

CONTENT ROAMING SERVICE

The Methodology of using Digital Content across Devices

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Abstract: e-Book reading is very popular in nowadays so that people often use their laptop, smart phone or specific e-book reader (e.g. Amazon Kindle, iRex iLiad, and Apple iPad) to read anywhere. However, users always encounter the obstacles such as switching to different mobile devices and synchronizing the latest reading history. In this research, we proposed a separated license methodology to achieve the purpose of content roaming in order to not only overcome the users' obstacles, but also provide total technical solution to ebook businesses. The methodology includes four processes: 1) license release and deployment; 2) licenses verification; 3) content transfer and 4) tracking user's records, enabling user to transmit their licenses offline. Grounded on the research contribution, both the demand side and the supply side in ebook market could benefit from the seamless reading convenience and the copyright issues.

1 INTRODUCTION

Awareness and ownership of ebooks reading devices are growing, spurred by marketing campaigns from Amazon.com or Apple.com recently as well as press coverage and word-of-mouth buzz. Users nowadays possess various digital devices (e.g. desktop, laptop, smart phone, and specific e-book reader) to utilize abundant digital contents. However, there is a main obstacle to the user: content transferring. Users usually have to register all of his device information first to let the devices have the rights to open digital content and the device has to connect to internet first. To let the users have better reading experience than before. This research reveals a content roaming mechanism to enhance the usability between devices. Content roaming is a general concept that digital content and its related information can easily transferred between devices. In this research, we deal with the digital right transferring and reading log transferring. Digital Rights Management (DRM), is an access I/O mechanism which combines devices and software (Dahl and Kevorkian, 2001; DigitalConsumer.org). DRM sets the access for digital content and combines the access with storage media to protect the copyright of digital content from published, used to remove. DRM protect the digital content from pirated, however, there are pros and cons of this mechanism. When DRM protecting

the copyright also limit the behaviour of uses and make users feel inconvenient. For these reasons, mentioned in declaration of consumers' rights, consumers have the "Space-shifting" which implies they can convert or play their digital content on one device to another once their content were legally acquired.

In order to accomplish "Space-shifting", we presents a solution based on the methodology of separated licenses for digital copy protection. Separated license implies the mechanism to divide a single authorized license, for example Xml, ODRL, to multiple copies of licenses, the mechanism also includes the solution of release, deployment, verification and transfer as mentioned above. By implementing this methodology, digital content can be transferred through various devices without verified by distant servers. Besides, the personal use record can be converged seamlessly via separated license mechanisms to overcome the barriers of using digital content across various devices.

2 RELATED RESEARCH

Today, the importance of customer experience and customer satisfaction has attracted increasing attention as both the concerns of service design and development in service-related industry has been

extended to service science in recent years in order to provide multi-disciplinary topics improving the service quality for service-based businesses (Hefley and Murphy, 2008; Parasuraman et al., 1988). In order to thoroughly build customer-centered service systems, the initial requirement analysis plays an essential role in the system development life cycle. Thus service blueprinting is the study of service systems design, which aims at the application of scientific, management, and engineering disciplines to improve service systems, particularly those involved in complex, IT-enabled services (Hefley and Murphy, 2008).

In addition, a DRM system usually involves four parties. First, content providers offer content; they own and want to protect its copyright. Secondly, distributors acquire digital content from content providers and deliver digital content to consumers' devices. Thirdly, clearinghouse operates the financial transaction as well as record status of users' licenses. Lastly, consumers acquire and use digital content in rules of use such as download or streaming. Based on different business models, DRM construct and adjust various structures for copy-protected digital content. One of famous examples is Microsoft Media Digital Right Management Software, which connected with Windows Media Player. Microsoft Media Digital Right Management Software, which combines windows media player, when users play protected digital content (e.g., audio or video), management software connects to access control center (also called rights issuers) to get the license to play the digital content. Other business cases, for example, Adobe's ADEPT also integrates electric reading devices to implement the purpose of e-books copy-protected technology. In application researches of offline copyright management, Sarmenta et al. (2008) presented the methodology which assisted through hardware devices, can verifies the number of times been used in offline status. Moreover, Kravitz and Messerges (2005) proposed 5 processes to deliver that digital content can be used through devices and copyright can also be protected, most of these processes, put their emphasis on discussion and design the content delivery between two endpoints, or communication process of permission request and content encryption. However, these 5 processes limited mentioned the topic of offline content and copyright management by designing separated licenses.

3 RESEARCH PROPOSTIONS

3.1 Service Analysis

In this research, service blueprinting tool is adopted to discover the fail points of an e-book user in his daily life. A service blueprint emphasizes different systemic layers overlapping in a service, from the layer of customer interaction and physical evidence to the layer of internal interaction within the service production process (Shostack, 1982; 1984). Accordingly, we depicted user's reading behaviour during a day after observing approximately 20 focus users. Take a knowledge worker's profile for instance, user may read news in the beginning of his day. In this morning time frame, eReader is the contact device of front stage (i.e. the visible artifact which user contacts). The back stage is the requested news downloading function of this eReader while the informational website is the support process to sustain the operation infrastructure. Based on collected users' behavioural data, the blueprinting figure reveals a major fail point that user feels inconvenient in switching their devices to read the same digital content. The phenomenon is usually happened when users need to use their mobile devices outside and to use desktops/laptops back to home or in office. The content in this switching moment is the same but the display devices could be multiple so that reading services should be synchronized within various devices in order to assist users to have seamless reading experience.

3.2 Content Roaming Architecture

To eliminate the above fail point, there are two important problems. One is to make the digital content transfer legally, the other is to let users switch their devices and receive the reading content easier than before. We propose a "content roaming" concept to reach a new level of e-reading. Content roaming represents that digital content can be used by different devices legally and seamlessly. This research presents a digital copy-protected solution which is based on the concept of separated license to implement legal transferring. The core concept of this methodology builds on separating traditional single license to Information license, Control license and adds Journal license.

In Figure 1, after distributed into different components, different separated licenses will pick out required data to be verified in verification stage. The details of essential modules are illustrated as follows.

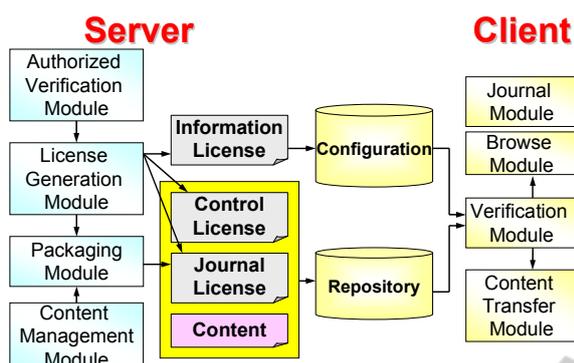


Figure 1: Methodology Structure.

License Generation Module: This module aims at generating and encrypting separated license. Separated license contains information license, control license and journal license. After licenses generated, license generation module encrypts the licenses and transfers to the configuration and repository on client side.

Packaging Module: The main function is packaging 1.Control licenses, 2.Journal license, 3.Digital content and 4.Prefixes for describing DRM information and packaging into a single format to release, in which, Prefixes are plain texts. Control licenses and journal licenses are encrypted with RSA encryption. The digital content is encrypted with AES encryption.

Configuration: Configuration on client side stores all verified information licenses. After generated and encrypted, information license will be transferred to client side and stored in configuration of client side.

Repository: This is a storage unit for digital content storage. Both control license and journal license will be sent to packaging module and packaged into deployment format.

Verification Module: This module will capture the information hidden in information license, control license and journal license, to verify the access.

Content Transfer Module: This module provides copyright protection mechanism. The main task ensures information license transaction can be executed safely and digital content be transferred correctly.

4 SERVICE DEMONSTRATION

In this section, we based on the above methodology structure to illustrate the three fundamental functions.

4.1 Release and Deployment of Separated License

According to the objectives of content roaming, this research designed a mechanism for separated license release and deployment. The core concept is dividing and deploying separated license into different components. Meanwhile, the information components and elements which the license located can be highly connected; moreover, mechanism also enables to encrypt and capture necessary information in verification period.

- (1) Client send download request to server.
- (2) Server Processes identity and access verification after receiving the download request.
- (3) Generate separated license: Information license, control license and journal license when the identity and access has verified.
- (4) Deploy information license to configuration on client side; Send control license and journal license to packaging module.
- (5) Packaging module obtains digital content from content management module.
- (6) Package control license, journal license and digital content into the file in deploy format.

4.2 Verification of Separated License

The verification mechanism of separated license is dissimilar to which of traditional single license.

- (1) Certify identity by information license. Take hardware ID, software ID user account and password apart to process identity certification.
- (2) Confirm access after passed identity certification.
- (3) Identify the access of control license and journal license. Control access encrypted and acquired from control license, browse record encrypted and acquire from journal license. Access verification will be finished after control access and browse record matched.
- (4) After access identification passed, browse record will be sent to journal module.
- (5) Journal module writes browse record into journal license.
- (6) Confirm (5), then open browse module and digital content.

4.3 Digital Content Roaming

The design for separated license deployment enables the function of digital content roaming; transaction transfer is the key of the design.

- (1) After original and new devices connected, ID of new device's hardware and software can be obtained, so that a new information license is also generated.
- (2) Generate transfer record, and attach transfer record to new information license.
- (3) Prepare to deploy new information license to new device, and save in configuration.
- (4) Execute (3).
- (5) Send request to abolish data license.
- (6) Abolish original data license.
- (7) Request digital content transfer.
- (8) Acquire file from repository in original device.
- (9) Transfer the file to repository in new device.

5 CONCLUSIONS

People nowadays have different kinds of digital devices to access abundant digital contents at various locations including desktop at home, smartphone on the bus, eReader on the way, and son on. Hence, the content transferring legally is an important issue to deal with. We first employed the service blueprinting tool to discover users' potential needs in digital reading. Also we discussed the usage of offline content and presented the methodology of separated license distribution for using digital content across mobile devices and synchronizing the use record. In this research, we proposed a robust solution for licenses distribution and encryption method, in addition, the system implementation of license release and deployment, license verification on client side, content roaming (transfer) across devices are also explained above. For transferring copyrights and usage, there are limits and difficulties still existed in digital right management. However, our proposed methodology assists digital content to transfer among different devices without connecting to distant server for verification. Furthermore, personal usage can be recorded in journal license through the design of separated license which can control the access without connecting to server side to rewrite the use access (e.g., frequency of use), meanwhile, use progress of digital content (e.g., the chapter or page number been read for the last time) can also be synchronized across two devices to diminish the barrier of record synchronization across

devices and to reach the seamless use experience for digital content.

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