Chapter I
Rights Expression Languages

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ABSTRACT

Rights expression languages (RELs) form a central component of digital rights management (DRM) systems. The process of development of RELs transforms the rights requirements to a formal language ready to be used in DRM systems. Decisions regarding the design of the conceptual model, syntax, semantics, and other such properties of the language, affect not only each other, but also the integration of the language in DRM systems, and the design of DRM system as a whole. This chapter provides a detailed analysis of each step of this process and the tradeoffs involved that not only affect the properties of the REL, but also the DRM system using that REL.

INTRODUCTION

Every time there has been progress in the ability to make copies of some intellectual work, the need for copyright has arisen. Traditionally, copyright has been expressed using natural languages, in sufficient detail, so as to have standing in a court of law. The advent of computers, the Internet, and digital content, has created the need for management of copyright electronically, also known as digital rights management (DRM). To manage copyright electronically, it is necessary that copyright agreements be expressed in a machine-readable form. Computers or intelligent devices can then interpret copyright agreements, and ensure that usage of copyrighted digital content is in accordance with the copyright agreement associated with the content. In DRM terminology, languages used to express copyright agreements in a machine-readable form are called rights expression languages (RELs).

Over the past several years, a number of RELs have been developed, with the eXtensible rights Markup Language (XrML) (“XrML 2.0 Technical Overview”, 2002) and the Open Digital Rights Language (ODRL) (Iannella, 2002) becoming
the most popular. Recently, XrML was adopted as the standard REL for inclusion in the MPEG-21 standard (“The MPEG-21 Rights Expression Language”, 2003) and ODRL was accepted by the Open Mobile Alliance as the standard REL for mobile content (“Enabler Release Definition for DRM V2.0.”, 2003). Nevertheless, these RELs have not been extensively used in applications, despite the fact that many businesses suffer from problems that could be solved using appropriate DRM technologies. For instance, Apple and Microsoft have created their own lightweight DRM technologies, iTunes and Windows Media DRM, respectively, that do not make use of any commercially available REL. Lack of standardized general purpose RELs has been one of the major reasons for the fragmented nature of the DRM industry.

The fragmented nature of the DRM industry, in turn has led to a lack of interoperability, and this is one of the major reasons for limited acceptance of DRM among content users. RELs play a major role in influencing the design of DRM systems. To understand the problems with DRM systems, it is therefore necessary to understand the process underlying the development of RELs, along with their role in DRM systems. There are many aspects to the process of developing a REL, which aims to map the rights requirements to a machine-readable language that is sufficiently expressive to capture these requirements. These properties include the structure, syntax, and semantics, among many other features of RELs. In this paper, we study the factors that influence the design of RELs, in terms of these properties, and how these properties, in turn affect each other and the design of DRM systems.

There has been other literature on this topic, especially ones that provide a comprehensive survey of RELs. Coyle (2004) provides an overview of the different elements of RELs along with important ways to analyze RELs. The discussion is based on four leading REL initiatives of the time, namely, ODRL, XrML, Creative Commons and METS Rights. Guth (2003) provides a similar analysis of RELs, along with additional discussion on applications supplemented with examples on sample licenses of different RELs. Barlas (2006), similarly, provides a comprehensive discussion on the role of RELs, along with an explanation of different RELs along with various standards adopted. Wang (2005) provides an analysis on the design principles of RELs, in which several issues such as interoperability, extensibility, identification, etc. are discussed. Jamkhedkar, Heileman, and Martinez-Ortiz (2006) provide another view for the design of RELs, in which they propose refactoring and simplification of RELs to allow easy interoperability and formalization. This paper provides a different approach in which it discusses different stages in the development of RELs, along with an emphasis on formal rights expression calculus.

The rest of the paper is divided into four sections followed by the conclusions. The following section provides the history of the attempts to develop RELs, along with the current RELs developed in industry and academia. This is followed by a section that provides an overview of the process of the development of a REL. After that we discuss the development of a conceptual model for rights, and the issues involved in the process. In Section “Formalization of RELs”, we discuss two types of RELs, namely XML-based and logic-based, and how formalization is achieved in these RELs. This is followed by a discussion on, how the decisions in the process of development of RELs affect the DRM system properties such as trust management, interoperability, and other system properties. Finally, we provide some useful conclusions.

AN OVERVIEW OF RIGHTS EXPRESSION LANGUAGES

Some of the earliest attempts to develop a formal language for expression of legal discourse date
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