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Geospatial Digital Rights Management (GeoDRM)

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How can we manage and protect the distribution of geospatial content as it moves through present and future distribution chains, across decentralized networks?

ABSTRACT:
Efforts to manage data ownership and data rights in the digital environment are of great interest to a broad range of geospatial data providers who need to control access to their data and how it is used. To date, lack of such control has been a barrier to broader adoption of Web based geospatial technologies. This article discusses current industry trends in addressing digital rights management (DRM) and describes work to advance data ownership issues within the Open GIS Consortium, Inc. (OGC) member-driven process.[1]

SIDEBAR:
GeoDRM: Persistent management and protection of digital content under a set of licensed rights and conditions. Consider this as providing positive control over geodata access in the dimensions of rights, space, and time.

How can we manage and protect the distribution of geospatial content as it moves through present and future distribution chains, across decentralized networks?

[1] This article is excerpted in part from "Open Digital Rights Management for Geodata -- Open GIS Consortium, Inc (OGC) Business Development Plan For Digital Rights Management," 21 December 2003, a document prepared by OGC staff in consultation with the Open Data Consortium (www.opendataconsortium.org), the GeoData Alliance (www.geoall.org) and the US Federal Geographic Data Committee (www.fgdc.gov).

GeoDRM supports geodata markets and "free" geodata libraries

As geodata becomes more widely available in digital form over the internet, it becomes easier to distribute, share, copy and alter. While this is generally a good thing, many organizations involved in the production and trading of geodata need to be able to protect their Intellectual Property (IP) assets as they move through the digital distribution value chain. In the world of e-commerce, access to geodata is treated as a commodity to be priced, ordered, traded and licensed. Organizations want to specify, manage, control and track geodata distribution within safe, open and trusted environments. To enable broader distribution and use of geodata while protecting the rights of producers and users, the industry needs a system of operating agreements and interoperable technologies.

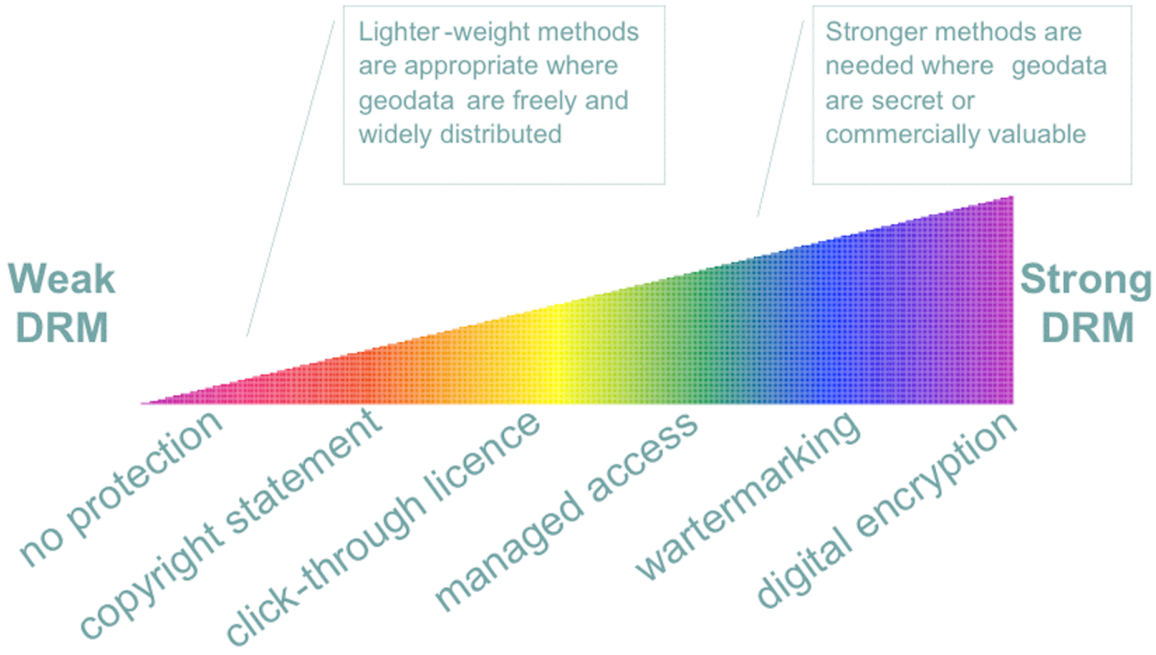

Figure 1 Ways of managing and protecting Intellectual Property

Direct monetary reward is often not the motivation or is only a minor motivation behind the desire for more rigorous control of IP assets. Prof. Harlan Onsrud of the University of Maine at Orono argues for the GeoData Alliance that the incentive structures implicit in "library systems" are an appropriate model for motivating data producers, collectors and traders to document, share and otherwise disseminate their geodata[2]. Onsrud observes that the library model of seemingly ad hoc agreements among stakeholders supports "…strong public goods, access and equity principles while fully protecting the intellectual property rights of authors and publishers." Onsrud envisions the establishment of a framework of operating agreements, similar to that in which libraries develop and share resources, as one way for geodata to be more accessible and useful to larger numbers of users.
Within the GeoDRM working group we are developing a GeoDRM Abstract Rights Model (ARM) that encapsulates the key concepts, roles and processes needed to manage and protect

[2] [2] Harlan Onsrud, "Exploring the Library Metaphor in Developing a More Inclusive NSDI." http://www.geoall.net/library_harlanonsrud.html

Intellectual Property. The objective is to develop a GeoDRM framework which supports the concept of distributed rights management, but is independent of specific business model, policy and technology.

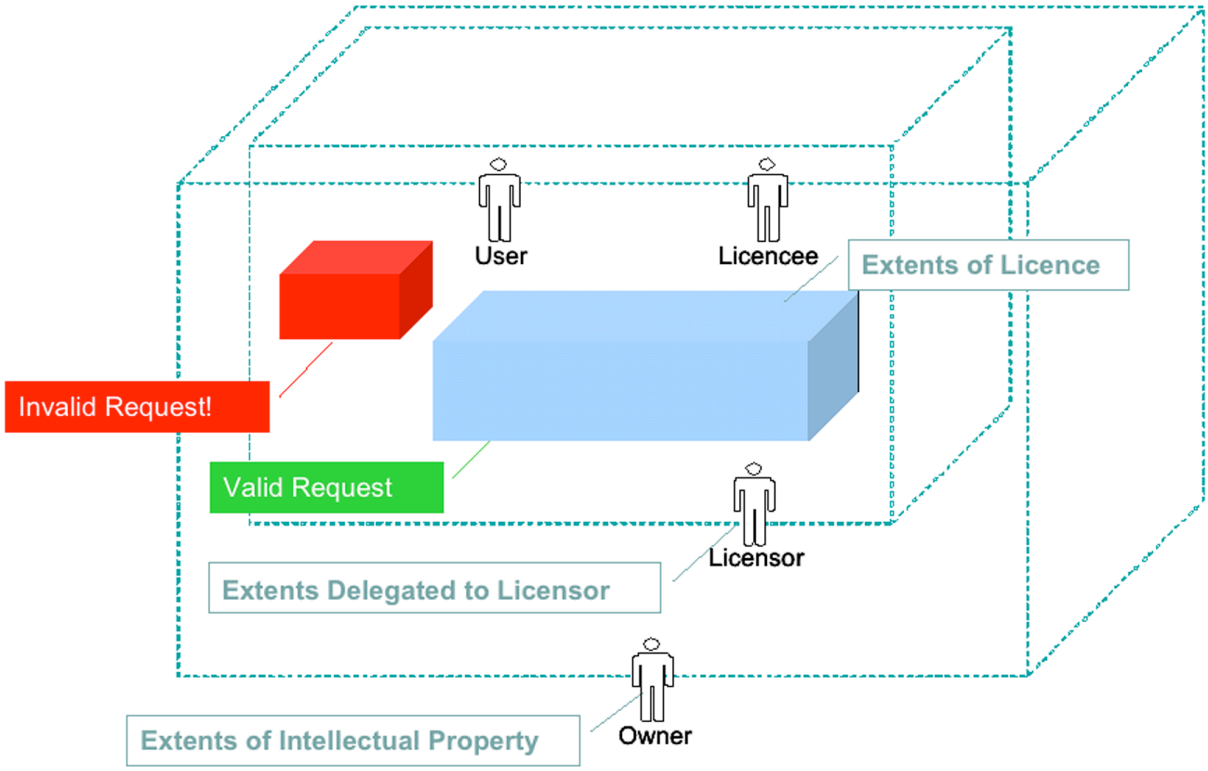

Figure 2 GeoDRM Abstract Rights Model (ARM)

Our model of rights management projects intellectual property into the three dimensioned world of rights, space and time. “Extents” define a block of intellectual property within those dimensions. Managing an protecting intellectual property becomes analogous to the way we license the rights to use real estate in the real-world. *Owner* of a block of intellectual property, may choose to use a *licensor* to generate licenses and distribute to the *licensee*, who in turn may ask the end user to perform some task within the constraints defined by that license. When a user requests access to data, content providers may then enforce that license at the point of distribution. License enforcement becomes the mechanical process of checking the extents of a request falls within the extents of the license.

Our goal is to define standard components within the framework to support key functions such as authentication and authorization, licensing, pricing and ordering, encryption which support the broad spectrum of business models within the geospatial community and may be implemented using existing DRM technologies.

Scenario

Imagine the year is 2008 and the Smallville Conservation Commissioner wants to include the Smallville bounding box portion of the Provincial Transportation map in a Protected Parcels Map on the Commission's web page. The Protected Parcels Map will be provided to the public only for viewing, printing, and copying as a simple screen image. By policies of Smallville and the Province, the actual Protected Parcels data and Transportation Data are not meant to be available online to citizens except by special permission.

The Commissioner is able to get the requested data by a simple web-based transaction that manages various parties' rights to the data. Though it is simple for the Commissioner, the underlying Web Services that enable the transaction are complex, and they represent years of work in the OGC and other standards organizations. Consider the "services" that must be enabled by standards before this vision of data sharing can become a reality:

1. Accessing the Broker Service on a data portal, the Commissioner keys in the rights she would like to have. She requests transportation data within the bounding area.

2. The Commissioner's request (including the access rights portion of the request) makes the Commissioner aware of a distributor who distributes provincial transportation data according to usage rights specified by the Provincial Transportation Authority, the content provider.

3. After the Commissioner clicks to initiate the transaction, a Packaging Service (which could be on the distributor's server but is probably on a packaging service provider's server) encrypts and "packages" the digital content into the format supported by the DRM system the distributor uses.

4. The protected content is transferred to the Distributor Service, which could be a web server or streaming server, for on-line distribution to the Commissioner.

5. The Distributor Service requests a digital license from the Certification Service used by the distributor.

6. The digital license containing content decryption keys and usage rules is sent to the distributor. The usage rules specify how the content may be used, such as copy permit, pay-per-view, a one-week rental, etc.

7. The Commissioner's client application downloads the digital content from the web server (or the client might request streaming content from the streaming server). To use the protected content, the user has to request a valid license from the distributor.

8. After receiving the request for a license, the distributor verifies the user’s identity using an Authentication Service, and charges the user's account based on the content usage rules.

9. The license is delivered to the client application by the Content Provider Service after the user has paid through the e-commerce Payment Service.

10. The client application decrypts the content and uses it according to the usage rights in the license.

11. After the transaction is complete, the distributor, using a Tracking Service, generates transaction reports which it sends to the Content Provider.

In this use case scenario, the Broker Service, Packaging Service, Distributor Service, Certification Service (which might include Rights Service, Licensing Service and Tracking Service), Authentication Service, Content Provider Service, and Payment Service are all Web Services (see sidebar) that operate through, and are largely defined by, consensus-derived open interfaces. These are the "nuts and bolts" of GeoDRM. The basic non-geospatial elements of some of these services have been defined and approved in standards organizations like W3C and OASIS. The OGC membership is building the geospatial extensions, or defining new GeoDRM services where necessary.

Core concept: digital licenses

The core concept in DRM is the use of digital licenses. Instead of buying the digital content, the consumer purchases a license granting certain rights with respect to the content. A license is a digital data file that specifies certain usage rules for the digital content. Usage rules can be defined by a range of criteria, such as frequency of access, expiration date, restriction of transfer to other devices, printing permission, copy permission etc. These rules can be combined to enforce certain business models, such as rental or subscription, try-before-buy, pay-per-use, etc. Protected content can be distributed though a client/server system, super-distribution2, digital audio/video broadcasting, or CDs. Without possessing digital license to the content, digital content is a sequence of scrambled bits. Often digital content and licenses are stored separately, which makes the system more flexible in a way that protected content can be freely distributed amongst users and license requests can take place later. Through digital licensing, content providers can gain much more control over what the consumer can do with the content.

DRM covers a broad spectrum of capabilities and underlying technologies supporting description, identification, trading, protection monitoring and tracking of all forms of rights usages for digital content assets. DRM is closely integrated with Content Management System (CMS) technology for creating metadata, storing and organizing digital content in support of workflow, search, browse, access and retrieval processes by users in workgroups, enterprises and information communities.

SIDEBAR:
What are Web Services? Web services are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web. Web services perform functions, which can be anything from simple requests to complicated business processes. Once a Web service is made available online, other applications (and other Web services) can discover and invoke the service.

SIDEBAR:
What are OGC Web Services (OWS)? The OWS Service Framework (OSF) identifies services, interfaces and exchange protocols that can be utilized by any application. OGC Web Services are implementations of services that conform to OGC's OpenGIS Implementation Specifications. Compliant applications, called OpenGIS Applications, can then "plug into" the framework to join the operational environment.

A complex task

The specific requirements for protecting IP rights by controlling geodata distribution and use are complex and vary with factors such as:

- The "business" of the organization (i.e., the motivations of commercial, public-sector, and academic organizations to make their geodata available)

- The type of data and media formats (e.g., physical, electronic, text, graphic, audio, video, vector, raster, observation, etc.)

- The content distribution channels (e.g., size of content, network bandwidth, types of end devices)

- The types and granularity of intellectual property rights to be protected and the contractual obligations for its use (e.g., unlimited distribution, license to use, license to reuse parts, limited distribution, sensitive/classified, etc).

An enabling technology standards foundation must be designed to meet the many requirements expressed in use cases put forward by OGC members.

A standards foundation for GeoDRM

Safe, open, interoperable and trusted environments for distribution and use of geodata require adoption of industry-standard specifications for the services described in the user scenario at the beginning of this article.[3] Content management and distribution platforms must be able to support multiple DRM technologies, insulating content owners from having to develop customized software applications to accommodate the underlying DRM technology or require specialized DRM expertise and construction of new distribution infrastructures. DRM solutions for geodata distribution and use must provide support for multiple content types and channels, including file-based and streamed documents, images, audio, video, software and email. Solutions must include adoption of suitable rights expression languages, extended or profiled for specialized geodata requirements and existing metadata standards.

[3] Successful GeoDRM also requires agreement on the definitions of rights, transaction models, etc. Confused legal semantics are not resolved by consensus on technical standards. An analogy might be a working telephone system connecting 100 people who have no language in common. [SHOULD WE EXPAND THIS TOPIC AND MAKE IT MORE THAN A FOOTNOTE?]

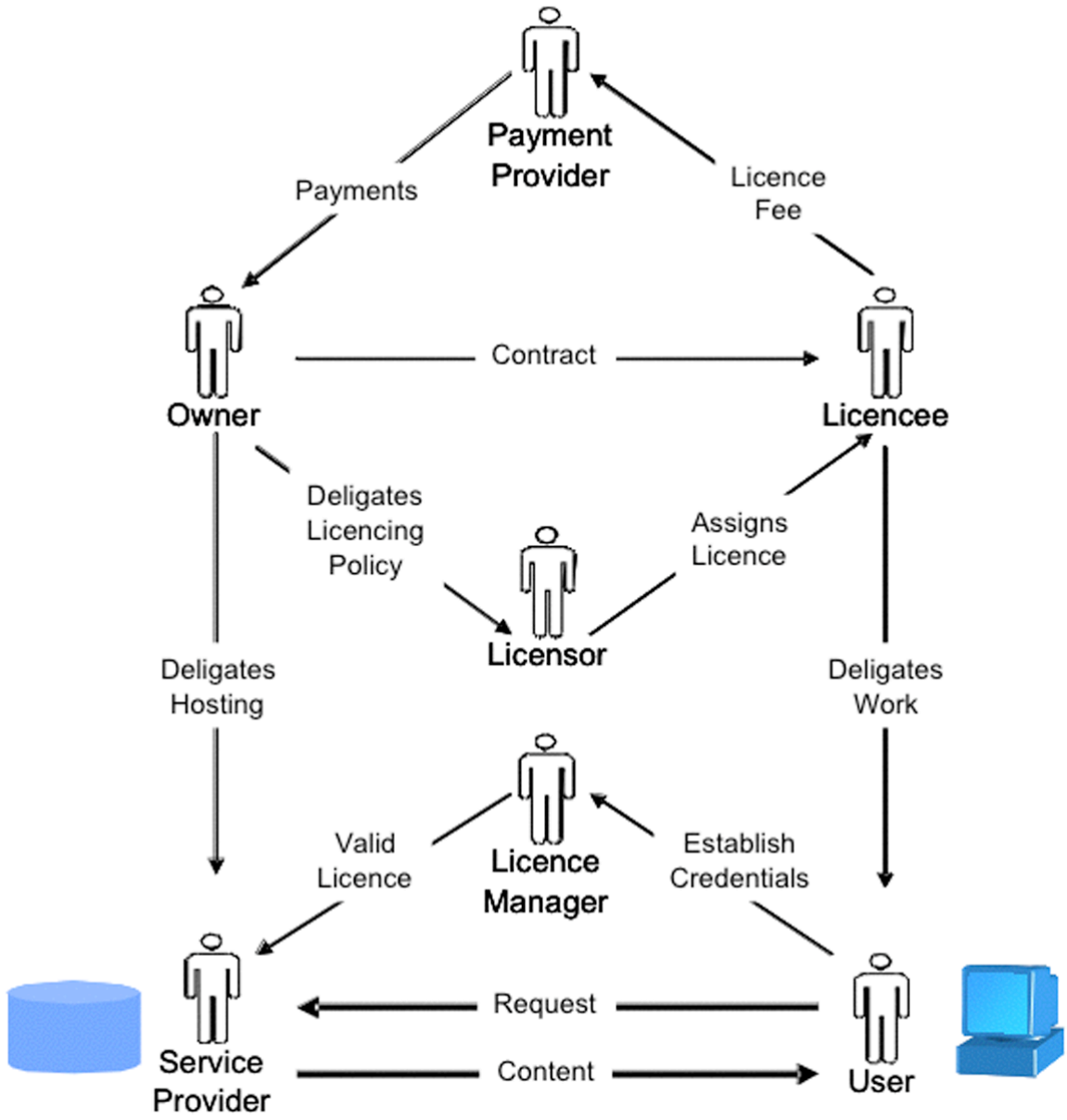

Figure 3 GeoDRM – Roles and Responsibilities

Standards-based DRM technologies are needed before systems of incentives and operating agreements can form and pave the way for geodata to be more accessible and useful to larger numbers of users while protecting IP assets and the rights of both producers and consumers.

GeoDRM standards work in OGC involves communication within the GeoDRM Working Group, Interoperability Experiments undertaken by member teams, and larger Interoperability Initiatives (Testbeds and Pilot Projects) to prototype, test and validate the target interoperable architecture. OGC's OWS-3 Interoperability Initiative, which begins in April, 2005, will include a GeoDRM thread.

Standards from several other standards organizations are relevant to GeoDRM:

- ISO REL: ISO/IEC 21000-5 is an open, elegant and extensible International standard for "rights expression." It is mathematically precise, based on XrML, and standardized by OASIS. It is XML-based, that is, it is profiled through standard XML Namespaces. It allows generic implementation to support multiple sectors, and it supports re-distribution and trust root chaining -- it deals with the whole value chain. This grammar can express whatever licensing agreements are necessary.

- The OASIS Rights Language is being developed to define an industry standard for a digital rights language that supports a wide variety of business models and has an architecture that provides the flexibility to address the needs of the diverse communities that have recognized the need for a rights language. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=rights

- XrML from Xrml.org provides a universal method for securely specifying and managing rights and conditions associated with all kinds of resources including digital content and services. http://www.xrml.org/

- The Open Digital Rights Language (ODRL) specification supports an extensible language and vocabulary (data dictionary) for the expression of terms and conditions over any content including permissions, constraints, obligations, conditions, and offers and agreements with rights holders http://www.odrl.net/

- MPEG Rights Expression Language (MPEG-REL, or MPEG-21) provides flexible, interoperable mechanisms to support transparent and augmented use of digital resources in publishing, distributing, and consuming of digital movies, digital music, electronic books, broadcasting, interactive games, computer software and other creations in digital form.

- Others include the Shibboleth Project, Digital Object Identifier (DOI), Open eBook Forum (OeBF), Publishing Requirements for Industry Standard Metadata (PRISM)

OGC's work involves close coordination with OASIS, whose basic framework is based on ISO/IEC 21000-5. The OGC membership is working to make OGC's GeoDRM framework compatible with other open standards for DRM. Initial GeoDRM components will build on the OASIS standards, particularly on those developed by the OASIS Security Services Technical Committee, such as the Security Assertion Markup Language (SAML).