

The Design of the Packaging Contents Authoring and Consuming System for IPTV Application Service

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Abstract— A feature of current IPTV service is that the IPTV provider purchases the rights of contents from author of the content and serves those to consumer monopolistically. In this environment, IPTV is indistinguishable from the way of old broadcasting service.

To shift away from this structure, it is necessary to guarantee the common user's participation like User Create Contents (UCC) and provide the open IPTV service that can give more opportunities to select the contents.

Moreover, there are some problems to conduct open IPTV service due to a variety of rights protection solutions designed by previous digital broadcast providers. So we need to define a new framework that can be used in overall open IPTV environment.

We design packaging contents authoring and consuming system for IPTV application service based on open IPTV.

Keywords— MPEG-21, IPMP, Open IPTV, IPTV, TV-Anytime

I. INTRODUCTION

Many people expect IPTV to be developed on landmark system that can provide a new service differentiated from previous things but it is only a substitute. Because IPTV has monopolistic structure in which Internet Provide Service (IPS) are the providers of IPTV. Consequently, they failed to maximize the merit of IPTV in terms of quality and quantity of the contents.

Recently, the industry has made an effort to introduce the Open IPTV service structure to overcome these situations. In the previous IPTV service, the IPTV provider signed up with contents authors and provided the consumers with contents monopolistically. But Open IPTV has opposite concepts to the previous IPTV. In Open IPTV environment, the IPTV provider acts as a messenger of contents and the consumers can receive any content regardless of the IPTV provider. Also, users can share their contents in this environment [10, 11].

In the meantime we need a new system for protection and management of the rights of contents because existing

solutions developed by previous digital broadcast providers are not suitable to the Open IPTV environment.

A new system must support registry, management, and search for a variety of the contents authored in the Open IPTV environment.

So this paper presents the tools for authoring and consuming package contents based on MPEG-21 Multimedia Framework. The MPEG-21 Multimedia Framework developed by Moving Picture Experts Group (MPEG) defines the framework for distributing multimedia contents on the online marketplace. We designed the package contents authoring and consuming tools and built the license server for supporting acquisition of rights of some contents, which is based on reference model described in MPEG-21 standards. And it includes streaming server for live broadcast.

The rest of this paper is organized as follows. Section II gives knowledge of theoretical background, which consists of MPEG-21, MPEG-21 IPMP and Rights Expression Language (REL). Section III provides system architecture and two scenarios of our system, and Section IV presents the design of the system. Finally, Section V concludes the paper.

II. THEORETICAL BACKGROUND

A. MPEG-21 Multimedia Framework

The standardization strategy of MPEG-21 defines the standard that describes the technique of protection and managements of contents when the digital contents are delivered to end-user. To define these standards, they conduct the standardization by subdividing in 7 basic parts consisted of Digital Item Declaration (DID), Digital Item Identification and Description(DII), Content handling and usage, Intellectual property management and protection (IPMP), Terminals & Networks, Content representation, Event Reporting [12, 13].

MPEG-21 is defined as follows for using in the MPEG-21 Multimedia Framework process.

Resource – Digital contents on the network.

Digital Item (DI) – basic unit of distribution and processing, which includes multimedia contents, identifier, and descriptor [1, 3, 4, 12, 14].

B. MPEG-21 Intellectual Property Management and Protection (IPMP)

When the Digital Item is handled on a diversity of networks and terminals during their life cycle, MPEG-21 offers the safety by protecting and managing the right of contents constantly.

MPEG-21 IPMP's standardization targets are the way of searching IPMP tool and exchanging message between IPMP tools. To achieve this goal, MPEG-21 IPMP creates IPMP component that protect the resource from a third party's access by encapsulating existing DIDL elements [5, 12, 13].

IPMP's standardization scope is only how the schema and involving tools that are used to protect the resource are delivered. In other words, they don't restrict the type of tools, so IPMP system guarantees the interoperability of DRM tools, encryption tools and decryption tools developed before IPMP. And it can describe and control the rights of resource using REL and Rights Data Dictionary (RDD).

C. Rights Expression Language(REL)

REL that represent the rights for the contents like usage type, conditions, a period of time is based on XrML 2.0 and its main schemas are REL Core, REL-sx and REL-mx. REL Core defines the overall concepts including license. REL-sx defines what is consumed such as fee and play time. REL-mx defines extended information of resource's usage [6].

REL's standardization target offers interoperability and scalability by defining and describing terms used by many content providers when they grant any rights to consumers.

REL represents the rights by means of consisting of 'Grant' which has 'Principal, Right, Resource, Condition' as its sub entity. By defining these 4 entities' relation, we can organize the License. The context and relation of entity is described in Figure 1.

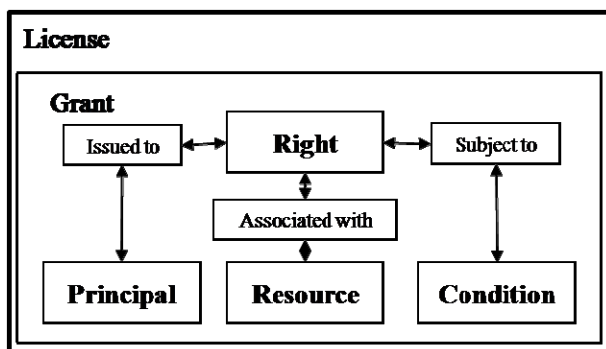


Figure 1. The REL Data Model

Principal – who exercise the rights

Right – the type of rights (play, copy, print)

Resource – right's target resource (video, audio, e-book)

Condition – specifies permission limitation

III.SYSTEM ARCHITECTURE & SERVICE SCENARIO

In this Section, We present the system architecture and service scenario. There are authors and consumers of package contents as an actor. And license server, package contents authoring & consuming tools, TV-Anytime User Preference Metadata Manager and package contents provide server are major elements of the system. Finally, we describe the general scenario and real-time streaming & VOD download service scenario [2].

A. Consumer

A consumer who consumes the granted contents using package contents consuming tools registers license server to request the rights of contents.

B. License Server

License server manages the rights of any content and the information of all members (Consumer, Contents Provider and Contents Author). When the consumer requests any content, license server links the consumer with the contents provide server. Finally, it also offers contents description that registered by authors to the consumer. A license made by license server has the rights information about play times, play, copy, print etc.

C. Package Contents Provide Server

Package Contents Provide Server gains REL file from License Server and packages license file and A/V media file to serve consumer. In this time, package contents file can be served on two ways of VOD or live streaming. To support live streaming broadcast, we built the Package Contents Provide Server as streaming server.

D. Package Contents Authoring Tool

This tool packages A/V media and license of consumer. The output file format only can be played by Package Contents Consuming Tool. It registers the tools used for packaging the resources at Tool Server.

E. Tool Server

The tools used in the course of packaging the A/V media and license are registered at Tool Server for interoperability between Package Contents Consuming Tools. If the consumers don't have any tool needed to play the package contents, they can download the tool from Tool Server. In this paper, Tool Server also manages the encoder/decoder and Package Contents Consuming Tool.

F. Package Contents Consuming Tool

This tool is used to consume package contents consisted of A/V media and a license. It analysis the license to judge whether the consumer has the right or not. If there is no tool to consume the contents, it requests that tool to Tool Server.

G. TV-Anytime User Preference Metadata Manager

We use TV-Anytime schema to control user preference information. When a user requests specific contents, the information that includes genre, play times and run time is

recorded in this manager's database. This data can be converted User Preference schema from TV-Anytime and be shared with contents providers. So the user can receive more interested contents by this manager. If the user doesn't want to record preference information, this information cannot be recorded to protect the user's privacy according to the TV-Anytime specification [8].

H. General Scenario

The general scenario presented in this paper is described in Figure 2.

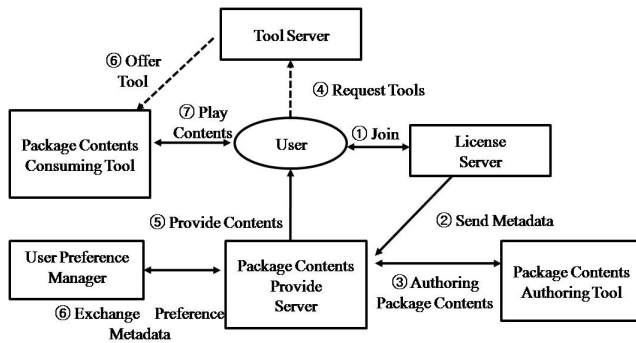


Figure 2. General Scenario of Total System

- The consumer joins the License Server to receive the descriptions about contents and gain the rights to the content by paying specific fees.
- Gaining the rights to consume the content. In this time, the consumer can select an interested content at first and renew the rights at later time.
- The License Server send selected contents and metadata that has consumer information to the Package Contents Provide Server.
- Package Contents Provide Server creates package contents with received contents and metadata and offers package contents to the consumer.
- The consumer can request selected contents at any time by live streaming or VOD download.
- When there are not tools at playing time, the request message is sent to the Tool Server automatically so that Package Contents Consuming Tool gets the tools such as decoder and decryption API.
- The consumer can play the package contents using Package Contents Consuming Tool and other tools.

I. Real time Streaming & VOD Downloading Methods

There are two methods on consuming the package contents for the consumer. The one allows the consumer to be able to play the package content after downloading it, the other is to get the package contents by real time streaming method. Figure 3 describes how to consume the package contents. Other procedures in this system are the same as general scenario.

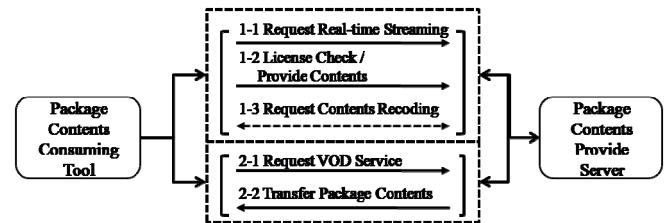


Figure 3. Real time Streaming & VOD Downloading Methods

IV. SYSTEM DESIGN

To verify the function as package contents authoring and consuming in Open IPTV environment, Package Contents Authoring and Consuming Tool must be presented. In this section, we describe the overall system design and present the Package Contents Authoring and Consuming Tool's design especially.

A. Package Contents Authoring Tool

Package Contents Authoring Tool's main role is packaging the A/V media resource and metadata and creates new package contents file. The users also create metadata format using this tool. Created package contents by this tool only can be played specific Package Contents Consuming Tool to manage the rights of resource and user's privacy. Figure 4 describes the design of this tool.

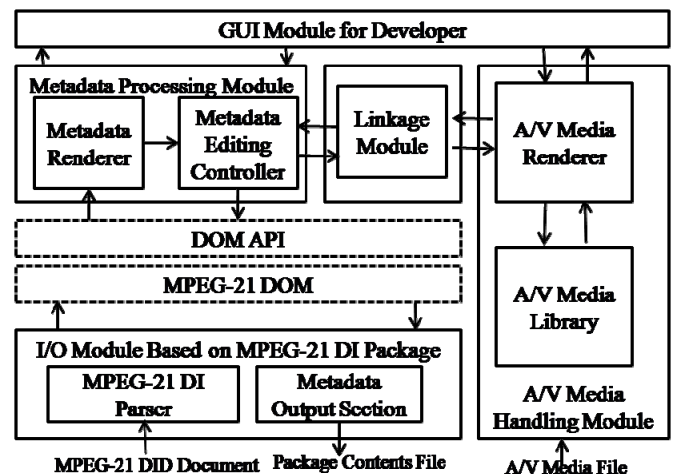


Figure 4. The Design of Package Contents Authoring Tool

1) GUI Module for Developer(Author)

This module make the developer control all modules in Package Contents Authoring Tool and render the metadata information in the form of tree. The developer can create and modify the metadata. Also, all changes are sent to each module so that the change is reflected at once.

2) I/O Module Based on MPEG-21 DI Package

This module is consisted of MPEG-21 DI Parser and Metadata Output Section. MPEG-21 DI Parser offer

XML/XML Schema parsing, validation check and rendering the metadata in the form of tree through the GUI.

Metadata Output Section output the modified package contents in the type of specific file format which is recommended by MPEG-21 Multimedia Framework. It can raise the interoperability.

3) A/V Media Handling Module

This module is consisted of A/V Media Renderer and A/V Media Library. A/V Media Renderer accesses any A/V media and renders it to support the preview function of package contents for developer. A/V Media Library plays a role as a repository of A/V media files.

4) Metadata Processing Module

Metadata Processing Module is consisted of Metadata Renderer and Metadata Editing Controller. Metadata Renderer does the validation check of the metadata by referencing MPEG-21 DI DOM objects on real-time. The developer can search, access and modify the metadata by Metadata Editing Controller using MPEG-21 DOM API. And we select WYSIYG interface for helping non-professional users.

5) Linkage Module A/V Media and Metadata

This module parses the location of the A/V media so that A/V Media Handling Module can handle the media files. Also, it supports passing the information of media to the Metadata Processing Module.

B. Package Contents Consuming Tool

The consumer can receive appropriate service using Package Contents Consuming Tool that offers a series of functions to play the package contents according to the rights described in the metadata. Also, the user can get the information of package contents and its metadata. And Digital Item list that come from package contents provider server can be displayed on display device. This tool has following parts – User GUI Module, I/O Module, MPEG-21 DI Management Module, DID Engine Module, Media Handling Module. This structure is described next Figure 5.

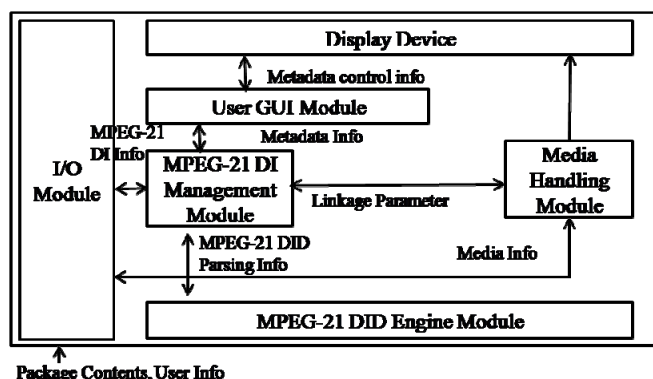


Figure 5. The Design of Package Contents Consuming Tool

1) User GUI Module

The users can control all of the modules offered by Package Contents Consuming Tools. Main functions are playback controller (play, stop, resize etc) and searching and inquiry the package contents list (Digital Item list).

2) I/O Module

I/O Module works as a network interface, which receives package contents from Package Contents Provide Server and the information needed to play that contents. These data are sent to MPEG-21 DI Management Module. In this point, the information is package contents itself and descriptions of media file (video-audio codec, file size, resolution, playing time).

Moreover, package contents list can be received by I/O Module. This information may help consumers select the contents. In other word, the output section sends the information of selected contents to Package Contents Provide Server. As a result of these courses, the user and provider can communicate each other interactively.

3) MPEG-21 DI Management Module

First of all, MPEG-21 DI Management Module un-package the MPEG-21 DI received from I/O Module into A/V media and metadata based on MPEG-21 DID. And each data is sent to the Media Handling Module and MPEG-21 Engine Module respectively. Lastly this module sends each MPEG-21 DI to User GUI Module to offering contents information for users. MPEG-21 DI means packaged data of the A/V media and the metadata.

Also, the parsed data from the DID Engine Module is returned this module to be offered to the users.

4) MPEG-21 DID Engine Module

MPEG-21 DID Engine Module parses the metadata gained from MPEG-21 DI Management Module to take involving descriptions. In this process, this module supports validation check. The description data is sent or not according to the result of validation check. If the result is not valid, error message may occur.

5) Media Handling Module

Media Handling Module sends the A/V media to User GUI to render the contents and offers playback control functions. Ahead of this course, this module analysis play-rights described in metadata to reflect the right when the user request to play package contents.

V. CONCLUSIONS

This paper presents a package contents authoring and consuming tool because of two reasons. One is to solve the interoperability problems between previous systems in closing IPTV environments. The other is to offer interactive application service between consumers and providers.

Features of this system are as follows. Because we design this system based on MPEG-21 standard, it is interoperable among all systems that adopt the MPEG-21 Specification. Moreover, this system can manage user preference using TV-

Anytime which is another broadcast specification. So the users will have opportunities to receive more interested contents as compared with the previous platform. Finally, our system can serve real-time streaming and VOD download service as well.

ACKNOWLEDGMENT

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