

Cloud-based 3D Menu Generation and Provision of Digital Broadcasting Service on Thin-client

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Abstract— The types of digital broadcasting such as IPTV or smartTV may include terrestrial broadcasting, content broadcasting, real-time broadcasting, bi-directional service and Video on Demand (VOD). A user menu is required to provide a user with these types of content systematically. Without the user menu, it is difficult to find a desired content among such abundant content. The user menu has been developed from a simple text-type menu into a sophisticated one using graphics. In particular, demands for three-dimensional (3D) content which looks more real and stereoscopic than two-dimensional (2D) content are increasing recently.

We provide a method and an apparatus for providing a cloud-based user menu to flexibly process the user menu in a digital broadcasting system.

A method for displaying a user menu in a broadcast receiving terminal in a digital broadcasting system includes receiving a user menu configured through a cloud server and rendering the user menu received from the cloud server in a digital TV.

A method for providing a user menu in a cloud server includes configuring the user menu in a cloud using a menu behavior pattern and providing the user menu for a broadcast receiving terminal connected to a digital TV.

The cloud server includes a menu configuring unit configured to configure the user menu in the cloud using the menu behavior pattern and a menu providing unit configured to provide the broadcast receiving terminal with the user menu configured through the menu configuring unit.

The digital broadcasting system includes the cloud server configured to configure the user menu using the menu behavior pattern, the broadcast receiving terminal configured to receive the configured user menu from the cloud server to be rendered in the digital TV and a resource server configured to provide resources necessary for the cloud server to configure the user menu and for the broadcast receiving terminal to render the user menu.

The cloud-based 3D menu system may maximize the flexibility of a method for processing a menu, resulting in those for easily providing a personalized menu, conveniently replacing a menu and configuring an independent menu on a terminal.

Keywords— Cloud, thin-client, UI, UX, 3D, menu

I. INTRODUCTION

With the rapid transition from analog to digital broadcasting, much more content is demanded for digital broadcasting than analogue broadcasting, and the types of such content are varied. The types of digital broadcasting may include terrestrial broadcasting, content broadcasting, real-

time broadcasting, bi-directional service and Video on Demand (VOD). The commercial examples of digital broadcasting are IPTV, DCATV, Smart TV and ODTV.[1]



Figure 1. Example of IPTV convergence service

The main environmental change brought on by digital broadcasting such as IPTV is an advent of a bi-directional broadcasting business that uses a telecommunication return channel. This is a change from ‘TV as a medium of transaction’, which is one way watching of analog TV, to ‘TV as a marketplace’, which connects the viewer directly, collects the viewer’s opinion bi-directionally, and reapplies the viewer’s reaction to service. Figure 1 shows various examples of bi-directional and convergence services combining broadcasting, telecommunication and related information [1,2,3].

A user menu is required to provide a user with these types of content systematically. Without the user menu, it is difficult to find a desired content among such abundant content. The user menu has been developed from a simple text-type menu into a sophisticated one using graphics. In particular, demands for three-dimensional (3D) content which looks more real and stereoscopic than two-dimensional (2D) content are increasing recently.

Generally, the user menu is configured through an application program of a Set-Top Box (STB) as a broadcast receiving terminal and displayed on a screen of a digital TV

connected to the broadcast receiving terminal shown in figure 2.

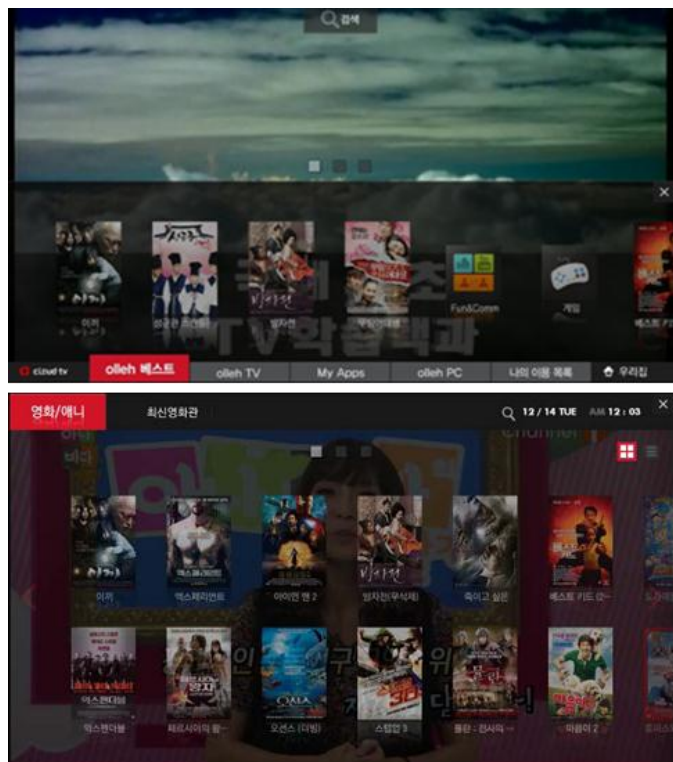


Figure 2. Example of IPTV user menu

In this case, it is not easy to change a default user menu that is initially installed in the terminal or to provide a user menu personalized for the user's preferences. In addition, it is even harder to configure a 3D stereoscopic menu with high definition.

In recent years, cloud computing is becoming very popular. It delivers infrastructure, platform, and software (application) as services, which are made available as subscription-based services in a pay-as-you-go model to consumers [4, 5, 6].

Using Cloud computing, it is possible to drastically reduce the cost and complexity of deploying 3D menu generation and delivery. Figure 3 shows example of 3D menu.



Figure 3. Example of 3D user menu

Using cloud technology in mobile service area to manipulate 3D UI/UX greatly helps resource management in mobile cloud computing [7].

In this paper, I describe 3D UI generation and delivery methods based on cloud technology.

II. CONCEPT OF CLOUD BASED UI

Figure 4 illustrates concept of cloud-based UI. The main concept of cloud-based UI is separation of menu manipulation and rendering. The client's role is only rendering of menu and all the other roles are handled by cloud server such as menu design, menu control and menu delivery.

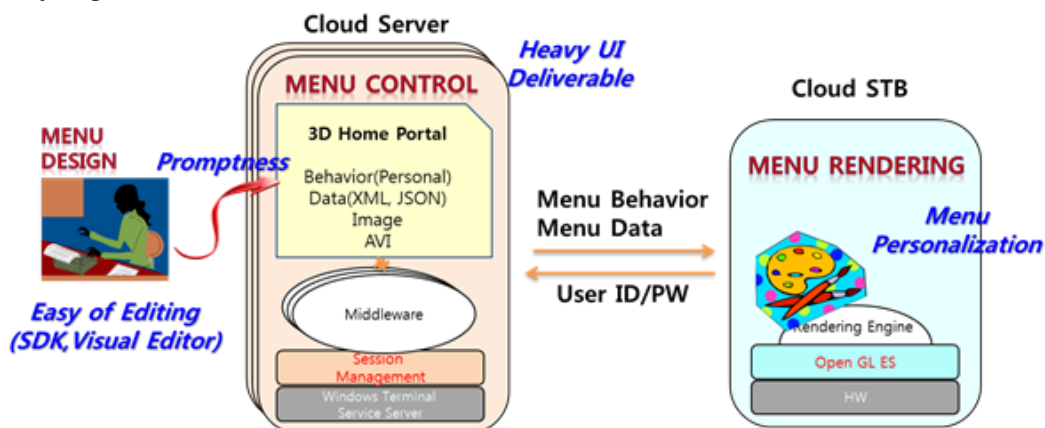


Figure 4. Concept of cloud-based UI

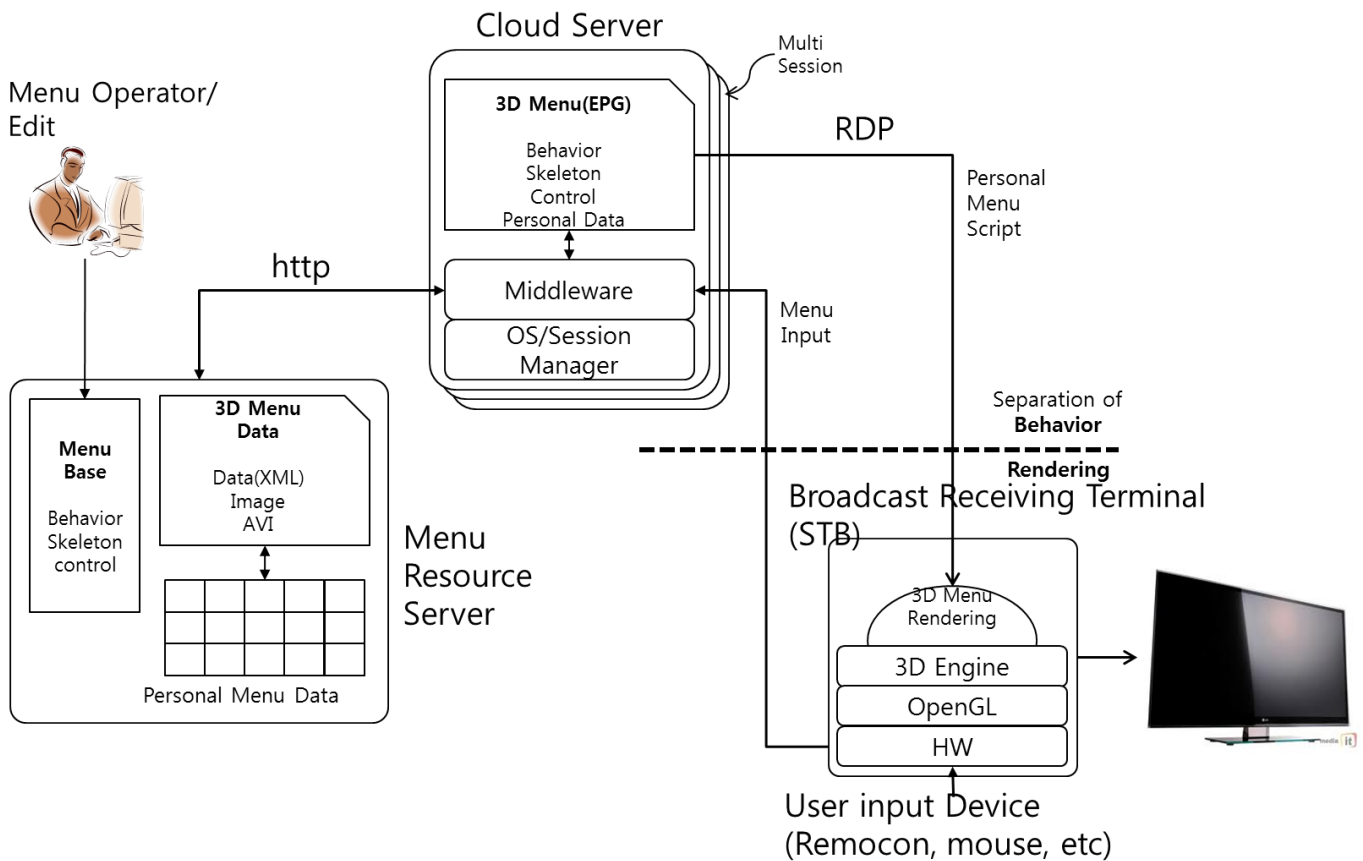


Figure 5. System Architecture of Cloud-based 3D UI

Figure 5 illustrates overall system architecture of cloud-based UI. The cloud-based UI system includes a broadcast receiving terminal labelled as STB attached a digital TV with input devices, a cloud server, and a resource server.

The present system is separately-structured such that, when a digital broadcast service is provided in the digital broadcasting system, the cloud server in the cloud configures a user menu to be displayed on a screen and the STB merely renders the user menu.

The user menu refers to a menu corresponding to a User Interface (UI) or a User Experience (UX). The user menu may be Electronic Program Guide (EPG) information or Interactive Program Guide (IPG) information such as a TV program log to help a user to search for a desired program with reference to time, title, channel and genre.

The user menu may be a three-dimensional (3D) stereoscopic image. In this case, the STB generates the 3D stereoscopic image by performing a rendering and outputs the 3D stereoscopic image to the digital TV.

In another example, the user menu may display upper content, such as My Menu registered by the user, real-time broadcasting, bi-directional service and VOD, and a channel of each of the upper content. Herein, the channel refers to lower content. If a channel is selected by an input command of the user inputting device, one of the lower content corresponding to the channel is displayed and, if none of the

lower content corresponds to the channel, detailed content corresponding to the channel may be displayed.

My Menu is a menu for user's favorite content; a real-time broadcasting menu is a menu for channels of terrestrial broadcasting, home-shopping, movie and other real-time broadcastings; bi-directional service menu is menu for games, shopping, singing, living information and any other additional services; and VOD menu is a menu for various types of VODs including movie, foreign soap-operas, terrestrial broadcasting, education and sports to be watched using a streaming or Down-and-Play (D&P) service.

The user menu may include a user's favorite channel, a previously-viewed channel, a watch history and a user-defined channel and be manipulated by a user command of the user inputting device. The user menu may be positioned in a region which the user designates on a screen of the digital TV.

The user inputting device receives a service request signal, a menu selection signal or a TV control signal from a user to be transmitted to the broadcast receiving terminal. For example, the user inputting device may be a remote controller.

The cloud server receives from the broadcast receiving terminal the service request signal or a menu selection signal input by a user through the user inputting device, implements the requested service and provides result data of the implementation to the broadcast receiving terminal. The

cloud server may be connected to a broadcast data transmitting server (Not Shown) via an Internet network.

The cloud server configures the user menu using a menu behavior pattern in the cloud and provides the configured a user menu for the broadcast receiving terminal. The menu behavior pattern includes a user menu skeleton, menu configuration data and menu control information. For example, the menu skeleton may include a structure of menu categories (upper and lower content and channels) and a region in which the user menu is to be displayed. The menu skeleton may be a tree structure made of upper and lower content and channels.

The broadcast receiving terminal functions as a general Set-Top Box (STB). In other words, the broadcast receiving terminal receives broadcast data from the broadcast data-transmitting server and outputs the broadcast data to the digital TV. The broadcast receiving terminal may be embedded in the digital TV or disposed outside of the digital TV.

The broadcast receiving terminal is connected to the cloud server via an Internet network. A plurality of the broadcast receiving terminals may be provided and simultaneously connected to the cloud server. The broadcast receiving terminal receives a service request signal, a menu selection signal or a TV control signal of the user inputting device to control the digital TV. In another example, the broadcast receiving terminal transmits an input command of the user inputting device to the cloud server and receives data from the cloud server to be output to the screen of the digital TV.

The resource server provides resources necessary for the cloud server to configure the user menu and for the broadcast receiving terminal to render the user menu. The resource includes text data, a menu image and video information.

III. CLOUD SERVER AND CLIENT DESCRIPTION

The cloud server includes a middleware and an operating system (OS).

The OS of the cloud server supports multi-session. The multi-session means that pluralities of the broadcast receiving terminals are able to be connected to the cloud server. The middleware implements the user menu, and specifically, if a user command, such as inputting of a menu button, is received from a user through the user inputting device, the middleware receives the user command from the broadcast receiving terminal to implement the menu.

If the menu is implemented, the middleware receives menu behavior pattern information from a menu base of the resource server. The behavior pattern information includes a menu skeleton and menu control information. The behavior pattern information of the menu base has the same skeleton with respect to each user. Meanwhile, the middleware receives personalized-menu data of the corresponding session from the resource server. The personalized-menu data has a different menu skeleton with respect to each user. The personalized-menu data includes a user's favorite channel, a list of watched VODs, a watch history and a user-defined channel.

The middleware combines the behavior pattern information of the menu base and the personalized-menu data so as to configure the user menu for the broadcast receiving terminal and provides the broadcast receiving terminal with the configured user menu. Remote Desktop Protocol (RDP) may be used for providing the user menu for the broadcast receiving terminal. The resource necessary for configuring the user menu by the middle ware and for rendering the user menu by the broadcast receiving terminal may be provided to the broadcast receiving terminal through the resource server in real-time. For example, the resource is provided in a manner that, if the broadcast receiving terminal requests the resource from the middleware using the RDP, the middleware connected to the resource server receives the resource from the resource server using HTTP and provides the resource for the broadcast receiving terminal. The resource may include text data of the menu, a menu image and a video menu.

A menu operator/editor may edit the menu base in real-time using a menu editing device. Since the menu base is updated through the user menu of the cloud server whenever the broadcast receiving terminal is turned-on, it is easy to reflect a change in the menu in real time. In other words, if all menu data is processed in the broadcast receiving terminal, a complex procedure is required to change the menu, but, according to the present invention, the menu data may be updated in real-time through the user menu of the cloud server.

The broadcast receiving terminal includes a menu-rendering unit, which includes a menu engine, an Open Graphics Library (OpenGL) and a hardware.

The broadcast receiving terminal acts as a STB to receive digital broadcast. The STB function of the broadcast receiving terminal is based on well-known techniques and is not a key technology of the present invention, so configurations of the broadcast receiving terminal will be explained mainly about a menu-rendering function in the present system.

The menu rendering unit performs a menu rendering using a menu behavior pattern and a menu resource which are necessary for the menu rendering. According to a rendering process, the menu rendering is performed by the menu engine configured to render the menu, and the rendered menu is painted on a graphic board of the hardware using the OpenGL. At this time, the menu engine may render a 3D stereoscopic menu.

IV. MENU STRUCTURE

Figure 6 is a reference diagram illustrating a method for configuring a cloud-based separately-structured stereoscopic menu according to an exemplary embodiment of the present invention.

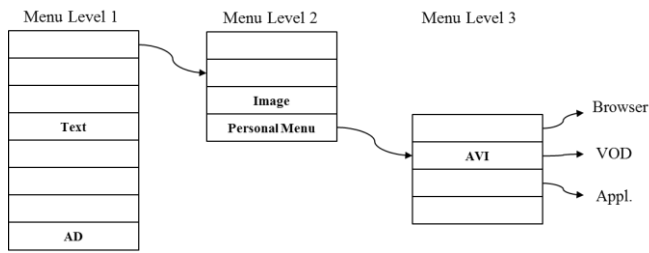


Figure 6. Cloud-based UI menu structure

Referring to figure 5, the broadcast receiving terminal receives a menu all at once or in phases.

The broadcast receiving terminal receives a menu from the cloud server all at once. For example, if a menu is configured in three phases as shown in figure 5, the broadcast receiving terminal downloads behavior pattern information about the three-phase menus from the resource server through the cloud

server 12, when turned on. In addition, only the personalized-menu data is downloaded from the resource server, if necessary. The above method makes it easy to configure and implement an entire menu.

In another example, the broadcast receiving terminal receives a menu from the cloud server in phases. For example, if the broadcast receiving terminal is turned on, a menu of the menu level 1 is downloaded from the resource server and, if an input signal is received from a user, a menu of the menu level 2 is downloaded from the resource server. The above method may be useful when the broadcast receiving terminal does not have sufficient capacity for the entire menu to be downloaded.

V. APPLICATIONS

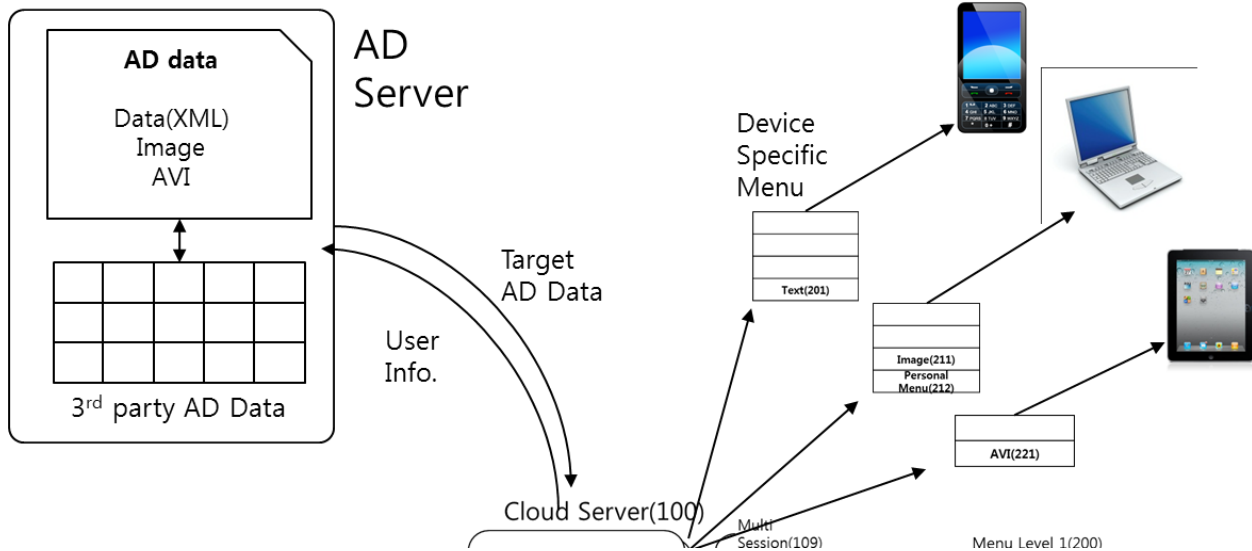


Figure 7. Targeted Advertisement Applications of Cloud-based UI

Figure 7 is a diagram illustrating a configuration of cloud-based UI system for providing a user menu in association with an advertisement according to another exemplary embodiment of the present invention.

Referring to figure 5, the cloud-based UI system further includes an advertisement-providing server in addition to the configurations as shown in figure 5. The advertisement-providing server is operated by a service provider or an advertiser and may store advertisement data in advertisement database to search for predetermined advertisement data in the advertisement database. The costs of the advertisement data may have been paid by the advertiser based on a contract. If the user information is provided to the advertisement-providing server through the cloud server when the broadcast receiving terminal is turned on, the advertisement-providing server performs a search in the advertisement database to select advertisement data suitable for a user and transmits the selected advertisement data to the cloud server. The cloud server inserts the selected advertisement data into an appropriate region of the user menu and provides the selected

advertisement data for the broadcast receiving terminal, and the broadcast receiving terminal provides the selected advertisement data for the user through the digital TV.

The cloud-based UI system further includes a display apparatus capable of reproducing broadcast content in addition to the configurations. The display apparatus includes all types of electronic apparatus capable of reproducing broadcast content to be displayed. For example, the display apparatus may be a portable terminal such as a smart phone, a smart pad, a laptop computer and a Personal Digital Assistant (PDA). A serviced screen output to the digital TV connected to the broadcast receiving terminal is simultaneously output to the display apparatus. In another example, a control screen is output on the display apparatus so as to control the screen while watching the screen so that a menu on the control screen may be selected using an interface such as a touch screen.

The cloud server may configure a distinctive user menu for each display apparatus and provide each display apparatus with the distinctive user menu. For example, it is possible to provide a text-type menu for a smart phone, menu images and

personalized-menu data for a laptop computer, and a video menu for a smart pad. Accordingly, the cloud server may configure a user menu according to a type of a display apparatus so that it is easy to configure the user menu according to each of various types of an N screen.

VI. CONCLUSIONS

As described above, the cloud-based UI system is separately structured such that the cloud server processes a menu behavior pattern and the broadcast receiving terminal merely renders the menu when a user menu is provided using cloud techniques in the digital broadcasting system. Due to the separate structure of the present invention, the broadcast receiving terminal merely renders the menu so that the flexibility of the menu processing method may be maximized, resulting in those for easily providing a personalized menu, conveniently replacing a menu and configuring an independent menu in the terminal.

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