Adaptive User Interface Modeling Design for Web-based Terminal Middleware

Sunghan Kim and Seungyun Lee

[1] Standard Research Center, ETRI, Daejeon, Korea
{sh-kim, syl}@etri.re.kr

Abstract. This paper shows the progressing research results how user interface can model in adaptive way with terminal middleware for TV services. Current TV terminals are diverse and multiple types of devices, and service is also supporting advanced functionality toward users. In the situations, user interface design skills are getting more important to UI designers, manufacturers and service providers, too. Therefore, we reviewed current terminal middleware to allow UI module working in terminal, and then shows a relevant use scenario for service requirements. From the requirement, this paper proposes experimental UI model to support adaptive UI between different types of TV devices, e.g. mobile and set-top, for seamless-like TV UI service.

Keywords: User Interface, Terminal Middleware, TV

1 Introduction

TV services are now already launching with several types of service, from traditional TV services, e.g. satellite, terrestrial and cable to WebTV by PC. And recently, new kind of TV service, e.g. IPTV, is appeared on traditional TV service domains. TV service maybe becomes a diverging point between traditional TV and new era of TV services in standardization respects.

TV service deploys new kinds of emerging TV services. These services are usually supporting high quality, differentiated data service to customer compared traditional TV service. New TV service can support user interface and interactive data service between TV service provider and users. And current TV devices are diverging from traditional TV model to mobile, Pad. From these backgrounds, recently TV screen are different size and capabilities, we need to consider how to design and support to user interface in an adaptive way to enable seamless user experience. Even though user interface is not new technology domain, but according to current advanced hardware interface performance, new approach is researching and experimenting with several systems to support advanced user interface.

Also, relevant standardization activity is also developing in W3C, ISO/IEC JTC SC29 WG11(a.k.a MPEG), etc. In W3C, MBUI WG(Model-based User Interface Working Group) has relevant activity on the issue of user interface, and MPEG also has standardization achievement in the scope of user interaction domain. In this paper, section 2 describes general web-based terminal middleware for supporting UI module in terminal, and in section 3 shows adaptive user interface modeling design and mechanism how to support UI in an adaptive way along the use scenario.

2 Web-based Terminal Middleware

Generally, Web-based terminal middleware is a terminal middleware whose characteristic is that it has one central middleware which orchestrates various applications. This orchestrating middleware, generally called “browser” or “user agent” in W3C terminology, processes a structured document and an interpretive language, usually called “script”, to enable various services.

Web-based terminal middleware enables basic, advanced interactive TV services for TV terminal device. It is required to review the general TV service requirements and architecture, as well TV terminal modes of devices. Web-based TV terminal middleware is needed to define the interfaces on IPTV terminal functional architecture and the structure of the presentation engine. Among interfaces, user interface module is necessary to support UI in device in an adaptive way. The presentation engine basically supports the markup, script processing and document object processing.

TV terminal middleware is generally need hardware-agnostic. Being one type of implementation, the WBTM in the TV terminal device should provide various integrated functional blocks and APIs for the high-level services, which could be programmed in WBTM script or by other methods, to implement TV services with the integration of TV services such as VOD, linear TV and so on.

TV services need to support seamless capabilities to users regardless of device types of model. Therefore, users can access the same TV service independently of different types of TV devices. Because of this fact, TV users and mobile users can share the same services/applications over different TV devices for some types of services, e.g. Facebook service, updated content notification, etc. So, TV service needs to support interoperability for web-based applications among different devices.

Therefore, user interface is required in the web-based core engine, which is to enable to support coherent user experience such kinds of web applications over different TV devices. Figure 1 gives the layered view of WBTM architecture.

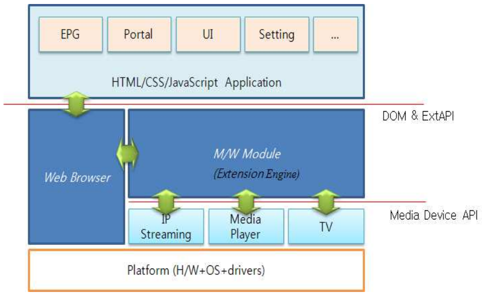

Fig. 1. Generic Framework of Web-based Terminal Middleware

2.1 Scenario of Adaptive User Interface

An example of adaptive user interface scenario is explained in figure 2. This figure illustrated how user demands the coherent and seamless UI service with his/her own devices. Now user has several devices around him/her, and service provider supports similar user coherent UI among devices. Terminal devices are in assumption loaded the web-based terminal middleware.

Mr. Kim is relaxing and watching TV program through TV terminal UI at home. And then, he received an emergent call from office to attend meeting in other city. So, he has to go out for the meeting, after stopping the movie immediately. It takes one hour to move from home to the meeting place. So, he hopes to see the continuous contents while moving on bus with other mobile phone. When he gets on the bus, he opens the mobile phone and connects the service provider for the movie contents, again. And then, he find that mobile UI is familiar to him, for service provider supports seamless UI screen for TV service. Therefore he enjoyed and finished watching the video to the end.

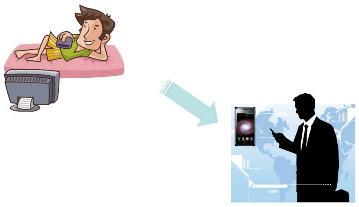

Fig. 2. Case for necessity of different user Interfaces

Figure 3 shows the flow for the use case of different devices with media processing together. Here two kinds of devices are STB and mobile phone, and content provider supports the composite of services.

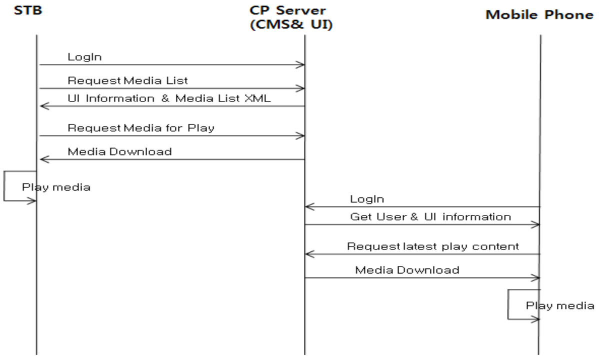

Fig. 3. UI service flow between different terminals

3 Model Design of Adaptive User Interface

3.1 Analysis and model

Research on UI is still studying and developing on the issue of user convenience. UI technology enables web-applications to use with user preference information together. Therefore user can find service more easily through comfortable UI and devices is required to design UI with the philosophy of user centric. UI research is related with modeling of context processing, which means user has interactions with devices. But, previous research is weakly deficient for sequential procedure in abnormal situations. It needs to define clear about description of interaction between user and device in specific procedure, and overcome the limit for the time-flow processing in abnormal completeness. Recent research is concentrated on building user profiles with XML-based model and allow available user interface by user preference.

AUI model is a model based on XML and user interaction. AUI model is available with asynchronous update of UI and change with Interactor class and Selection class for context and data processing. Some features of model is user interface is divided into abstract level and concrete level, abstract level is independent of platform and concrete level is possible working on various platform such as graphical touch-based smart phone, multi-modal device. As well, UI is considering in normal user and handicapped user in user perspective, and on multiple devices environment. Therefore, model makes it possible to use in appropriate web application model in TV service environment.

To support adaptive user interface model is necessary to define diagram of class structure, which shows the relationship among entities on device. The class structure is below in figure 4.

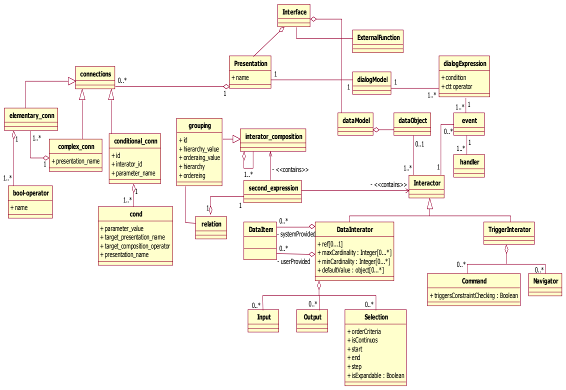

Fig. 4. UI service flow between different terminals

Table 1. Class name and roles

Class name	Descriptions
Connections	· Show that being of next presentation after user interaction · elementary connection, complex connection, conditional connection
Grouping, relation	· Two type of user interaction components
Interactor	· Target of user interaction or target of "only output" · Category of user interaction: selection, edit, control, interactive description, etc · "only output" interactor : object, description, feedback, alarm, text, etc
Control	· navigator, activator
Selection	· Selection of user predefined list · On number, Interactor selects connection
Edit	· User can edit manually on Interactor, text(textedit), number(numberedit), position(positionedit),generic object(objectedit)
Grouping	· Interactor element group
Relation	· Group having relationship each other
Composite Description	· Group display for mixed of Descriptionand Navigator element
Repeater	· Content repeat for general data source
Data Model	· Data type for interface · Interactor status update · data model define for XML Schema Definition
Event Model	· UI update status for each interactor
Dialog Model	· Presentation interaction for event in time. · CTT operator for fime relationship
Interactor	· DataInteractor for UI input/output or Trigger Interactor for UI command · Selection, Input, Output Data Interactor
Trigger Interactor - Command	· Command interaction unit update in UI Navigator

3.3 Client-Server Mechanism

Figure 5 shows the flow diagram between client and server. User interface receives input signal from main display, in fact through internal input Class. After receiving data input, DataInteractor Class updates to Interactor's status or various UI status by changing data element value. Through this processing, Server is saving the updated user profile information, and continues to process the Interactor-Presentation-Interface class in order, then display on user device. Other procedure also can be modeled in client server model.

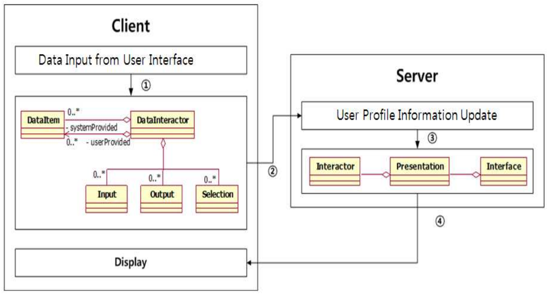

Fig. 5. Example of Client-Server interaction: User data registration

6 Summary

This paper described on progressing research result of UI for TV service in the environment of multiple devices by user. General terminal middleware is described for the platform of UI modeling, which is targeting for seamless UI service. And, UI modeling is analyzed for adaptive UI design for client-server architecture. Still further research is going and necessary for further research.

Acknowledgements. "This research was supported by the ICT Standardization program of MKE(The Ministry of Knowledge Economy)"

References

1. ITU-T IPTV, http://www.itu.int/ITU-T/IPTV/index.phtml
2. ATSI, https://www.atis.org
3. OIPF, OIPF Forum, www.oipf.tv
4. ISO/IEC 23004, Information technology – MPEG Multimedia Middleware (MPEG-E)
5. A. Puerta, and J. Eisenstein. “A Representational Basis for User-Interface Transformations.” 2001 CHI Workshop on Transforming the UI for Anyone, Anywhere. Seattle WA, March (2001)
6. A. Puerta and J. Eisenstein. “Towards a General Computational Framework for Model-Based Interface Development Systems.” Knowledge-Based Systems, Vol. 12, 1999, pp. 433-442.
7. D. Thevenin and J. Coutaz. “Plasticity of User Interfaces: Framework and Research Agenda”, in Proceedings of INTERACT’99. Edinburgh: IOS Press 1999.
8. J. Vanderdonckt and P. Berquin. “Towards a Very Large Model-Based Approach for User Interface Development”, Proceedings of UIDIS’99. Los Alamitos: IEEE Press 1999, pp. 76-85.