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A STUDY ON CLOUD-BASED MEDIA SERVICE REFERENCE MODEL SUPPORTING MULTI-DRM

[1]YOUNGMO KIM, [2]BYEONGCHAN PARK, [3]YU-HYEON WON
[4]BYUNG-GI KIM AND [5]SEOK-YOON KIM

[1,2,3,4,5]Soongsil University, Seoul, Korea

E-mail: [1]pbc866@ssu.ac.kr, [2]ggdd1130@gmail.com, [3]ymkim828@ssu.ac.kr, [4]bgkim@ssu.ac.kr, [5]ksy@ssu.ac.kr

ABSTRACT

In the online content distribution platform, DRM technology is the core technology for implementing business model, and most distribution platforms use only one DRM technology. While the sales amount in these content distribution platforms is distributed to the copyright owner and the content distributor accordingly, the copyright owner and user cannot choose a different DRM purchase cost since only the DRM technology proposed by the content distributor is used. In this paper, we analyze the requirements for constructing media service platform supporting multi-DRM with more than one DRM and propose a cloud-based media service model that supports multi-DRM based on these requirements. The simulation results shows that the profit settlement part of the proposed reference model yields fair dividend payment to participants according to the actual usage rate of DRM and contents.

Keywords: *Cloud Media Service, DRM, Copyright, Reference Model*

1. INTRODUCTION

Recently, media service companies are increasingly seeking to build services using cloud computing for the low cost and high efficiency of UHD TV and 3D broadcasting contents production and processing [1]. However, the current cloud environments have limited capability for copyright protection [2].

DRM technology applied to existing media services uses one DRM technology because of installation cost, and even if two or more DRM technologies are used, it is not flexible to DRM interoperability. However, in an environment where DRM technology is supported in the form of a cloud service as in the cloud environment, multiple DRM technologies can be used, and there is no need to separately install two or more DRM technologies[10].

In addition, in the conventional cloud media service distribution platform, the content provider registers his/her own content and the content user uses the content. Since the media service distribution platform has only one DRM technology dependent on the platform, however, the content provider has to package her contents using different DRM in order to register their contents on various platforms [3].

In addition, content providers can not directly participate in content distribution and profit distribution due to the fixed revenue ratio for each platform[6, 7, 8, 9]. Therefore, the integrated media platform supporting multi-DRM, which can be used in various platforms by purchasing one or more DRM, is required. A profit settlement model is also required where contents providers can participate directly in the distribution of content and profit distribution applied in the platform [4, 5].

In this paper, we analyze the requirements for constructing a multi–DRM–enabled cloud-based integrated media service and propose a reference model for building a real system based on the specified requirements. We also propose a profit distribution model in media service by applying a profit settlement method applied to the media service.

2. RELATED RESEARCH

2.1 DRM

DRM(Digital Right Management) technology is a technology that safely protects all contents associated with DRM technology in the process of creating, distributing and using digital

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contents and controls the use of digital contents according to the right information. Existing DRM technology protects contents stored contents mainly using encryption technology, authentication technology, key management technology, packaging technology, rights expression technology and usage control technology[12, 13].

2.2 DRM Interoperability

DRM interoperability technology is a technology that is designed to guarantee compatibility between different DRM technologies, and EXIM, CORAL, MARIN, ULTRA VIOLET are representative of it. Among them, EXIM (Export / Import) technology, developed by Korea Electronics and Telecommunications Research Institute (ETRI), ensures compatibility between one DRM technology and other DRM technologies applied to music contents provided by online music service [14]. CORAL and MARLIN are DRM interoperability technologies standardized by Intertrust, Panasonic, Philips, Samsung and Sony [15, 16]. CORAL is a technology that enables users to use content in accordance with the applied DRM license after purchasing contents. MARLIN is a technology that allows content purchased on various media platforms to be used without restrictions within the range of devices owned by the user. It is used to protect video contents and is supported by ULTRA VIOLET, developed by DECE(Digital Entertainment Content Ecosystem) [17]. ULTRA VIOLET is an integrated platform service designed to provide integrated multimedia services based on DRM technology to provide content in cloud environment.

2.3 Cloud-Based Media Service Reference Model

In the cloud-based media service reference model presented in [8], components for each system and member are presented in accordance with the requirements for cloud-based media services, and roles and interfaces for each components are described. Based on the proposed components, an operational plan is presented, and real-time and non-real-time content usage and provision scenarios are described. However, existing cloud-based media service reference model are described only in terms of media service operations on the cloud, and only the 'copyright management' component is simply described as far as copyright protection technologies are concerned. The components described here merely verify copyright when registering content on the media platform, but do not mention copyright protection techniques that can actually be applied to the content.

3. CLOUD-BASED INTEGRATED MEDIA SERVICES PLATFORM AND ANALYSIS OF THEIR REQUIREMNTS

3.1 Media Services Platform

The proposed cloud-based media service in this paper is the platform that supports one or more multi-DRM and is divided into three systems and three members. Three systems are DRM Market System (DMS), DRM System (DS) and Cloud Media Service System (CMSS), and three kinds of membership are made up of DRM Service Provider (DSP), Content Provider (CP) and USER, as shown in Figure 1.

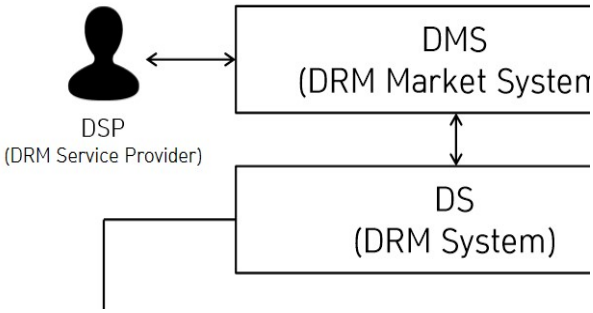

Figure 1: Cloud-based media service platform configuration with multi-DRM support

The DSP registers its DRM with the DMS, and the registered DRM information is sent to the DS. The CP purchases the DRM to be applied to its contents from the DMS and then registers and serves content to the CMSS. When USER uses the content, DS checks the license key to see if the DRM license is valid, and finally receives service. Therefore, in this cloud-based media service platform, DMS, DS, and CMSS should function as core components and analyze their requirements for implementation of reference models.

3.2 DRM Market System Requirements

The DRM Market System provides a variety of resources needed to provide services to the CP wanting to use DRM and the DSP to receive DRM. Figure 2 shows the usage flow of the DRM Market System.

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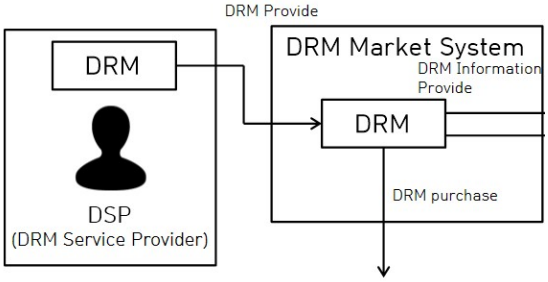

Figure 2: DRM Market System usage flow diagram

DMS must register DRM from DSP. The registered DRM shall send the DRM information to the DS. The registered DRM is sold to the CP. Table 1 shows the requirements for configuring these systems.

Table 1: DRM Market System Requirements

Number	Requirement Name	Description of Requirements
REQ-DMS-1	Configuration	All services must be provided to register and provide DRM.
REQ-DMS-2	User Management	It is necessary to manage user information to provide services for DSP and CP.
REQ-DMS-3	Billing/Settlement/Refund	The billing policy for the DRM service and the transparent settlement and refund of the DRM used should be made.
REQ-DMS-4	Security	It must be securely provided for user personal information and DRM registration, use and transmission from security threats.
REQ-DMS-5	Service Resources	To provide a service resource for configuring resource management and DRM and DRM usage management system for providing DRM service.

3.3 DRM System Requirements

The DRM System should provide all necessary service resources to provide the DRM Market System and the license key for the DRM information to the Cloud Media Service System. Figure 3 shows the usage flow of the DRM System.

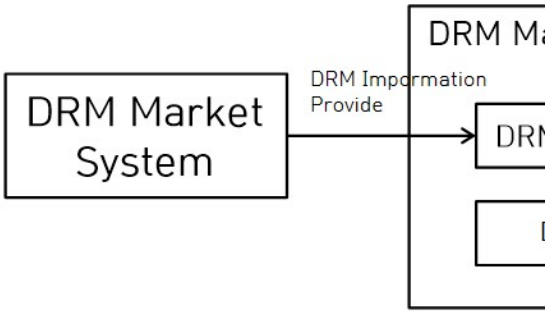

Figure 3: DRM System usage flow diagram

The DS provides the DRM information from the DMS and generates the DRM license key using the received DRM information. The generated license key confirms the DRM associated with the content. Table 2 shows the requirements for constructing such a system.

Table 2: DRM System Requirements

Number	Requirement Name	Requirement Detailed Description
REQ-DS-1	Service Configuration	Provides DRM information and generates license key.
REQ-DS-2	Security	DRM information should be securely provided from security threats.
REQ-DS-3	Service Resources	Provide services for DRM license verification.

4.4 Cloud Media Service System Requirements

Cloud Media Service System must provide the CP to receive content, the DMS to receive DRM information, the DS to receive the DRM license key, and all the service resources needed to provide services to the USER using the content. Figure 4 shows the usage flow of the DRM System.

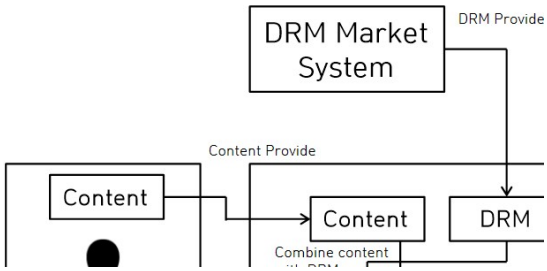

Figure 4: Cloud Media Service System usage flow diagram

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The CMSS receives the content from the CP and receives the DRM information that the CP purchased from the DMS. In CMSS, CP contents and DRM information are combined, and DRM combined contents are used by USER. Table 3 shows the requirements for constructing such a system.

Table 3: Requirements for Cloud Media Service System

Number	Requirement Name	Description of Requirements
REQ-CMSS-1	Service Configuration	All services must be provided to provide and receive content.
REQ-CMSS-2	User Management	CP and USER to provide services for the user information should be managed.
REQ-CMSS-3	Billing / Settlement / Refund	The billing policy for the content service and transparent settlement and refund of the used content should be made.
REQ-CMSS-4	Security	It must be securely provided for the registration, use, and transmission of personal information and contents from the threat of security.
REQ-CMSS-5	Service Resources	Service resources such as resource and content management and DRM usage management for providing content services should be provided.

4. CLOUD-BASED MEDIA SERVICE REFERECE MODEL SUPPROTING MULTI-DRM

4.1 DRM Market System Reference Model

The functions of the DRM Market System are based on the requirements mentioned in Section 3.2, and the components necessary for the system are constituted. The components constituting the DMS are shown in Figure 5.

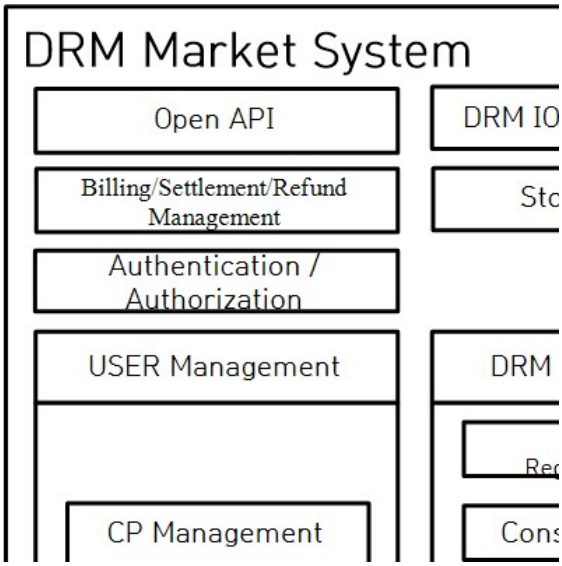

Figure 5: Components of DRM Market System

Table 4 shows the functions of each component of DMS.

Table 4: Component functions of DMS

Classification	Explanation
Open API	An interface that allows DMS to access other systems. Provides an interface that DMS can access to provide DRM information to DS. It also provides an interface to access DRM from DMS to CMSS
DRM IOP Management	A component that sends DRM information to DS from DMS. All registered DRMs are automatically sent to the DS.
Sales / Settlement / Refund Management	A component for sales / settlement / refund of DRM in DMS. The DRM is determined by the DSP registering the DRM. The sales method is divided into a flat rate system and a meter rate system. Also, the DRM sold should be able to make a transparent settlement according to the type of sales. When a refund is made for the DRM sold, a transparent refund should be made according to the sales method.
Storage Space	A component that stores DRM in DMS. And serves as a server for storing the DRM whose integrity test has been completed.

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Authentication / Authorization	A component that manages the access and use rights of users accessing DMS. And performs authentication for all users using the service of DMS. The user who accesses the service for the first time allows the user to register, and the user who is already registered as a user serves as an authentication to confirm whether or not to register.
User Management	A component that manages user information using DMS. User has DSP and CP. - CP management. A managed component for purchasing DRM from DMS. You can purchase the registered DRM from the DMS. The CP information must be provided and provided to access the CP management. - DSP management. A managed component for registering DRM in DMS. The DMS must be able to register DRM and be able to identify and settle how much DRM has been used.
DRM Management	A component that registers and manages DRM in DMS. - Register / delete DRM A component that registers DRM in DMS. The DSP registers and deletes the DRM and inputs the DRM registration information for registering the DRM. - Consistency test A component that performs consistency test on DRM registered in DMS. Conduct a consistency test to verify that the DRM registered in the DMS is a usable DRM. The DSP shall be able to verify the results of the integrity test against the registered DRM. - DRM information Management The part that DMS checks and manages the registered DRM. DRM information registered in DRM can check / manage / modify DRM information, and DRM can be purchased. With DRM, you can check DRM information. - DRM Synchronization A component that continuously updates the registered DRM in DMS. Synchronization is performed only for the DRM of the registered DSP, and synchronization is continuously performed. - DRM Deployment A component that enables the DMS to provide the requested DRM in the CMSS. And assigns a method and a transmission path for DRM distribution.

4.2 DRM System Reference Model

The functions of the DRM System are composed of the components required for the system based on the requirements mentioned in Section 3.3, and the components constituting the DS are shown in Figure 6.

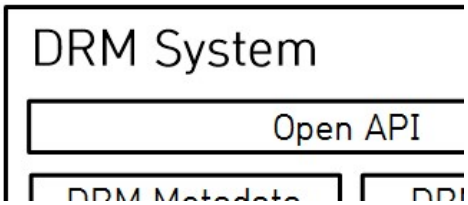

Figure 6: Function of DRM System

The functions of each component of the DS are shown in Table 5.

Table 5: Component functions of DS

Classification	Explanation
Open API	An interface that enables DS to access other systems. Provides an interface to access DRM information from DMS. It also provides an interface that can be accessed by CMSS to provide DRM licenses.
DRM Metadata Management	A component that manages DRM license of DS. And generates and manages the DRM information transmitted from the DMS as metadata.
DRM License Server	A component that manages DRM license of DS. Generate DRM license based on DRM metadata management. When DRM applied content is used from CMSS, it confirms whether DRM applied to the content is valid or not.

4.3 Cloud Media Service System

The functions of the Cloud Media Service System are based on the requirements mentioned

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in Section 3.4, and the components necessary for the system are configured. The components that make up the CMSS are shown in Figure 7.

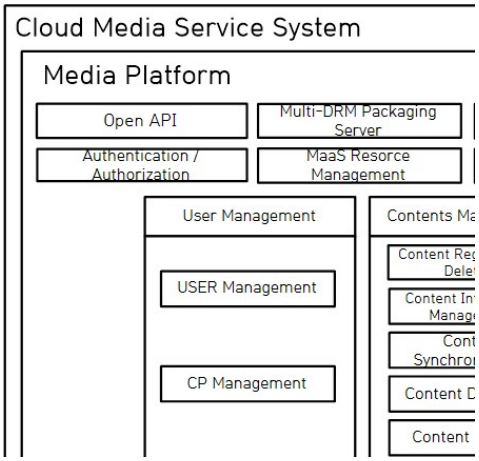

Figure 7. Functions of the Cloud Media Service System

The component functions of CMSS are shown in Table 6.

Table 6: Components functions of CMSS

Classification	Explanation
Open API	It is an interface that enables DS to access other systems and is a RESTFul based API. Provides an interface to access content from CP. Provides an interface to access DRM from DMS. Provides an interface to access DRM licenses from DS. Provides an interface to access cloud providers for cloud resource support.
Multi-DRM Packaging Server	It is a component that packages DRM into registered contents. And has a function of combining the DRM provided by the DMS with the content.
Content Streaming Server	It is a component that serves as streaming when contents are used in CMSS. When the USER uses the content on the platform, the transmission path is allocated to provide the streaming service using the network resources.
Authentication / Authorization	It is a component that manages the access and use rights to users accessing CMSS. And performs authentication for all users using the service of the CMSS. The user who accesses the service for the first time allows the user to register, and the user who is already registered as a user serves as an authentication to confirm whether or not to register.
Sales / Settlement / Refund Management	It is a component for sales / settlement / refund of contents in CMSS. The sales method has a flat rate and a meter rate. Also, the DRM sold should be able to make a transparent settlement according to the type of sales. When a refund is made for the DRM sold, a transparent refund should be made according to the sales method.
User Management	It is a component that manages user information using CMSS. User has CP and USER. - USER Management It is a managed component for purchasing content from the CMSS. The registered content can be purchased from the CMSS. USER information must be provided and provided to access USER management. - CP Management It is a managed component for registering content in the CMSS. The CMSS must be able to register the content and be able to determine how much of the content has been used and settled.
Contents Management	It is a component for registering and managing contents in CMSS. - Content Registration / Deletion It is a component that registers contents in CMSS. The CP can register and delete the content, and enter the content registration information for registering the content. - Content Information Management It is a component that manages information about registered contents in CMSS. The CP should be able to check / manage / modify the contents information with respect to the registered contents, and the USER who purchases the contents should be able to check the contents information when approaching to purchase the contents. - Content Synchronization It is a component that continuously updates the registered DRM in CMMS. Synchronization is performed only for the DRM of the registered CP, and synchronization is continuously performed. - Content Distribution It is a component that enables the CMSS to provide the requested content in USER. Assign a method and a transmission path for content

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	distribution. - Content Broking CMSS is a component that mediates content. Provide the cloud provider with information about the content used when USER tries to use the content.
Cloud Provider	It provides cloud resources to provide media services. - Open API It is an interface that enables the Cloud Provider to work with other systems. Provides an interface to interact with Media Platform. - Service Synchronization Cloud Provider is a component that continuously updates the registered content. Only the content that has been registered on the Media Platform is synchronized and Synchronization continues to work. - Storage Space It is a component that stores contents registered in Cloud Provider. Content registered in Media Platfrom is stored in the storage area of the Cloud Provider. - Content Management It is a component that manages the contents registered in the cloud provider. Manage the content registered in the Media Platform. Provides access to content on the Media Platform.

5. REIFICATION OF THE REQUIREMENTS SATISFACITON AND APPLICAITON OF THE PROFIT SETTLEMENT MODEL

In this section, we verify whether the reference model is designed to meet the requirements derived in Section 2 and compare the proposed model against the existing profit settlement model when the proposed profit settlement model is applied to the reference model.

5.1 Requirements satisfaction for implementing media services platform

We compare the reference model for building a cloud-based media service platform supporting multi-DRM proposed in Section 3 and the requirements for building the proposed platform in Section 2.

5.1.1 Satisfaction of DRM Market System requirements

Table 7 compares the components of DRM Market System by requirements. According to Table 7, there are 10 functions that meet the requirements and 5 functions that satisfy some requirements.

Table 7: Features by DMS requirements

Requirement number	Component functions of the reference model	Satisfaction
REQ-DMS-1	Ability to receive and delete DRM	○
	DRM management function	○
	DRM evaluation function	Δ
	Web Services Features	Δ
	Service monitoring function	Δ
REQ-DMS-2	System administrator functions	Δ
	DRM user management function	○
	DRM provider management function	○
REQ-DMS-3	Sales / Settlement / Refund Features	○
REQ-DMS-4	System user access function	○
	Network security features	Δ
REQ-DMS-5	Interworking with other systems	○
	Ability to transfer DRM information to other systems	○
	System availability check function of registered DRM	○
	Update DRM list in system	○

※ O : Satisfaction, Δ : Some satisfaction, × : Not satisfied

If you look at the details by requirements, the satisfaction of DMS's requirement number REQ-DMS-1 is satisfied from two things. DRM must be able to be deleted and received from DRM. Also, it satisfies the requirement by being able to manage the provided DRM. However, it is not satisfied because there is no function to evaluate the registered DRM. Also, for all users who use DMS, the service should be provided by the web service method. However, since the web service is provided by the administrator of the DMS at the discretion, there is no function in the reference model. In addition, service monitoring is a technology provided through Web service, which informs the DMS users about the problem of the

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system and can not satisfy the requirement unless the Web service is implemented. REQ-DMS-2 is a requirement to manage all users who use DMS, and the functions of DRM users and providers are specified, but DMS system administrator should be added and functions should be specified. REQ-DMS-3 satisfies the requirements in the proposed reference model as a requirement to sell, settle and refund DRM. The requirement of REQ-DMS-4 satisfies the requirement because it has security for all users using DMS. However, the network part does not satisfy the requirement because it can not be implemented by the DMS alone. Requirements of REQ-DMS-5 should be able to interoperate with other systems, and since the registered DRM is transferred to another system and the usage amount of the used DRM is implemented in the reference model, it satisfies the requirement. Also, since the list update function for the registered DRM must be performed, the requirements are satisfied.

5.1.2 Comparative analysis of DRM System requirements

Table 8 compares the DRM system requirements by component. According to Table 8, there are 3 functions satisfying the requirement and 1 function satisfying some requirements.

Table 8: Features by DS requirements

Requirement number	Component functions of the reference model	satisfaction
REQ-DS-1	DRM information management function	O
	DRM license generation function	O
REQ-DS-2	Network security features	Δ
REQ-DS-3	Interworking with other systems	O

※ O : Satisfaction, Δ : Some satisfaction, × : Not satisfied

The requirement number REQ-DS-1 of the DS satisfies the requirement because it plays the role of generating the DRM license key by receiving the DRM information from the other system. REQ-DS-2's security in the network is not satisfied by the requirement because it can not be solely DS. The REQ-DS-3 satisfies the requirement because it must receive the DRM information from the DMS and provide the license key to the CMSS.

5.1.3 Comparative Analysis of Cloud Media Service System Requirements

Table 9 compares the components of the requirements of the Cloud Media Service System. According to Table 9, there are 15 functions satisfying the requirements and 7 functions satisfying some requirements.

Table 9: Features by CMSS requirements

Requirement number	Component functions of the reference model	satisfaction
REQ-CMSS-1	Ability to receive and delete content	○
	Content management function	○
	Content search function	Δ
	Content evaluation function	Δ
	Content reconstruction function	Δ
	Ability to provide the content you want to use	○
	Content management function in cloud server	○
	Ability to store content in the cloud server	○
	Web Services Features	Δ
	Service monitoring function	Δ
REQ-CMSS-2	System administrator functions	Δ
	Content user management function	○
	Content provider management function	○
REQ-CMSS-3	Sales / Settlement / Refund Features	○
REQ-CMSS-4	System user access function	○
	Network security features	Δ
REQ-CMSS-5	Interworking with other systems	○
	Content and DRM Combination	○
	Content list update function in the system	○
	Ability to transfer content to other systems	○
	Ready to use content	○
	Content list update function in cloud server	○

※ O : Satisfaction, Δ : Some satisfaction, × : Not satisfied

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If you look at details by requirements, requirements of CMSS REQ-CMSS-1 satisfies the requirement by being able to receive, manage, and delete contents from CP. However, the proposed reference model does not satisfy the requirement because there is no content search, evaluation, and reconstruction function. When the USER wants to use the content, it satisfies the content provisioning requirement by providing it in a streaming manner. The requirement to store and manage the content registered by the CP in the cloud server is required. There is no function in the reference model because it is a service provided by the administrator at the discretion of the web service method for all the users using the CMSS. In addition, service monitoring is a technology provided through web service, which tells CMSS users about the problem of the system. Therefore, if the web service is not implemented, it can not satisfy the requirement. REQ-CMSS-2 is a management requirement for all users who use the system. The requirements for the content provider and the user are satisfied, but the system administrator is not available and the requirements are not satisfied. REQ-CMSS-3 satisfies the requirements in the proposed reference model as a requirement to sell, settle and refund content. REQ-CMSS-4 is a security function that satisfies the requirement because it must be secured to all users using CMSS. However, network security does not satisfy the requirement because CMSS alone is not possible. The requirements of REQ-CMSS-5 should be able to interoperate with other systems and satisfy the requirements because the registered contents are transferred to other systems and the usage amount of the used contents is implemented in the reference model. In addition, since it is required to update the list contents of the registered contents, it satisfies the requirements and satisfies the requirement because the content list must be updated in the cloud server.

5.2 Verification Using Profit Settlement Model of Media Service Platform

Another method for verifying the proposed reference model in this paper is a comparison using the settlement model. The settlement model in the media service platform consists of two systems, CMSS and DMS, and the structure is shown in Figure 8.

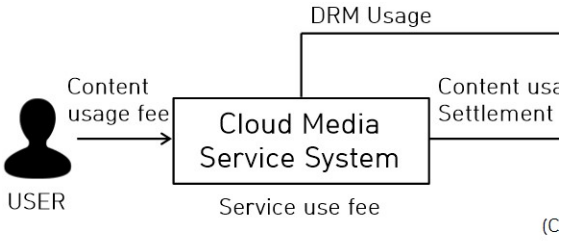

Figure 8: Purchase and settlement structure

USER will pay for the content to be used and purchase it from CMSS, and CMSS will settle the amount of CP, excluding service usage fee, to CP. The settlement of the content usage will be settled by the CP according to the USER usage type, and The type of usage is divided into a flat rate system that can be used without restriction for a certain period and a meter rate system that is purchased by selecting the content to be used.

The CP will pay for the DRM to be used from the DMS, and the DMS will settle the amount to the DSP excluding the service usage fee. The DRM is settled to the DSP according to the usage pattern selected by the DSP to sell its DRM and the amount of the DRM used. The usage type is divided into a flat rate system and a flat rate system[11].

5.2.1 Flat-Rate Profit Settlement Model of CMSS

The flat rate settlement model is settled according to the number of usage and usage of the content used by USER. Table 10 shows the settlement based on the usage rate of contents.

The results of the CMSS flat rate settlement model show that USER is settled to the CP at the rate of using the content and is distributed equally as much as the cost ratio within the purchase of the flat as much as using the content. However, the flat rate settlement model may have a problem that the more the USER uses the more content, the less the settlement cost settled to the CP.

5.2.2 Meter-Rate Profit Settlement Model of CMSS

Table 11 shows the meter rate settlement model for individual items purchased and settled for all contents registered in the CMSS.

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When we look at the results of the meter rate settlement model, we can see that each content is settled to the CP except for the commission fee of CMSS. It may be advantageous in terms of settlement because the amount to be settled to the CP is higher compared to the flat rate settlement model.

5.2.3 Flat-Rate Profit Settlement Model of DMS

The flat rate settlement model is settled based on the number and usage of DRM applied to content within CP's all DRM registered with DMS. The DMS flat rate settlement model is shown in Table 12.

As seen from the results of the DMS flat rate settlement model, it can be seen that the CP is charged to the DSP as the usage rate of the DRM applied to the content as in the case of the subscription model of the CMSS, and is distributed equally to the DSP. However, the flat rate settlement model may have a problem that the more the CP uses the more DRM, the less the settlement cost settled to the DSP.

5.2.4 Meter-Rate Profit Settlement Model of DMS

The meter rate settlement model of the DMS balance system purchases and applies the DRM to be applied to the content by the CP, and the content is settled according to the usage amount of the DRM. Table 13 shows the meter rate settlement model for the DMS-based system.

Based on the results of the DMS meter rate settlement model, DRM 1 and DRM 2 were purchased for the CP content. It is possible to calculate the usage amount of each DRM in the purchased DRM, and to see the result of the settlement to DSP by excluding the use fee of DMS. The meter rate settlement model can reduce the burden on the DRM purchase cost since the CP selects the DRM to be applied to the content. In addition, since the settled DSP is settled as much as the DRM is used, a higher settlement can be obtained as compared with the flat rate.

Table 10: CMSS flat rate settlement model

USER (Won)	Content 1 (%)	Content 2 (%)	Content 3 (%)	Content 4 (%)	Usage Fee (%)	Settlement of CMSS (Won)	CP1 settlement (Won)	CP2 settlement (Won)	CP3 settlement (Won)	CP4 settlement (Won)
10,000	20	80	-	-	3	300	1,940	7,760	-	-
	30	10	20	40	5	500	2,850	950	1,900	3,800
	40	-	37	23	7	730	3,720	-	3,411	2,139
	15	23	39	23	9	900	1,365	2,093	3,549	2,093
	52	10	9	29	11	1,100	4,628	890	801	2,581
	100	-	-	-	11	1,100	8,900	-	-	-

Table 11: CMSS meter rate settlement model

USER (Won)	Usage Fee (%)	Settlement of CMSS (Won)	CP settlement (Won)
2,000	3	60	1,940
	5	100	1,900
4,000	7	280	3,720
	9	360	3,640
	11	440	3,560

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Table 12: DMS flat rate settlement model

CP (Won)	DRM 1 (%)	DRM 2 (%)	DRM 3 (%)	DRM 4 (%)	Usage Fee (%)	DMS settlement (Won)	DSP 1 settling (Won)	DSP 2 settling (Won)	DSP 3 settling (Won)	DSP 4 settling (Won)
100,000	-	50	-	50	3	3,000	-	48,500	-	48,500
	30	-	70	-	5	5,000	28,500	-	66.500	-
	15	23	38	24	7	7,000	13.950	21,930	35,340	22,320
	54	-	11	35	9	9,000	49,140	-	10,010	31,850
	6	71	23	-	11	11,000	5,340	63,190	20,470	-
	-	-	-	100	11	11,000	-	-	-	89,000

Table 13: DMS meter rate settlement model

DRM 1 Purchase (Won)	DRM 2 Purchase (Won)	Applied Content	DRM 1 Usage amount (%)	DRM 2 Usage amount (%)	Usage Fee (%)	DMS Calculate (Won)	DSP 1 Calculate (Won)	DSP 2 Calculate (Won)
100,000	50,000	Content 1	50	50	3	2,250	48,500	24,250
		Content 2	70	30		2,250	67,900	14,550
		Content 3	25	75	5	3,125	23,750	35,625
		Content 4	90	10		4,750	85,500	4,750
		Content 5	56	44	7	5,460	52,080	20,460
		Content 6	32	68		4,620	29,760	31,620
		Content 7	47	53	9	6,615	42,770	24,115
		Content 8	81	19		8,145	73,710	8,645
		Content 9	13	87	11	6,215	11,570	38,715
		Content 10	100	-		11,000	89,000	-

6. CONCLUSION

In this paper, we have proposed requirements for building a cloud-based media service platform supporting multi-DRM that can be used on multiple platforms, and a reference model that can be referred when building a real platform based on the requirements. In the design of proposed cloud-based media service reference model supporting multi-DRM, we have considered reference items from the service function point of view by individuals/operators who want to build media service for certain applications and system on cloud.

In order to verify the proposed reference model, we have confirmed that the requirements derived in Section 2 were properly reflected in the reference model and the working of this model was verified through the profit settlement model. As a result of the verification, it was shown that the satisfaction level of requirements derived to implement this reference model was very high and the profit settlement part of the proposed model yields fair dividend payment to participants according to the usage rate of DRM and contents portraying the usage style of users.

Using the proposed reference model in the future, it is expected that the content user may pay less for the content purchase since the content provider can purchase a single DRM that can be used on multiple platforms instead of paying fees for platform-dependent DRMs. On the other side, DRM providers may be more disadvantageous in profit settlement than when platform-dependent DRMs are applied. However, the disadvantage of DRM providers can be alleviated if considering that the media service system supporting multi-

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DRM is a free competitive market to DRM providers and participating into the system yields a better opportunity for a good technology provider. It is expected that this reference model is implemented on a real platform and further research on the related issues is done.

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