

Implementing a Copyright Management System

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While Copyright Management Information (CMI) is not a new concept, it has not been a universally applied one. This article aims to review the different ways CMI's can be represented as well as the possibility of implementing them via Oracle technologies. Such an approach is justified in the absence of any wide scale, industry accepted, standard for implementation.

Keywords: Copyright Management Information, metadata, document identifiers, watermarking.

1 Introduction

i. General considerations

Copyright Management Information is a (relatively) new concept and an original one as regards definition in that it has been initially defined through a series of international agreements. This approach is on one hand part of the advantage of CMI, on the other part of the problem.

By adopting an international standard, the formation of national entrenchment (already fixed national attitudes towards a legal concept) has been avoided successfully. However, adopting such a standard meant that implementation on an international level had to precede general implementation on the national level. Since national regulation would have necessarily followed wide scale adoption by the national economic agents, an international regulation in the field would not necessarily be flexible enough, nor would it be based on practical experience.

However, considering the advantages of having a homogeneous regulation on an international level, it is advantageous to design a system in the light of these regulations which could easily fit in the limits of the national laws of all the signatories.

ii. Rights Management Information

One definition of Rights Management Information (CMI) comes from the WIPO Copyright Treaty of 1996, a treaty to which Romania is a signatory. Article 12 paragraph 2 of the treaty defines rights management information as "information which identifies the work, the author of the work, the owner of any right in the work, or information about

the terms and conditions of use of the work, and any numbers or codes that represent such information, when any of these items of information is attached to a copy of a work or appears in connection with the communication of a work to the public" [1].

As reflected by the definition, the range of protected information is sufficiently large as are the means by which it can be represented. As regards the range of protected information, Rights Management Information can represent any kind of information about the author, the owner of the rights (which can only refer to the economic rights as the moral rights are non transmissible in Europe and hardly regulated in the United States) or any kind of information regarding the terms of use for the respective protected content.

The possibilities of representation for CMI are also a reasonably wide set, as the information can not only be represented in its basic form (storing the information about the author etc.), but also any numeric representation of it. The possibility of actually storing a link to an external database with the actual information has been discussed with the conclusion that such a solution would also fall within the scope of the protection.

The protection granted by the convention is defined in paragraph 1 of the same article, as the signatories will take measures to protect against:

- i. removal or alteration of any electronic rights management information without authority;
- ii. distribution, import for distribution, broadcast or communication to the public,

without authority of works or copies of works knowing that electronic rights management information has been removed or altered without authority

In the European legislation, the protection of CMI is regulated through the European directive 29/2001 on the harmonization of certain aspects of copyright and related rights in the information society which aims to bring about a certain degree of homogeneity in the copyright related regulations of member states. While the success of the directive in other copyright related fields was not entirely clear (e.g. relating to legal copyright limitations), in the field of CMI the harmonization was successful in the respect that national legislation was harmonized, albeit without notable effect on the content management industry.

Article 6 of the directive defines rights management information as “any information provided by rightholders which identifies the work or other subject-matter referred to in this Directive or covered by the sui generis right provided for in Chapter III of Directive 96/9/EC, the author or any other rightholder, or information about the terms and conditions of use of the work or other subject-matter, and any numbers or codes that represent such information”[2].

The scope of the protection is significantly wider than the one provided by the WIPO treaty as it includes management information for the sui generis “database right” provided by the directive. Rights management information can refer both to the author's rights as well as those of other involved parties.

The accepted representation of the rights management information is, as in the WIPO treaty, both in their original form and by any numbers or codes that might represent it. Again, an acceptable representation would also be a link to an external database containing the actual information about the author etc.

Member states are obligated to provide adequate protection against:

- i. the removal or alteration of any electronic rights-management information
- ii. the distribution, importation for distribu-

tion, broadcasting, communication or making available to the public of works or other subject-matter protected under this Directive or under Chapter III of Directive 96/9/EC from which electronic rights-management information has been removed or altered without authority

Again this protection is not restricted to just copyright information, also applying to the sui generis database right.

The United States also grant protection to copyright management information through the Digital Millennium Copyright Act (DMCA), under title I (WIPO treaties implementation), section 103 (Copyright protection systems and copyright management information). In the definition of the DMCA, copyright management information can mean information “conveyed in connection with copies or phonorecords of a work or performances or displays of a work, including in digital form, except that such term does not include any personally identifying information about a user of a work or of a copy, phonorecord, performance, or display of a work”[3]. Such information can be comprised of:

- i. the title and other information identifying the work, including the information set forth on a notice of copyright.
- ii. the name of, and other identifying information about, the author of a work.
- iii. the name of, and other identifying information about, the copyright owner of the work, including the information set forth in a notice of copyright.
- iv. with the exception of public performances of works by radio and television broadcast stations, the name of, and other identifying information about, a performer whose performance is fixed in a work other than an audiovisual work.
- v. with the exception of public performances of works by radio and television broadcast stations, in the case of an audiovisual work, the name of, and other identifying information about, a writer, performer, or director who is credited in the audiovisual work.
- vi. terms and conditions for use of the work.
- vii. identifying numbers or symbols referring

to such information or links to such information.

viii. other information required by the Register of Copyrights except information concerning the user of a copyrighted work. The US definition is much more detailed than the European one since the incentive to avoid equivocal legal texts is greater under common law systems.

Protection of CMI under US law forbids any person to “knowingly and with the intent to induce, enable, facilitate, or conceal infringement”:

i. provide copyright management information that is false, or

ii. distribute or import for distribution copyright management information that is false.

Also forbidden without the consent of the copyright owner or the law are the

i. intentional removal or alteration of any copyright management information,

ii. distribution or import for distribution copyright management information knowing that the copyright management information has been removed or altered without authority of the copyright owner or the law, or

iii. distribution, import for distribution, or public performance of works, copies of works, or phonorecords, knowing that copyright management information has been removed or altered without authority of the copyright owner or the law,

iii. Importance CMI

Use of Copyright Management Information can solve a series of problems pertaining to content provision.

One such problem is that a content provision system would preferably function identically irrespective of the fact that the works are subject to copyright law (such as in the US legislation) or author’s rights (such as the protection systems found in continental Europe).

Since the information included in or associated to the work can contain the name of the author, this can function as an effective, even if basic, recognition of authorship thus narrowing the gap in regulation between the two stances on copyright (US law grants the

right to be recognized as author only for a very narrow category of creators) [4].

Another advantage is that since the work can link to the complete terms of use, the risk of confusion for the buyer is minimized, as long as the terms are available before the actual purchase of the work in question. The buyer of the work would thus be aware of the possible limitations in use which would lead to better buyer protection and at the same time to higher trust in such a system. If, on the other hand, it is considered that by simply downloading the image, for example, we have a system equivalent to shrink wrap licenses, and thus knowledge of the terms would be doubtful.

If such a content distribution system integrating copyright management information would become widely used, collective rights management organizations would be capable to better trace the movement of copyrighted works and thus better administrate the rights of the authors. Such a system would thus increase the revenue that authors receive.

On a fiscal level, being able to better follow transactions and the conditions in which they are performed would allow the state to maximize tax revenue from these transactions.

There are of course possible negative effects to the widespread use of such a system.

For example, the above discussion assumes that it would be the name of the author that would be included in or linked to by the content, but that is not necessarily the case. If for example the name included would be that of the distributor, many of the above advantages would vanish. More importantly, the impression in the mind of the buyer that the distributor is the creator would be accentuated. This would in turn widen the gap between the European, author centered vision, and the American, owner centered one.

Another such possible negative effect is that a state or an organism would more easily apply censorship to content, if the state was so inclined. Filtering would no longer be provider based but would instead be transformed into content based filtering without the need for complicated processing of the content. As such, content based filtering would become

practical for more states desiring to impose censorship.

2.Types of CMI implementation

While both international and European protection has a large enough scope to allow for various implementations the question which must be answered is “how is rights management information represented in a practical example”. There are several ways through which the author and other rights holders etc. can be associated to the content. An important objective in a practical implementation is that the information should be stored separately on the content provider's side while the content consumer should always get both sets of data (content and management information); from an administration point of view, it would be preferable that at the content provider's level the management information be kept separately.

Below we discuss shortly the various ways in which management information can be associated to content.

A first distinction which has to be taken into account when talking about the representation of CMI is if the information is readily apparent to the user. Information associated to media content can have numerous purposes which determine the method by which it is associated to said content. From this point of view, the method can be:

- apparent, in which the information is visible to the user without the need to a special mechanism (e.g. the information is readable through the same software as the content itself)
- covert, in which the information is not viewable unless a special mechanism is used (e.g. the name of the author is stored as meta data in an image)

Another distinction relates to the presence of the information in the document. From this point of view, methods of representation for copyright management information can be classified as:

- direct representation, where the CMI is present in the document in its final form (e.g. the author's name appears as meta data in the document)

- indirect representation, where the CMI is not present in the document, but it is replaced with a link to the actual information (e.g. the image contains meta data which represents a link to a web page which when accessed provides the actual information about the author)

i. Watermarking

Watermarking is the process of embedding information in content. When watermarking is done by digital means we refer to digital watermarking.

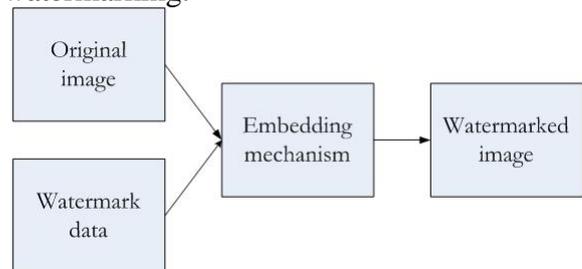


Fig. 1. Watermarking

An important distinction must be made between visible and invisible watermarking. Visible watermarking refers to the case where the added information is visible to the user via the same means used to view the content. Its purpose is an overt one, warning the user of the rights related to the use of the content or identifying the author. Frequently, this type of watermarking is used to limit the use of a free demo copy of the content as opposed to a copy with no limitations which can be bought.

Invisible (covert) watermarking is not readable by the same means as the content itself, but rather by a different mechanism. It is used to identify the author and serves as a means of proving the identity of the creator in the case where the content is used without right. Invisible watermarking would then be brought up in a subsequent legal action and proven by technical expertise. While visible watermarking is supposed to transmit information to the user (who the author is, what is the extent to which he has transmitted rights to the user etc.), invisible watermarking assumes that at least some users will not respect the limitations set by the rights owner.

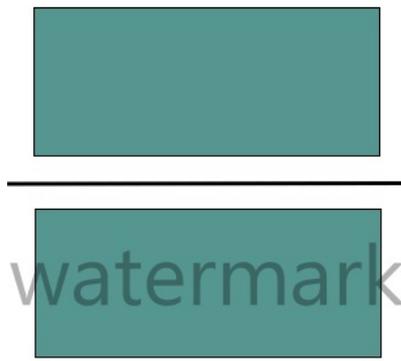


Fig. 2. Image without and with watermark

Since in this case the information is covert, if it is removed by the user the right owner will have to prove that the user had reasonable grounds to know that he was removing CMI in order for the protection granted to CMI to come into effect. This will, however, have no effect on other possible legal actions based on copyright infringement.

Watermarking can consist for example of the actual signature of the author embedded into an image, be it visible or invisible.

In the case of invisible watermarking, it can be that the intention of the rights owner is that the information remains invisible or the invisibility is simply generated by a technical restriction.

For example, it may simply be that the information is stored as meta data in such a way that while it is not readable by typical content reading software (e.g. image viewers), it is readable by other tools. This case is similar to embedding a link to the CMI as while the actual information is not present in the content, it is accessible to the user.

If, however, the intention was that the invisible watermark not be utilized in any way by the user, we are in fact talking about a steganographic signature.

ii. Steganography

Applying steganographic techniques to digital watermarking consists in introducing additional information in content in such a way that the user cannot read them by the means intended to read the content itself. Moreover the user is not intended to read the additional information as the purpose of the rights holder is to be able to prove ownership even if the user intends to infringe on the rights.

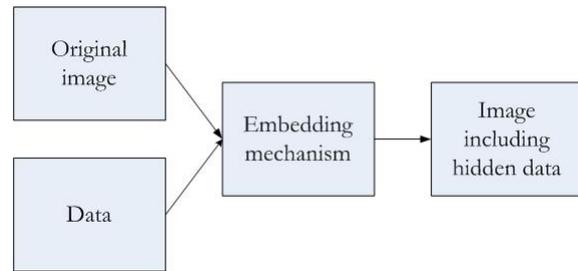


Fig. 3. Steganography

Since the regulation of CMI assumes that the user intentionally removes the information from the content; in the case of steganography the user is assumed to not even know that the additional information is there so unless the rights owner can prove the information was intentionally removed, he cannot invoke the special protection.

However, the covert information will still be useful as a method of proving authorship in the event of a legal action based on copyright infringement.

iii. Content meta data

Meta data is, in its simplest description, data that describes data.

In what a copyright management system, the needed information can not only be included in the content itself, but actually associated with the content in such a way that delivery of the content is always accompanied by the delivery of meta data.

The advantage of such an approach stems from the fact that it requires no modifications to the content itself. The disadvantage, however, is that the delivery of the metadata along with the content has to be reliable in order for the system to reach its goal.

The meta data in question can be of diverse nature, depending on the actual implementation of the system. For example delivery can refer to the whole specter of information included in the definition of CMI, but also to links to such information, a preferable approach in the case where the information has significant size (i.e. terms of use).

Another use of metadata is to use it internally to keep track of modifications to the content, such as the watermark applied to an image. For example, image meta data can specify that a watermark is to be applied on delivery of the image, although the image is stored

unmodified.

iv. Embedded links

A different method of including CMI in digital content is to include a link to the information instead of the information itself. Since a link to the information will usually lead to a non interchangeable proprietary solution, this will most likely get in the way of a generalized content management system. The solution is to include a unique identifier of the object in a standardized naming scheme which leads us to the subject of digital object identifiers.

Since the size of the rights management information can be prohibitively large, especially in the event that the rights holder has an interest to include the whole text of the licensing terms, an alternative method has to be taken into account. Links to the information are the most flexible way of achieving the required goal of making the rights information without weighing the content with too much meta data. This of course raises the necessary quality standard since while the embedded information is accessible at the same time as the image, the information to which the link points might not be accessible in the case of insufficient quality of service standards.



Fig. 4. Extracting an embedded link

Upon the delivery of the content, the link will be extracted and processed at the buyer's end.

v. Unique object identifiers

One of the main problems with digital content provision is how to allow for increased interoperability between content providers and at the same time limit the problems arising from the infringement of copyright related rights (referring also to CMI).

A solution to this problem came with the advent of unique object identifiers which allow accessing a certain object through the use of a general naming scheme, somewhat in the way a certain web page is accessible through

a URL.

An example of such a unique object identifier is DOI (Digital Object Identifier), which is an alphanumeric string identifying an object coming from a registered publisher. A DOI is composed of a directory name, a publisher name and an item identifier. As it is independent of the object's location it can serve as a unique identifier for the respective work and can be referred to by any copies of it.

Directory identifier	Rights holder identifier	Work identifier
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Fig. 5. General form of an object identifier

While the DOI is just an example, and not yet a general standard for any type of content, it does show the main components such an identifier should have: the location where the information can be found, the rights owner (be it the copyright owner such as in the US, or the author) and an identifier of the work.

3.Possible technological solutions

Implementation of multimedia management for documents is possible by using either relational or object-oriented databases. The most known solutions are the Oracle Database System and Jasmine.

Oracle Database comes with an integrated feature which is incorporated in the database system called Oracle InterMedia. This feature gives the database system the possibility to manage non alphanumerical information often found in enterprise applications such as video, images, audio etc. supporting such functions as storage, management, alteration and retrieval.

Oracle InterMedia gives the Oracle Database the stability, scalability, flexibility of an easy to implement and use mechanism for multimedia data management while maintaining a classic approach [7]. This is possible because all DDL/DML operations can be used via simple SQL or PL-SQL commands. These commands work not on the data itself but rather on the metadata associated with the multimedia information.

The metadata we refer to is created automati-

cally by Oracle InterMedia upon storage of the multimedia content in the database [8].

Details of an approach involving the use of Oracle InterMedia for a copyright management system based on image watermarking are presented in the section below.

4. Effective implementation

In order to implement a simple application using Oracle InterMedia, some basic steps have to be made:

i. On the DDL level:

A table that should store blob information:

```
create table test_blob(cod number(10),
photo Blob);
```

Another table for the storage of InterMedia

```
create or replace procedure insert_picture(p_name test_inter.name%type, p_cod
test_inter.cod%type) is obj ORDSYS.ORDImage;
ctx raw(4000):=null;
begin
    insert into test_inter (name,photo,cod) values (p_name, ORDSYS.ORDImage (ORD-
SYS.ORDSOURCE(EMPTY_BLOB(),NULL,NULL,NULL,SYSDATE,NULL),NULL,NULL,NULL,NULL,NU
LL,NULL), p_cod);
    select t.photo into obj from test_inter t where t.cod = p_cod for update;
    obj.importFrom(ctx,'FILE','IMAGES',p_name);
    update test_inter t set t.photo=obj where t.cod= p_cod;
    commit;
end insert_picture;
/
```

Some examples of image processing procedures that can be applied on the records

objects:

```
create table test_inter(name varchar2(20), photo ordsys.ordImage, cod
number(10));
```

ii. On the DML level:

First of all, in order to load multimedia resources a directory alias is created in the database schema, for the disk location of the physic directory, such as:

```
grant create any directories to scott
create or replace directory IMAGES as
'd:\pictures';
```

Once the alias is made, multimedia records can be inserted in the database, calling the following procedure:

stored in the InterMedia table are shown below.

Setting the contrast

```
create or replace procedure contrast(p_cod test_inter.cod%type) is Image ORD-
SYS.ORDImage;
begin
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('contrast = 50');
    Image.setProperties;
    UPDATE test_inter SET photo = Image WHERE cod=p_cod;
    COMMIT;
end contrast;
/
```

Flipping process

```
create or replace procedure flip(p_cod test_inter.cod%type) is Image ORD-
SYS.ORDImage;
begin
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('flip');
    Image.setProperties;
    UPDATE test_inter SET photo = Image WHERE cod=p_cod;
    COMMIT;
end flip;
/
```

Extracting a part of the image

```
create or replace procedure cutting(p_cod test_inter.cod%type) is Image ORD-
SYS.ORDImage;
begin
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('cut= 0 0 50 50');
```

```

        Image.setProperties;
        UPDATE test_inter SET photo = Image WHERE cod=p_cod;
        COMMIT;
end cutting;
/

```

Modifying RGB

```

create or replace procedure modifyRGB(p_cod test_inter.cod%type) is Image ORD-
SYS.ORDImage;
begin
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('fileFormat=RPIX');
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('channelOrder=GRB');
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('fileFormat=TIFF');
    Image.setProperties;
    UPDATE test_inter SET photo = Image WHERE cod=p_cod;
    COMMIT;
end modifyRGB;
/

```

Image rotation

```

create or replace procedure rotation(p_cod test_inter.cod%type) isImage ORD-
SYS.ORDImage;
begin
    SELECT photo INTO Image FROM test_inter t where t.cod=p_cod FOR UPDATE;
    Image.process('rotate=90');
    Image.setProperties;
    UPDATE test_inter SET photo = Image WHERE cod=p_cod;
    COMMIT;
end rotation;
/

```

In order to report multimedia information, using for example Oracle Reports, the binary information of the BLOB part of the ORDI-

mage object will be transferred in the blob table using the following procedure:

```

create or replace procedure transfer(p_cod test_inter.cod%type) is auxord ORD-
SYS.ORDImage;
auxblob Blob;
begin
    select photo into auxord from test_inter i where i.cod=p_cod for update;
    auxblob:=auxord.getContent;
    insert into test_blob(cod, photo) values(p_cod,auxblob);
    commit;
end transfer;
/

```

After the transfer is finished, images can be reported quickly and easily using even the wizard of the Oracle Reports.

5. Conclusions

Copyright management information, while not reflected in a generally accepted standard, would allow associating the identity of the rights holder with the work with great consequences in the way we regard everyday use of copyright. Furthermore, although such a generalized system would be based on a mainly technological solution, it would have significant legal consequences.

For example, the famous dichotomy between the way the common law countries and the civil law countries perceive copyright would be significantly reduced, as associating the name of the author with his work would give him recognition of authorship no matter what the actual text of the law is. An in depth discussion on the consequences of applying CMI's on the regulation of moral rights is outside the scope of this paper, but will be discussed in a future one.

One further advantage stemming from the existence of a copyright management system, or at least a set of (proprietary) systems with

interconnection features, is streamlining on-line transactions related to content provision and thus facilitating access to said content.

As for the practical approach to designing a rights management information system, Oracle InterMedia springs to mind if not as the solution at least as a model as to how the system would have to be implemented. More details on its use for the implementation of watermarking and other mechanisms related to rights management information can be found in another article by the same authors which will be published in the same time frame.

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