모바일환경에서의 스트리밍 서비스를 위한 DRM 시스템에 대한 연구

한명묵* · 안용학**

요 약

본 논문에서 모바일 환경에서의 VOD 스트리밍 서비스를 위한 DRM 시스템을 제안한다. 제안하는 시스템은 모바일 환경에서 사용되어지기 위해 독자적으로 구축된 클라이언트 서비스를 위한 핵심요소인 DRM 클라이언트 매니저(컨슈머)와, DRM 서비스를 제공하는 DRM 서버로 구성된다. 컨슈머는 이러한 모바일 환경에서 효율과 처리능력을 극대화하기 위해 클라이언트에서 독립적으로 존재하고, 라이센스 서비스, 컨텐츠 서비스, 접근 서비스 그리고 트랙킹 서비스로 구성된다. DRM 서버는 VOD 스트리밍을 위한 스트리밍 서버, 분배자, 라이센스 서버, 그리고 프로바이더로 구성된다. 제안하는 시스템은 기존의 DRM 시스템에서 처리하는데 어려운 모바일 환경에 적합한 구조를 가지고 있으며, 클라이언트 매니저에서 라이센스 매니저를 이용해서 2차 배포문제를 풀 수 있다.

A DRM System for Streaming Services in Mobile Environment

Myung-Mook Han* · Yong Hak Ahn**

ABSTRACT

This study proposes a DRM system for VOD streaming services in a mobile environment. The proposed system consists of DRM client manager (Consumer), in which core components for client services are independently constructed to be used in a mobile environment, and DRM server, which provides DRM services. Consumer independently exists in the client to maximize efficiency and processing capacity in such a mobile environment, and consists of license service, content service, access service, and tracking service. DRM server consists of streaming serverfor VOD streaming, distributor, license server, and provider. The proposed system has an architecture suitable for a mobile environment that is difficult to process in the existing DRM system and can solves the super-distribution using license manager in client manager.

Key words : DRM(Digital Right Management), Client Manager, Mobile Environments

---

* 경원대학교 컴퓨터소프트웨어전공
** 가톨릭대학교 컴퓨터정보공학부

1. Introduction

Network users have rapidly increased along with a remarkable development of the Internet, and the distribution of various digital contents through Internet has increased [1-2]. Lots of information has been digitalized to be a part of our daily lives, as in the form of eBook, e-mail, MP3 and MPEG. However, since there is no change in quality even with their repetitive copy and copy is easily made it becomes a social controversy [3-4].

DRM (Digital Rights Management) is a system that can continue to protect and manage the rights and profits of persons concerned with the copyrights of digital contents by preventing unauthorized users from using them through encryption technologies. DRM provides a technical protection measure to solve such problems as their reckless and illegal reproduction and to secure a proper protection of copyrights to them.

The importance of DRM technologies has been increased with a rapid increase and spread of the Internet make such DRM technologies important. In particular, there is an increasing demand of applying the existing DRM to wireless terminals in a situation where such wireless terminals (PDA or Internet phone) which have recently replaced desktop PC's for a use of services provided on the Internet [5-6]. However, an application of the existing wired DRM to a wireless device based on a mobile environment that is characteristic of such restrictions as a low speed in data transmission speed and a high failure in transmission, including less memory resources and restricted processing capacity, may cause lots of the resulting problems [7].

Until now, there have been studies on DRM architecture that include WMDRM (Windows Media DRM) [8] that provided by only SDKs (System Development Kits) on content protection and license management, EMMS (Electronic Media Management System) [9] that provides protection for most of contents ranging from video, music, documents, rich media and software, and LWDRM (Light Weight DRM) [10] that defines a huge DRM system in a lightweight.

WMDRM is useful a system development because of provided by SDKs, and provides Portable Device Playback for transferring and playing the protected media to a portable terminal. However, it is very difficult to implant the system because of provided by SDKs only, that is, because it provides not streaming services but download services only. And it is very difficult to apply in case of streaming services for VOD (Video On Demand) in a mobile environment, especially. LWDRM designed to solve the forgoing problems also has a problem in that it has very restricted services available with its focus on lightweight.

In this study, we proposed aDRM system suitable for a mobile environment by forming core components on the part of client services independently of the client for improving efficiency of DRM services in such amobile environment and considering super-distribution.

The proposed system was designed in compliance with OMA DRM [11] standard for wireless DRM technologies.

2. The proposed DRM System

In the existing a DRM system, DRM server manages the overall performance and the client

simply connects to the server to use its services. It is suitable for the communications network that has its own processing capacity to some degree, while it has lots of problems in terms of processing capacity in the communications network if it's applied to a mobile environment as it is. In the viewpoint of super-distribution and streaming services, it is difficult to expect efficiency under a mobile environment from the existing DRM system [3-5].

To solve such problems, we propose the architecture moving the core parts of client services in the existing DRM system into the actual client of a mobile device, thereby maximizing efficiency in a mobile environment and considering such a super-distribution.
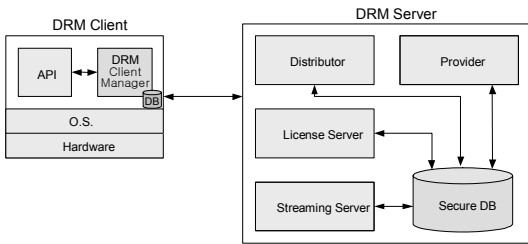

(Figuer 1) The proposed DRM system

(Figure 1) shows the proposed DRM system architecture. The proposed system consists of DRM Client Manager (Consumer) that takes charge of license and information related to the contents on the part of a client, and DRM Server for contents distributor and license services.

The proposed system operates by requiring contents information to DRM server through authentication from the client. Upon receiving the request of contents from the user, the client sends a new connection to the server, and receives a

response from it and then outputs information to the user. DRM server sends relevant information in the database with operation of contents service if the request relates to contents information, and responds to the request from the client with operation of license services if it relates to license.

2.1 DRM Client Manager

DRM Client Manager is the core components that use DRM in a client. That is, it is configured independently in a mobile device. (Figure 2) shows the overall architecture of DRM Client Manager.
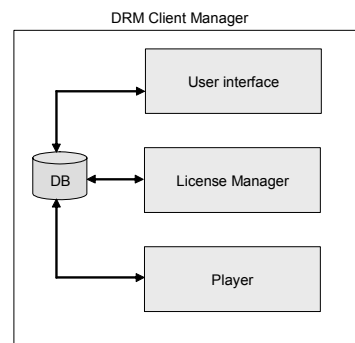
(Figure 2) The DRM client manager

The manager is independently operates in the client side, consisting of user interface function for user requests, license manager for license requests and managements, and player for playing protected contents.

- **User interface** : User interface is the function of user interface that a user requests the contents. A user can connect to a server through device authentication. User interface manages contents information and records a response from the server on database in accordance with contents request, in which such

information is used to manage and protect se-
lected contents.

- **License manager** : License manager requests
  a license for contents selected in accordance
  with given usage rule to the license server and
  receives license in a response to it. License is-
  sued from the server is saved in secure DB
  and manages licenses required for playing la-
  ter. In particular, the license manager in the
  client side manages licenses in accordance
  with super-distribution through synchroniza-
  tion with license server.

- **Player** : Player determines whether it is pos-
  sible to play or not, depending on contents se-
  lected and their license. If there is a license
  with proper authority, it requests streaming
  services to thestreaming server and decrypts
  encoded contents transmitted from the st-
  reaming server, performing the play function.
  If it is not proper, a normal play will not be
  performed even though relevant contents are
  requested.

2.2 DRM Server

DRM server has to provide services for a spe-
cific port to respond to requests from a client and
also has to provide interface for server manager
and contents provider. DRM server largely con-
sists of distributor, license server, streaming ser-
ver and provider. (Figure 3) shows each function.

- **Distributor** : Distributor responses to request
  from the user interface through authentication
  for processing requests from a client and pro-
  vides the client with contents information and
  lists, including information about creating mes-
 sage and setting connection for such processing.
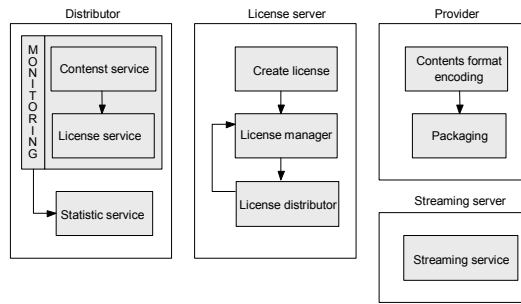
(Figure 3) The DRM server

- **License server** : License server takes charge
  of managing license on super-distribution, au-
  thority and licenses issued as well as issuing
  of license on contents. The license server keeps
  the latest information through synchronization
  with license manager in the client side and per-
  forms a function of license manage on super-
  distribution that may occur thereafter.

- **Streaming server** : Streaming server takes
  charge of streaming function of contents ex-
  plained by streaming descriptor. Streaming des-
  criptor defines instructions for streaming agent
  and contents meta-data for streaming service
  of contents, and sends encrypted contents at
  the request of a client.

- **Provider** : Provider performs encrypted orig-
  inal contents in the form of DRM content along
  with their header. Header information included
  in DRM content contains the format of original
  contents, contents identifier, encryption infor-
  mation and rights issue service information.

2.3 Communication of Client and Server

The proposed system architecture consists of cli-
ent and server. Each component requires message
communication process to send and receive re-
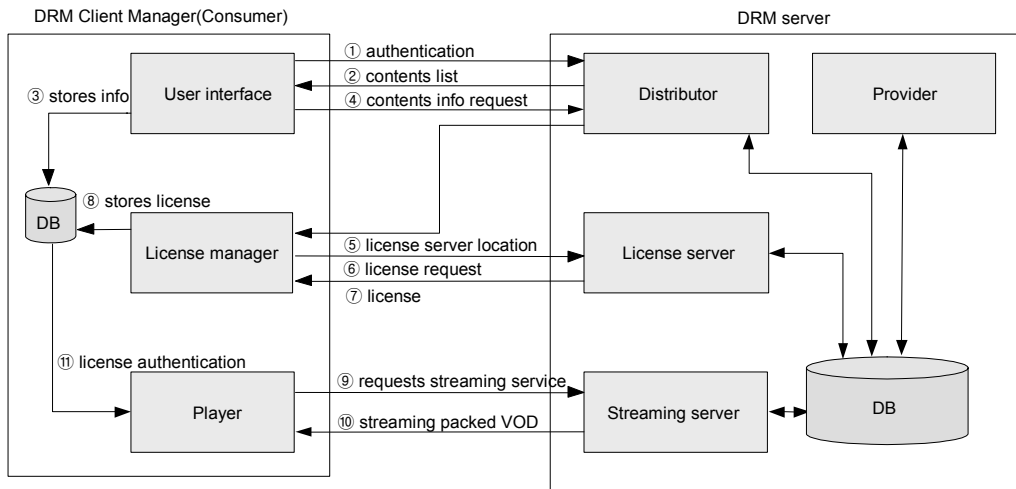
(Figure 4) Communication between client and server

sponses within a system, and requests from a user.

(Figure 4) shows the flowchart of communications between a client and a server :

At the request of a user, a client that interfaces with the user sets connection to contents server and sends a message. Authentication information is also sent to the server together with the message and the server confirms its reception by sending ACK. Upon receiving request from the client, the server returns information on contents list in database using response message. With the selection of contents by the user, the contents server sends response message in accordance with the request of contents information.

The response message contains URL (Uniform Resource Locator) of streaming server and URL of license server. The license server issues a relevant license according to the license request of the client and stores such information in database. It inspects whether it is a proper request using information on license and contents in the database at the request of Play by the user

and requests streaming services for relevant contents through connection to streaming server thereafter.

2.4 Services

<Table 1> shows an overview of services in general DRM system [1, 4].

⟨Table 1⟩ Overview of services in DRM architecture

Services	Functions
Content	Search and protection of contents, user authentication, contents information management
License	License type, license management, synchronization, super-distribution
Access	Authentication responsibility, user registration service
Tracking	Contents statistics information
Payment	Service for payment system
Import	Convert, update and delete contents
Client	Authentication management, user license and super-distribution
Streaming	VOD streaming

In general, services available in the existing DRM system include contents service, license service, access service, tracking service and import service. Considering VOD streaming and super-distribution in a mobile environment, client service and streaming service for client side are also required in addition to those services.

3. Validation

3.1 Technology Overview

The proposed system is constructed to independently operate core components from the client services of the existing DRM architecture in the client side, in consideration of a given processing capacity in a mobile environment. For the evaluation of the proposed system, its services available were compared with them of the existing DRM system. The existing DRM system includes Microsoft's Windows Media DRM (WMDRM) [8], Electronic Media Management System (EMMS) [9] and Light Weight DRM (LWDRM) [10].

WMDRM consists of Content Packaging for protecting media, Content Hosting for distributing contents, License Clearinghouse for issuing and managing a license, Content Playback for playing the protected media, and Portable Device Playback for transferringand playing the protected media to a portable terminal. They are provided by SDKs (Software Development Kits) of WMDRM.

IBM's EMMS provides protection for most of contents ranging from video, music, documents and rich media to software. EMMS, a kind of web application, consists of Web Commerce Enabler that is provided in the web, Clearinghouse that processes transaction information, client SDK that provides SDK, Content Preparation Development SDK that takes charge of content packing,and Content Hosting Program that operates in the server and involved in content distribution, and payment service for payment function.

LWDRM, a lightweight version of huge DRM system, uses file format of Local Media File (LMF) and Signed Media File (SMF), including Client Tool, a consumer side application that provides accounting service interface alone. Even if it has very restricted functions, its concept has reinforced its position up to now by bringing up a problem of heavy weight for the first time.

3.2 Discussion

Services availablein a general DRM system are as shown in <Table 1>. Bandwidth, processing capacity and resource restriction of a wireless network have to be considered for VOD streaming in a mobile environment.

<Table 2> shows a comparison of the existing DRM system with the proposed system in terms of overview services.

With consideration of small memory resources, restricted processing capacity, and wireless network bandwidth, client service and streaming service are required for VOD streaming service in a mobile environment.

As shown in the table, the proposed system architecture can solve a problem of mobile network bandwidth that has a low speed of data transmission and a high failure in packet to some degree by placing the core components of client

services available in the existing DRM system into the client side as an independent service.

⟨Table 2⟩ Overview of provided services of DRM

DRM Services	The proposed system	WMDRM	EMMS	LWDRM
Content	O	×	×	×
License	O	×	O	O
Access	O	O	×	×
Tracking	×	×	×	O
Payment	×	O	O	×
Import	O	O	O	O
Client	O	×	×	O
Streaming	O	O	×	×

In addition, it is required to have measures for managing information on license in the client side in terms of super-distribution for a repetitive distribution of contents purchased by a user through e-mail, CD-ROM and diskette. To solve such problem, this study presents a solution by placing an independent license manager at the client side, thereby solving the problem through synchronization with license server.
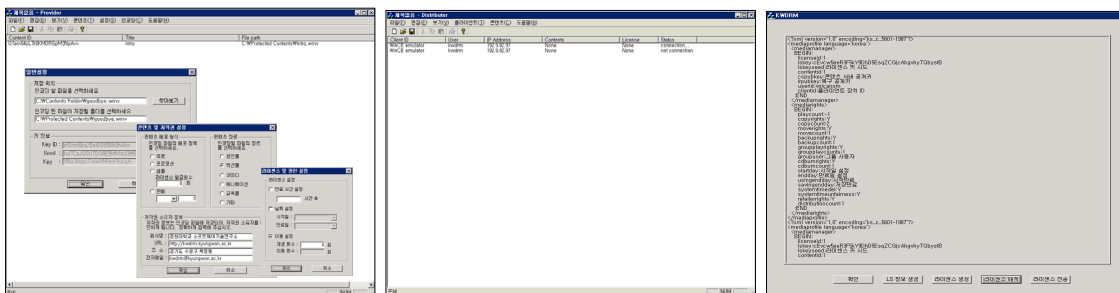
(Figure 5) shows the DRM server consists of provider, distributor, license server. and (Figure 6) shows the DRM Client Manager.

(Figure 6) DRM Client Manager

4. Conclusion

This study proposed DRM system for mobile VOD services. The proposed system maximizes the efficiency and processing ability in a mobile environment by managing the core components of a client as client manager at the client side in order to solve the problem that it is difficult to apply the existing DRM system structure to such mobile environment.
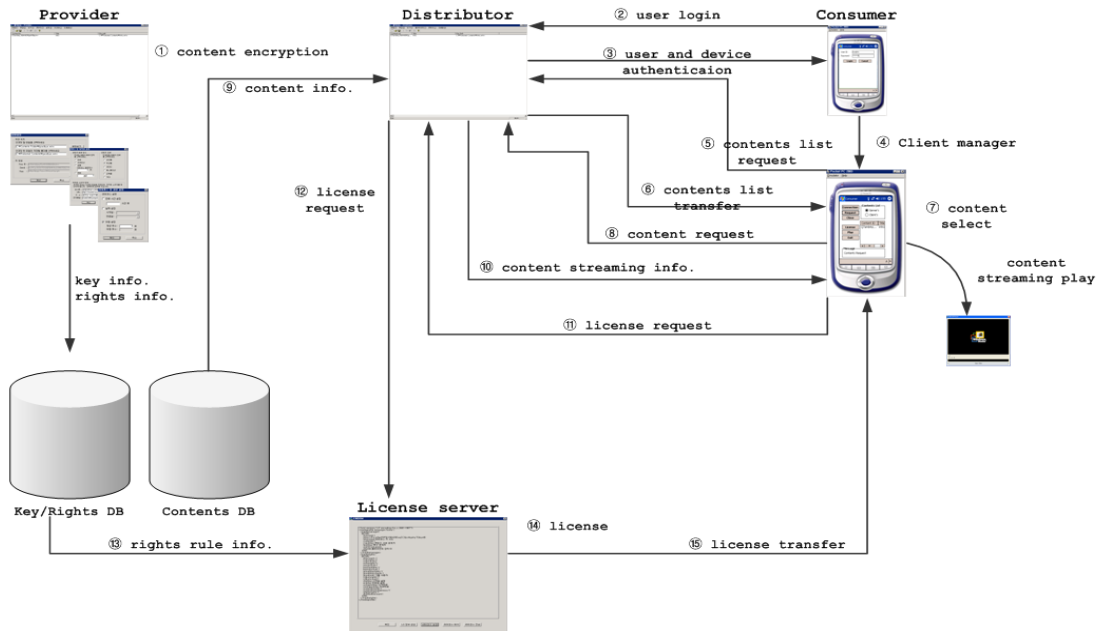

(a) provider　　　　(b) distributor　　　　(c) license server

(Figure 5) DRM server

(Figure 7) Data flow between the DRM Client Manager and the DRM server

The proposed system largely consists of DRM Client Manager and DRM server. DRM Client Manager includes user interface for interface with a user, license manager for requirement and management of a license, and player for playing protected contents. DRM server includes distributor, license server, streaming server and provider.

Since DRM Client Manager can perform VOD streaming services of mobile environment in the proposed system structures, we solve the problem that the existing DRM system has, and present a solution for super-distribution.

References

[1] Sam Michiels, Kristof Verslype, Wouter Joosen and Bar De Decker, "Towards a Software Architecture for DRM", DRM '05, pp. 65-74, Novermber 2005.

[2] Qiong Liu, Reihaneh Safavi-Naini and Nicholas Paul Sheppard, "Digital Rights Management for Content Distribution", Australasian Information Security Workshop 2003 (AISW2003), Conferences in Research and Practice in Information Technology, Vol. 21, 2003.

[3] Bogdan C. Popescu, Bruno Crispo, Frank L. A. J. Kamperman, "A DRM Security Architecture for Home Networks", DRM '04, pp. 1-10, October, 2004.

[4] Pramod A. Jamkhedkar, Gregory L. Heileman, "DRM as a Layered System", DRM '04, pp. 11-21, October, 2004.

[5] Alapan Arnab, Adrew Hutchison, "Fairer Usage Contracts For DRM", DRM '05, pp.

1-7, November, 2005.

[6] G. L. Heileman and C. E. Pizano, "An overview of digital rights enforcement and the MediaRights technology", Technical report, Elisar Software Corporation, Apr. 2001.

[7] Thomas S. Messerges, Ezzat A. Dabbish, "Digital Rights Management in a 3G Mobile Phone and Beyond", DRM '03, pp. 27-38, October, 2003.

[8] Micro Corporatioin., Windows Media DRM (WMDRM), 2005.

[9] IBM, IBM Electronic Media Management System (EMMS), http://www-306.ibm.com /software/data/emms.

[10] Fraunhofer Institute, "Light Weight DRM (LWDRM)", http://www.lwdrm.com.

[11] OMA., Open Mobile Alliance, http://www. openmobilealliance.org.

한 명 묵

1980년 연세대학교 공과대학 (공학사)
1987년 뉴욕공과대학교 컴퓨터공학과(공학석사)
1997년 오사카시립대학교 정보공학부(공학박사)
1998년~현재 경원대학교 컴퓨터소프트웨어전공 부교수

안 용 학

1995년 순천향대학교 전산학 (공학사)
1997년 경희대학교 전자계산공학과(공학석사)
2003년 경희대학교 전자계산공학과(공학박사)
2000년~2004년 송호대학 정보산업계열 조교수
2005년~현재 가톨릭대학교 컴퓨터정보공학부 조교수
관심분야 : 멀티미디어 데이터처리, 멀티미디어 정보보호, 전자상거래 시스템