# MPEG-21 Rights Expression Language: Enabling Interoperable Digital Rights Management

**Xin Wang**
*ContentGuard*

The Internet has spawned a revolution in the way people distribute content and access services. At the same time, the availability of broadband and wireless networks has increased, as have the capability and portability of computing and consumer electronic devices. These factors have fueled the development of new technologies to automate, manage, and secure content flow and service access over the Internet. The recently approved ISO standard, MPEG-21 Rights Expression Language (REL), is one such technology.[1] This language is precise, flexible, extensible, and rich in expressing rights. Thus, it can support reliable, flexible, and cost-effective interoperable digital rights management (DRM) systems and applications for electronic commerce and enterprise management of content and services. (See the "Benefits of Having an REL in Digital Rights Management" sidebar for the importance of an REL for DRM systems.)

## Objectives

The MPEG-21 REL is an XML-based rights expression language for specifying terms and conditions regarding the authorized distribution and use of any content, resource, or service. Its goals are to

▧ define a machine-interpretable language's syntax and semantics to specify rights unambiguously;

▧ provide an authorization model to determine if a principal has the right to act on a resource according to REL expressions; and

▧ support many business models in the end-to-end distribution value chain.

The MPEG-21 REL provides flexible, interoperable mechanisms to support transparent, augmented use of digital resources in publishing, distributing, and consuming digital content while protecting such content and honoring the rights, conditions, and fees specified for that content. The MPEG-21 REL also specifies access and use controls for digital content when financial exchange isn't part of the terms of use, and it supports the exchange of sensitive or private digital content.

This language isn't just for the entertainment industry. Enterprises and individuals can use it to enable the authorized distribution and persistent protection of valuable data, content, and resources in accordance with privacy and confidentiality requirements. The MPEG-21 REL must also be rich enough to express a wide variety of business models and to enable multitier distribution and use of all types of digital content.

## Key concepts

The MPEG-21 REL's primary function is to specify rights regarding digital resources. Using this language, anyone owning or distributing digital resources can identify which principals (users, groups, devices, systems, and so on) may use those resources, the rights available to those principals, and the terms and conditions regarding the allowable exercise of those rights.

For example, consider a movie, *Ocean Wilds*, distributed by the Acme Studio to Alice, an owner of a DVD player. A typical MPEG-21 REL expression might make the statement, "Under the authority of Acme Studio, Alice is granted the right to play *Ocean Wilds* during November 2003." Figure 1 shows this simple REL expression in its structural form. In MPEG-21 REL terminology, Alice is a *principal*, "to play" is a *right*, ocean-Wilds.mpg is a *resource*, "during November 2003"

## Benefits of Having an REL in Digital Rights Management

Digital rights management involves a collection of hardware, software, services, and technologies for persistently governing authorized distribution and use of content and services according to their associated rights. It also involves managing consequences of that distribution and use throughout their entire life cycle or workflow. Developing effective and efficient DRM systems requires the ability to specify and communicate rights information among participants at each step of the life cycle or in the workflow. For example, a content user must know which rights are associated with a piece of content. A content distributor must communicate which rights are available for consuming the content and must understand which rights pertain to distributing that content. A content provider that's upstream of the supply-distribution-consumption value chain must ensure the precise granting of both use and distribution rights as intended for every participant in the end-to-end value chain.

Thus, a common rights expression language (REL) that can be shared by participants in the workflow and life cycle is essential for more than just interoperability. It's also essential for conveying to the participants that rights will change during the workflow and life cycle as content moves from the creator to the aggregator, the distributor, the retailer, and the consumer. Finally, a common REL is essential for resolving system issues such as authentication and trust that are necessary to validate rights expressions' authenticity, integrity, and trustworthiness.

```
license
    grant
        Alice
        play
        oceanWilds.mpg
        during November 2003
    issuer
        Acme Studio
```

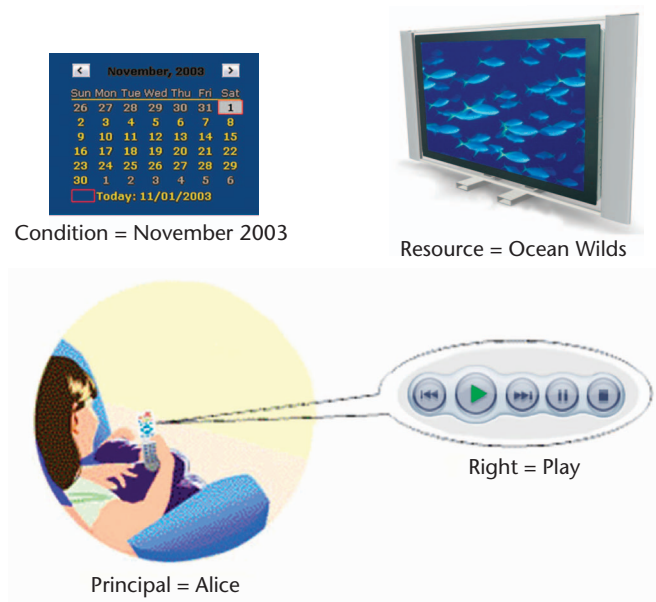*Figure 1. Example of a rights expression language (REL) expression.*



Condition = November 2003

Resource = Ocean Wilds

Right = Play

Principal = Alice

*Figure 2. Elements involved in the license allowing an owner of a DVD player (Alice) to plays a movie (Ocean Wilds) in November 2003.*

is a *condition*, and Acme Studio is an *issuer* of the right, as Figure 2 shows.

Although this example is simple, it captures the essence of every MPEG-21 REL expression. A *principal* encapsulates the identification of a party to whom a right is granted. When this element is omitted, the grant goes to any party. A *right* enables the granting of a principal to exercise against a resource under some condition. Typically, a right specifies an act (or activity) or class of acts that a principal may perform on the associated resource, or using those resources. The MPEG-21 Rights Data Dictionary provides a list of rights for multimedia content.[2] A *resource* is the object of the right granted to a principal. Examples include a digital work (such as an e-book, an audio or video file, or an image), a service (for example, an e-mail service or a B2B transaction service), or even a piece of information (such as a name or an e-mail address) that a principal can own. A resource can also be a grant, and in this case a right about the grant can be specified within the parent grant. A *condition* specifies the terms, conditions, and obligations for exercising a right. A simple condition is a time interval for the exercise of a right. A slightly more complicated condition might require the existence of a valid, prerequisite right that some trusted entity has issued. When there are no conditions, the associated right can be exercised with no constraints. An *issuer* is an element in a license that identifies the principal who issues the license. The issuer can digitally sign the license, signifying that the issuer does indeed bestow the grants contained in that license.

The right-granting portion of the statement, "Under the authority of Acme Studio, Alice is
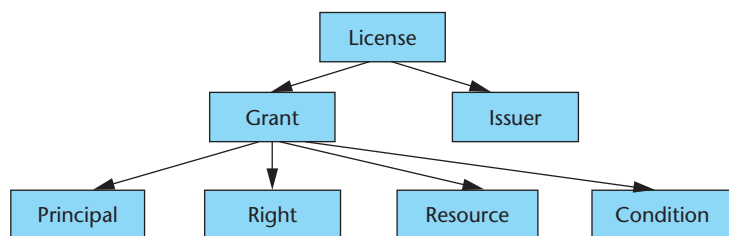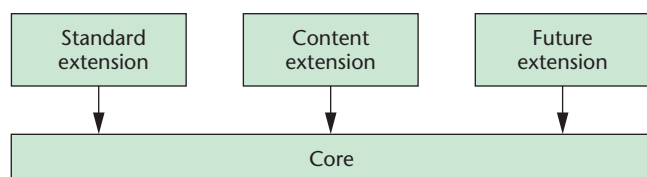
*Figure 3. Data model of a license.*



*Figure 4. Extensibility structure of the MPEG-21 REL.*

granted the right to play *Ocean Wilds* during November 2003," is a *grant*, and the entire statement is a *license*, which in this case includes both the grant and the issuer. A *grant* is the element in the license that essentially gives a right to a principal over a resource, subject to a condition. A *license* is a container of grants, issuers, and some other related information. Conceptually, a license is the issuance of grants by their issuing party.

These basic elements and the relationships between them constitute the MPEG-21 REL data model, which Figure 3 shows. Additional elements related to issues such as variable declaration and reference, delegation control, and revocation are available in the REL.[1]

### Extensibility and profiling

The MPEG-21 REL's key elements (principal, right, resource, and condition) are extensible. Defined using the XML Schema and the World Wide Web Consortium's namespace recommendations, the MPEG-21 REL is itself specified in extensions. Figure 4 shows its various architectural parts.

The core contains definitions of general constructs at the heart of the REL's authorization model. The standard extension contains definitions of concepts generally and broadly useful and applicable to DRM usage scenarios. The multimedia extension contains definitions of DRM concepts (for example, rights, resources, and conditions) specifically related to multimedia content such as books, music, and video. Other parties may define their own, possibly domain-specific, extensions to

the MPEG-21 REL and its future extensions. They can accomplish this using standard, existing XML schema and XML namespace mechanisms.

Although many communities will likely create extensions to the baseline MPEG-21 REL, it's also possible to profile the language according to its definition flexibility and extensibility structure.[3] This involves creating a subset of the language for a specific purpose. As content moves through the value chain down to many different devices, this profiling capability will become important. For example, the language's full power won't be necessary for a mobile phone, as it would for a PC, so a slimmer version of the REL—a profile—should be available to express usage rights. Thus, it's possible to exploit the MPEG-21 REL for a range of applications, from powerful servers to lightweight consumer devices.

### Expressiveness

The MPEG-21 REL has rich expressiveness in terms of business models and the potential applications it supports. Some common types of licenses that the MPEG-21 REL can express include usage, offer, distribution, and certificate.

### Usage license

A usage license certifies that the issuer authorizes the principal the right to exercise the specified usage right on a resource if the stated conditions are met. A usage license contains rights such as *play* and *edit* for content use. For example, the usage license in Figure 1 grants a principal, Alice, the right to play a movie for the month of November 2003.

### Offer license

An offer license expresses that a certain principal has the right to obtain other rights by meeting a set of listed conditions. The offer license uses "obtain" as the right, and treats as resources the other rights being offered in the form of grants. For example, the license in Figure 5 gives Alice an offer to obtain the usage right to play a movie for the month of November 2003 if she pays a flat fee of $4.00.

### Distribution license

A distribution license expresses that a certain principal has the right to issue particular other rights to other principals, provided the principal abides by a set of conditions. Content owners can use distribution licenses in the distribution value chain to allow distributors to distribute content.

```
license
    grant
        Alice
        obtain
        grant
            Alice
            play
            oceanWilds.mpg
            during November 2003
        flat fee $4.00
    issuer
        Acme Studio
```

*Figure 5. Example of an offer license.*

```
license
    grant
        somemoviewarehouse.com
        issue
        grant
            anyone
            play
            oceanWilds.mpg
            during November 2003
        per use fee $3.00
    issuer
        Acme Studio
```

*Figure 6. Example of a distribution license.*

```
license
    grant
        Alice
        possessProperty
        movieClubMembership
    issuer
        Acme Studio
```

*Figure 7. Example of a certificate license.*

Distributors can use such licenses to let retailers sell content. For example, the distribution license in Figure 6 shows that Acme Studio grants a company, somemoviewarehouse.com, the right to issue to any other principal the right to play a movie for the month of November 2003, if that company pays a fee of $3.00 for every such issuance.

### Certificate license

A certificate license represents the issuer's assertion that a principal possesses some properties (for example, roles and attributes). The right to possess property characterizes a certificate license. In many cases, a principal is required to possess this kind of license before being granted other rights. For example, in Figure 7, the issuer certifies that Alice is a member of a certain movie club.

### Conclusion

The MPEG-21 REL is an international standard for expressing and interpreting rights for using and distributing content, resources, and services. As an enabling technology for interoperable DRM, its adoption by industry and incorporation into products will certainly take time. The challenge is to proliferate the REL's adaptation across many different DRM systems as well as conditional access and authorization systems. Moreover, the REL must pervade not only entertainment but also many other applications, such as enterprise, medical information, and even privacy protection. **MM**

## Further Reading

For more information about MPEG-21, including overviews, FAQ sheets, and working documents, see http://www.chiariglione.org/mpeg. In addition to the MPEG-21 Rights Expression Language (REL) specification,[1] educational material for the MPEG-21 REL is available at ContentGuard's Web site.[2] This material includes basic and advanced feature examples of the language, simple and complex real-world use cases, and design guideline papers for real-world applications, such as creating extensions and profiles. It also features an MPEG-21 REL online license creation demonstration and an interpretation software developer's kit (an SDK for interpreting REL expressions).

### References

1. *ISO/IEC 21000-5:2004*, "Information Technology: Multimedia Framework, Part 5: Rights Expression Language," Int'l Organization for Standardization (ISO) and Int'l Electrotechnical Commission (IEC), 2004.
2. "MPEG REL Resources," ContentGuard; http://www.contentguard.com/ MPEGREL_reference.asp.

## References

1. *ISO/IEC 21000-5:2004*, "Information Technology: Multimedia Framework, Part 5: Rights Expression Language," Int'l Organization for Standardization (ISO) and Int'l Electrotechnical Commission (IEC), 2004.
2. *ISO/IEC 21000-6:2004*, "Information Technology: Multimedia Framework, Part 6: Rights Data Dictionary," Int'l Organization for Standardization (ISO) and Int'l Electrotechnical Commission (IEC), 2004.
3. "Profiling MPEG Rights Expression Language: Concept, Approach and Application," ContentGuard, 2003; http://www.xrml.org/reference/ MPEG-REL-Profiling.pdf.

*Readers may contact Xin Wang at xin.wang@ contentguard.com.*

*Contact Standards editor John R. Smith at jsmith@us. ibm.com.*