Position Locating Function

This function acquires the user's location information using the terminal for the DLP Service ("Terminal"). For example, this function can be applied to pedestrian navigation targeting the owner of the Terminal and to sightseeing information guidance.

② Position Notifying Function

This function gives the location information of the Terminal to businesses and ASPs. For example, this function can be applied so that the owner of the Terminal can make an emergency call and a security service company can rush to the scene.

③ Position Registering Function

This function registers the location information of the Terminal to the DLP Center so that businesses and ASPs can refer to the information. For example, this can be applied to manage the duties of employees working outside the office and manage the delivery records of couriers.

④ Person Finder Function

This is a function for businesses and ASPs to obtain location information of Terminals. For example, this can be used in child welfare and protection services and rental car management.

(2) ASP Support Function

The ASP Support Function provides the following functions that can be used when businesses and ASPs produce applications utilizing location information.

① Group Information Management Function

This function divides the owners of Terminals into arbitrary groups to obtain the location information of the terminals and to manage the scope of the service.

② Zone Observing Function

This function sets a specific area (zone) to observe the entry and exit of Terminals with respect to that zone.

③ Push-type Information Distributing Management Function

This function distributes and sends information set up in advance to the terminal of a user who belongs to a group specified by the Group Information Management Function when he/she enters the zone set by the Zone Observing Function.

3. System Configuration

Figure 1 illustrates the network configuration of the DLP Service. Terminals owned by employees and ASP users are connected to the DLP Center via NTT DoCoMo's network. Application systems of businesses and ASPs are connected to the DLP Center via dedicated lines, Integrated Services Digital Network (ISDN) and the Internet. It is also connected to employees and ASP users who use the application system; however, the method depends on the application system. Connection via the Internet involves encryption by Secure Sockets Layer (SSL) and Transport Layer Security (TLS) to cipher the location information.

The DLP Center consists of the following five server groups.

(1) Request Admission Server Group

This server group admits requests from Terminals, businesses and ASPs. The Request Admission Server Group admits requests by the Location Information Service Access Protocol (LISAP), which is the unified interface in DLP.

(2) Positioning Server Group

This server group actually locates the Terminals. When a new positioning method needs to be added to the DLP, it can be easily done by adding a compatible Positioning Server to the Positioning Server Group.

(3) User Administration Server Group

This server group performs authentication tasks upon the admission of requests from Terminals, businesses and ASPs, and registers and administers user's location information. The User Administration Server Group keeps the user authentication password and the license password for using the service, and decides whether to permit the use of the service or not by matching the passwords. Also, users' location information is registered with the User Administration Server Group based on the Request Admission Server Group's registration request.
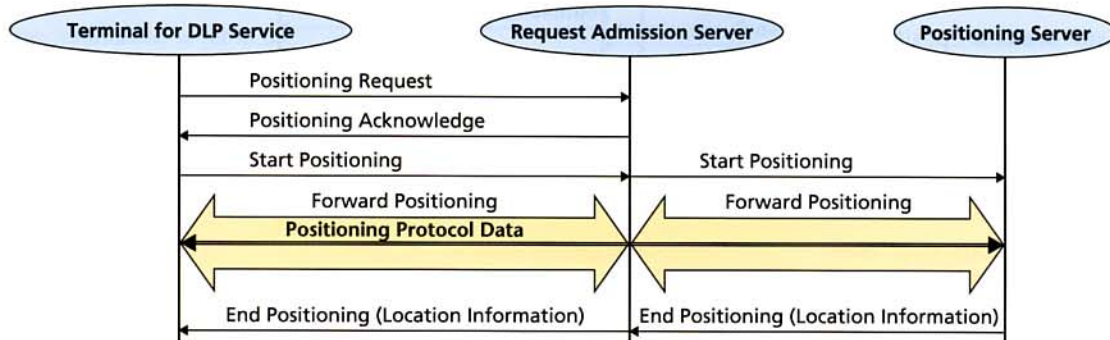
(4) ASP Support Server Group

This server group provides the aforementioned ASP Support
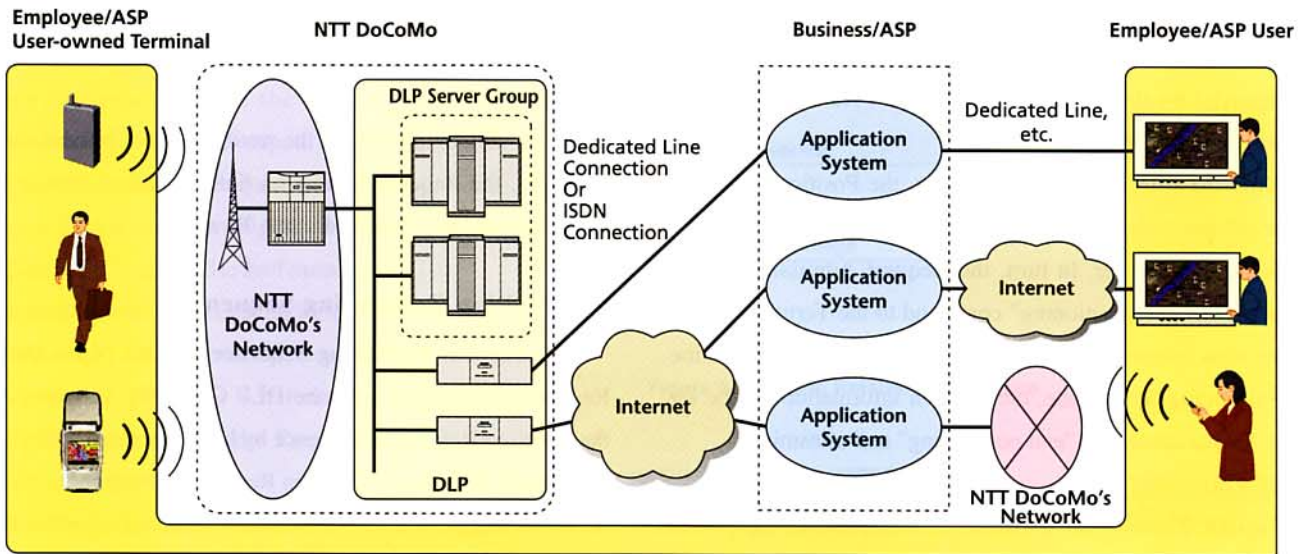
ASP: Application Service Provider
DLP: DoCoMo Location Platform
ISDN: Integrated Services Digital Network

Figure 1 Network Configuration of DLP Service

DLP: DoCoMo Location Platform
GPS: Global Positioning System

Figure 2 GPS Positioning Sequence

Functions, which are provided by the Common Gateway Interface (CGI). ASPs can easily make location information applications using the ASP Support Function by creating a program based on CGI.

(5) Status Monitoring Server Group

This server group gathers the log of DLP server groups and manages and monitors the status of servers.

4. Service Sequence

The service sequence of the Location Information Provisioning Function can be broadly divided into: Position Locating Sequence; Position Notifying Sequence; Position Registering Sequence, and Friend Finder Sequence. The description of each sequence is as follows.

4.1 Position Locating Sequence

Position Locating Sequence consists of two types of service sequences, depending on whether the positioning is done by the Global Positioning System (GPS) or base stations (BSs).

(1) GPS Positioning

Figure 2 shows the Position Locating Sequence by GPS positioning.

① A Terminal sends a "positioning request" command to the Request Admission Server at the DLP Center.

② The Request Admission Server authenticates it and sends a "positioning acknowledge" command to the Terminal.

③ The Terminal sends a "start positioning" command to the Request Admission Server. In turn, the Request Admission Server sends a "start positioning" command to the Positioning Server.

④ Subsequently, by a "forward positioning" command, the positioning protocol data is transparently transmitted and received by the Terminal, the Request Admission Server and the Positioning Server.

⑤ After the completion of positioning, the Positioning Server sends an "end positioning" command to the Request Admission Server. In turn, the Request Admission Server sends an "end positioning" command to the Terminal. If the location information (positioning results) is generated on the Positioning Server side, the location information can be set in the parameters of "end positioning" and transmitted.

(2) BS Positioning

Figure 3 shows the Position Locating Sequence by BS positioning.

① A Terminal sends a "positioning request" command to the Request Admission Server at the DLP Center.

② The Request Admission Server authenticates it and sends a "positioning acknowledge" command to the Terminal.

③ The Terminal sends a "start positioning" command to the Request Admission Server. In turn, the Request Admission Server sends a "start positioning" command to the BS Positioning Server.

④ The BS Positioning Server sends an "end positioning" command (in which the location information of the Terminal positioned with reference to BS information is set in the parameters) to the Request Admission Server. In turn, the Request Admission Server sends an "end positioning" command (in which the location information is set in the parameters) to the Terminal.

4.2 Position Notifying Sequence

Figure 4 shows the Position Notifying Sequence.

① A Terminal sends a "notification request" command (in which the location information is set in the parameters) to the Request Admission Server.

② The Request Admission Server authenti-

cates it and sends a "notification order" command (in which the location information is set in the parameters) to businesses and ASPs.

③ After the completion of the notification to businesses and ASPs, the Request Admission Server sends a "notification acknowledge" command to the Terminal.

4.3 Position Registering Sequence

The Position Registering Sequence consists of the Position Registering Sequence with the DLP Center by Terminals, and the Location Reference Sequence by businesses and ASPs.

Figure 5 shows the Position Registering Sequence.

① A Terminal sends a "registration request" command (in which the location information is set in the parameters) to the Request Admission Server.
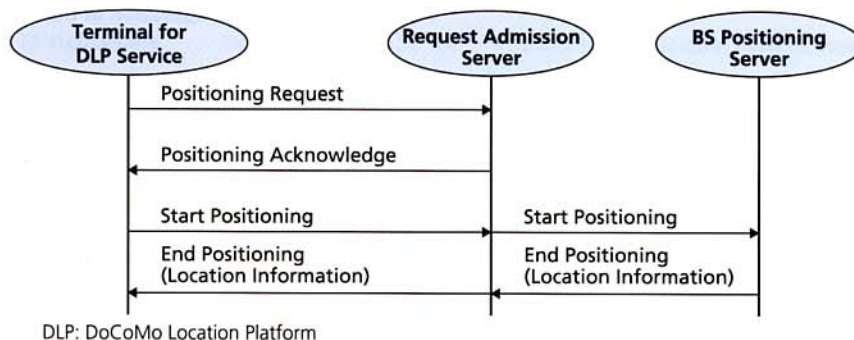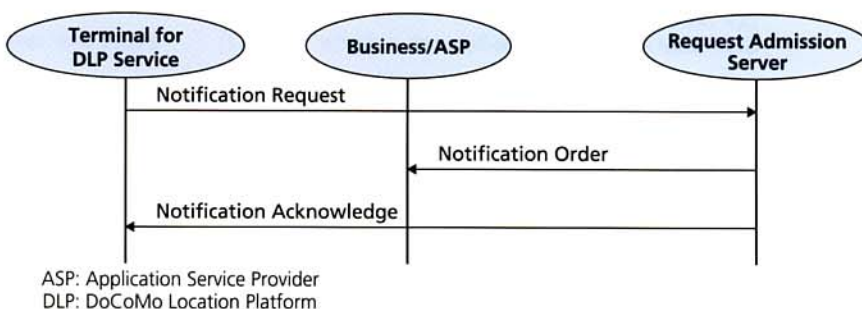

DLP: DoCoMo Location Platform

Figure 3 BS Positioning Sequence

ASP: Application Service Provider
DLP: DoCoMo Location Platform

Figure 4 Position Notifying Sequence
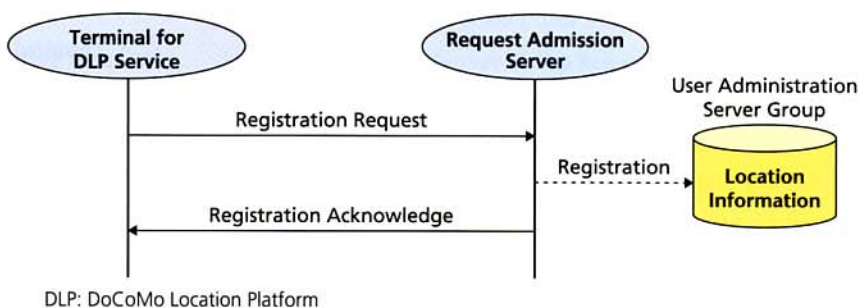

DLP: DoCoMo Location Platform

Figure 5 Position Registering Sequence

② The Request Admission Server authenticates it and registers the location information with the User Administration Server Group.

③ After registration, the Request Admission Server sends a "registration acknowledge" command to the Terminal.

Figure 6 shows the Location Reference Sequence.

① A business/ASP sends a "reference request" command to the Request Admission Server.

② The Request Admission Server authenticates it and refers to the stored location information.

③ After reference, the Request Admission Server sends a "reference acknowledge" command (in which the location information is set in the parameters) to the business/ASP.
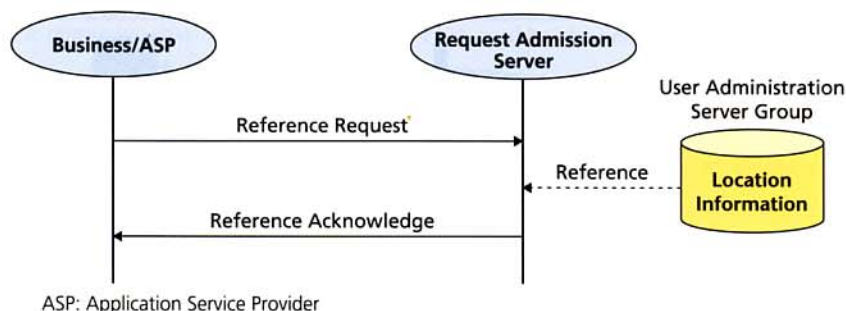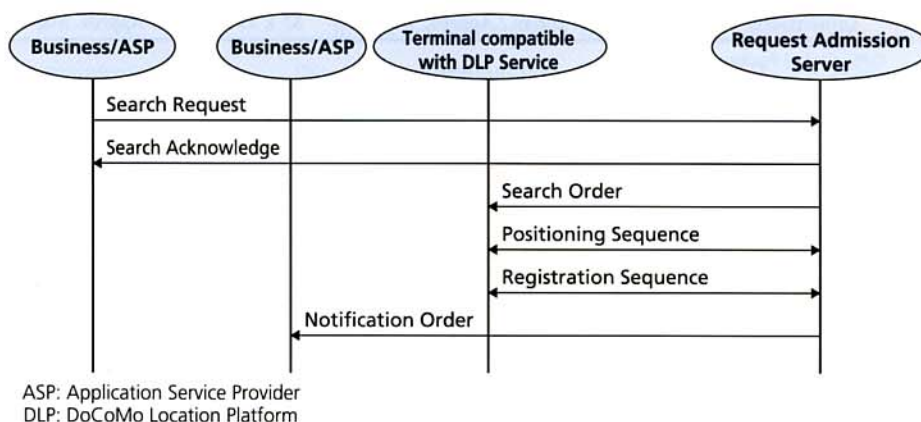
4.4 Person Finder Sequence

Figure 7 shows the Person Finder Sequence.

① A business/ASP sends a "search request" command to the Request Admission Server. In response, the Request Admission Server sends a "search acknowledge" command. As parameters, the "search request" includes the identifier of the Terminal subject to search and the business/ASP to be notified.

② The Request Admission Server establishes a session with the Terminal and transmits a "search order" command.

③ The aforementioned Position Locating Sequence operates for positioning.

④ The Position Registering Sequence operates if the registration of location information has been specified upon "search acknowledge" in Step 1).

⑤ The Request Admission Server sends a "notification order" command to the business/ASP to be notified.

In the event of using the ASP Support Server Group, the ASP Support Server engages in transmission and reception with the Request Admission Server in place of the business/ASP using LISAP, and acquires and notifies the location information to the business/ASP on its behalf.

Figure 6 Location Reference Sequence

Figure 7 Person Finder Sequence

5. Terminals for the DLP Service

Currently, there are three types of terminal brands for the DLP Service, as shown in **Table 1**.

The first type is a hybrid GPS/radio terminal using packet links. It has no voice communication functions, but can connect with an external GPS antenna. It is a terminal dedicated to location information for the person finder.

The second type is a Personal Digital Assistant (PDA) with GPS functions, which requires the insertion of a Personal Computer Memory Card International Association (PCMCIA)-type GPS card. This also uses packet links, and can be used for both position locating and the person finder.

The third type is a PDA terminal using Personal Handyphone System (PHS) links (P-in Comp@ct and P-in m@ster). The PDA has a built-in GPS antenna and a dedicated viewer for checking the user's location.

6. Service Examples

Examples of major services using the DLP Service are described below.

Table 1 Example of Terminals compatible with DLP Service

Exterior			
Product Name	JRP-20 (Japan Radio Co., Ltd.)	Cassiopeia E707+Gpstar (Casio Computer Co., Ltd. and Japan Radio Co., Ltd.)	Navigating Terminal for School Excursions (Seiko Epson Corporation)
GPS Method	JRC Method (Independent Positioning)	JRC Method (Independent Positioning)	EPSON Method (Positioning Compensation Possible)
Communication Method	Packet Communication (PDC-P)	Packet Communication (PDC-P)	PHS Communication
Terminal Type	Hybrid GPS/Link	PDA+CF-Card Type (GPS Card)	Hybrid GPS, PDA + Link Insertion
Dimensions	62 x 88 x 26mm / Approx. 180g	57 x 35 x 22mm / Approx. 50g	82 x 125 x 32mm / Approx. 240g

GPS: Global Positioning System
PDA: Personal Digital Assistant
PDC-P: PDC-mobile Packet data communication system
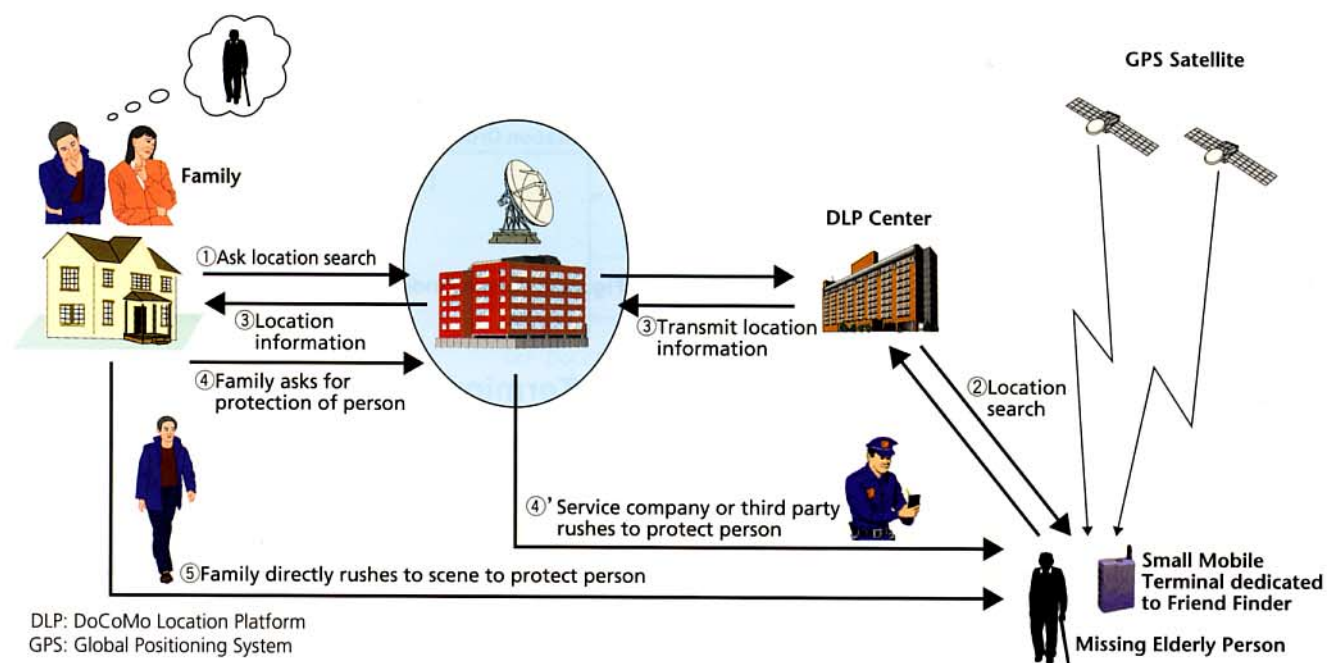PHS: Personal Handyphone System

Figure 8 Elderly Care Service

6.1 Elderly Care Service

In this service, the person who needs a special care carries a terminal dedicated to location information such as JRP-20 all the time, so that in case of an emergency, the terminal's location can be searched (person finder) and the family/staff can rush to the location to take care of him/her. (**Figure 8**)

Specifically, the service works in the following manner.

① If the person who needs a special care gets lost, his/her family asks the ASP providing elderly care service to search for the missing person's location.

② In response to the search request, the ASP searches his/her location.

③ After positioning, the ASP gives the location information to the family.

④ The ASP immediately rushes to where the missing person is in order to take care of him/her, if requested by his/her family.

⑤ The family rushes to where the missing person is directly to take care of him/her.

The merit of this service is that the family can spend less time taking care of the person, and that they can ask the ASP to take care of him/her when they are shorthanded.

6.2 Maintenance Staff Support Service

In this service, the maintenance staff of a company that repairs and maintains printers, etc. always carries a location information terminal such as Cassiopeia E707+Gpstar so that in the event of any faults in a customer's product, his/her terminal's location can be searched (person finder) and the staff can go and repair the product (**Figure 9**).

Specifically, the service works in the following manner.

① A client company calls the maintenance company by phone, etc. and asks for repair.

② The maintenance company locates the maintenance staff via the DLP Center.

③ After locating the maintenance staff, the maintenance company informs the client company of approximate time for him/her to arrive there and confirms the status of the faults.

④ The confirmed description of the faults is sent to the maintenance staff's PDA, and he/she heads to the scene.

The merit of this service is that the maintenance company can immediately identify where the maintenance staff is, and that he/she can efficiently undertake the maintenance tasks without returning to the company. The client company can roughly find out what time he/she will arrive, which helps to improve their service.

6.3 Sightseeing Service for Students on School Excursions

In this service, students on a school excursion carry a PDA (Navigating Terminal for school excursions), by which they can immediately acquire information on tourist sites and other places around them by referring to their user location informa-
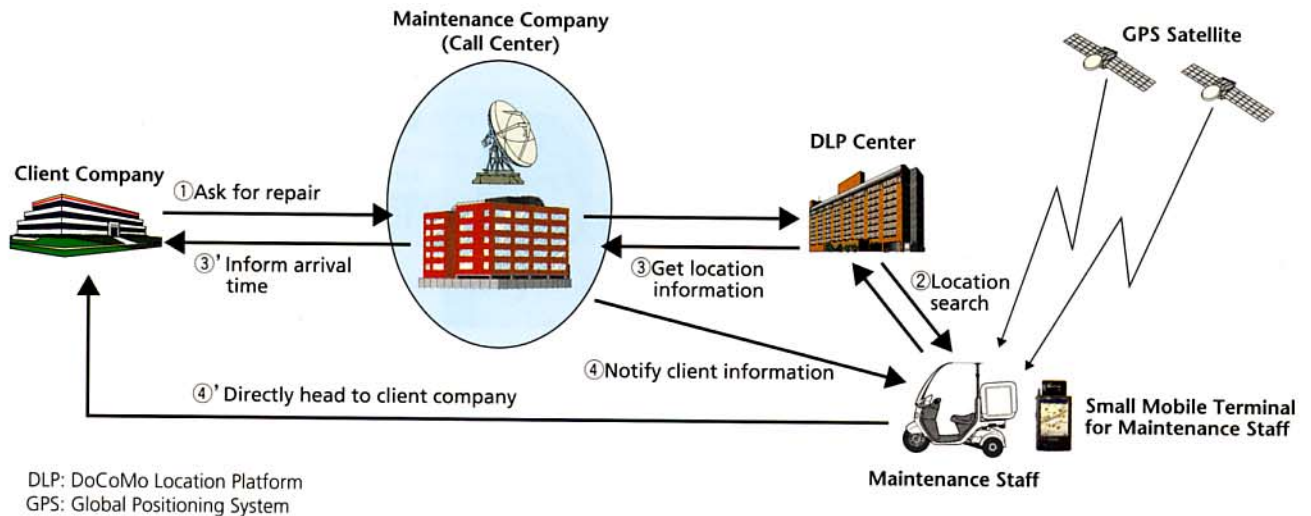

DLP: DoCoMo Location Platform
GPS: Global Positioning System

Figure 9 Maintenance Staff Support Service

ASP: Application Service Provider
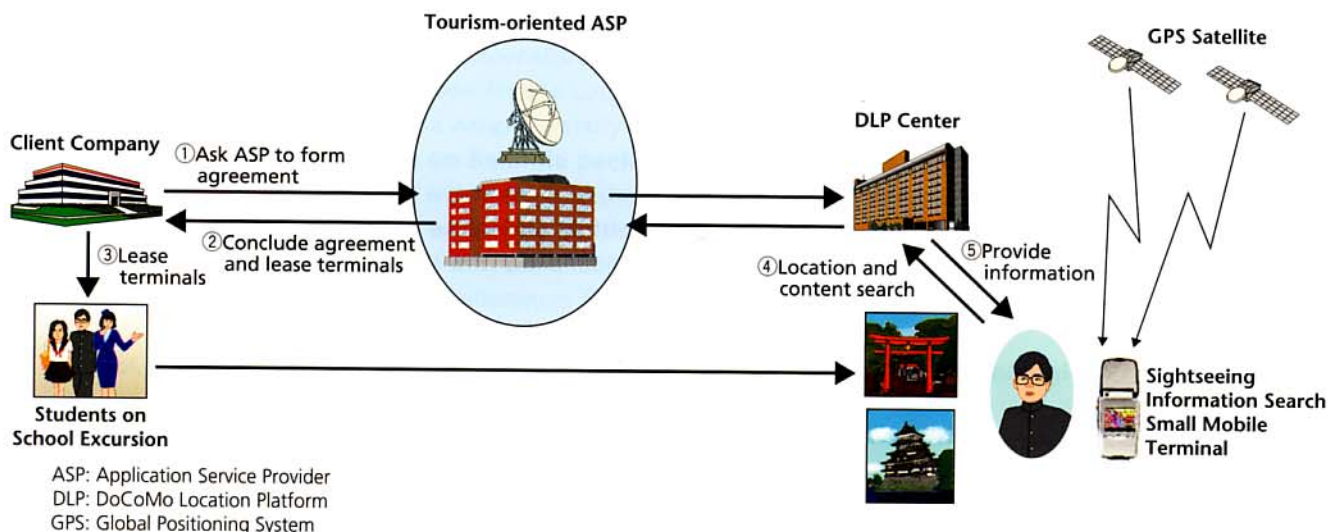DLP: DoCoMo Location Platform
GPS: Global Positioning System

Figure 10 Sightseeing Service for Students on School Excursion

tion based on positioning, in their free time and on other occasions (**Figure 10**).

Specifically, the service works as follows.

① A sightseeing information provider asks a tourism-oriented ASP to form an agreement.

② The tourism-oriented ASP leases terminals to the sightseeing information provider.

③ The sightseeing information provider leases the terminals to students on a school excursion.

④ The students executes location search by the DLP Service, and based on this information, asks the ASP for travel information.

⑤ According to the information on coordinates sent from the ASP, students engage in a work-study program relating to the destination.

The merit of this service is that the students can immediately get the information they want on the spot. In addition, teachers can check where the students are in their free time (person finder), and after the school excursion, they can plot the location where they took the picture on the map in the digital camera data and supply them in the form of CD-ROM.

A similar service to this would be to provide sightseeing information and information relating to the status of hotel/train reservations to ordinary tourists.

7. Conclusion

This article described the overview of the DLP Service. In the future, NTT DoCoMo will focus on developing terminals using BS information of the PDC mobile Packet data communication system (PDC-P) and various GPS terminals, in addition to developing new location information content.

GLOSSARY

ASP: Application Service Provider
CGI: Common Gateway Interface
DLP: DoCoMo Location Platform
GPS: Global Positioning System
ISDN: Integrated Services Digital Network
IT: Information Technology
LISAP: Location Information Service Access Protocol
PCMCIA: Personal Computer Memory Card International Association
PDA: Personal Digital Assistant
PDC-P: PDC mobile Packet data communication system
PHS: Personal Handyphone System
SSL: Secure Sockets Layer
TLS: Transport Layer Security