AUTO-GPS | Location Information Services | Home Electronics Linking

Technology Reports

Application Functions for Winter/Spring 2009 Models —Providing an Exciting "All in One" Feeling—

*In recent years, the role of mobile terminals has been shifting from communications as in phone and mail services and information access via the Internet to lifestyle and behavior support. NTT DOCOMO has developed key functions supporting this trend for its winter/spring 2009 models. These include an "AUTO-GPS function" that enables the provision of information and services based on the user's current location and a "Blu-ray Disc™*1 recorder linking function" for transferring digital TV broadcast content recorded on a Blu-ray Disc recorder to a mobile terminal for viewing.*

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1. Introduction

The mobile market has become increasingly sophisticated and diversified in recent years, and as users become inundated with services, products, and information, the need has been felt for "life-assist functions" in mobile terminals to support individual behavior in accordance with the user's lifestyle. Recognizing this need, NTT DOCOMO developed the i-concier service as a step toward the ultimate mobile terminal that can function like "Aladdin's magic lamp" [1].

Now, for its winter/spring 2009 models (**Photo 1**), NTT DOCOMO has developed a variety of key functions as the next evolutionary step in the "all in one" concept toward the ultimate mobile terminal. Two of these key functions are the "AUTO-GPS function" and the "Blu-ray Disc recorder linking function" that aim to enrich the user's life via a single mobile terminal in line with his or her needs.

The AUTO-GPS function enables the provision of enhanced behavior-support services based on the user's current location. The Blu-ray Disc recorder linking function transfers digital TV broadcast content recorded on a Blu-ray Disc recorder to a mobile terminal enabling the user to enjoy video programs at a level of quality surpassing that of One Seg programs.

In this article, we describe these two important functions that are being provided in winter/spring 2009 models.

2. AUTO-GPS Function

2.1 Service Concept

The AUTO-GPS service concept is shown in **Figure 1**.

With AUTO-GPS, the mobile terminal automatically performs GPS positioning and notifies the service provider of positioning results without the user having to perform any deliberate terminal operations. This function exploits the fact that a mobile terminal "moves from place to place together with the user." Thus, by automatically notifying a provider of the terminal's

*1 **Blu-ray Disc™**: "Blu-ray Disc" is a trademark.

Photo 1 Winter/spring 2009 models

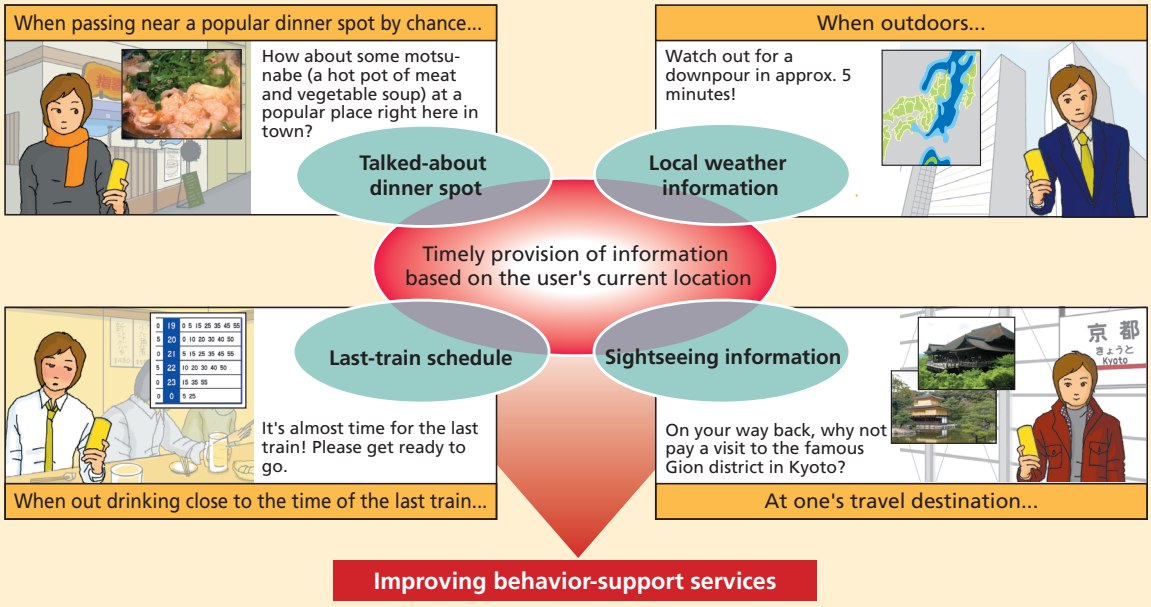

Figure 1 AUTO-GPS service concept

(user's) location information, there is no need as in the past to have the user purposely transfer such information by a terminal operation. This approach enables the provision of behavior-support services that are closely linked with the user's individual behavior.

2.2 Operation Overview

Needless to say, location information consists of personal data that must be handled carefully. AUTO-GPS has been designed to need only the high-security i-appli DX[*2] mechanism and the i-concier service to operate. In the new winter/spring 2009 models, AUTO-GPS can be used with a maximum of four services simultaneously. Here, a service combining i-appli DX and the i-concier service using AUTO-GPS is called an AUTO-GPS-based service.

AUTO-GPS operation is shown in

*2 **i-appli DX**: A functional extension of i-appli software running on i-mode-compatible mobile terminals. As a special type of i-appli registered on the i-mode server, it can use functions requiring high security such as those for accessing user data.

Figure 2 and summarized below.

(1) Commence AUTO-GPS operation after user registration of one or more AUTO-GPS-based services

(2) Perform GPS positioning according to status detection described below

(3) Notify AUTO-GPS-based service providers of positioning results

(4) Have AUTO-GPS-based service providers provide various services according to positioning results so received

On receiving positioning results, an AUTO-GPS-based service provider sends an i-appli call[*3] or i-concier information to the mobile terminal based on the area in which the user is currently active thereby providing a behavior-support service.

In addition, while the AUTO-GPS function operates continuously as long as an AUTO-GPS-based service is registered in the mobile terminal, it is also equipped with a mechanism for temporarily suspending its operation when the terminal's remaining battery charge drops below a certain level so as to maintain essential mobile terminal functions.

2.3 Status Detection Function

When GPS positioning and location-information notification is performed repeatedly at fixed intervals, it is done so according to the mobile terminal's (user's) movement locus. However, if the mobile terminal should be in a stationary state, unnecessary GPS positioning and location-information notification will be repeated for the same location affecting power consumption in the mobile terminal.

For this reason, deciding whether the mobile terminal is moving or in a stationary state is done by the terminal itself, and GPS positioning and location-information notification is per-

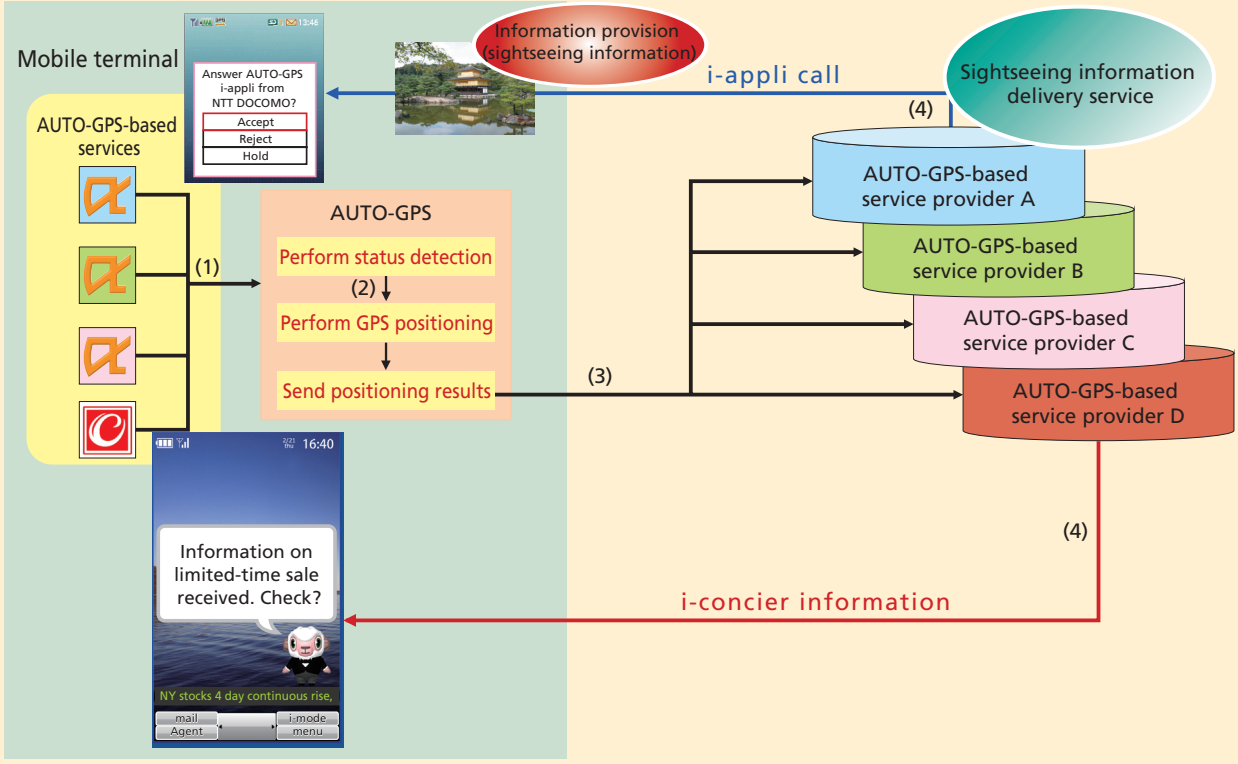

Figure 2 AUTO-GPS operation

*3 **i-appli call**: A "push" function executed by a mobile terminal or information-provider server to initiate an i-appli on another mobile terminal via the network.

formed only when the mobile terminal is judged to be moving. This prevents redundancy in location-information notification and optimizes positioning opportunities.

Furthermore, as various means of movement can be detected—from small means of movement on the walking level to large means of movement by transport facilities (train, car, etc.)—base-station area information and walking information are combined to make a moving/stationary status decision.

Status detection logic is shown in **Figure 3**. Making a status decision on the basis of base-station area information is performed by the base-station area-switching detection section using information on the base-station areas that the mobile terminal has been camping in (Fig. 3(1)). However, as the base-station area that the mobile terminal is camping in may change even in a stationary state due to the radio environment, movement cannot be detected solely on the basis of a change in base-station area. To prevent erroneous detection, the history of base-station areas that the mobile terminal has been camping in for a certain period of time up to the present is recorded in the mobile terminal and cross-referenced with the mobile terminal's current base-station area. For example, a mobile terminal's base-station area might change at a certain point in time from base-station area A to base-station area B. Now, if base-station area B is not included in the mobile terminal's base-station camping history, the mobile terminal is judged to be moving. On the other hand, if base-station area

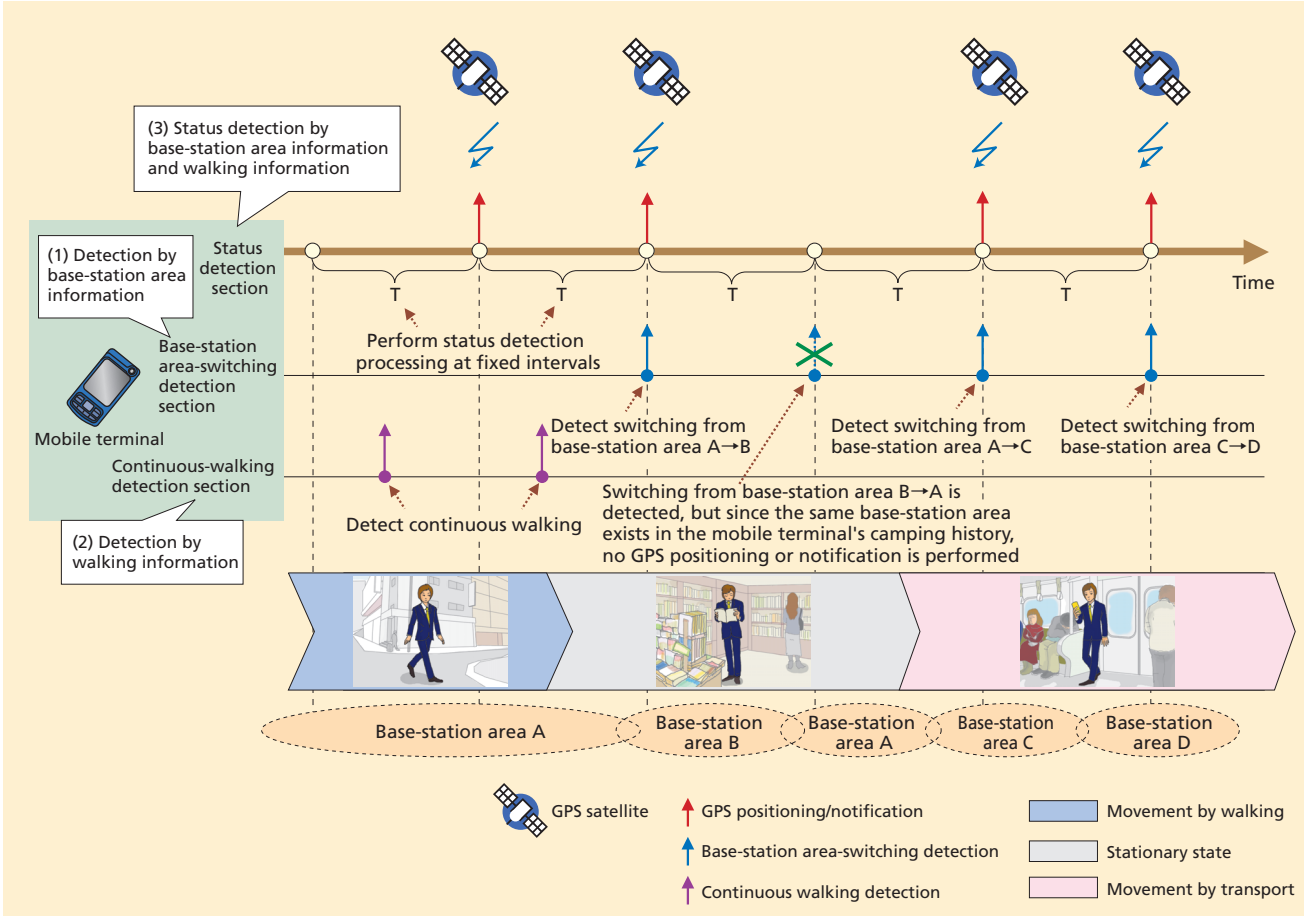

Figure 3 Status detection logic

B is included in the camping history, the function decides that the mobile terminal's base-station area is simply switching frequently (the mobile terminal is in a stationary state) and performs no GPS positioning or notification as a result.

Judging the mobile terminal's state can also be performed by the continuous-walking detection section on the basis of walking information (Fig. 3(2)). The user is determined to be moving by walking if continuous walking above a certain threshold value is detected.

Finally, the status detection section periodically checks for continuous walking and base-station-area switching (Fig. 3(3)) to decide whether to perform GPS positioning and notification.

2.4 AUTO-GPS Positioning Function

As described above, one issue in implementing the AUTO-GPS function is power consumption. Typical positioning from a GPS menu involves Assisted-GPS (A-GPS) to improve positioning performance by obtaining data (hereinafter referred to as "assist data") needed by the mobile terminal to perform GPS positioning such as the user's rough location data from the FOMA network and orbital data for the GPS satellites. However, as the mobile terminal is always in a communications state during positioning, the downside of obtaining new assist data every time positioning is performed is that power is needed to perform such communications in addition to the power needed by the GPS module to perform positioning.

The flowchart for the AUTO-GPS positioning function is shown in **Figure 4**. Making use of the fact that positioning is performed at short intervals during movement, the AUTO-GPS positioning function saves assist data obtained from previous positioning and data obtained by actual GPS positioning in the mobile terminal for use in subsequent GPS positioning. This means that the same positioning performance as A-GPS might be achieved when performing standalone positioning without accessing the network. If the assist data stored in the mobile terminal is judged to be valid, the AUTO-GPS positioning function performs standalone positioning (Fig. 4(a)), and if invalid, it performs A-GPS positioning (Fig. 4(b)).

In addition, given that assist data will be obtained from the network when beginning the positioning process in A-GPS, a rough position corresponding to the base station's position can be obtained even if GPS positioning fails. In contrast, no assist data is obtained in standalone positioning, which means that no rough position will be stored. For this reason, the AUTO-GPS positioning function will initiate an A-GPS positioning procedure in the event that standalone positioning fails thereby obtaining assist data while omitting the GPS-positioning process itself (Fig.

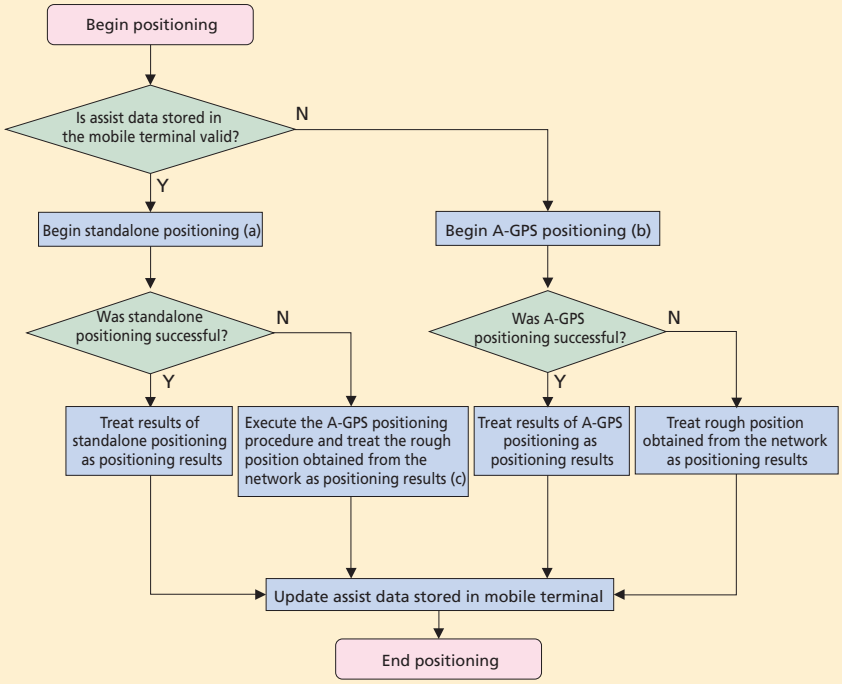

Figure 4 Flowchart of AUTO-GPS positioning function

4(c)). This enables rough location information to be obtained even in an environment in which GPS positioning is failing thereby enabling real-time positions that track user movement to be obtained at any time.

Applying this kind of positioning scheme enables the same level of positioning performance as A-GPS to be maintained while significantly reducing power consumption compared to A-GPS (**Figure 5**). This function also has the effect of reducing traffic caused by network access in A-GPS thereby reducing the impact of A-GPS positioning on network facilities.

2.5 Temporary Suspension Function of Location Information Notification

As described earlier, positioning results obtained by the AUTO-GPS function are passed to each of the AUTO-GPS-based service providers in question. However, some services may not require constant notification of location information. For example, the AUTO-GPS-based service for advising the user of last-train departure time does not require notification of location information when the train is not operating (that is, during non-service hours). It has thus been made possible to temporarily suspend location information notification to any AUTO-GPS-based service by using an HTTP response to an HTTP request advising location information. This has the effect of suppressing unnecessary traffic and reducing the power consumed by the mobile terminal (**Figure 6**).

3. Blu-ray Disc Recorder Linking Function

3.1 Service Concept

The Blu-ray Disc recorder linking function converts digital TV broadcast content recorded on a Blu-ray Disc recorder to mobile-terminal-oriented video content exceeding One Seg quality and transfers that content to the user's mobile terminal for playback. An overview of this function is shown in **Figure 7**. Although viewing of TV broadcasts by the One Seg system and transfer services for analog broadcasts have been around for some time, this function became feasible by the launching of the "Dubbing 10" system in Japan that sets rules on the copying and transfer of digital TV broadcasts with the aim of relaxing limits on the number of copies that users are allowed to make.

3.2 Content Transfer

For the sake of user convenience, this function enables video content to be transferred by direct USB connection between the Blu-ray Disc recorder and mobile terminal making the insertion and removal of a microSD card unnecessary. The function also supports a USB-based encrypted-transfer function to protect the copyrights of digital

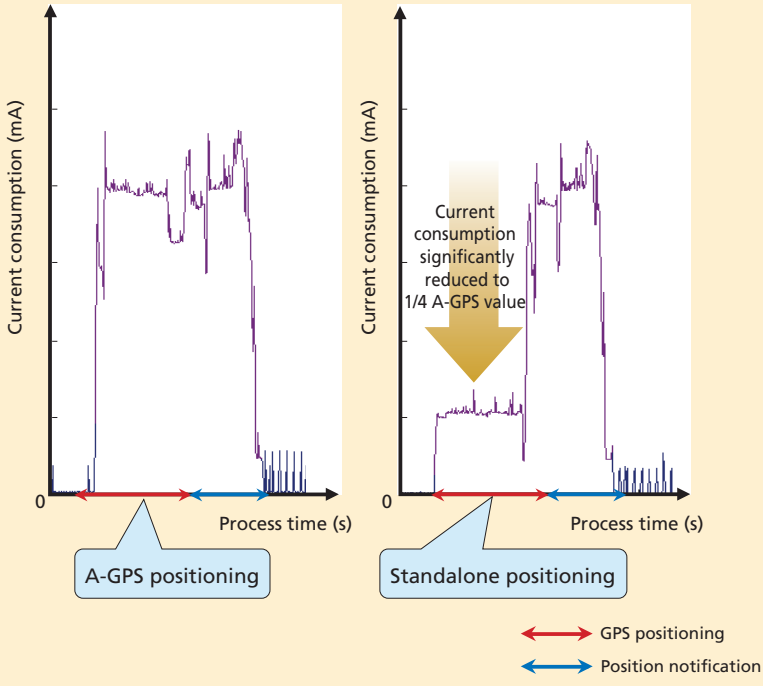

Figure 5 Examples of current consumption in A-GPS and standalone positioning

TV broadcast content, and it performs encryption by the Content Protection for Recordable Media (CPRM)[*4] mechanism when storing content on a microSD card.

3.3 Video Content Format

The H.264 Mobile Video Profile of SD-Video[*5] was adopted here as the format for recording video content on microSD cards. This is a standard that sets video-content specifications assuming playback on mobile terminals. Devices that conform to this standard can be easily linked.

The video specifications of this function are compared with major video services in **Table 1**. These specifications were established under the conditions of providing high-quality video exceeding the quality of existing One Seg and i-motion services and keeping the time needed to transfer content via USB within a tolerable range.

3.4 Playback-capability Notification Function

The Dubbing 10 system allows for nine copies and one transfer, but since the copy/transfer count will be incremented even when transferring content to a device not capable of playing back that content, strict management is needed with regard to the playback capability of the destination device. With this in mind, the Blu-ray Disc recorder linking function is equipped with a playback-

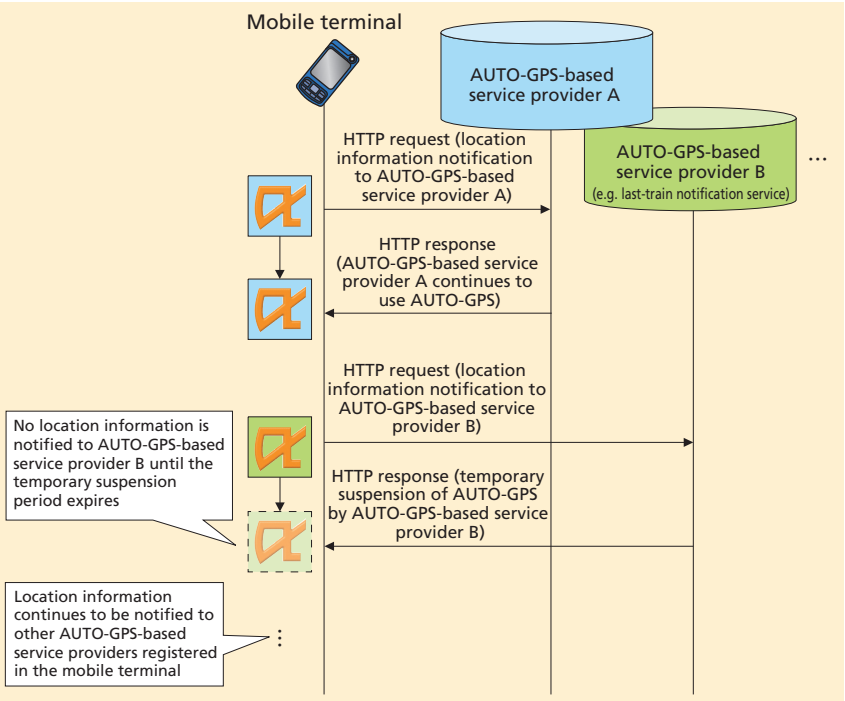

Figure 6 Sequence for temporarily suspending location information notification

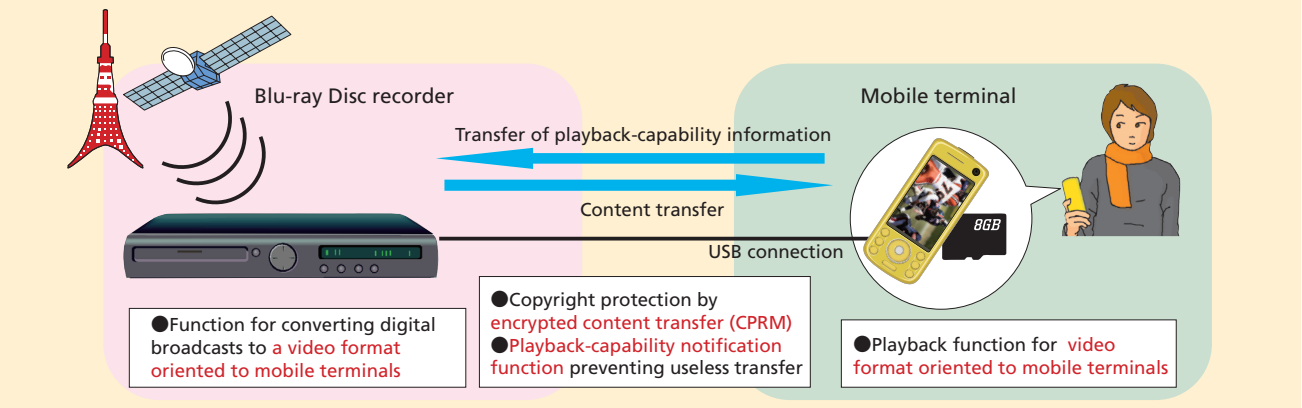

Figure 7 Blu-ray Disc recorder linking

*4 **CPRM**: A copy control mechanism used when storing content on DVDs and SD cards.
*5 **SD-Video**: A standard of the SD Association specifying the data format for recording video on SD cards.

capability notification function to notify the Blu-ray Disc recorder that the mobile terminal stores information on playback capabilities. This function is implemented by storing the playable video formats and associated specifications on the microSD inserted in the mobile terminal and by enabling the Blu-ray Disc recorder to read that information. The effect of this function is to facilitate the generation of video that fits playback capabilities as the number of devices having linking functions increases and the playback performance of mobile terminals and the video-generation specifications of Blu-ray Disc recorders diversify.

Table 1 Specifications of video services

	Blu-ray Disc recorder linking	One Seg Broadcasts	i-motion
Video codec	H.264/AVC*	H.264/AVC	H.264/AVC MPEG-4
Bit rate	Max. 1 Mbit/s	Max. 384 kbit/s (approx. 128 kbit/s in actual use)	Max. 768 kbit/s
Max. resolution (horizontal × vertical)	640 pix × 360 pix	320 pix × 240 pix	320 pix × 240 pix
Frame rate	30 fps	15 fps	30 fps

* H.264/AVC : A video coding system developed jointly by ITU-T and ISO/IEC. It can achieve a compression rate approx. twice that of the existing Moving Picture Experts Group-2 (MPEG-2) standard.
fps : Frames Per Second

4. Conclusion

The AUTO-GPS function and Blu-ray Disc recorder linking function developed as new applications for winter/spring 2009 models mark the further evolution of the mobile terminal from a communication and information-access tool to a concierge-type terminal supporting personal behavior.

With the aim of supporting personal lifestyles with even more convenient services, we will continue to develop services ideal for mobile terminals, including services that exploit real-time features using location information, high-mobility services that can be used either indoors or outdoors, and services that feature two-way linking between all kinds of home electronics devices in addition to Blu-ray Disc recorders.

REFERENCE

[1] H. Suzuki et. al: "Application Functions for Autumn/Winter 2008 Models (1) i-concier and One-step User Memory Back-up Functions," NTT DOCOMO Technical Journal, Vol. 10, No. 4, pp. 45-50, Mar. 2009.