

Network Music Terminal System Design and Implementation Based on IPTV Set-top Box

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Abstract—The existing music projects terminal are mostly websites that computer can access, the mobile client and rare television set-top box terminals. Under the new forms of triple play, network music system of integrated information system supports three nets four terminal and with key technology such as network music creation, transmission and display and so on. In computer, mobile phone, radio and television four terminal, this paper mainly introduces the network music terminal system based on IPTV set-top box in the design thought, system architecture and main technology and so on, and present the final test data.

Keywords—IPTV, set-top box, terminal system, JSE

I. INTRODUCTION

In recent years, with the growing emergence of various new media, from the trend of the whole point of view, the total number of national television audience has been stable, per capita per day watching TV time tend to be saturated. The demand of information to the people no longer want to passively accept one-way, but take their personal feelings and needs to ask for the information and services. Therefore, IPTV came into being and become the focus of attention. IPTV (Internet Protocol Television) is interactive network Television, which use broadband network as infrastructure, and the Internet, multimedia, communication, and other technology at an organic whole. It's a new technology that provide customers with a wide range of interactive services, including digital Television through the IP Protocol.

Under the new forms of triple play, network music integration of information system in the face of the new business will be across network, strong across terminals, interactive features and so on, support key technology such as music creation, transmission and display in three nets four terminal network. As one of the four terminals based on IPTV set-top box, television terminal system can directly use the existing user set-top boxes and TV as the terminal display, which meet the needs of users to enjoy interactive services and has a good application prospect.

II. DESIGN IDEA

Through the study found that the previous EPG portal design of IPTV system, electronic program guide adopts B/S mode, so that users don't need to download the client program, through the browser to access a specific server address, can obtain the corresponding service. The embedded browser in set-top box in the IPTV system is responsible for the responsibility of the browser. So, in this system the embedded systems and embedded browser middleware inside the set-top boxes as the main composition of the system software.

The set-top box terminal application as the display interface towards users by the TV shows, is the only interaction portal between system and users. It plays an important role for the presentation of the business, the function of the system to provide the user experience, operational business promotion and so on. In this system, the user interaction with the system is not like we use the mouse and keyboard, the computer browser, can be arbitrarily select and drag any place on the screen. The tools users can only use is a set-top box remote control, done through to control the movement of the cursor. Considering comprehensive factors, therefore, in order to have better user check-up, the design should follow the following principles:

- The functions of as much as possible by letting users choose to replace the user input.
- Combined with the experiment used set-top box memory is small, low power consumption, the efficiency of consideration, the main logic on the server side.
- Because the page final carrier is TV shows, and different with web page display, we should follow the design principle of TV page.

III. DESIGN STRUCTURE

The realization of the TV set-top box terminal system uses: page + MySQL + Apache web server + NFS + Hadoop storage systems. Each page is made up of three parts: PHP, JavaScript, and HTML part. Server side includes: the Apache server, NFS

server and Hadoop storage systems. The whole structure of the TV set-top box terminal system is as follows:

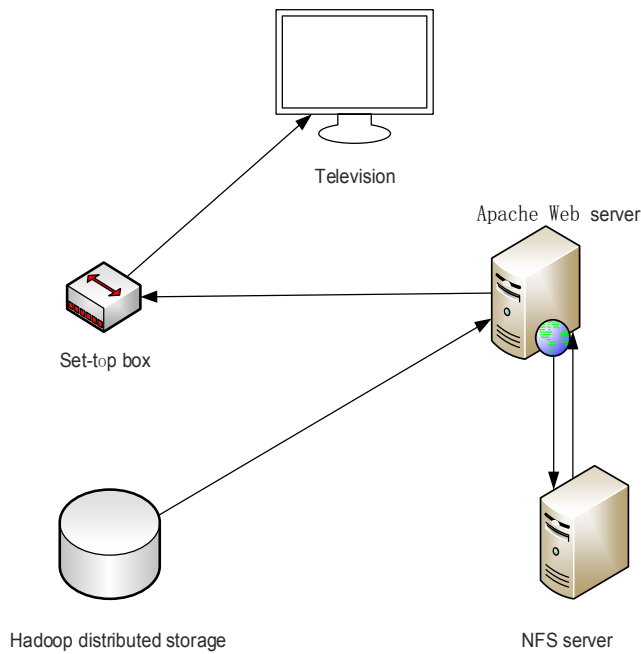


Fig. 1. The whole structure of the TV set-top box terminal system

All parts of function introduce:

- Television: present the system content to the user, and complete the interaction with the user.
- Set-top box: request to the Apache Web server, call the page on the server resources and application.
- The Apache Web server: parse Web language, receiving the request of the set-top box, and call the relevant program to give a response.
- Hadoop distributed storage: storage resources, the use of distributed storage system in a variety of formats required for images, audio files, etc.
- NFS server: to mount the distributed storage of resources into the Apache Web server, and the Apache Web server mount to the set-top box, then set-top boxes, between the Apache Web server and distributed storage resources like on a computer, you can visit and call each other.

IV. MAIN TECHNOLOGY

A. The embedded browser

Browser as the interaction bridge between IPTV set-top box and users, is an important part of the set-top box terminals system. Common desktop browsers such as Microsoft Internet Explorer, Netscape Netscape, open source, Mozilla and opera,

etc. With Internet explorer, Opera has embedded version, the above versions of most browsers are across multiple platforms. The desktop browser functionality is uneven, but most can realize the basic browsing capabilities. What they have in common is the HTML page display effect is very good.

Perfect browser, rich function, support for multiple media formats of audio and video plug-in form and the opposition of these advantages are these browsers huge volume and high requirements for machine configuration. This is one of the biggest difference of desktop browsers and embedded browser. In addition, the desktop browser is based on the general operating system, usually used for desktop computers such as PC, MAC, etc. and embedded browser are usually based on the special system.

At present, the embedded browser is divided into two categories, one kind is used in mobile phones, based on the wireless channel, supports WAP protocol embedded browser, also known as the WAP browser, another kind is the browser used in the project, this embedded web browser used in the digital TV terminal. The embedded browser has the following features:

1) The CPU overhead. Consumer electronics CPU capacity is weak, low power consumption, wide variety, mostly RISC architecture, some of them are based on special DSP core, the processor computing power is not nearly as the PC's CPU. Embedded browser can run when the frequency below 100 MHz.

2) Smaller memory occupation. The memory of the set-top box we use are 125MB, in general, the embedded browser runtime occupy within 6M, code less than 1M. Therefore, using the embedded browser is better.

3) Set-top boxes use television as a display device. It is necessary to consider the characteristics of the TV show: standard TV show is in the range of 720 * 576, but a lot of analog television actually can't display so big range, generally recommended range for 640 * 480, this is what embedded browser considering when typesetting. In addition, there are still part of TV use cathode ray tube to display by interlaced scanning way, resulting in lines, images, text is easy to appear on the TV flashing. Embedded browser support software of flash and combining the set-top box chip hardware anti flashing functions, overcome it well.

4) Consumer electronic products are generally operating by remote control, remote control can't be as complicated as a keyboard. The button on the remote control generally includes: the up and down or so direction key, confirm key, return key, digital and other function keys. The embedded browser, mainly by the direction key, confirm and return keys to operate.

The embedded browser used in this system is ANT Software Limited's Galio browser, Galio specially used in the development of TV terminal and optimization, has the following advantages: The function of the web and flexibility. Using a standard remote control operation, do not need any mouse or keyboard. Widely support today's TV standard.

Fluid graphics transformation, help to create a truly dynamic user experience. With a strong application and ANT target content development kit (CDK). Galio browser can provide powerful and deliver applications for TV feature rich and robust solutions that can bring excellent TV experience to the user.

B. The implementation of the IPTV set-top box the JSE method

User interface development for STB based on embedded browser must write all sorts of control set-top box function page, these complicated features currently contains JavaScript web page can be used to implement. But its object structure cannot meet the set-top box internal function calls and customer requirements. In order to extend the functionality of JavaScript, improve its ability to handle set-top box specific functions, the general is JavaScript extension (the JSE) provided by the embedded browser in the form of imitation JavaScript language to achieve.

Because the JSE is not a standard part of JavaScript syntax, need to register, when using the embedded browser. After registration done the specific function can be called in the web page. Registered in the browser starts the JSE object variables is global variables, in the different page start for registration is local variables.

Based on embedded browser for EPG (Electronic Program Guide) system development, the system want to do something, which is often the existing ordinary browser cannot achieve. For example, user starts the play, but when to play, the official start need to have a way to tell interactive web to record the related information, after all this if only from the user just when he began to hit the start timing is not scientific, there is a ready time to collect data and decoding. If the play is over, then also need a mechanism to real-time notification interface flow has ended, and can return to play selection menu, etc. These pages are needed to real-time processing external events trigger method referred to as active events.^[2]

Its main principle is embedded browser to launch a active event listeners to be responsible for monitoring triggered by external events, as shown in fig 2. In the ant Galio registration part has been designed for standard processing method `document.addEventListener()`, to specify the corresponding handler.

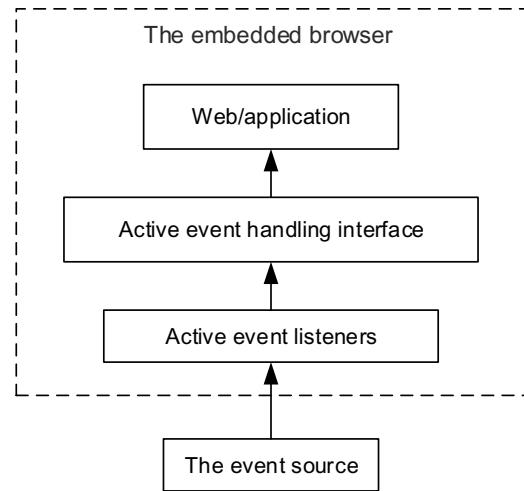


Fig.2 . The embedded browser active events principle

For example, realize the function of play in interactive web pages by global variables JSE method in Ant Fesco embedded browser. First defined in web transparent color for background, and pay attention to the bgcolor label. Second in the startup phase by using the onload function to call correlation function to start the active event handling mechanism:

```
< body bgcolor=#00000030 leftmargin=0 topmargin=0
onload= Video.setevent(); >
```

Join the key value processing function in the relative position of the web page to function the play button, at the same time call the corresponding JSE function `Vide.Play(..)`, which start streaming media play. At the same time at the end of the page to add to play active event processing methods:

```
Video.setevent = function videoEvent(event)
{
    If(event = 8)//end of the media stream
    {
        //Processing after the broadcast
    }
}
```

C. Online audio transcoding

IPTV as audio and video applications on the IP network audio and video coding adaptability requirements are: High compression efficiency and good image quality; Requirements of IPTV transport independently of the decoding standard; Demand media synchronization time as short as possible; Requires decoding way must have sophisticated DRM system support; For terminal supports multiple encoding or decoding ability online upgrade function. Select audio and video codec standard factors should be considered are: Coding standards standardization degree and range of application; The advanced nature of coding standards; The support of the transmission system; Industrialization; License fee policy.

Grading methods for MPEG-2 in space and time to provide space and time between different resolution video format compatibility, backward compatibility MPEG-1. MPEG-2 are widely used in cable TV and other fields in home, American ATSC and DVB of Europe, Japanese ISDB digital television broadcast system also take MPEG-2 as source coding standard.

As shown in fig.3 below, MPEG-2 system part of the main specification is how to one or more of the streaming video and audio streams and other auxiliary data flow compound into a data stream to adapt to the storage and delivery. The set-top box can not play the usual common mp3, wav audio format, can only play TS (Transport Stream). So when start playing the audio stored in the database, we have to transcoding first. FFmpeg is one set can be used to record, convert digital audio, video, and can be transformed into the flow of the open source computer program. Use LGPL or the GPL license. It provides a complete solution of recordings, conversion and the fluidization of audio and video. In this project, using FFmpeg program for transcoding audio content. Because the song size not too big, transcoding speed very quickly, so the transcoding and play online.

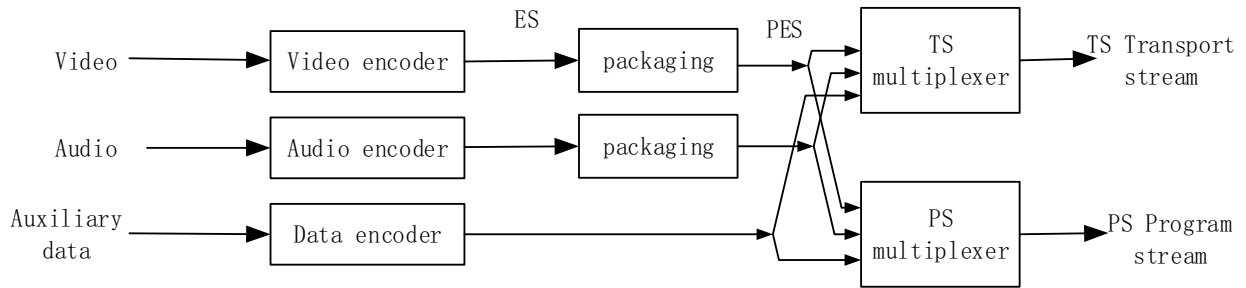


Fig.3. MPEG-2 system data stream storage and delivery

V. TEST RESULTS

In the project, through constructing VPN simulation test the Internet environment, mainly test the time of system call resources, read the data and process the data, through the required time of page jump to response. Network music terminal system based on IPTV set-top box test results are shown in the following table. Because the page jump to play page need online transcoding, therefore, other jump can be completed in two seconds except this one, according to enter the play page will have certain fluctuation due to the size of the music files. By the data shows, this system can meet the user experience. If we want perfect effect and further improve the efficiency, set-top boxes and other hardware equipment, network speed, the allocation and call of resources, the performance of procedures are all the factors needed comprehensive promotion.

TABLE I. TEST RESULTS

Jump to	Home page	Song list page	Search result page	Play page	Personal page
Average time	1.2s	2.0s	1.9s	4.0s-8.0s	1.8s

VI. CONCLUSION

This paper presents the network music terminal system based on IPTV set-top box design thought, system architecture, main technology and test results. When the set-top box can not play the usual common audio format we have like MP3, WAV, etc. We use the existing resources through transcoding them online using FFmpeg. It is low configuration requirements for set-top box, high applicability, can satisfy the user's requirement. How to further improve the system efficiency is the goal of our further research.

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