

# Personalized and Interactive Broadcasting System

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**Abstract.** In this paper we present the context of personalized and interactive streaming system. We define a server and terminal model for the system and based on Advanced Television System Committee (ATSC) standard, the streaming system model has been implemented. Electronic Program Guide (EPG) using Program and System Information Protocol (PSIP) and MPEG-4 technologies for personalization and interactivity have been addressed in detail and their applications are also introduced.

## 1 Introduction

In the broadcast era, digital television broadcast has become an important role in the next generation multi-media broadcast. The digital television broadcast does not simply mean a mere shift from analog to digital but provision of personalization and interactivity to its users. The personalized and interactive television delivers various information and entertainment services to users at a terminal over interaction channel as well as existing broadcast channel. An application using EPG is a commonly used service of the personalized functionalities. EPG application service includes channel information, searching and recommendation of the specific programs to users based on their preferences in the past. Moreover, MPEG-4 technology has an impact on the area of multimedia broadcast with its capabilities. It has helped multimedia broadcast to realize the interactivities with and personalization for users.

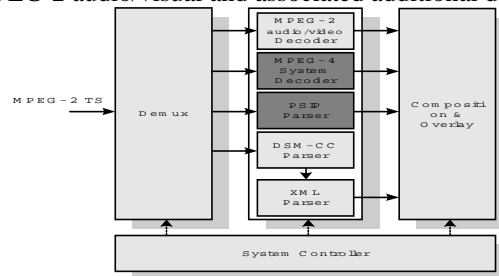
In this paper, we propose the architecture of the personalized and interactive broadcasting system based on ATSC platform. The suggested structure is characterized by personalization and interactivities using PSIP [2] and MPEG-4 technologies. In section II, the structure of personalized and interactive broadcasting system is explained. Section III describes implementation of personalized and interactive data, and conclusion section follows.

## 2 Structure of personalized and interactive broadcasting system

In this paper functions and architecture of a personalized and interactive broadcasting system for interactive television broadcast are described. The personalized and inter-

active broadcasting system uses the technologies of MPEG-2 and MPEG-4, and is compliant with ATSC standard [1].

The system consists of MPEG-2 TS generator, Contents file server, Data encapsulator, Data injector, PSIP server, MPEG-2 TS pump and a user terminal. MPEG-2 audio/video TS is generated in MPEG-2 TS generator, and ancillary and MPEG-4 data from contents file server is encapsulated into TS packets. Data injector is used to insert ancillary and MPEG-4 data into MPEG-2 audio/video TS with supporting synchronization. EPG data, then, are encapsulated to TS in PSIP server. In MPEG-2 TS pump, two TSs are remultiplexed into one TS and delivered to user terminal through TS network. Remultiplexed TS is decoded and consumed at user terminal. A user terminal consists of Demux, MPEG-2 A/V decoder, MPEG-4 decoder, PSIP parser, Storage Media Command and Control (DSM-CC) parser and Extensible Markup Language (XML) parser as show in Figure 1. It fundamentally consumes multimedia data consisting of MPEG-2 audio/visual and associated additional data.



**Figure 1.** The Structure of a user terminal.

The multiplexed MPEG-2 TS including MPEG-2 A/V, MPEG-4 and ancillary data is demultiplexed and decoded in each blocks depending on their types (Figure 1). After decoding, different types of data are composed, rendered, and displayed on the screen at a user's requests. The system controller controls all parts of the blocks.

Following section describes EPG application using PSIP for personalization and MPEG-4 technology for interactivity.

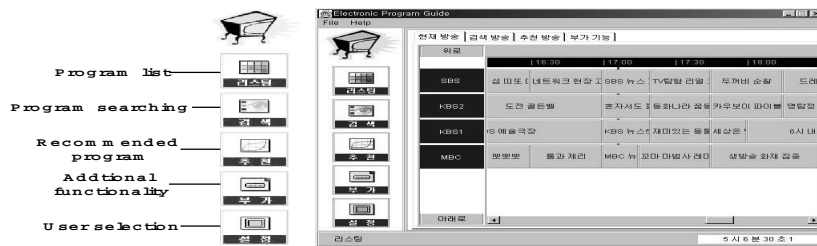
### 3 Implementation of personalized and interactive broadcasting system

#### 3.1 Implementation of EPG using PSIP

The PSIP is used to provide program list, service list and navigation of programs to user terminals. The PSIP constructed as a hierarchical structure consists of System Time Table (STT), Master Guide Table (MGT), Virtual Channel Table (VCT), Rating Region Table (RRT), Event Information Table (EIT), and Extended Text Table (ETT). Mainly a EIT and a ETT are used for personalized EPG application.

In a server side, EIT, ETT and Extended Text Message (ETM) data are encoded and packetized into private section and transported as TS packets to clients. An EIT contains information for events such as titles and start times. An ETT contains ETM streams. An ETM is a multiple string data structure and may represent as a description in different languages.

In a user terminal side, TS packets with the EIT, ETT and ETM are demultiplexed and passed to PSIP parser. With PSIP tables parsed, the EPG information is gathered and consumed by users. Figure 2 illustrates an example of the EPG application implemented in personalized and interactive broadcasting system.



**Figure 2.** An example of an EPG application. The PSIP parsed data such as channel and corresponding time information are displayed by clicking “Program lists” as shown. With a Data Base (DB) in a client side, personalization such as “Recommended program” can be achieved.

The basic EPG application provides only information on channel and corresponding time at a user’s request. However, our EPG application strengthens the personalized and interactive mechanism not only by providing basic EPG functionality but also by adding more functions; that is, it monitors a user’s preferences such as channel, program’s genre and saves them in a DB so as to recommend the user his/her preferable channels or programs later.

### 3.2 Implementation of interactivity with MPEG-4 technology

A scene description in MPEG-4 systems provides not only description of the properties of audio/visual (A/V) objects but also determination of the placement of them in space and time. In addition, it provides the interactivities to the A/V object using interactive nodes. MPEG-4 elementary streams consist of Initial Object Descriptor (IOD), Object Descriptor (OD), Binary Format for Scene (BIFS) and audio/visual stream. They are encapsulated as TS packets and inserted into MPEG-2 TS using MPEG-4 over MPEG-2 technology and finally transported to clients.

In user terminal side, TS packets with IOD, OD, BIFS and associated A/V data are demultiplexed and passed to MPEG-4 system decoder. After being decoded, A/V contents are composed and rendered on the screen with a user’s interaction in proper time as shown in Figure 3.

When MPEG-4 data is parsed and ready for a composition, users will see the yellow-brighten ‘trigger button’ on upper-right side (Figure 3.a). With clicking it,

users can enjoy an interactive service such as former contest winners, individual profiles and additionally focused photos in menu bar on the top as shown in right side of figure 3.b.



**Figure 3.** An example of MPEG-4 applications for interactivity. (a) shows the main program, Miss Korea 99, with MPEG-2 A/V and (b) shows the output of interactivity with MPEG-4 technology at a user's request (additional photos are displayed by clicking additionally focused photos, one of the menu on the top of the screen).

## 4 Conclusion

We are convinced that technologies of MPEG-4 systems and EPG using PSIP information are the most proper solution of the personalized and interactive broadcasting system based on ATSC platform. MPEG-4 systems provide users interactivities to carried contents in MPEG-2 TS in digital broadcasting environment, and PSIP information may be used to provide personalized service of EPG to a program. The personalized and interactive broadcasting system, which is implemented based on ATSC platform, includes functionalities of both personalization and interactivity. For on going research to further improve the proposed personalized and interactive broadcasting systems, we are basically focusing on providing the more intelligent and interactive service of personalized EPG by adding functions such as an automatic update of users' preferences and interactive contents utilizing DBs. In addition, we have already started developing our own MPEG-4 systems decoder for the purpose of porting onto a Set-Top Box.

## References

1. ATSC Standard A/90, "ATSC Digital Television Standard", 2000
2. ATSC Standard A/65A, "Program and System Information Protocol", 2000
3. ISO/IEC 13818-1 | ITU-T Rec. H.222.0, "Information technology – Generic coding of moving pictures and associated audio information: Systems", International Standard, 1994