



Digital Right Management in e-Learning Security (DRM-eLS)

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Abstract— Regularly important documents are being transferred among different internet users for smooth running of web applications. One of the major web applications is e-Learning. In e-Learning, digital-multimedia contents like video as class lecture, seminar talk, group discussion etc. and pictures like diagrams, architectures, models etc., texts like class notes, assignments, short notice etc. are required to be transferred to the learners. These documents may be created by different authors and may be sent to different group of learners. All learners have not right to access all of these documents, i.e. A particular document is made for a particular group of users not for the others and how only they will be able to utilise their rights? What is the validity of particular e-content? Who are the persons are responsible to issue the rights and how? Our concern is to discuss the security issues using Digital Right Management (DRM) technology in e-Learning system. We have also considered different Digital Right Expressions Languages (DRELS) like Digital Property Rights Language (DPRL) or eXtensible Rights Mark-up Language (XrML), which are the language for writing software licenses for digital documents.

Keywords— e-Learning, DRM, e-content, Digital Right Expression Language (DREL), DPRL, XRML

I. INTRODUCTION

For the last twenty years, different bodies have been formed for dealing with the Digital Right Management problems for web based digital contents. Some of them are Open Platform Initiative for Multimedia Access (OPIMA), who developed hooks to allow proprietary DRM systems to interoperate MPEG. The Video Content Protection System (VCPS) is a standard for digital rights management, proposed to enforce protection on DVD (Read & Write) content and related media. Digital Transmission Content Protection, or DTCP, is a DRM technology that aims to restrict digital home technologies including DVD players and televisions by encrypting interconnections between devices. High-bandwidth Digital Content (Copy right) Protection (HDCP) is a form of digital copy protection and DRM developed by Intel Corporation [8]. Rights Expression Language (REL), Organisation for the Advancement of Structured Information Standards (OASIS) with its eXtensible Commerce Mark-up Language (XCML) also initiates a vital role to implement the safeguard of digital content. Besides, there are Open Mobile Alliance (OMA), Secure Digital Music Initiative (SDMI) with its portable device specification, the DVD Forum's CSS Open e-Book Forum who are also taking care of digital content security. The MPEG-21 Rights Expression Language (REL) is an XML-based language for DRM, providing a universal method for specifying rights and conditions associated with the allocation [10].

In E-Learning, authors have intellectual property(IP) rights on their academic papers, the publisher holds copyright on their published books, the learners will have usage rights for their registered courses, but all these rights may change over time. We will discuss all issues related to DRM in e-Learning system with suggested Secure Digital Right Management (DRM) architecture for e-learning system so that all the learners may rely on their learning materials, certificates, question papers, lecture video, mark sheets etc., all authors can provide their academic notes, papers without any uncertainty in their mind. Basically it will create a trust in the mind of all the users related to e-Learning system.

Digital Right Management (DRM) is a software which provides technologies for the authorized users. Basic objective is to bring trust to e-learning users using DRM software/package. E-Learning documents like class notes, lectures (Audio file .mp3/mp4,etc or video file .wma/.avi, etc.) and diagrams etc. will be controlled by DRM Package and after that it will be safe to use, access, transfer without any hesitation of genuineness. The different entity has different kind of control, like licensing right, key generation right, intellectual property(IP) rights, copyright, usage rights, distribution right, transactional right, storage rights etc. as per the policies of the organisation.

II. DATA MODEL AND DIGITAL RIGHTS EXPRESSION LANGUAGE (DREL)

A digital rights expression language is a grammar for expressing rights on digital documents. These rights can be interpreted by different application program. DREL can be used to express what may be done by whom with under what conditions with respect to digital documents. Let us take an example to issue licenses by the authority to different users using most common digital rights expression languages namely XRML (eXtensible Right Markup Language) or Digital Rights property Language (DPRL).

The first version of the rights expression language that became XrML was developed at Xerox PARC, and called the Digital Property Rights Language (DPRL). In DPRL or XRML the main specification includes syntax, English description of components and an algorithm for determining set of policies. The following figure -1 is data model for

License policy distribution where license authority (Issuer) issuing the rights to different users (learners, teachers, authors, etc) subject to the resources and attributes. Each part of the model tree describes clearly as follows with respect of e-learning context [10][11][9].

A. License Authority

An authority is a person or a group of persons responsible to issue licenses in the form of rights. Generally senior managers in the systems act as authority. Obviously they have to act as per the policies of the organisation. The authority can also apply a digital signature or digital certificate on specific e-contents at the time of different transactions.

B. Grant

This represents the features in the package which is controlled by Digital Rights and conditions [5].

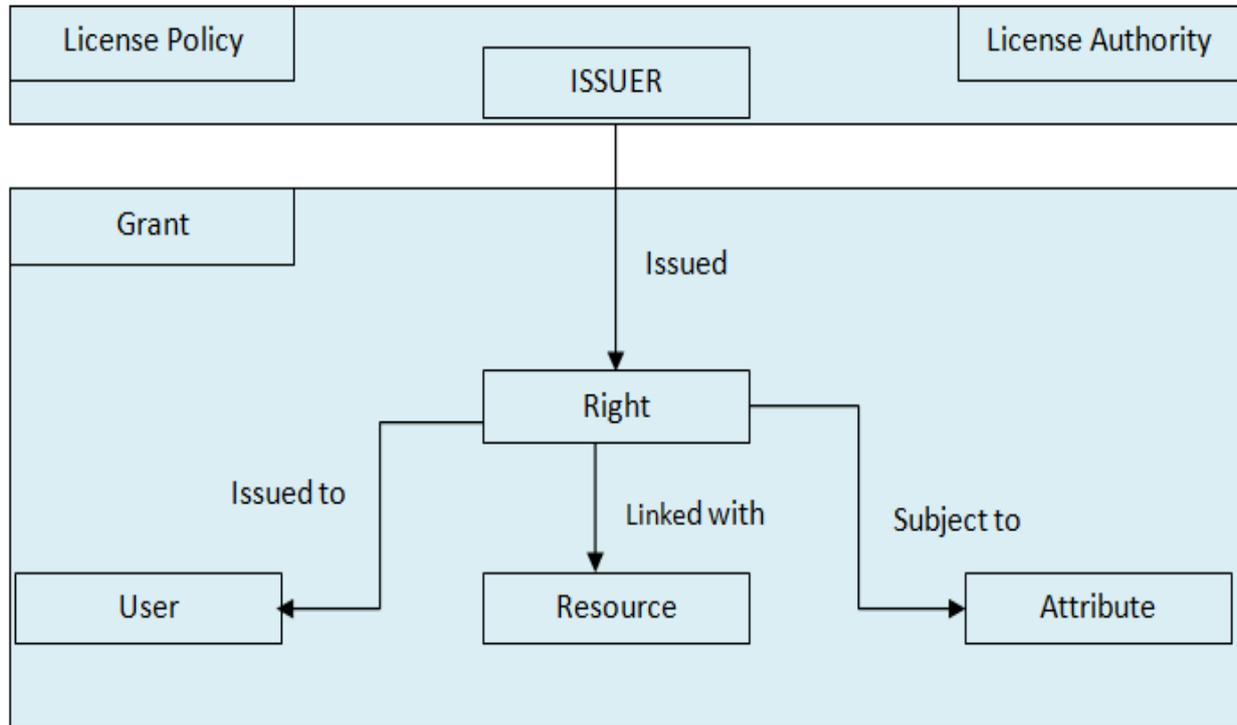


Fig 1: Model tree for DREL

C. Users

E-learning users are the learners, manager teachers and authors, to whom a right is granted and revoked (if required). Like teachers having right to upload lecture notes. Concerned students can download the lecture notes, e-mark sheet or e-certificate via DRM or other authentication. No two learners will be able to download same e-certificate, there must exist some separate decryption key or biometric authentication. Also there must be module to check the user's repetition access on same e-content.

D. Right

A right is the act that users can be granted to work out against some e-resource under some condition. Typically, a right specifies class of acts that users may perform on or using the associated resource. For instance, the e-Learning server provides a set of e-lectures with specific rights, such as read, print (certain number of times). This right element should be extensible, so that different rights for different applications can be defined and modified as per the requirement of the teachers/ authors of the learning system [10].

E. Resource

A resource is the "thing" to which users can be granted a right. A resource can be a digital work (such as an eBook, lecture audio or lecture video file, or any diagram), a service (such as a group e-mail service or SMS service for small e-notice).

F. Attribute

An attribute specifies the terms, conditions, and obligations under which rights can be exercised. For example, a simple attribute is a time interval within which a right can be exercised e.g. e-forms fill up for examination or e-registration. There always be a duration limit, max number of sessions, max number of users, max number of trials and last date after which learners are unable to access the e-content[7].

Let us continue with the example of DREL by e-notice as discussed in the paper of Barik. Let us consider a University is running e-Learning courses where all administrative posts like Registrar, Controller of Examinations and System Scientist are there. E-notice is same as notice announced by any e-Learning Institution. It must be uploaded in a server so that all concerned users can get an alert to view the content of the notice. If there is anything to be modified that can be done through the administrators of the e-Learning organization. Notice will automatically move to the back up server as discussed with some pre-defined scheduler send to user. Whole process must be supervised by the concerned Manager of the department. Two other DERL tags e-Registration and e-Certificate have been shown in the figure-2[1].

e-Notice	e-Registration	e-Certificate
View All users	Applicable Any user	Download/Print Authentic learner
Modify Administrators	Verify Administrator	Edit No user
Time Limit Certain period	Validity Life time	Duration Lifelong
Issuer Dept. Head	Issuer Registrar	Issuer Controller

Fig 2: DERL of e-notice, e-registration and e- certificate with respect to specific data model

III. DRM AND E-LEARNING ISSUES

Digital rights management issues related to e-Learning is essential to make the system more secure. There are many DRM issues related to e-learning documents. Few of them are described below[1]

- Authors may wish to make a paper free for academic use for their own organisation, charge a fixed amount for commercial users and others. Some kind of license key may be used
- Publishers may initially charge a fee for new resources then reduce a certain percentage of it after a specific time period. It may vary with respect to Authors, Learners or other academician.
- Examination bodies may make papers available for examination period only and to a specific group of users not for the others. All questions may be available very after completion of examinations.
- Educational contents often have multiple authors. Authors' institutions may have different policies for managing IPR, copyright and reuse.
- Aggregated resources will have multiple authors, rights and licences.

There are many instances in e-learning system where learners may alter e-content for experiment or for their own benefit. e.g. at the time of conducting tests, at the time of document production, learner may violate the format at the time of sending email, interacting with DRM package or posting to bulletin boards or blog.

There may be different issues (as discussed following) to maintain Quality of Services (QOS) and Reliability of the e-content. Some of them

- In the educational community attribution and quality service must have top priority.
- Reuse may only be permitted if authors are properly recognized.
- Re print/upload is also required if there is any temper of documents or manual mistake after proper verification
- Reliability is taking a vital role.

IV. DRM AND E-LEARNING SECURITY

Basic objective of the DRM package should be managing security keys or license key and distribution procedure to different users for the digital contents (say, notes, solutions, etc.), managing security of eBook and public domain documents from tampering. License Data Dictionary is responsible to store the details of these security keys. It also requires a supervision of critical document such as bank notes, passport, personal and family records[3]. To enhance security, DRM manager may apply encryption or digital signature on few or all e-contents. Also it is require to manage the e-content as well as maintain the log of each users and transaction of each users to maintain the non reputation. Quality services may be maintained the he feedback system, discussion form and user tracking system.

V. ARCHITECTURE

E-Learning Digital Right Management (EDRM) is a software which provides technologies to all online authorized users to access the e-documents from the server. Initially DRM was applied to manage only video and audio files but now it is used to protect all kinds of e-contents in the web services. Digital rights are always dynamic in nature. It varies upon the policies of the organization or situation e.g. in case of e-Learning system, the author has intellectual property rights where as the service provider i.e. institutions generally hold copyright protections on their study materials and lectures (in audio & video format). On the other hand students should have usage rights as they are only authorized persons to use those e-materials [2].

The figure-3 shows the architecture of TeDRM (Trust on e-learning Digital Right Management) which is basically related with the hardware, software, License database and technology. In e-Learning, transactions occur either from remote machine(s) or from centralized server(s), we will apply DRM technologies with cryptographic algorithm like digital signature, encryption, digital certificate etc. to ensure TeDRM strongly [4][6].

The proposed Trust on e-Learning Digital Right Management (TeDRM) framework contains four main parts as given below

A. E-content License Server

E-Content license server contains all the related e-contents as well as license of those contents. License generator will be responsible to generate user license and DERL tag (like the figure -2).It is the duty of the license storage manager to store all e- content and associated license code in the license database server.

B. Encryption Server

The main responsibility of the encryption server is to apply encryption on digital content, Signature of issuer, license code and DREL tag.

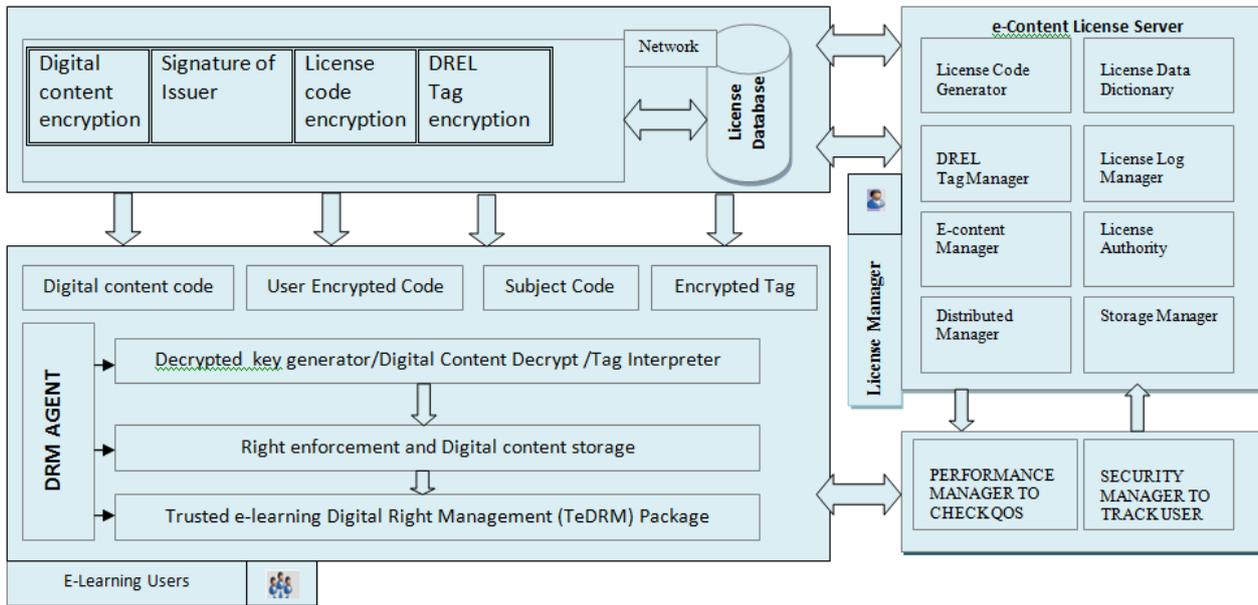


Fig 3: DRM Frame work (Architecture) for e-Learning System

C. DRM Agent

DRM agent will generate the decryption key for the encrypted content and interpreted encrypted DREL tag. Followed by all rights to be enforced on the digital content to create a trusted e-Learning Digital Right Management (TeDRM) package.

D. Feedback:

There will be two parts, one to look after the performance for the quality of services and another to track the users and to maintain logs for security purpose. These performances of Quality of Services (QOS) and user tracking will ensure the trust in the users mind.

The Table –I shows the Comparison of proposed DRM architecture with JIANGS’ architecture[2]

TABLE I
COMPARISON OF PROPOSED DRM ARCHITECTURE WITH JIANGS’ ARCHITECTURE

Attribute	Proposed DRM architecture	Jiang DRM architecture[2]
Copyright protection	High	High
License key	To all content	On some content
License Server	Exists	Not always
Issuer Signature	Exists	Exists
License encryption	Always	Not exists
E-Content encryption	Exists	Fully exists
REL Tag encryption	Always	Exists
Quality Assurance	Feed back	NA
Log file	Maintain	Maintain
License update	NA	NA

The proposed Architecture achieved the following securities

- **Key Security:** The license key is used in all encryption/decryption process in the TeDRM. This task is basically giving square protection to the key. This square wrapping protection of license key will keep the system as secured as possible[5].
- **Integrity:** License Integrity will be achieved by using Issuer digital signature. The entire license are signed by the issuer and verified in TeDRM.
- **Content Security:** The e-content are used by the encryption/decryption process in the TeDRM to keep the system as secured as possible.
- **Authentication:** DREL tag encryption will ensure the entity authentication as well as system authentication.
- **Availability:** As DERL is based on XML, it will be available to the learners.
- **Readability:** The DERL tag (Either in DPRL of XrML) enables the user to read the e-contents easily.
- **Trust on Users:** QOS and feedback will generate the trust in the users' mind in TeDRM.

VI. CONCLUSIONS

In respect to the trust, TeDRM provides strong control over the access to any kind of transaction of documents so that no user from top to bottom has any hesitation in using the received documents. Proposed DRM framework in ensure the all kind of key and data security. Maintain the integrity applying digital signature by the issuer. Encrypted DREL tag authenticated and makes it available to all kind users. Security lo manager and performance managers are responsible maintain quality of services by proving the feedback. We have just started our research in DRM security on e-learning data so we need travel long distance to initiate the solution of problems cost effective DRM or applications of DRM in independent domain, and multimedia data.

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