

docomo TV terminal as “Your TV”

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In recent years, set top boxes oriented to video delivery have become increasingly popular around the world. However, they have yet to be adequately equipped with content recommendation functions tailored to user preferences based on viewing history. To achieve such a function, NTT DOCOMO has developed a home device as “Your TV” that features zapping viewing based on user viewing history centered about d ACCOUNT^{®*1} and a multi-account function envisioning family usage.

1. Introduction

In light of the recent spread of home devices centered about video services, NTT DOCOMO has developed the docomo TV terminal^{®*2} set top box as “Your TV” based on the product concept of “broadening the enjoyment of all NTT DOCOMO video services on the family’s home TV as desired by each member of the family” [1]. In other words, this product, while assuming family usage, can also meet individual viewing needs.

An external view of the docomo TV terminal is shown in **Photo 1** and main specifications are



Photo 1 External view

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*1 d ACCOUNT[®]: A free common ID for using a variety of services provided by NTT DOCOMO such as net shopping and digital content. A registered trademark of NTT DOCOMO, INC.

*2 docomo TV terminal[®]: A trademark or registered trademark of NTT DOCOMO, INC.

listed in **Table 1**.

Set top boxes up to now have featured a usage format in which users actively select the content that they wish to watch from a program schedule that includes standard recommendations from the service provider. Consequently, with the aim of encouraging passive viewing tailored to individual users, NTT DOCOMO introduces automatic zapping made possible by inferring the content or programs that each user would like to watch at the present moment from viewing history and presenting those recommendations on the home screen as the user’s first view (**Figure 1**).

Conventional set top boxes have also suffered from a variety of issues including the difficulty of setting multiple accounts for family usage and of using a remote control unit in addition to hard-to-understand Frequently Asked Questions (FAQ) on terminal operation.

This article provides an overview of docomo TV terminal, explains the mechanism of d ACCOUNT and the user experience^{*3} with the Home app that resolves the above issues, and describes the technology and specific usage scenarios of the “Osusume hint (Recommended Usage Hints)” function.

Table 1 Main specifications

Color	White
Size	107 mm (W) × 107 mm (D) × 25.5 mm (H)
Weight	209 g
OS	Android TV 7.0
CPU	Quad Core 1.6GHz
Internal memory capacity (RAM/ROM)	RAM3GB/ROM16GB
HDR	HDR10, HLG, Dolby Vision
DLNA	Supports only the DMS function. docomo TV terminal apps are needed for viewing. DLNA/DTCP-IP (Hikari TV for docomo only)/DTCP+ (Hikari TV for docomo only)
LTE	LTE/3G/GSM not supported (no insertion of UIM card)
External ports	HDMI2.0a Gigabit Ethernet USB2.0×1 port, USB3.0×1 port
Wi-Fi	IEEE802.11ac/a/b/g/n, MIMO supported
Bluetooth	Bluetooth4.2
Remote control	Built-in mike for voice input, Bluetooth, infrared supported
Supported services	DTV, d anime store, dTV channel, DAZN for docomo, Hikari TV for docomo

DLNA : Digital Living Network Alliance

DMS : Digital Media Server

DTCP: Digital Transmission Content Protection

HDR : High Dynamic Range

HLG : Hybrid Log Gamma

MIMO: Multiple Input Multiple Output

^{*3} User experience: Everything a user feels when using, consuming, or owning a product or service.

2. Application Configuration of docomo TV terminal

The application configuration of docomo TV terminal is shown in **Figure 2**. Loaded on the Android™*4 TV OS application layer, these applications are divided into basic functions and video

services. The former consists of the “Home app,” “d ACCOUNT setting app” for authenticating and managing the user’s d ACCOUNT, and “Osusume hint” for presenting advice on terminal operation, while the latter consists of various applications for running video services such as “dTV®*5” and “Hikari TV®*6” that output video content. The following

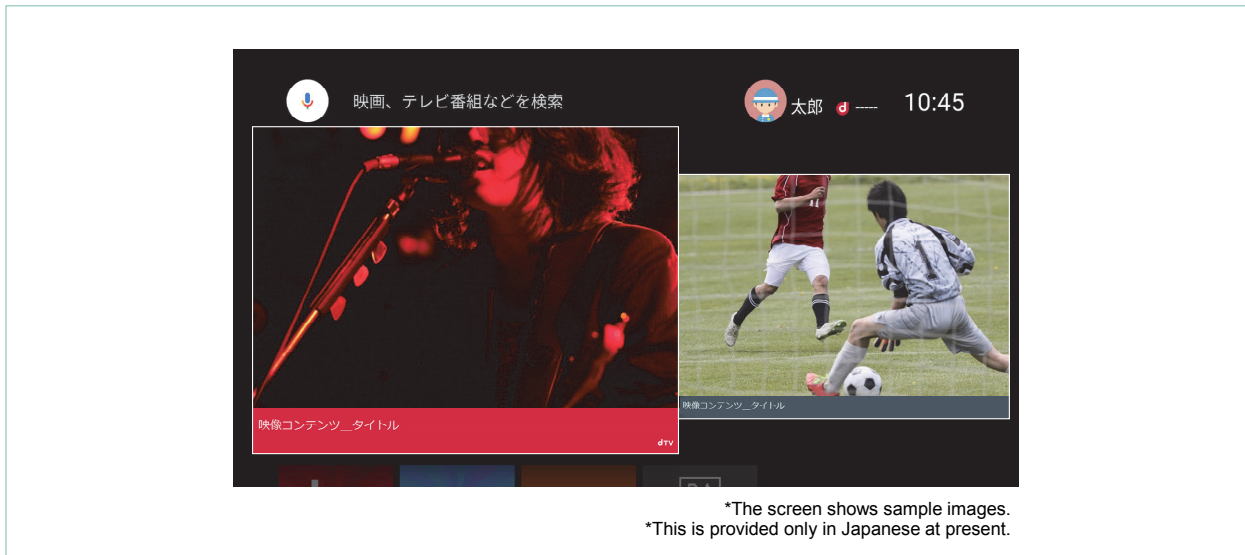


Figure 1 Zapping UI

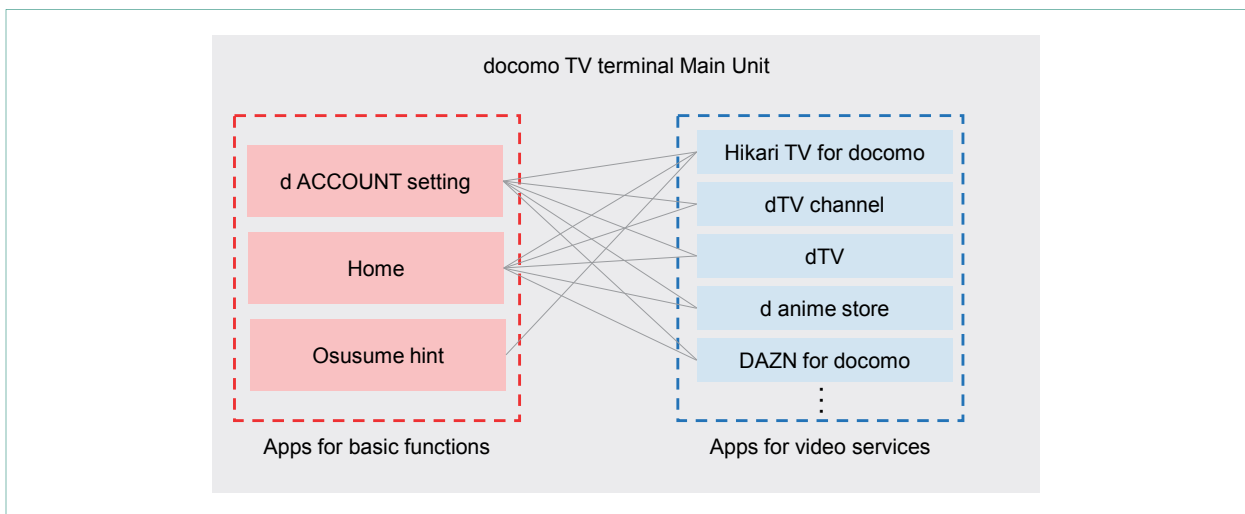


Figure 2 Application configuration

*4 Android™: An open source platform targeted mainly at mobile terminals and promoted by Google Inc. in the United States. A trademark or registered trademark of Google LLC in the United States.

*5 dTV®: dTV, dTV channel, and dTV terminal are registered trademarks of NTT DOCOMO, INC.

*6 Hikari TV®: A video delivery service operated by NTT Plala Inc. A registered trademark of NTT Plala Inc.

describes the technology for achieving “Your TV” and specific usage scenarios.

3. User Management by d ACCOUNT

3.1 Multi-account Function

Contract information and usage conditions for each user with respect to the various types of services provided by NTT DOCOMO are managed using d ACCOUNT, a free common ID [2]. With docomo TV terminal, the user only has to log into the terminal once. There is no need to log in every time a different service is used since account information can be referenced from the d ACCOUNT setting app.

As described above, account management by the d ACCOUNT setting app is similar to that of a smartphone, but while a smartphone corresponds to an individual account, docomo TV terminal, which envisions family usage at home, was designed to manage multiple accounts. This is called a multi-account function.

In the case of family usage, selecting your own icon from among multiple user icons when the terminal starts up enables you to log in to all services from your own account as shown in **Figure 3**. The docomo TV terminal uses this multi-account function to present recommended content in a zapping-type format on the home screen based on the viewing history of each account. In this way, “Your TV” comes to life immediately after starting up the terminal.

3.2 Authentication Processing with d ACCOUNT Setting App

A user’s d ACCOUNT, which is used as login information for many services, is securely managed in the form of a token*⁷ at login time on that terminal. The docomo TV terminal as well uses a token for the d ACCOUNT setting app to perform authentication processing for various services thereby enabling single sign-on*⁸ within the terminal.

The docomo TV terminal also displays an icon and user name as account information on the screen.



*This is provided only in Japanese at present.

Figure 3 Account-registration and account-viewing screens

- *⁷ Token: The result of converting information into a character string, used here to transform d account information into a character string that cannot be understood by another party.
- *⁸ Single sign-on: The ability of logging into multiple services with a single account.

Switching from this icon and user name to another user changes the active user (the account currently using the terminal).

3.3 Simple Account Registration

Account registration results in automatic authentication. For example, when a user purchases a terminal at a store, a d ACCOUNT will be registered on the terminal on the store side making it unnecessary for the user to register a d ACCOUNT again when connecting from home (although an authentication key must be input from the user’s smartphone). This scheme saves the user the trouble of making initial d ACCOUNT settings on the terminal and enables the user to start using services anytime after making the purchase simply by connecting the terminal to a power supply and the Internet.

Of course, d ACCOUNT registration on the terminal may also be performed manually, and for this case, NTT DOCOMO provides a registration method using a pairing code*9 that simplifies input by linking with the user’s smartphone. In this method, the user inputs the code displayed on docomo TV terminal using the d ACCOUNT setting app on the user’s smartphone. This action registers the d ACCOUNT registered on the smartphone with the docomo TV terminal as well (Figure 4).

3.4 Smartphone Authentication

The docomo TV terminal takes into account the use case of switching among multiple accounts. It therefore recognizes the need for privacy and requires a password when switching accounts to prevent other users from using one’s own account.

However, the need for inputting a password may

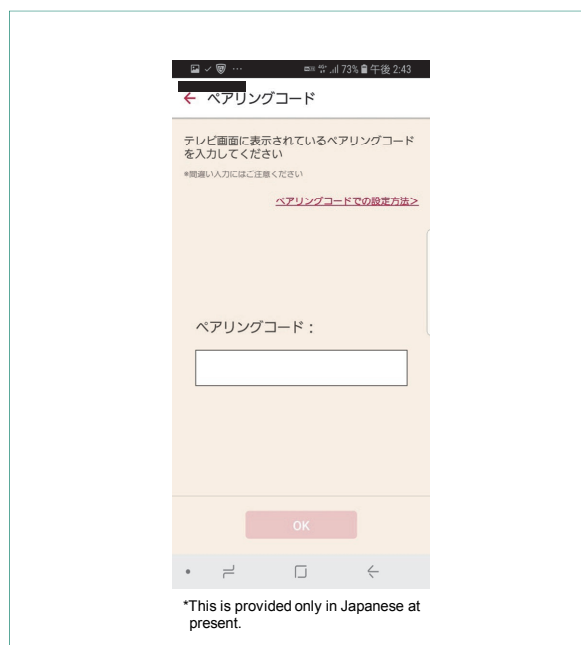


Figure 4 Registration by pairing code

frequently occur in actual use. With this in mind, NTT DOCOMO also provides a function for performing authentication by smartphone to avoid the security-related problem of displaying a password on a screen at the time of input and to eliminate the annoyance of having to input a password by remote control every time. In this regard, authentication by smartphone can already be performed by a function provided on the d ACCOUNT setting app for smartphones. This function can also be used to perform d ACCOUNT authentication on a computer browser or a set top box such as docomo TV terminal by having that equipment send a notification to the smartphone and then using biometric authentication processing (fingerprint/iris authentication) on the smartphone. This scheme negates the need for inputting a password on the screen and makes the authentication process simpler and more secure. The docomo TV terminal

*9 Pairing code: An identifier for performing d ACCOUNT authentication.

provides the same sort of function enabling authentication by smartphone to be used as an alternative to password input on the terminal (Figure 5).

4. User Experience Features

4.1 Product Concept and Provided Value

The product concept can be broken down into three features: all NTT DOCOMO video services, home TV, and support for each family member. Each of these features is summarized below.

1) All NTT DOCOMO Video Services

This feature means exactly what it says: purchasing this product enables the user to experience the freedom of enjoying all NTT DOCOMO video services. As of September 2018, these video services included DTV, d anime store, dTV channel[®], DAZN^{®*10} for docomo, and Hikari TV for docomo, but there had not been a device in the NTT DOCOMO product lineup that could use all of these services. For example, Hikari TV that assumes the use of an optical circuit could not be viewed

with a smartphone, and dTV terminal[®] sold in the past supported the viewing of only DTV and d anime. This development of docomo TV terminal has made it possible to view all video services.

2) Home TV

This feature emphasizes the use of a TV terminal for viewing video services instead of a smartphone. However, in contrast to using a smartphone that assumes input by a touch panel, using a TV terminal assumes input operations by a remote control corresponding to the TV screen display, which has a negative effect on operability (degree of simplicity, degree of freedom, etc.). For example, when selecting content in a carousel format^{*11}, only one step is needed when using a mobile device such as a smartphone while two or more steps are needed when using a remote control. There is therefore a need for improving operability with a remote control when a TV terminal is the target device.

3) Support for Each Family Member

Differences in viewing habits emerge in relation to the number of users. “Home TV” presents

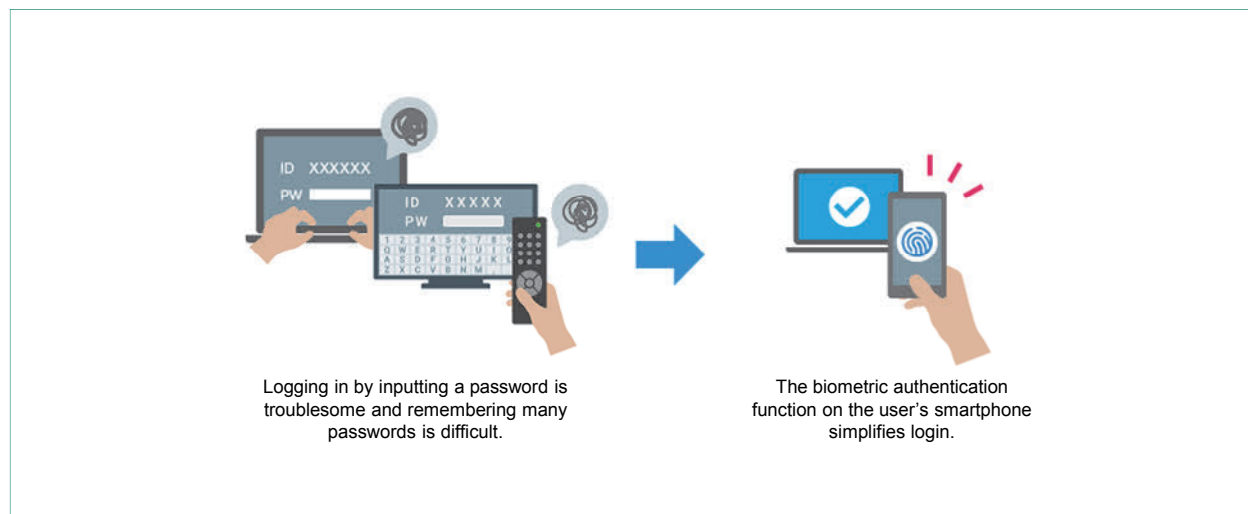


Figure 5 Authentication by smartphone

*10 DAZN: A trademark or registered trademark of Perform.

*11 Carousel format: A scheme for displaying multiple objects in a linked manner and for selecting a particular object by sliding to it.

an image of a TV set in a family’s shared living space like a living room in contrast to that of an individually owned smartphone. It means that the whole family may view content together or that an individual member of the family may view personally preferred content. In short, users’ needs change according to usage scenario, so there is a need for an environment that can meet the needs of a variety of users.

In light of the above, the value that docomo TV terminal aims to provide can be summed up as “the ability to comfortably enjoy the NTT DOCOMO video services that I as a member of my family would like to watch right now on our TV screen.” A User Interface (UI)^{*12} has been designed to achieve this value.

4.2 UI Designs on the Home Screen

Two UI designs called “multiuser personalization” and “zapping UI” were proposed for the docomo TV terminal as described below.

1) Multiuser Personalization

In the case of a family, this refers to a state in which the information required for the father, mother, and each child is optimized for the father, mother, and each child, respectively. Consequently, in addition to the scenario in which the family enjoys content together, this implies the provision of personalized information so as to satisfy the preferences of the user operating docomo TV terminal. Personalization of content is thought to be achieved by providing “recommendations based on the current service contract^{*13}” and “recommendations based on a viewing log^{*14}.” With this in mind, the following UI elements are required.

- The user (personalized information) who wishes to log in when starting up the terminal must be easy to select
- After login, the user must be treated as being one and the same for all services
- Information on users not logged in must not be displayed

In the case of a dedicated device, user authentication can be easily performed at a prescribed position within the startup sequence. In an Android environment, however, all applications can operate in an asynchronous manner, which makes it difficult to implement a function for suppressing the launch of other applications until user authentication completes. To solve this problem, this product is designed with a function for logging into the Home app—the starting point of user operations—so that other applications cannot be used in a non-logged-in state. The startup sequence of the docomo TV terminal is shown in **Figure 6** (1) – (3) and described below.

- (1) Although corresponding to a return from SLEEP mode in a smartphone, pressing the power button always launches the Home app on the framework^{*15} layer so that the screen of another application does not accidentally appear in front of the user. It must also be considered that multiple startup modes exist and that there are cases in which terminal startup is not equal to the Home app startup, so extra information is given so that terminal startup is understood. This scheme achieves a function that ensures startup of the Home app on the first screen.
- (2) To provide for the case in which another

*12 UI: Operation screen and operation method for exchanging information between the user and computer.

*13 Recommendations based on the current service contract: Recommendations that prioritize user-contracted services from among all video services provided by NTT DOCOMO.

*14 Recommendations based on a viewing log: Recommendations

that specify content that the user would like to watch next based on a viewing log.

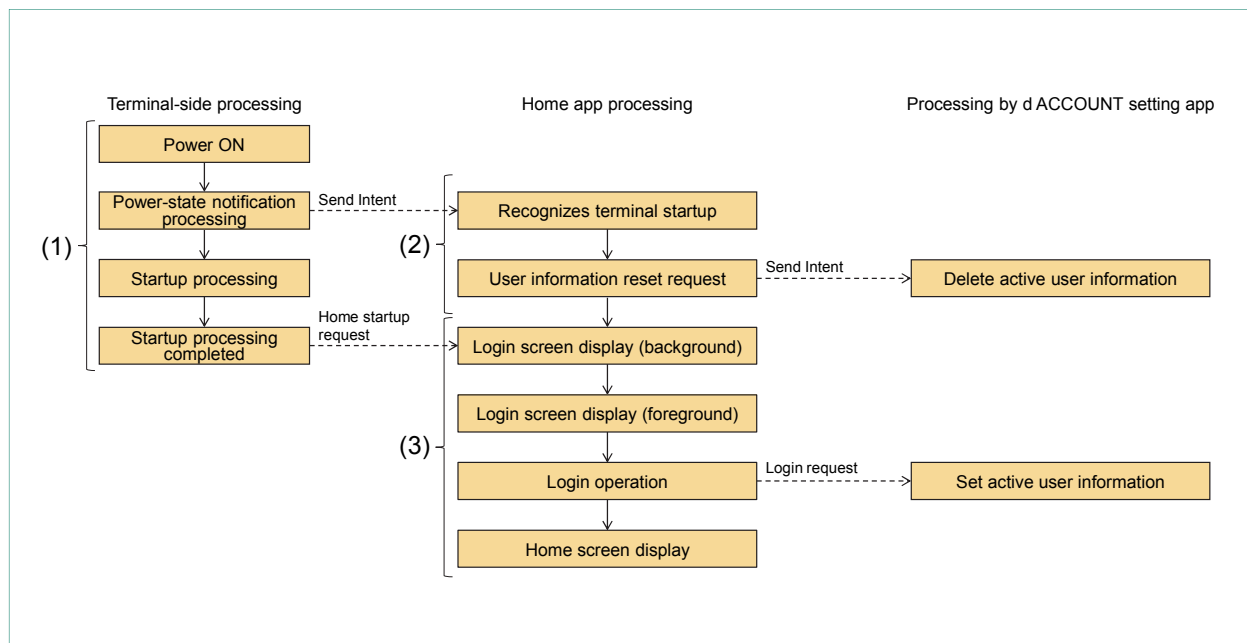


Figure 6 Terminal startup sequence

application has obtained user information through an interrupt during the user authentication process, this step performs processing that sets active user information to 0. The idea here is to prevent a certain service application from using, for example, the mother's user information at the instant when the father is trying to log in.

- (3) At this point, login processing of the designated account begins. This processing resets active user information thereby enabling each service application to make use of that user information.

An example of the user experience with the login screen of the docomo TV terminal is shown in **Figure 7**. After the user selects his or her own icon, NTT DOCOMO video services become available and content oriented to that user will be rec-

ommended. Additionally, for users that value privacy, specifications call for the input of a password when logging in to an account that the corresponding user wishes to be closed off.

2) Zapping UI

This UI design refers to operations that enable the user to select the content to be used next while actually viewing that content.

In the case of television broadcasts, the numerical buttons on the remote control unit can be used to switch instantly from one program to another. In comparison, a number of operations are needed in the case of video services before viewing can begin. In general, these consist of the following three steps that can feel burdensome to the user: (A) search for video using keywords that come to mind, (B) select the content of interest from the search results presented, and C: decide whether to continue watching the selected content.

*15 **Framework:** Software that encompasses functionality and control structures generally required for software in a given domain. With a library, the developer calls individual functions, but with a framework, it handles the overall control and calls individual functions added by the developer.



Figure 7 Login screen

To eliminate this burden, it was proposed that this product include the experience of video content playback on the home screen.

The user experience with the zapping UI of the docomo TV terminal is shown in Fig. 1. Here, the content most likely to be of interest to the user is displayed in the first focus^{*16} after starting up the Home app. The playback of that content then begins so that the user can decide whether to continue watching. Then, once the playback of that content completes, the UI automatically advances to the next item of content and begins playback again so that the user can decide in a passive manner whether to continue watching that content. Furthermore, so as not to hinder users who wish to perform operations in an active manner, this UI features a layout that places startup icons of various NTT DOCOMO service applications at the position of the second focus thereby enabling the user to start up a target service in one step.

This zapping UI requires highly accurate recommendations, but since the Home app cannot

control the recommendation function provided by the Android standard, such high accuracy is difficult to guarantee. As a consequence, this product is combined with a server that performs integrated analysis of user information to prepare recommendations. The function configuration of this recommendation process is shown in **Figure 8**. In this process, the Home app passes only the d ACCOUNT identifying information to the server as an argument. The server, in turn, uses this information to return optimal recommendations based on the user's service contract conditions, viewing log, etc.

Incorporating these “multiuser personalization” and “zapping UI” UI designs in the Home app achieves a UI that fulfills the product concept.

5. Osusume hint (Recommended Usage Hints)

5.1 Overview of Osusume hint

The docomo TV terminal incorporates the Osusume hint [3] function first incorporated in smartphone

*16 Focus: Highlighting an icon etc. to confirm a process before inputting or executing.

models of the 2016 summer season. This service displays helpful information on how to use the target terminal in a more comfortable and enjoyable manner according to the usage habits and conditions of each and every customer. In this regard, the docomo TV terminal uses the name “information” instead of “hints” since the plan for the future is to

display “information” for various services in the form of an “Information List” in addition to hints on terminal operation (Figure 9).

We note here that this is the only application—a NTT DOCOMO original function—in the Android TV OS that encourages terminal operation and usage appropriate to the customer.

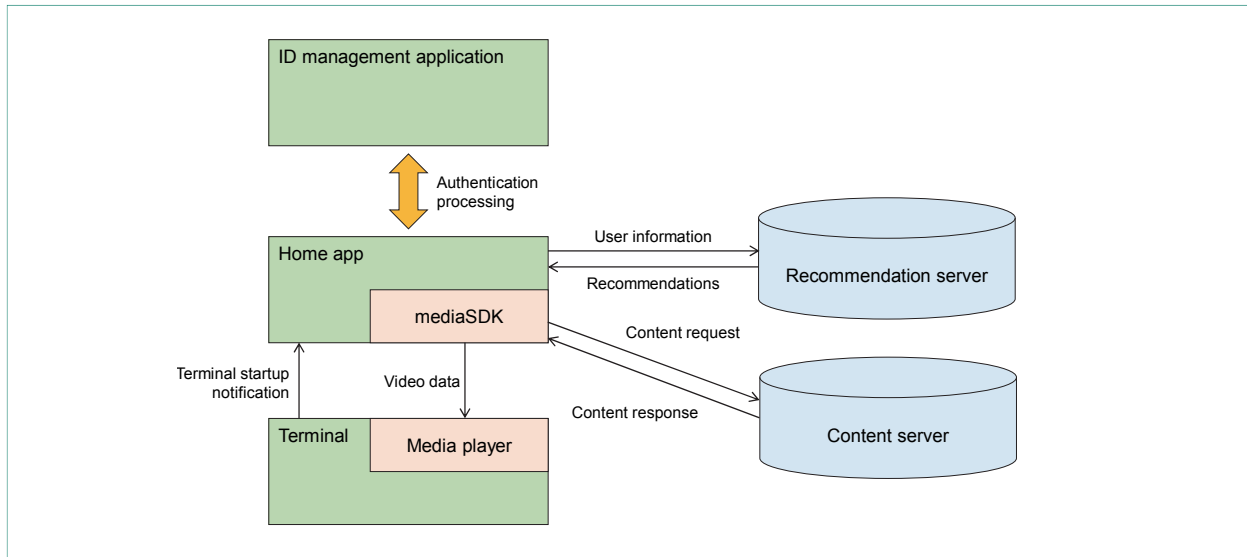


Figure 8 Function configuration chart



Figure 9 Information list

5.2 Information Display Methods

Two methods are provided for viewing helpful information. The first is pressing Information displayed on a recommendation and the second is to press the “Information” button on the remote control and selecting the information desired (Figure 10). The information so selected is designed to provide a more intuitive, easy-to-understand information display by playing back a video and encouraging the user to operate the terminal in the way shown. The video shown, which is uploaded on YouTube™*17, is played back on YouTube using WebView*18 from the Osusume hint app screen. However, considering that screen operations cannot be simultaneously performed while watching the video, a QR code®*19 function has been incorporated so that the video can also be viewed on the user’s smartphone for convenience sake.

5.3 Information Updating

The content of Information needs to be modified and optimized whenever a new version of the terminal OS is released or when user usage patterns change. For this reason, the Osusume hint app periodically checks the server for the presence of a new rule-set database and updates the app’s database with the latest information if necessary. In this way, the terminal can always display the latest information. Furthermore, since information content is delivered in accordance with each user’s usage history, switching to another account when multiple d ACCOUNTs are registered will display the information optimized for that account.

5.4 Built-in Information Button

The docomo TV terminal features a built-in “Information” button on the remote control unit to

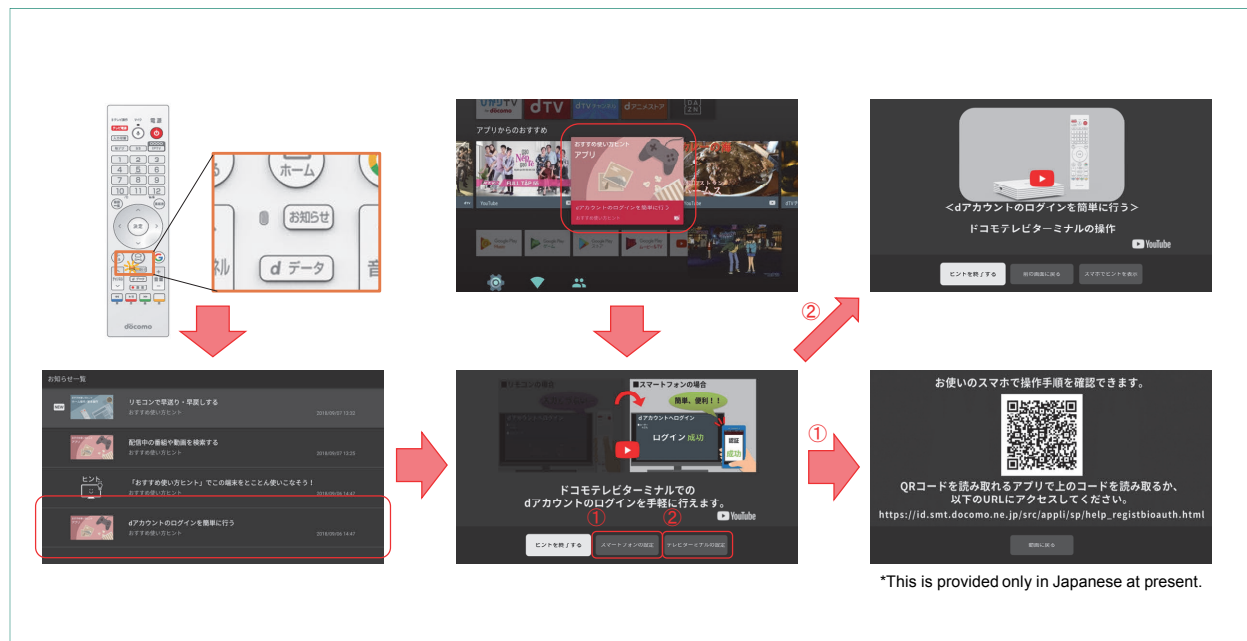


Figure 10 Methods of using Osusume hint

*17 YouTube™: A trademark of Google, LLC.

*18 WebView: A function for displaying a Web page within an application.

*19 QR code®: A type of two-dimensional bar code. A registered trademark of Denso Wave Incorporated.

make it easy to watch previously displayed information at any time. By pressing this button, the user can view the latest item of information as well as a list of previously displayed information in the form of an “Information History.”

The latest update to docomo TV terminal adds a function for turning on an LED situated next to the “Information” button whenever “important information” is being displayed (Figure 11). The purpose of this LED function is to advise the user that this is content that NTT DOCOMO would like the customer to grasp as soon as possible. This function can also be handled from a database. Additionally, for users who were not able to check such “important information” in real time, docomo TV terminal also incorporates a mechanism for lighting the LED as a reminder to prevent that information from being missed. Going forward, the plan is to make the content displayed in “Information” all the more convenient by displaying not only terminal operation hints but also information on various NTT DOCOMO services.

6. Conclusion

This article described in detail the means and technologies used for achieving “Your TV” as one concept of the docomo TV terminal. Going forward, we plan to study mechanisms for providing



Figure 11 Information LED

new viewing experiences tailored to individual user needs while expanding built-in services not only in smartphones but also in home devices as new user contact points.

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