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OSKAR UDDENBERG

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Abstract

The MPEG Group is developing the Open Access Application Format as part of the MPEG-A standards. The Open Access standard defines an exchange format which can be used to release content to the public domain and governing the content in a less restrictive form.

The Open Access Application Format combines and integrates several MPEG standards into one standardized exchange format. The MPEG standards used in Open Access might be patented. In this thesis, these patents has been examined and their relevance within Open Access has been analyzed and described to ensure that the standards used is done so in a way that does not compromise patent law.

The MPEG group provides reference software for the Open Access standard. This software is a basic reader and editor of the exchange format and can be used as library for further implementations. Using this software as a basis, a showcase for the Open Access Application Format has been developed to demonstrate the flexibility and capabilities of the standard.
Sammanfattning

Arbetsgruppen MPEG utvecklar standarden Open Access Application Format som en del av MPEG-A:s standarder. OAAF är definierat som ett format skapat för att enklare kunna publicera material till den publika domänen och att som upphovsrättman kunna behålla kontroll över materialet.


Arbetsgruppen MPEG har utvecklat mjukvara att användas tillsammans med den nya standarden. Mjukvaran är en enkel hanterare av det standardiserade filformat som medföljer OAAF. En del av detta examensarbete syftar till att genomföra och beskriva utvecklingen av ett showcase till den nya standarden, med ovan nämnda mjukvara som referens. Showcaset syftar till att visa upp de fördelar standarden medför för nya användargrupper.
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I would also like to thank my supervisors Dipl.-Ing. Florian Schreiner at the Lehrstuhl für Datenverarbeitung in Munich and Dipl.-Ing. Hannes Ebner from the Royal Institute of Technology in Stockholm for their helpful insights and valuable comments during the writing of this thesis.
Chapter 1

Introduction

1.1 Background

The MPEG Group is developing the Open Access Application Format as part of the MPEG-A standards. Open Access AF defines an exchange format which can be used to release content to the public domain and governing the content in a less restrictive form. This standard uses technologies from other MPEG standards to package the creations from content authors into a file. The content creator can attach different licenses and metadata to the created content. The support of metadata makes it easy to store information such as name of the author, time of creation etc. and can be used to search for specific content by criteria in a content database.

The Open Access Application Format standard has been created as a result of using parts of other MPEG standards together with parts of external standards. The MPEG-A group has requested an analysis of the patents filed regarding the MPEG standards used due to possible copyright infringements. Should these patents cover parts of the new standard, it is likely that the new standard would need revisions and be released publically at a later date. The MPEG-A group has also concluded that the target group of OAAF would be the users of the public domain. They have suggested a development of a showcase with some of the main advantages of the standard implemented, presentable in a web-accessible form. This would promote the standard to the above-mentioned users, and thus increase the number of initial and long-term users of OAAF.
1.2 Problem

The Open Access application format combines and integrates parts of some MPEG standards into a standardized exchange format. The parts of the MPEG standards used in Open Access might be patented. An examination whether such patents exist or not are to be carried out. Should such patents exist, further examination whether the patents are a part of the new standard or not will be carried out.

The MPEG group provides reference software for the Open Access standard. This software is a basic reader and editor of the exchange format and can be used as library for further implementations. By developing a showcase for the new standard, using the reference software as a basis, the flexibility and capabilities of the standard can be demonstrated to new users.

1.3 Method

Initially, the work was started out with a literature study through all material that concerns the MPEG-A Open Access standard. This included a study of patents in general and the more specialized field of software patents. To understand the ways of patent law, relevant patents applied to the standard was examined in regards to their relevance. The patents was technically evaluated in their scope and compared to the actual use within the new standard.

The reference software to the Open Access Application Format was written in Java. It provided only the basic functionalities of the standard. The author of this thesis created an adapted use case using the reference software and the standard as a basis, and used this to design an architecture of as well as the components needed for a showcase of the standard. After this the implementation of the showcase was conducted by the author of this thesis together with an assessment of what improvements the showcase would benefit from.

It is important to try to assess what kind of reliability and validity a thesis such as this would have. Reliability is defined by Bell as “[...] a measurement of how well an instrument or a method returns the same result on different occasions, but under the same circumstances” (Translation by Oskar Uddenberg) (p.117).[1]. Validity is
defined by Bell as “[...] whether a certain question measures or describes exactly what is intended to be measured or described.” (Translation by Oskar Uddenberg) (p.117),[1]. She mentions that the definition itself is vague and that it leaves several questions unanswered (p.117),[1]. The author of this thesis had no practical experience in examining patents from earlier, all knowledge of how to do so have been acquired during the writing of this thesis, using relevant literature and by asking people with experience in examining patents. It is also important to mention that the author have not examined the patents from a juridical point of view. Each patent is valid under the laws of each country where they have been applied for, and to acquire patent law knowledge for each country within Europe and the U.S would be outside of the scope of this thesis. The assessments made here are made from a pure technical point of view. Still it would raise the reliability and validity of the results of the patents if they were to be examined by a patent lawyer or a patent agent, which is intended to be done by the assigner.

The showcase has been developed with new users in mind, and what advantages the new standard would provide for them. This has been achieved by discussing what components the showcase would contain with the developers of the standard. The only field-test of the showcase was a small presentation held by the author of this thesis to the developers and several doctoral students as well as other students writing their thesis at the faculty where the showcase was developed. The response was positive, but since the showcase has not been tested in a controlled environment with proper evaluation methods afterwards, this would lower the validity of the resulting showcase.

1.4 Expected goals and results

The examination of the patents would result in:

- Examination of the patents currently used in the standard.

- Evaluate each patent’s importance to the standard as well as comparing the actual use of the relevant patents to the intended use from each patent.

The development of this showcase shall include:

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• Examination and modeling of the possible use cases for potential users.

• Description of a showcase founded on one use case and specification of the implementation in a demonstrator.

• Implementation of the showcase using the Open Access reference software as basis. A possible scenario is a web interface with a content database that exploits the advantages of the standard.

1.5 Limitations

This thesis will not manage patents outside of the MPEG-7 or MPEG-21 standards. Patents written in any other language than Swedish, English and German will also be excluded. This work will implement a showcase for a specific scenario in the application of the standard. Additional features in the management of contents as well as a high performance of the implementation are not part of the assignment.

1.6 Terms and Definitions

The abbreviations used in this thesis along with its definitions are presented in Table 1.1.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF</td>
<td>Application Format</td>
</tr>
<tr>
<td>CC</td>
<td>Creative Commons</td>
</tr>
<tr>
<td>CSS</td>
<td>Cascading Style Sheet</td>
</tr>
<tr>
<td>DDL</td>
<td>Description Definition Language</td>
</tr>
<tr>
<td>DI</td>
<td>Digital Item</td>
</tr>
<tr>
<td>DID</td>
<td>Digital Item Declaration</td>
</tr>
<tr>
<td>DIDL</td>
<td>Digital Item Declaration Language</td>
</tr>
<tr>
<td>DII</td>
<td>Digital Item Identification</td>
</tr>
<tr>
<td>DRM</td>
<td>Digital Rights Management</td>
</tr>
<tr>
<td>DSSSL</td>
<td>Document Style Semantics and Specification Language</td>
</tr>
<tr>
<td>EPC</td>
<td>European Patent Convention</td>
</tr>
<tr>
<td>EPO</td>
<td>European Patent Office</td>
</tr>
<tr>
<td>ER</td>
<td>Event Report</td>
</tr>
<tr>
<td>ER-R</td>
<td>Event Report Request</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>GWT</td>
<td>Google Web Toolkit</td>
</tr>
<tr>
<td>HTML</td>
<td>HyperText Markup Language</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual Property</td>
</tr>
<tr>
<td>IPMP</td>
<td>Intellectual Property Management and Protection</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization of Standardization</td>
</tr>
<tr>
<td>JAXB</td>
<td>Java Architecture for XML Binding</td>
</tr>
<tr>
<td>JS</td>
<td>JavaScript</td>
</tr>
<tr>
<td>JSP</td>
<td>Java Server Pages</td>
</tr>
<tr>
<td>MDS</td>
<td>Multimedia Description Schemes</td>
</tr>
<tr>
<td>MPEG</td>
<td>Moving Pictures Experts Group</td>
</tr>
<tr>
<td>OA</td>
<td>Open Access</td>
</tr>
<tr>
<td>OAC</td>
<td>Open Access Content</td>
</tr>
<tr>
<td>RDD</td>
<td>Rights Data Dictionary</td>
</tr>
<tr>
<td>REL</td>
<td>Rights Expression Language</td>
</tr>
<tr>
<td>RPC</td>
<td>Remote Procedure Call</td>
</tr>
<tr>
<td>URI</td>
<td>Uniform Resource Identifier</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>USPTO</td>
<td>United States Patent and Trademark Office</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
<tr>
<td>XSL</td>
<td>Extensible Style-sheet Language</td>
</tr>
<tr>
<td>XSLT</td>
<td>Extensible Style-sheet Transformation</td>
</tr>
</tbody>
</table>

Table 1.1: Table of Abbreviations

15
Chapter 2

Open Access Application Format

2.1 An introduction to the Open Access Application Format

The Moving Pictures Experts Group, from now on referred to as MPEG, is a working group of ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission). They are in charge of the development of standards for coded representation of digital audio and video. The group was founded in 1988 and have developed among other standards MPEG-1, MPEG-2, MPEG-4, MPEG-7 and MPEG-21 as mentioned and described in table 2.1. Recently, MPEG started out to work on new lines of standards including the MPEG-A, MPEG-B, MPEG-C, MPEG-D and MPEG-E lines, all with different purposes to fulfill. MPEG-B, MPEG-C and MPEG-D aims to provide systems, audio and video specific standards, and MPEG-E is to provide support for downloading and executing different multimedia applications. The line of standards that has been examined in this thesis is MPEG-A, or Multimedia Application Format. It aims to create a framework which integrates the elements of the different MPEG standards to one single specification, using metadata together with media information to ease the possibility of interchanging, managing, editing and presenting media [2].

The ISO/IEC FDIS 23000-7 Open Access Application Format is part of the MPEG-A line of standards. It has been developed to be used when content creators wishes
MPEG standards

<table>
<thead>
<tr>
<th>MPEG standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPEG-1</td>
<td>The standard on which such products as Video CD and MP3 are based</td>
</tr>
<tr>
<td>MPEG-2</td>
<td>The standard on which such products as Digital Television set top boxes and DVD are based</td>
</tr>
<tr>
<td>MPEG-4</td>
<td>The standard for multimedia for the fixed and mobile web</td>
</tr>
<tr>
<td>MPEG-7</td>
<td>The standard for description and search of audio and visual content</td>
</tr>
<tr>
<td>MPEG-21</td>
<td>The standard that defines a multimedia framework</td>
</tr>
</tbody>
</table>

Table 2.1: MPEG standards

to release their material publicly. Content here refers mainly, but is not limited to multimedia files such as presentations, word processing documents, video streams, and audio files. As the content creator wishes to release his or her material, he or she might find it important that the user of the content can freely access the content but should at the same time be aware of what he or she is allowed to do with it. The content creator might also find it beneficial to get information of when his content is being used or modified. The Open Access Application Format aims to solve these problems by describing a new way of releasing and exchanging contents in packages, complete with attached metadata, rights which specify intended use of the content and the possibility of sending and receiving reports when the rights are exercised from the content. The Open Access Application Format has been constructed by using parts of other MPEG standards, in this case MPEG-7 and MPEG-21 as described in figure 2.1.

2.2 Technical summary of Open Access AF

As described in figure 2.1, the standard is composed by parts from other standards. Below are brief descriptions of the most common elements of parts of the standards used in Open Access AF. The elements used from each part are presented in the tables below. For a more detailed explanation of the Application Format, the complete specification is available in the document ISO/IEC FDIS 23000-7:2008(E) part 7: Open Access Application Format [3].
2.2.1 Digital Item Declaration

<table>
<thead>
<tr>
<th>ISO/IEC 21000-2 Information Technology - Multimedia Framework (MPEG-21)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part</strong></td>
</tr>
<tr>
<td>Part 2: Digital Item Declaration</td>
</tr>
</tbody>
</table>

Table 2.2: Structures used in OA AF from ISO/IEC 21000-2

Open Access Application Format uses some elements from the MPEG-21 ISO/IEC 21000-2 Digital Item Declaration standard [4] as specified in Table 2.2. OA AF is then able to describe the contents in a hierarchical structure, associating the content with textual information using structures like Container:s, Item:s, Descriptor:s, Statement:s and Resource:s.
The `Descriptor` element is used to associate descriptive data with a parent element containing a `Statement` element that contains the actual descriptive value. The `Statement` itself could contain information in any data format using plain text or well-formed XML to describe it.

The `Descriptor` can be attached to several other elements in the structure. A set of the `Descriptor` s together with a `Resource` form the parts of a `Component` element. The `Resource` would be the reference to an asset such as a video clip or audio clip and the `Descriptor` s would contain information about the `Resource`.

The `Component` s together with other sets of `Descriptor` s and `Annotation` s form the element `Item`. The `Descriptor` s describe the `Item` itself and the `Annotation` s allow the elements within `Item` s to be expanded with more `Descriptor` s, without affecting the original contents of the `Item`.

The `Item` s themselves are described within `Container` elements. The `Container` element consists of a grouping of `Item` s and/or `Container` s, together which `Descriptor` s that contains the descriptive information about the `Container`.

The top-level element of the structure is the `DIDL` element containing one `Container` element and a `DIDLInfo` element, describing the DIDL document itself. The `DIDLInfo` element can be used to define a digital signature for the entire DIDL document.

### 2.2.2 Digital Item Identification

| ISO/IEC 21000-3 Information Technology - Multimedia Framework (MPEG-21) |
|-----------------------------|-----------------------------|
| Part | Elements used from part |
| Part 3: Digital Item Identification | Identifier | RelatedIdentifier |

Table 2.3: Elements used in OA AF from ISO/IEC 21000-3

Using parts of MPEG-21 ISO/IEC 21000-3 Digital Item Identification standard [5], the content can be uniquely identified as a particular work by a specific author. It
also allows referencing to other items which might be related to the current item. The elements used are shown in Table 2.3.

This is done by using the Identifier and the RelatedIdentifier elements. The Identifier:s are stored within Descriptor:s of the Component and Container elements mentioned in Chapter 2.2.1: Digital Item Declaration. The Identifier:s within the Component can only be present once for each Item, and identifies the Item the Component belongs to. The Identifier element can also identify a Container as a creation from a specific author and is therefore only allowed once per Container.

The RelatedIdentifier element specifies how an item is related to other items. Using the attribute relationshipType which may contain the isAdaptationOf and HasAdaptation, the content can be described as a derivation of the referenced element or that the referenced element is a derivation of this content.

### 2.2.3 File Format

<table>
<thead>
<tr>
<th>ISO/IEC 21000-9 Information Technology - Multimedia Framework (MPEG-21)</th>
<th>Part</th>
<th>Structures used from part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 9: File Format</td>
<td>box</td>
<td>iloc</td>
</tr>
<tr>
<td>ftyp</td>
<td>infe</td>
<td></td>
</tr>
<tr>
<td>hdlr</td>
<td>mdat</td>
<td></td>
</tr>
<tr>
<td>iinf</td>
<td>meta</td>
<td></td>
</tr>
<tr>
<td>xml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.4: Structures used in OA AF from ISO/IEC 21000-9

The Open Access Application Format uses an object-structured file format based on the MPEG-21 File Format [6] and boxes as they are defined within the specification of the ISO Base Media File Format [7]. The boxes are summarized in Table 2.4.

The three main boxes of the object-structured file are the ftyp box which describes that the file is an Open Access file, the meta box which contains the metadata of the digital items stored within and the mdat box which contains the continuous binary data of the files contained within.
The meta box contains 4 box types: the hdlr box, the iinf box, the iloc box and the xml box. The hdlr box describes that the meta box contains MPEG-21 Metadata. The iinf box contains a number of infe boxes as well as the total count of the infe boxes stored within. The iloc box is a database describing the offsets and sizes of each digital item stored within the Open Access file and corresponds to infe boxes with the same ItemID. The xml box contains a single DIDL which describes all the digital items in the file as well as included MPEG-21 REL licenses, MPEG-7 Metadata and Event-reporting requests.

Finally, the infe boxes within the iinf box contains the specific information of the items stored within the Open Access file. It references to the Resource element of the ISO/IEC 21000-2 Digital Item Declaration [4] by using a Item_name field, specifying a file name of the item that has to be identical to the URI specified in the reference attribute of the Resource element.

### 2.2.4 Metadata

<p>| ISO/IEC 15938-5 Information Technology - Multimedia Contents Description Interface |</p>
<table>
<thead>
<tr>
<th>Part</th>
<th>Elements used from part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 5: Multimedia Description Schemes</td>
<td>Address Email</td>
</tr>
<tr>
<td></td>
<td>Affiliation MaterialType</td>
</tr>
<tr>
<td></td>
<td>Agent MediaLocator</td>
</tr>
<tr>
<td></td>
<td>Author MediaUri</td>
</tr>
<tr>
<td></td>
<td>CopyrightString Name</td>
</tr>
<tr>
<td></td>
<td>Creator Organization</td>
</tr>
<tr>
<td></td>
<td>Creation RelatedMaterial</td>
</tr>
<tr>
<td></td>
<td>CreationInformation Rights</td>
</tr>
<tr>
<td></td>
<td>CreationCoordinates RightsID</td>
</tr>
<tr>
<td></td>
<td>Date Role</td>
</tr>
<tr>
<td></td>
<td>Description TimePoint</td>
</tr>
<tr>
<td></td>
<td>DescriptionMetadata Title</td>
</tr>
<tr>
<td></td>
<td>ElectronicAddress Url</td>
</tr>
</tbody>
</table>

Table 2.5: Elements used in OA AF from ISO/IEC 15938-5
The subset used from the MPEG-7 Multimedia Description Schemes standard [8] is being used to be able to describe the content with metadata. Examples of metadata used are titles, author information, copyright text, license URIs and web page links as well as creation dates. The most important elements used to describe this is shown in Table 2.5 and are given brief descriptions below. The metadata of Open Access is stored using a MPEG-7 descriptor in a *Statement* block within the DIDL of Open Access.

The **Mpeg7** element is the top-level element containing a **Description** element with the metadata. The **Description** element contains two elements: the **DescriptionMetadata** and the **CreationInformation** elements. The **DescriptionMetadata** element stores the **Rights** element, which in Open Access contains **RightsID** elements which stores the URI to the license. The **CreationInformation** element contains the **Creation** element as well as a set of **RelatedMaterial** elements used to describe the item.

The **Creation** element describes the title of the item using the **Title** element and the **Creator** element, that uses other elements to specify the authors and their roles played in creating the content such as the **Role** and the **Agent** elements. The **Agent** element contains the detailed information about the author, such as name, affiliation, address and email. The **Creation** element also includes the **CreationCoordinates** element which describes the creation date and a **CopyrightString** element to describe the licensing of the content.

### 2.2.5 Rights Expression Language

An MPEG-21 Rights Data Dictionary [9] together with a subset of the MPEG-21 Rights Expression Language standard, the OAC (Open Access Content) profile [10] renders the possibility of creating a license containing one or more grants to each digital item. These grants can be exercised by a certain individual or by the public. The Rights contained within allows for specifying what the user may and may not do with the content such as executing or adapting it. Using Conditions allows specifying conditions such as whether content can be use commercially or if source code must be distributed together with the content.
The Open Access Application Format currently supports rights and conditions elements specified in Table 2.6. The Play, the Print and the Execute elements are provided for content consumption; Play includes playing a video or audio clip or displaying an image or text document, Print refers to the making of a fixed physical representation such as a hard-copy print of an image or text and Execute refers to the primitive computing process of executing [10].

Also available to describe the usage of the content are the rights elements Adapt, GovernedAdapt and GovernedCopy. The Adapt element identifies the act of changing transiently existing content to derive new content [11], the GovernedAdapt element represent the right to adapt the content but under the the same restrictions as the original content [10] and the GovernedCopy element represents the right to copy the content and at the same time let certain rights being associated to the copied content [12].

Some condition elements are also provided including the copyrightNotice that represents the condition to notice the copyright information to the user while a right is exercised and the nonCommercialUse element that represents the condition to inform the user that the content is not for any commercial use while the right is exercised [10].

Table 2.6: Elements used in OA AF from ISO/IEC 21000-5:2004/FDAM 3:2008(E)
2.2.6 Event Reporting

<table>
<thead>
<tr>
<th>ISO/IEC 21000-15 Information Technology - Multimedia Framework (MPEG-21)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part</strong></td>
</tr>
<tr>
<td>Part 15: Event Reporting</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Table 2.7: Elements used in OA AF from ISO/IEC 21000-15

The subset used from the MPEG-21 Event Reporting standard [13] is also a valuable addition to the Open Access AF. The elements used are shown in Table 2.7. It gives the content owner an option of using a feedback channel when Open Access files are being used or derived by other users informing the content creator of such actions. When the rights from the subset of MPEG-21 REL are exercised, an Event Report can be created and sent in the form of an email or by using the HTTP POST-method directly to the owner.

Event Reporting within Open Access can be described from two elements: the ER and the ER-R elements. The ER-R element is specified within a Descriptor and Statement blocks within an item and contains three elements: the ERRDescriptor element which describes the general information of the Event Report, the ERSpecification element which contains the data to be included in the ER and how it is supposed to be delivered and the EventConditionDescriptor element which describes under what condition the Event Report should be sent.

The Event Report itself, stored in the ER element, contains two elements; the ERDescriptor which contains the general information of the ER and the ERData element which contains information in the sender of the ER and what event that made the ER to be sent.
The sending of reports is defined as when the events extract and/or derive occurs. The extract operation is defined to occur when one of the rights Play, Print, Execute or GovernedCopy is exercised. The derive operation is defined to occur when one of the rights Adapt or GovernedAdapt is exercised. The Open Access client then reads the Event Report Request and creates and sends an appropriate Event Report to the recipient.

2.3 Benefits of the standard

The new standard, at the time of writing of this thesis has not yet been publically released and promoted. It has therefore not up until this point in time been used in any large projects by the industry or other parties. One suggested way of usage would be similar to how BBC:s Creative Archive project has been implemented [14].

The standard is meant to be helpful both to the content author as well as the user of the content. The author has the possibility of releasing his content with meta-information about the content and the corresponding license to it. If the license is available online, a hyperlink to it can be provided. An alternative is to present the user with the license directly, as he or she tries to open, copy or adapt the content.

With the help of the MPEG-21 OAC REL-profile [10], the author can express his intentions of usage of the content using available rights and conditions from the standard. Since the user could be one person or the public, this is expressed with the help of rights and who they apply to.

Another important part of the standard to the content author is the use of Event Reports [13]. The author can apply this as a feed-back mechanism to the content which results in the author receiving notifications whenever the content is extracted, reused or derived. This way, the author can get statistics of the usage of the content as well as notifications whether the content is being properly used or not. The content is also attached with a unique identifier as it is released to be easily identifiable later on.

The user’s main advantage is the provided meta-information of the content. This gives him or her an overview of the items given and whether it fits his intended use of the content.
Chapter 3

Patent Analysis

3.1 Premises

The standard of Open Access Application Format is based on parts of standards of MPEG-7 and MPEG-21. These, in turn, are developed by different companies who are contributing to ISO. Some of these companies have protected their contributed work by applying for patents in one or several countries.

Patents are a part of what is called Intellectual Property. Intellectual Property is defined by Henri Charmasson as “[...] intangible creations of the mind that can be legally protected.”(p.10),[15]. It is in turn divided into two parts, assets and rights. While assets are the intangible creations such as the invention, formula or brand name, the rights contains the four types of legal protection that can be used against unauthorized use of the assets by others (Chapter 1),[15].

These four types are:

- Trademark
- Trade Secrets
- Copyrights
- Patents
Trademarks are any visible sign or device used by a business enterprise to identify its goods and distinguish them from those made or carried by others. Trademarks protects the traders and manufacturers of goods from unfair competition and the customers from imitations of products [16]. Trade secrets are used by not releasing commercially advantageous pieces of information to the public, thus avoiding unnecessary competition from competitors (p.16),[15]. Copyrights is defined as “[...] the exclusive, legally secured right to reproduce, distribute, and perform a literary, musical, dramatic, or artistic work” [17].

The patent is a temporary legal right granted to an inventor by the government to prevent others from manufacturing, selling or using his or her invention (p.45)[15]. It is important to remember that a patent is always temporary. E.g. in the U.S. the time frame is 20 years under the condition that the patent was filed after June 8, 1995 [18]. The patent allows you as the owner to go to court and prevent someone from using your invention as long as the patent is valid.

3.1.1 International differences

Patent processes differ to some extent between different countries as well. The USPTO (United States Patent and Trademark Office) as well as the European Patent Office are considered to be the authorities that set the rules that the patent offices of other countries follow. Some distinct differences can be seen between these offices as well and are discussed below.

When two people apply for a patent on the same invention, in Europe the filing date is considered the most important. This is also true even if one inventor can show that he invented the invention before another inventor; the first to file for the patent receives it. In the United States an investigation is concluded; investigating logbooks from laboratory research, establishing dates for prototypes and so forth.

If an invention has been publically available in Europe before the application for the patent has been filed, the application will automatically be rejected. With “publically available” it is implied that the invention has been sold, given a lecture about, published in a magazine and so forth. It does not matter who made it available; inventor or not.
In the United States there is a one-year grace period. This means that the inventor can freely publish his invention without losing his patent rights. This is only valid in the USA though; the inventor still loses the right to apply for a patent in Europe [19].

In the United States, you as the inventor are forced to specify the best way (to your knowledge) of how to use the invention. This makes sure that you cannot apply for a patent and withhold the most advantageous way of using it. In Europe, there are no such demands and thus any type of use can be described in the patent [20].

One of the most important differences between the two patent offices is that a US patent is valid in the whole territory of the United States and allows the patent holder to prevent anyone from making, using or selling in the USA the patented invention. In contrast to this, 27 countries has signed the treaty of European Patent Convention. These countries are Austria, Belgium, Bulgaria, Switzerland, Cyprus, the Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Italy, Liechtenstein, Luxembourg, Monaco, the Netherlands, Portugal, Romania, Slovenia, Slovakia, Sweden, Turkey and the United Kingdom (Chapter 18). [15]. The European Patent Office (EPO) in Munich grants patents under the EPC. A European patent can therefore be considered a “bundle” of national patents, and can only be annulled by separate proceedings in each separate country [21].

3.1.2 Software patents

To this, the problem with software patents has to be considered. First of all, it does not have a universally accepted definition [22]. One definition suggested by the Foundation for a Free Information Infrastructure is that a software patent is a “patent on any performance of a computer realized by means of a computer program” [23]. In 2005, the European Patent Office suggested that a software patent is a patent for a “[...] computer program claimed as such, or an algorithms or computer-implemented business method that make no technical contribution [...]” [24]. As of today, all of the traditional means of protecting intellectual property such as patents, copyright and trade secrets are also applied to software in one manner or another. In the United States the Congress has instated a new type of case in which these traditional means may be insufficient with the help of the Digital Millennium
Still, there are a number of issues concerning patenting software. An intense ongoing debate discusses whether software and computer-implemented inventions should be patentable or not and whether software patents encourage or discourage innovation.

On the one hand, some of the arguments for the possibility of patenting software include:

- Patenting software inventions promotes investment in research and development
- Software patents resulting from the production of patentable ideas can increase the valuation of small companies
- A patent must publicly disclose the invention and so educate the public and advance the state of the art of the invention. Thus patents accelerate software development by making previously unknown and not obvious software inventions public
- Protection for software by patents is already sufficiently limited

On the other hand typical arguments against protecting software with patents are:

- Traditional copyright has provided sufficient protection to facilitate massive investment in software development
- Software patents may affect open source and small to medium software enterprises (SME:s) that do not have a large defensive patent portfolio
- Software patents allow investment companies to purchase patents from others and generate lawsuits to collect revenue off the monopoly granted by the patent
- Software patents take an extremely long time to grant, between 3½ and 4 years. By the time patent applications issue as patents, the inventions claimed therein will be perceived to be already in the public domain [26]

Due to the massive amount of information to go through while analyzing patents and the technical knowledge required to understand the differences between filed patents and new unfiled ones, many companies and inventors hire a patent attorney or patent agent to do this work for them (Chapter 3).[15].
3.1.3 Work of a patent attorney or patent agent

Many professionals working with IP have, since it is a very complex field, narrowed their practice to areas of expertise, such as working with patent applications, IP litigation or entertainment copyright purposes. It is therefore important to find an expert that is qualified within the fields where the IP belongs. One must also decide if to use the services of a patent attorney or a patent agent.

Both agents and attorneys have to meet two criteria to be registered as official patent attorneys and agents. They have to have a technical or a scientific education or experience. This is usually an engineering or scientific college degree. They also have to pass an exam about patent application procedures given by the patent office closest to their location.

A patent attorney has the possibility to help anyone interpret the law, apply it to his or her case, give him or her legal advice and represent him or her in front of judicial and administrative authorities. By being registered to the patent office (in the case of United States: USPTO or Europe: EPO), the attorney is also able to represent the owner in a patent application.

The patent agent differs from the patent attorney as he or she cannot interpret the law beyond the issue of patentability, tell the owner whether his or her invention infringes on an existing patent or what the patent will cover. He or she is still able to help the owner in doing an anticipation search on the invention and give the owner an impression whether the invention is patentable or not (Chapter 3),[15].

3.2 Patents concerning the Open Access Application Format

Open Access is a Application Format and specified as Part 7 of MPEG-A (ISO/IEC 23000-7). It uses several elements of parts from other standards from MPEG. ISO provides a list where they specify what filed patents apply to their standards. The list [27] specifies each patent with the associated ISO Standard Reference and what part of the standard the patent applies to. Also, the companies who registered the
<table>
<thead>
<tr>
<th>Search engine</th>
<th>Address(URL)</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>USPTO</td>
<td><a href="http://www.uspto.gov/patft/index.html">http://www.uspto.gov/patft/index.html</a></td>
<td>USPTO patents, covers recent patents</td>
</tr>
<tr>
<td>esp@cenet</td>
<td><a href="http://ec.espacenet.com">http://ec.espacenet.com</a></td>
<td>European Commission - European Patent Office search engine, 60 million worldwide patents</td>
</tr>
<tr>
<td>DEPATISnet</td>
<td><a href="http://depatisnet.dpma.de">http://depatisnet.dpma.de</a></td>
<td>German equivalence to esp@cenet, covers the search engine of EPO and in addition, german patents</td>
</tr>
</tbody>
</table>

Table 3.1: Table of Search engines

patents has been listed. In general, no patent application or reference number has been given within the list. Thus, each patent has been found by searching with a combination of the elements of the parts of each standard as search terms together with the names of the companies. All patents found given by the list is referred to in the bibliography, Appendix A: Patent search results.

3.3 Search method

The search engines listed in Table 3.1 has been used to find the patents: Google Patents, esp@cenet and DEPATISnet all offer complete patents as search results although Google Patents is the only one allowing the user to search the complete patent. USPTO, esp@cenet and DEPATISnet allows search from abstracts, titles, patent numbers and assignees of the patent to mention some search elements. Since few patents mention MPEG, ISO or the names of the elements from the parts of the standards in the abstract or title, the risk of some patents not being found has to be considered. It is therefore imperative to find and use the central expressions and
terms to each separate part of the standard in order to get as accurate results as possible. The words used as search terms are given within Tables 2.2-2.7 in Chapter 2: Open Access Application Format of this thesis.

To quantify the relevance of the patents, a scale of relevancy has been used (ordered from most relevant to least relevant) and is described with criteria here:

• Relevant

If the main claim or claims based on the main claim of the patent describes methods and/or ways of implementation of methods using similar terms mentioned in the specification of OAAF and the part of the standard examined, this patent would be considered Relevant.

• Less relevant

Claims from this patent might coincide with how the standard is used within Open Access AF but depends of the interpretation of the claim/claims. One possibility is that the author of this thesis has been unable to deduce whether what is claimed in the patent coincides with the new standard or not. If such is the case, such patents should be more thoroughly examined by a patent agent or patent lawyer. Another possibility is that what is claimed within the patent could coincide with the new standard, but it depends of how what is claimed is implemented and used. Since the reference software provided by the Lehrstuhl für Datenverarbeitung is the only current implementation, this criteria has been used for patents to be taken under consideration should new software be constructed. This criteria has also been used when functionality described within the claims of the patent could be implemented within the new standard at a later stage of development. The exact reasons for each patent has been specified together with each separate analysis.

• Not relevant

No claims from this patent does coincide with how the part of the standard in question is used within Open Access AF. If what is claimed in the main claim or claims based on the main claim of the patent does not coincide with neither terms, methods or ways of implementation used within the standard of OAAF and the relevant part of the MPEG standard, the patent is considered Not relevant.
These criteria are presented to give the reader of this document an approximation in relevance when different patents are compared to each other.

### 3.4 Patent analysis results

This section intends to present the user with the patents analysed. The patents in the following sections are presented with a short description of each patent as well as the result of the analysis. Before each section, a brief description of the results for the entire section is given and if special considerations has been taken into account, this is also mentioned here.

#### 3.4.1 Digital Item Declaration (ISO/IEC 21000-3)

<table>
<thead>
<tr>
<th>Company mentioned in list of ISO</th>
<th># of references</th>
<th># of patents found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matsushita Electrical Industrial CO., Ltd.</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Total # of references in list of ISO</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Total # of patents found</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3.2: ISO list references and search results of ISO/IEC 21000-3 Digital Item Declaration

The use of MPEG-21 Digital Item Declaration within Open Access is described in Chapter 2.2.1: Digital Item Declaration of this thesis.

The references in the list and number of patents found are presented in Table 3.2. Both references to patents belongs to Matsushita Electric Industrial Co., Ltd. 3 patents were found with the search engines; of these three patents were two patents deemed *Not relevant* and one patent deemed *Less relevant*.

**US 2007/0143219 A1 - Method for delivering content and content server which delivers content**

The patent describes a method for delivering digital content as well as a content server which can deliver content. It focuses on DRM (Digital Rights Management).
and IPMP (Intellectual Property Management and Protection) for generic digital content. The purpose of the invention is to solve the problem of low efficiency in reading and analyzing the REL and IPMP descriptions of a DID document. It makes it possible for a user to efficiently obtain a protection canceling tool without wasting time to perform reproduction or the like of the content.

The method described in this patent make use of the Digital Item Declaration described in the standard ISO/IEC 21000-2 and the description of the first claim in this patent could be considered similar to how the software of Open Access AF is used. Claims 2-7 covers encryption which is not part of OA AF and claims 8-10 concerns the content server that are also vague enough to cover parts of OA AF. In the sections Disclosure of the Invention and Best mode for carrying out the invention it clearly states that the invention is supposed to increase efficiency when comparing IPMP descriptions and REL descriptions for each DID. This is not part of the Open Access AF. Although it is probable that this patent is not relevant to the Open Access standard, the patent is graded Less relevant due to the problems interpreting the claims.

**US 2005/0271205 A1 - MPEG-21 digital content protection system**

The patent is very similar in its drawings and its descriptions to US 2007/0143219 A1 above. It makes use of DRM and IPMP to carry protection signaling and rights expression data and relates to the protection and management of a digital content independent of any data format.

This patent describes in the first claim a method of digital content protection with digital rights expression compromising a number of steps. These steps include the use of the Digital Item Declaration, as the item parsed in this patent is a DID, as well as the use of a IPMP or REL-IPMP Control Graph holder which is not used by the Open Access Application Format. This is due to the fact that Open Access AF makes use of ISO/IEC 21000-5 Amd 3 - The OAC Profile [10] which do not make use of the above mentioned graph holder. The other four claims refer to the first claim as a basis. This patent must therefore be considered Not relevant to the Open Access standard.
This patent describes a system with two devices which send and receive encrypted digital content between them. The system use unique device identifiers for devices that are registered to a server to ensure that content might be sent between the identifiers. The system makes use of a DID engine that parses and executes a DID.

The claims of this patent does not coincide with how Digital Item Declaration is used within OA AF and the digital content protection system described is not used for Open Access AF. This patent must therefore be considered *Not relevant* to the standard.

### 3.4.2 Digital Item Identification (ISO/IEC 21000-2)

The use of MPEG-21 Digital Item Identification within Open Access is described in Chapter 2.2.2: *Digital Item Identification* of this thesis.

<table>
<thead>
<tr>
<th>Company mentioned in list of ISO</th>
<th># of references</th>
<th># of patents found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matsushita Electrical Industrial CO., Ltd.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total # of references in list of ISO</strong></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Total # of patents found</strong></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3.3: ISO list references and search results of ISO/IEC 21000-2 Digital Item Identification

The references in the list and number of patents found are presented in Table 3.3. The patents were found with the search engines; of these two patents were both deemed as *Not relevant* to Open Access AF.

**US 2007/0143219 A1 - Method for delivering content and content server which delivers content**

The patent describes a method for delivering digital content as well as a content server, which can deliver content. It focuses on DRM (Digital Rights Management) and IPMP (Intellectual Property Management and Protection) for generic digital
content. The purpose of the invention is to solve the problem of low efficiency in reading and analyzing the REL and IPMP descriptions of a DID document. It makes it possible for a user to efficiently obtain a protection canceling tool without wasting time to perform reproduction or the like of the content.

DII is briefly mentioned in the Background art section as a key technology used in connection with Digital Items. They refer to that the invention can effectively be used when protection information in the DI is stored in the content with content ID or DII. No references are made to the DII within the claims of the patent. This patent should therefore be considered Not relevant to Open Access AF.

**US 2005/0271205 A1 - MPEG-21 digital content protection system**

The patent is very similar in its drawings and its descriptions to US 2007/0143219 A1 above. It makes use of DRM and IPMP to carry protection signaling and rights expression data and relates to the protection and management of a digital content independent of any data format.

This patent was also referred to for DID and as stated there it is very similar to the previous patent. It refers to Digital Item Identification on a few places in the document but states it as one of the technologies usable together with the invention but does not specify it as necessary. As the patent still describes an IPMP or REL-IPMP Graph Holder in the description of the invention and due to the fact DII is not mentioned within the claims of the patent, this patent should also be considered Not relevant to Open Access AF.

### 3.4.3 File Format (ISO/IEC 21000-9)

The use of the MPEG-21 File Format within Open Access is described in Chapter 2.2.3: File Format of this thesis. As stated in the list and in the specification of OA AF, the standard uses an object-structured file based on the MPEG-21 File Format and Boxes as they are defined within the specification of the ISO Base Media File Format [7]. The ISO Base Media File Format belongs to the MPEG-4 standard, but since OA AF uses attributes from that file format (Boxes like `ftyp` or `meta`), it should be considered relevant to search for patents for MPEG-4 file format. The MPEG-21 file format standard [6] does not appear to have any patents pending or
filed, according to the list from ISO.

Only two companies listed have patents for ISO Base Media File Format in the list of ISO. These are Matsushita Electric Industrial CO., Ltd. (3 patents) and Apple Computer Inc. (1 patent). The search engines deliver no results for patents concerning the file format from Matsushita but Apple specifies patent numbers (US Pat. App 6,134,243 and 6,453,355) for two patents in the ISO list. US Pat. App 6,453,355 is an updated patent of US Pat. App 6,134,243 which is why only US Pat. App 6,453,355 has been analyzed. It has been deemed as Not relevant to Open Access AF.

**US 6,453,355 B1 - Method and apparatus for media data transmission**

This patent is also very generally formulated. It describes a method for processing data in media files which has been transmitted in a data communication medium. The patents consists of several drawings depicting the method and one single claim.

The patent depends heavily on time-related sequences of media, a possible attribute of a digital item in the OA standard but not necessary. It does not refer to the boxes used within OA AF; it focuses on movie and media data boxes which OA AF does not make use of. To this, the claim is not consistent with the file format used in Open Access Application Format. It must therefore be considered that this patent is Not relevant to the standard of Open Access AF.

### 3.4.4 Multimedia Description Schemes (ISO/IEC 15938-5)

The references in the list and number of patents found are presented in Table 3.4. The use of MPEG-7 Part 5: Multimedia Description Schemes within Open Access AF is described in the Chapter 2.2.4: Metadata of this thesis. The list from ISO mentions 28 references to patents, and 27 patents have been found and analyzed. Of these 27 patents have 6 patents been deemed Less relevant and 21 patents deemed Not relevant.

This part of the patent analysis was more complicated due the size of the standard of ISO/IEC 15938-5 Multimedia Description Schemes as compared to the small part of the standard Open Access AF makes use of. A combination of company names,
general and more specific words were used as search terms to get more accurate search results. How the search terms were divided are given in Figure 3.1.

This search generated very different search results from the companies stated from the list of ISO. Several companies did not generate any results at all with the search engines which is peculiar in itself. This is more thoroughly analyzed in Chapter 3.5: Conclusions. General search terms (especially MPEG and MPEG-7) generate a lot more results and have been gone through by hand. Some of the specific search terms (related to the metadata used in Open Access) are more common than others (e.g. Address, Url, Title) and has therefore been used in a combination with the more unusual specific search terms such as CreationInformation and RelatedMaterial.

Since Google’s search engine is the only engine that is able to search through entire patents (but US ones only), it has been used to a larger extent than the other search engines. This was estimated to increase the chances of finding relevant patents. This has resulted in 23 patents being found with the help of Google Patents, the last 4 provided by the esp@cenet search engine.

Figure 3.1: Search terms used for Multimedia Description Schemes
<table>
<thead>
<tr>
<th>Company mentioned in list of ISO</th>
<th># of references</th>
<th># of patents found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Bosch GMBH</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CIE Columbia Innovation Enterprise</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Kokusai Denshin Denwa Co., Ltd</td>
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<tr>
<td>Denso Corporation</td>
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<tr>
<td>Ericsson</td>
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<td>3</td>
</tr>
<tr>
<td>Electronics and Telecommunications Research Institute</td>
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<td>4</td>
</tr>
<tr>
<td>Association Française de Normalisation</td>
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<td>Geocast Network Systems, Inc.</td>
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<td>Heinrich-Hertz-Institut für Nachrichtentechnik Berlin</td>
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<td>Hitachi, Ltd</td>
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<td>Victor Company of Japan, Limited</td>
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</tr>
<tr>
<td>LG Electronics Institute of Technology</td>
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<tr>
<td>Toshiba Corporation</td>
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<tr>
<td>Vivcom Inc</td>
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<td>0</td>
</tr>
</tbody>
</table>

| Total # of references in list of ISO | 28 |
| Total # of patents found            | 27 |

Table 3.4: ISO list references and search results of ISO/IEC 15938-5 Multimedia Description Schemes
WO 2006/001565 A1 - Extended description to support targeting scheme, and TV anywhere service and system employing the same

This patent is unfortunately only available as a cover page (complete document is not possible to download with any of the search engines). It describes the implementation of TV-anywhere service by using MPEG-21 Usage Environment Description (UED) tools. The cover page drawing suggests that that patent makes use of Multimedia Descriptions Schemes but adapted to TV Anytime. This is not similar to how description schemes are used in the Open Access Application Format. Since the claims of this patents are missing, a full analysis cannot not be performed and is therefore evaluated as Less relevant to Open Access AF.

US 6,803,919 B1 - Extracting texture feature values of an image as texture descriptor in a texture description method and a texture-based retrieval method in the frequency domain

This patent describes a way of describing textures in images within the frequency domain and converting image signals to those in the frequency domain of a polar coordinate system. Describing images in the frequency domain is not an infringement of Open Access AF as such functionality is not provided. Neither is any of the claims of the patents mentioning use of MDS as it is being used in Open Access AF. This patent should therefore be considered Not relevant to the standard.

US 2007/0101266 A1 - Video Summary Description scheme and method and system of video summary description data generation for efficient overview and browsing

This patent provides a video summary description scheme for describing video summary intervals by metadata that provides overview functionality and makes it feasible to understand overall contents of the original video in a short time. It states that the main purpose of the patent is to store frame and audio information out of video intervals or segments with the help of a Video Summary Description Scheme.

It divides a video into certain intervals, analyses and stores the information of the separate intervals according to rules specified by the Description Scheme. This functionality is not provided by the Open Access Application Format and the claims does not show similarities to how MDS is used within OA AF. This patent is therefore
considered *Not relevant* to the standard.

**US 7,234,104 B2 - System and method for authoring multimedia contents description data**

This patent describes a method for authoring metadata for describing multimedia contents. It is extremely general in its definition of the system; in its first claim it includes steps like browsing multimedia content and edit effectively edit a portion of the metadata document that relates to a specific interval of the multimedia contents. The patent also mentions that this method is meant be used via a transmission system (No examples are given within the patent). It is suggested that this is done remotely over a network of some kind. The editing of metadata remotely is definitely not part of the Open Access standard, and although it is unlikely to be relevant to Open Access AF, this patent is considered *Less relevant* to the standard due to the problems interpreting the first claim.

**US 2005/0086684 A1 - Method to reproduce a multimedia data flow on a client terminal, corresponding device, system or signal**

This patent describes the reproduction of a multimedia flow (animated graphic, audio- or video signal) in an user terminal. It uses parts of MPEG-4 to a greater extent, metadata from MPEG-7 is mentioned in the document as the data flow mentioned in the patent makes use of MPEG-7 Description Schemes. The patent does not make any claims on the description schemes itself and no specific elements or types from the standard are mentioned. It must therefore be assumed that this patent is *Not relevant* to the standard of Open Access AF.

**US 6,973,257 B1 - Method for indexing and searching moving picture using motion activity description method**

This patent describes a method of how to index and search through a moving picture, concentrating on parts of each frame that changes when the frame changes. This patents only reference to a MPEG-7 decoder and no references to description schemes, descriptors or elements thereof are mentioned, not in the descriptions or in the claims themselves. The Open Access Application Format does not make use of a MPEG-7 decoder and this patent must therefore be considered not relevant to Open Access AF.
US 2006/0161559 A1 - Methods and systems for analyzing XML documents

This patent describes a method of analyzing XML documents. The system scans an XML document, identifies different dimensions that span the XML document and detects scoping relationships between these dimensions. It only briefly mentions MPEG-7 and makes no references to Multimedia Description Schemes or its elements. Open Access AF makes use of JAXB for unmarshalling XML into Java objects which restrictively uses a DOM parser to parse the document. This patent describes parsing the document either with a DOM-based or SAX-based parser.

This patent depends on how the method of analyzing the XML documents are implemented together with the standard as the claims of the patent are vaguely defined. Therefore, this patent must be considered Less relevant to Open Access AF.

US 6,941,325 B1 - Multimedia Archive Description Scheme

This patent describes how to characterize a multimedia archive having records and associated record descriptions via a multimedia description scheme. This is done by considering the data stored as a cluster, in a coordinate system. Although this patent makes use of description schemes and descriptors, the claims of this patent does not show any similarities to how description schemes are used in Open Access AF. Neither does Open Access AF consider the information it processes as a cluster. This patent must therefore be deemed Not relevant to Open Access AF.

US 2005/0289183 A1 - Data structure of metadata and reproduction method of the same

This patent describes how to apply metadata to single frames in a video feed. The metadata used does not show any obvious similarities to how metadata is applied with description schemes in the Open Access standard neither in descriptions nor in claims. Elements used are very few and does not comprise of any elements used in OA AF. Open Access AF does not comprise of the functionality of entering information on single frames in a video feed and this patent should therefore be considered Not relevant for the Open Access Application Format.
US 2006/0053150 A1 - Data Structure of metadata relevant to moving image

This patent describes a method of combining video with metadata in a way similar to the above patent (US 2005/0289183) but intends to show information simultaneously of different objects in the video stream. Such functionality is not available in Open Access AF and as described in the analysis of the former patent, no obvious references are made to description schemes as they are used in Open Access AF. It must therefore be considered Not relevant to the standard.


This patent describes a method of performing a multimedia contents description with the use of an MPEG-21 interface for supporting intellectual property management and protection for multimedia contents. The patent mentions that it means to expand on the limitations of MPEG-7 Multimedia Description Schemes to a broader spectrum of multimedia content. The illustration of the new descriptions model does not show any obvious similarities to how description schemes are used in the Open Access standard but the first claim are vague enough to be potentially relevant to how MDS is used within Open Access AF. Due to the problem of interpreting the claim, this patent is considered Less relevant to the standard.

US 6,789,088 B1 - Multimedia Description Scheme having weight information and method for displaying multimedia

This patent describes how to index multimedia using a weight indexing scheme. It means to increase performance of multimedia indexing and browsing by assigning weights to multimedia items. Description schemes and elements are used in the attached illustrations but since weighing multimedia items is not a part of Open Access AF, this patent must be considered Not relevant to the standard.

US 7,082,431 B2 - Content Retrieval Apparatus and method

This patent describes a way of decreasing the degree of redundancy of content from increasing when the quantity of term expressions is increased, when a content description (multimedia content) is being retrieved. More exact, the patent means to patent a common language to translate between the Query Language used to query the multimedia information stored and the Content Description Language used to
describe the content itself. In the sense of multimedia description schemes, no obvious evidence of possible infringement can be found neither in descriptions nor in claims of the patent. This patent should therefore be considered Not relevant to Open Access AF.

**US 6,546,135 B1 - Method for representing and comparing multimedia content**

This patent describes a new way of representing syntactic and semantic attributes of multimedia content. It is built upon MPEG-7 (it makes use of descriptors) but the extension which is built upon MPEG-4 does not show any similarities to the use of Multimedia Description Schemes in Open Access AF. To that, Open Access AF does not spatially and temporally segment content in order to extract it which is especially focused on in the claims. Therefore, this patent should therefore be considered Not relevant to Open Access AF.

**US 2001/0047357 A1 - Subjective information record for linking subjective information about a multimedia content with the content**

This invention relates to content distribution and to a subjective information record for linking subjective information about multimedia content within the content. This subjective information record can be used as a description scheme and is therefore connected to MPEG-7 Multimedia Description Schemes. Nevertheless, OA AF does not make use of subjective information records and no similar elements or types from the description schemes are specified within the claims of the patent. It must therefore be considered Not relevant to Open Access AF.


This patent describes a method of how to represent multimedia information via descriptors; generating meta-descriptors from the descriptors and attaching the meta-descriptors to the multimedia. Descriptors are a central part of Multimedia Description Schemes of MPEG-7 but the task of the meta-descriptors mentioned in this patent is to describe the most useful information the descriptors in one or several repositories contain and by using this information enhance searching for specific items within clusters of digital contents. This is done letting the meta-descriptor assign weights to the most probable types of contents the descriptor should describe
(e.g. color 50% and texture 50% from a picture). Although this is not currently used in the MDS used in Open Access AF, this functionality might be supported at a later stage of its development. This patent must therefore be considered Less relevant to the standard.

**US 2001/0032084 A1 - Multimedia information structuring and application generating method and apparatus**

This patent is describing an application generating method using two documents; one with multimedia information (XML or DDL) and one as a style sheet (e.g. XSL). The result is an application, a XML or an HTML document with the multimedia information as generated by the style sheet. The attached illustrations do not indicate any usage comparable to how MDS is used within Open Access AF. It makes use of a client/server system and generating new style sheets when search queries find that the original style sheet is missing which is not a part of the Open Access AF. Therefore, this patent must be considered Not relevant to the standard.

**US 7,092,873 B2 - Method of upgrading a data stream of multimedia data**

This patent describes a way of upgrading a multimedia stream with text pronunciation information to ease the possibility of using SSML, Speech Synthesis Markup Language. Some elements used in OA AF (Author, creationInformation) are mentioned but as an example of a scheme, not as a central part of the invention. Neither the claims coincides with how MDS is used within OA AF. This patent should therefore be considered Not relevant for Open Access AF.

**US 7,055,168 B1 - Method for interpreting and executing user preferences of audiovisual information**

This patent describes how to select one or more video / audio streams and compare user preferences programmed into the used device and compare it to the audio / video attributes. By doing so the patent means to give the viewers a better audiovisual experience to what they like. This patent mentions MPEG-7 and uses description schemes to store attributes in a structured way. This patent does not compare to how description schemes are used in Open Access AF, neither does it claim the exclusive use of description schemes or parts of it. The patent must therefore be considered Not relevant to Open Access AF.
US 7,178,107 B2 - Audiovisual information management system with identification prescriptions

This patent describes a method of describing an audio, video or an image with user preferences information such as browsing, filtering, search and device preferences. It makes use of Multimedia Description Schemes but does not claim rights to it. In future versions of the reference software of the Open Access AF, functionality similar to what is mentioned in this patent might be implemented. This patent should therefore be considered interesting if future versions contain functionality such as letting users save preferences such as how to browse, filter and search his or her digital items as well as store information on what device the items preferably might be examined.

Current versions of the reference software does not show similarities to either preferred embodiment of the invention or the invention itself and this patent must therefore be considered Less relevant to the Open Access Application Format.

US 7,240,285 B2 - Encoding and distribution of schema for multimedia content descriptions

This patent describes how to encode and to distribute schemes for multimedia content descriptions. The patent uses tokens to prioritize what parts of the content to read and what to interpret primarily and secondly.

MPEG-7 is described in the background section of the patent but the usage of the description schemes with tokens is not similar to how Open Access AF uses it neither in claims nor in descriptions. This patent must therefore be considered Not relevant to OA AF.

US 6,944,608 B2 - Method and apparatus for organizing data pertaining to audiovisual content

This patent describes one way of how to organizing data pertaining to audiovisual content. More specifically, it tries to deal with the problem if a description of content is semantic or syntactic. MPEG-7 is also here mentioned as a background to the patent but the patent itself describes how a matrix is created based on a descriptive list and an accessing list. This is not used by Open Access AF in terms of description schemes and the patent is therefore considered Not relevant to the standard.
US 7,203,692 B2 - Transcoding between content data and description data

This patent describes a method of how to transcode data between content data and description data, the content in an MPEG-4 format to a description in an MPEG-7 format. The transcoding is done by using rules in a XSLT format. Parts of MPEG-7 MDS that OA AF uses are not mentioned in the text or in the examples of code given and transcoding with XSLT is not used within the Open Access Application Format. The claims of the patent show no similarities to the use of MDS within OA AF and it is therefore reasonable to believe that this patent is Not relevant for the standard.

US 7,089,543 B2 - Use of formal logic specification in construction of semantic descriptions

This patent describes how to use an occurrence description scheme to search for, filter or browse content when all information of the content is not interesting to the viewer. The patent describes solving the problem of automatically constructing high-level semantic descriptions with the help of formal logic. The patent states that the main reason for this problem is the lack of formal specification of logic within MPEG-7 semantic descriptions which suggests that it aims to extend MPEG-7. This is not used within Open Access AF.

The claims themselves show no similarities to how MDS is used within the standard and the patent must therefore be considered Not relevant to the Open Access AF.

US 6,961,754 B2 - Interactive access, manipulation, sharing and exchange of multimedia data

This patent describes a method for providing an intelligent multimedia services environment in a network, adapting visual content to a screen to one user who can adapt the content visually and send it to another user. It makes use of content descriptions but does not give any obvious references to MDS or elements of MPEG. The usage of the Content Descriptions within the claims does not show similarities to how MDS is used in the Open Access Application Format and this patent is therefore deemed Not relevant to the standard.

This patent describes a method of selecting television content in a digital mobile television communication system. MPEG-7 is mentioned as a possible markup language in the patent to sequence descriptions and user preferences but no further references to MPEG or Description Schemes are made. Since no obvious similarities between the patent and the Open Access AF can be found, it must therefore be considered *Not relevant* to the standard.

US 6,690,725 B1 - Method and a system for generated summarized video

This patent describes a way of using key-frame based video summarization to manage and transmit video information and to provide a method and a system for shot boundary detection and key frame extraction. This patent does not cover Multimedia Description Schemes as part of MPEG-7 and should therefore be considered *Not relevant* for the Open Access AF.

### 3.4.5 Rights Data Dictionary (ISO/IEC 21000-6)

<table>
<thead>
<tr>
<th>Company mentioned in list of ISO</th>
<th># of references</th>
<th># of patents found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contecs: DD LLC</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Total # of references in list of ISO</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Total # of patents found</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3.5: ISO list references and search results of ISO/IEC 21000-6 Rights Data Dictionary

The references in the list and number of patents found are presented in Table 3.5. The list from ISO mentions 2 references to patents and 1 patent have been found and analyzed. This patent has been deemed *Relevant* to the Open Access Application Format.

The references in the list and number of patents found are presented in Table 3.6. The use of a subset of MPEG-21 Part 5: Rights Expression Language within Open Access is described in the Chapter 2.2.5: Rights Expression Language of this thesis. From 3 references from the list of ISO, 12 potential patents were found. From these patents, 9 patents were deemed Not relevant and 3 patents were deemed Relevant to the Application Format.

US 6,963,858 B2 - Method and apparatus for assigning consequential rights to documents and documents having such rights

This patent claims a right management system including one or more consequential
Table 3.6: ISO list references and search results of ISO/IEC 21000-5:2004/FDAM 3:2008(E) Rights Expression Language, AMENDMENT 3: OAC (Open Access Content) profile

<table>
<thead>
<tr>
<th>Company mentioned in list of ISO</th>
<th># of references</th>
<th># of patents found</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Corporation</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Microsoft Corporation</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>OASIS Rights Language Technical Committee (ContentGuard, Inc.)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Total # of references in list of ISO</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Total # of patents found</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

rights associated with the digital content. This patent seems to be very generally defined and the claims cover a general rights management system similar to the MPEG REL used by Open Access AF. This patent should therefore be considered Relevant to the Open Access AF standard.

**US 7,299,171 B2 - Method and system for processing grammar-based legality expressions**

This patent describes a way of improving speed of interpreting legality expressions. It does make several references to the MPEG REL but it is focusing on how to partition and index legality expressions into units of evaluation in its main claim. This does not coincide with how Open Access AF uses REL and this patent should therefore considered *Not relevant* to Open Access AF.

**US 7,206,765 B2 - System and method for supplying and managing usage rights based on rules**

This patent describes a method for enforcing rights expressions and how to compare a rights expression given by a provider of content with a rights expression given by a potential user of the content. The main claim of this patent show similarity to how MPEG REL works and as that is used by Open Access AF, this patent should therefore be considered Relevant to the Open Access standard.
US 2003/0182142 A1 - Rights Expression System

The patent claims to describe one rights expression system for facilitating creation and modification of rights expressions written in a REL based on one or more schemes that are provided. This is defined in a very general way and the given illustrations shows of examples of schemes and elements used in the Open Access AF and the MPEG definition of ISO/IEC 21000-5. This patent should therefore be considered Relevant to Open Access AF.

US 2003/0182142 A1 - Systems and methods for creating, manipulating and processing rights and contract expressions using tokenized templates

This patent describes a way of manipulating rights expressions to use in a rights management system by including one or more tokenized templates. The tokens work as placeholder for one or more data items and a license instance creation module can replace the tokens with the actual data items to create actual license instances.

This patent describes another way of implementing a rights expression system using tokens within its claims, something that the Open Access AF does not do. Elements used in the patent are not similar to elements used in OA AF. This patent should therefore be considered Not relevant for Open Access AF.


This patent describes a method for managing a legality expression adapted for the use in a system for processing said legality expression compromising a number of steps. This first claim is also defined very generally to ensure maximum coverage of the patent. This patent focuses heavy on security related issues and makes in its claim use of a removable storage devices such as a card with a magnetic strip with a card reader or membership cards that allow for authorization. This is not similar to the use of REL within the Open Access AF and this patent must therefore be considered Not relevant to the standard.

US 2006/0206931 A1 - Access control policy engine controlling access to resource based on any of multiple received types of security tokens

This patent describes an access control policy engine associated with a resource that
determines whether a user is allowed to have access to the resource. No references are made to REL, to the elements used of MPEG REL and the main claim does not show any similarities to the way REL is used in Open Access AF. Therefore, this patent must be considered *Not relevant* to the standard.

**US 2006/0206925 A1 - Delegating right to access resource or the like in access management system**

This patent describes how a resource is provided access to via an administrator to a requestor with the help of credentials. The first claim also specifies different ways of doing so. None of these ways seems to have similarities to how MPEG REL or its subdivision thereof uses rights expressions and this patent should therefore be considered *Not relevant* to Open Access AF.

**US 2006/0206712 A1 - Long-life digital certification for publishing long-life digital content or the like in content management system or the like**

It is described in this patent how a digital certificate is employed to produce a digital signature for a digital construct. This is used together with a certificate validity period and a signature validity period to ensure the time period of when the digital signature is considered to be valid. The description of how an embodiment of the invention could be done by defining the certificate in XML according the syntactic of MPEG REL. This is also mentioned in the claims of the patent.

The main reason for this patent though is to extend the lifespan of the validity of the signature and the certificate. This is done by setting the signature creation validity period to a relatively short time period and the certificate validity period to a relatively long time period and is specified in the claims of the patent. This technique is not used within Open Access AF and the patent must therefore be considered *Not relevant* to Open Access AF.


It is described in this patent a method of how to dynamically apply a rights management policy to a message by allowing an administrator to associate certain rights management policies with certain senders and recipients of messages. Users and groups of users with these rights are also defined. This (also according to the main
claim of the patent) seems to be another way of defining rights and grants to users but it does not show any similarities to Open Access AF in respect to MPEG REL. It should therefore be considered *Not relevant* to Open Access AF.


This patent has several similarities to the patent US 2005/0216745 - *Method for dynamic application of rights management policy* as they share inventors, the patents are filed the same day by the same company and the description on both patents are very similar. The focus on this patent lies in how to allow an administrator to automatically update a rights management protected message as it passes through a message transfer agent.

Since the former patent is not considered relevant for the OA AF standard and this patent seems to be an extension of the former patent and the fact that the claims of this patent does not apply to how REL is used in Open Access AF, this patent will be considered *Not relevant* to Open Access AF.

**US 2006/0242081 A1 - Supplementary trust model for software licensing/commercial digital distribution policy**

The abstract of this patent describes a flexible use licensing system for an application compromising a plurality of licensable products each with an application level product policy definition license and a licensable product policy definition license corresponding to each licensable product. It lays focus heavily on how products can be licensed online against a license server and be permitted to run on the computer of the user. This is the main description of the first claim and since no similarities to Open Access AF or MPEG REL can be found, it is concluded that this patent is *Not relevant* to Open Access AF.

### 3.5 Conclusions of patent analysis

The results from the patent analysis can be viewed in Table 3.7. Patents have been searched for from parts of the MPEG-7 and MPEG-21 standards. From the 46 patents that have been found and examined thoroughly, four patents seem to have
Table 3.7: Distribution of degree of relevancy for patent analysis

<table>
<thead>
<tr>
<th>Feature</th>
<th>Relevant</th>
<th>Less relevant</th>
<th>Not relevant</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
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</tr>
<tr>
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<tr>
<td>Summary</td>
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<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>46 patents</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

features that might be contained within the Open Access Application Format and seven patents has been considered less relevant due to different reasons. These 11 patents should be examined by a patent lawyer or patent agent in order to get a better grade of relevancy.

Four relevant patents out of 46 analyzed patents might be interpreted in one of two ways:

- The search method used was too inefficient to give reasonable results
- There are few to no attributes of Open Access contained within patents covering the MPEG standards

The search method in itself uses the biggest online search engines available today, covering US and European patents. Several smaller search engines with coverage of separate countries in other parts of the world are available but cover either patents in other languages or just one country and have therefore been excluded. The search terms concerning each standard have been narrowed down to ensure getting as accurate results as possible.

This leaves us with the second option of the two alternatives. The list of ISO specifies what companies have patents concerning parts of standards from MPEG-7 and MPEG-21. Open Access makes use of relatively small parts of these parts of the standards. Notice the sum of Not relevant patents given for ISO/IEC 15938-5 Multimedia Description Schemes in Table 3.7. This part of MPEG-7 is huge and
the amount of irrelevant results is therefore not surprising. It is also not remarkable that the few relevant patents found belongs to parts of MPEG-21 that are noticeably smaller and where the Open Access Application Format uses a larger part of the parts mentioned such as the ISO/IEC 21000-6 Rights Data Dictionary.

Also remarkable is the amount of patents found for companies concerning ISO/IEC 15938-5 Multimedia Description Schemes. A little more than 50% of the companies stated in the list did not return any patent results at all. The same problem occurred when searching for patents concerning ISO/IEC 21000-5 Right Expression Language. IBM was referenced from the list of ISO and no patents at all from IBM could be found.

Possible reasons for this could be that some of the companies have patents only covering Asia or other parts of the world which has not been included in this search. Another possibility that should be considered is that the patents have either been sold to other companies or belongs to subsidiaries of the company, thus filed with another company name.

A third possibility is that several companies have filed some patents under their full name, some patents under abbreviations of the company name. Examples of this are patents from CIE (Columbia Innovation Enterprise). The full company name reveals over 2000 results with Google Patents, in comparison to zero patents when the abbreviation is used. Although it has been assumed that the names of the companies given in the list of ISO should match the given company names in the patents, this cannot be taken for granted.

Another interesting fact is the absence of the European patents. 45 out of 46 patents found and analyzed are U.S., which raises the question if European patents are harder to find. The reason for this depends on the online search engines available. Both DEPATISnet and esp@cenet offer searching for inventors and assignees but searching the content of the patent is limited to the abstract and the title of the patent. The search terms used are generally not mentioned in these parts, they are more likely to be found in the detailed descriptions within the patent which are unsearchable. This would explain the absence of these patents from the search results.
Chapter 4

Showcase development

This part of the thesis intends to describe the planning, development and implementation of a showcase for an Open Access system. The prerequisites of a showcase is discussed by creating a use case based on the benefits of the standard to the user and describing what demands technologies used for the implementation must meet. Lastly, the implementation is described, the resulting showcase evaluated and further improvements to it suggested.

4.1 Prerequisites of a showcase

This section intends to describe the prerequisites of a showcase. This is done by describing what functionality the Application Format could provide to the showcase itself and the requirements on the technology the showcase would use.

4.1.1 Modeling of a use case

Several use cases to exemplify how the standard could be use were given in the document MAF Overview [28] provided as Application Scenarios. These use cases have been used as a basis for developing a more suitable use case for the showcase. This section describes what features from the Application Format the showcase would benefit from and explain how each feature could be used with the help of the
use case. The feature description is written in a normal font and the use case in a *italics* font.

**User Interface**

In its most basic form, the user looking for public material would need a “portal” to search for content. This would take the form of a website, where the content is presented to the user in a simple way. The use of a website is also convenient as many users are comfortable with such an interface from earlier experiences with web browsers.

*The web designer Mark is currently working on a new set of icons he developed, created for web developers who wishes to enrich their web sites or web applications with graphic elements. Mark is a relatively new designer and wishes to release some of his work for “free” in order to create a name for himself. Mark decides to publish his designs online in a portfolio that presents the user with the icons he created. This way, he knows that he is able to reach a larger audience with his work.*

**Content Metadata**

To provide the content within the user interface, a basic set of Open Access-released files would be used; the showcase being able to read in these files sorting out the relevant metadata and reveal the content to the user. Examples of metadata to be shown would be the title of the file, the author and the applied rights attached to each item. The released files presented within the showcase would also be provided as downloads. The downloaded material would then be used together with the Open Access reference software allowing the user to extract the content he or she is interested in.

*Mark package his icons in a Open Access file, where his icons contain metadata describing the name of each icon, his name as the author and then assigns rights to the icons depending on what the user will be allowed to do with the content. This way, the users of his material would have an easy time finding what they are looking for and to know instantly whether they can use the icons they way they want to or*
not. Should the web developer find material he or she is interested in, it will be easy for him or her to download the package of the icons directly from the portfolio.

Content Search

![Diagram of licenses]

Figure 4.1: Licenses intended to be supported within the showcase

The way of presenting the information to the user has traditionally been in a table of some kind presenting the user with files sorted by name, date when the files were uploaded or by rating; the popularity of downloading the item. Open Access provides new possibilities of sorting the digital content with the inclusion of metadata applied to the items.

One way of presenting the user with the digital items would be to sort them according to what licenses apply to each item. The way Open Access AF can describe licenses is provided in Chapter 2.2.4: Metadata. A user aware of the free licenses available and what they stand for could find the content supporting these licenses faster. The more common freely available licenses today are available from Creative Commons [29], GNU [30] as well as the Public Domain [31]. The licenses intended to be
supported in this showcase are depicted in Figure 4.1. These licenses give the user a possibility of licensing his work with different rights presented to the user with an attached license, or just a hyperlink to a web page. Presenting the items directly with the license and a link to it to the user would be a valuable addition to the showcase.

Mark knows that the users of his material would be somewhat familiar with the licenses available for free on the web. The web developers using designs from others need to be sure that content they have on their web sites not created by them is being used without breaking any copyright laws, license agreements etc. Mark therefore decides to tag his icons with license tags, depending on what license he chooses to apply to each icon. He will then be able to present his icons on a separate page in the portfolio sorted on what licenses apply to each icon. In the case that the users do not know about how the licenses work, Mark decides to provide an extra description of the licenses, just in case.

Another way of presenting the user with the digital items would be to sort them according to what rights apply to each item. An user aware of the rights available from the MPEG-standards would then be able to quickly find e.g. executable or printable content. The Open Access Application Format provides the rights Play, Print, Execute, Adapt, GovernedAdapt and GovernedCopy for this purpose, as presented in Figure 4.2 and described in Chapter 2.2.5: Rights Expression Language of this thesis. The user has the ability to click on a digital item which would allow him / her to be presented with the rights together with the rest of the metadata applied to the item. Each right would also be explained in a short text form directly within the show case.
Mark also decides to tag his icons with rights information explaining to the user whether he or she can print the icons, use them commercially or distribute them to other users. A quick overview of such rights would probably also be interested to the web developers, as Mark know that some of his friends are interested in further designing his icons. As the icons are tagged, he is able to present the other developers with the icons sorted by what rights apply to them on a separate page in the portfolio. Not every user understands what the rights represent and he therefore explains each right in the showcase briefly.

The content user might also find it useful to see the relationship between content and its derivatives. This would be valuable if the content user has found content almost similar to what he or she is searching for but needs parts of the content or something more from the content. An example of this would be a part of a song the content user needs or an image with adjusted colors. This is supported in the Open Access AF, described in Chapter 2.2.2: Digital Item Identification of this thesis and shown in Figure 4.3.
This could be represented in the showcase by specifying that one item within the content is a derivative of another item within the content or from another item not included in the database. This item could also have originated from another item within the content or an item not included in the database. This would then simplify the search for new content the user is looking for that is similar to something else the user found or that has another license or other rights applied to it allowing the user to do what he or she wishes to do with the content.

Mark does not work alone on his designs. He is part of a network of web designers, which allows the users of the network to share their material and help each other to further improve the designs. Three other designers, Fredrik, James and Mark, have seen the icons Mark developed and have been allowed to further improve them. Mark realizes that if he would allow them to publish their derived work in his portfolio, it would benefit him and the others. Mark’s colleagues published their work with the help of Open Access as well, applying metadata similar to what Mark has done.
With the use of the new standard, Mark would be able to add a third page to his portfolio where the original and the new icons are not only shown, the relationship between them could also be presented to the other designers. This would allow the designers who make use of Mark and his colleagues icons to easily find new icons that suits their needs better.

4.1.2 Requirements of functionality

Using the use case described in the previous chapter, a set of functional requirements has been developed for the showcase. An evaluation of how well the finished showcase has fulfilled this set of requirements is given in Section 4.4: Conclusions of this chapter.

- Simple website with the digital items presented to the user
- Digital items read in from Open Access-released files
- Downloadable released files with digital items
- Items presented with attached metadata, such as name of the item, author of the item and the applied rights to the item
- Present the user with the digital content sorted by what licenses applies to it as well as presenting the licenses themselves to the user
- Present the user with the digital content sorted by what rights applies to it as well as presenting the rights themselves to the user
- Present the user with the digital content sorted by what relationship the item has with other digital items as well as describing the types of relationships to the user

4.1.3 Requirements of technology

One technical prerequisite for the development of the showcase was to be able to use functionality of the ISO/IEC 23000-7 Open Access Application Format reference software. The obvious advantage is the implementation of the features of the
standard, such as the packaging and extraction of digital content, the possibility of applying metadata to each digital item, such as file name, author, description and title, applicable rights and relationships each item has with other digital items. The packaged content can be digitally signed, to be able to identify the content as a specific work of a certain author later on. This software is written in Java and it is therefore suitable to find a technology supporting Java in developing the showcase.

The second equally important prerequisite for this implementation was the consideration of building the showcase as a web application. Unfortunately, no consistent definitions of the term web application can be found and the meaning in this thesis is therefore explained here.

Web applications consists of moving traditional software, usually installed on the computer of the user to the web, dividing the application into server-side code and a client-side code. The advantage of this is the possibility of running several instances of the application remotely, and to let the client interface be contained within a web browser. The main work is done directly on the server, thus saving resources for the user and only presenting the user with the data that is interesting to him or her. The application is available on any computer with a browser and the necessary web technologies installed.

**Java Servlet**

The Java Servlet [32] is a Java programming language class used to extend the capabilities of servers that host applications accessed via a request-response programming model. It is most commonly used by extending functionality of applications hosted by web servers. Servlets can handle HTTP Get-requests, construct responses to these requests and track session information. They are portable, easy to develop in one developing environment and to deploy in another (different operating systems, different servers). They are usually run in a special secure environment such as inside servlet-supported web servers or in stand-alone servlet web containers.
JSP (Java Server Pages)

Java Server Pages [33] is a technology that is able to dynamically generate HTML, XML or other types of documents in response to a web client request. This allows the user to embed Java content into static content.

This is done by using JSP actions, a type of XML-like tags, to invoke the built-in functionality. JSP allows the developer to extend the functionality of standard HTML or XML tags by implementing their own JSP tag libraries. Using a JSP compiler compiles the code into either a servlet in Java code, which must then be compiled by a Java compiler, or byte code for the Servlet directly.

Apache Tomcat

Apache Tomcat [34] is a Servlet Container, implemented by the Apache Software Foundation. It implements the Java Servlet and the Java Server Pages (JSP) specifications from Sun Microsystems and provides a HTTP web server environment for Java code to run. Apache Tomcat is released under the Apache Software License.

Google Web Toolkit

Google Web Toolkit (GWT) [35] is an open source Java software development framework that allows web developers to create Ajax applications in Java. The main advantage of this technology is its possibilities to make use of Java classes, compiling them into HTML and JS (JavaScript) as they are deployed. Google Web Toolkit provides classes that define Widgets, GUI-elements such as checkboxes, buttons and textboxes. Widgets provide the functionality and are placed in Panels, which can also contain other panels. The developer create new Widgets based on simpler ones, connect them to Java classes that contain the functionality they wish to have, encapsulate the Widgets in proper panels to build up the GUI, compiles and test the code and finally deploys the application when it is ready. Google Web Toolkit offers two ways of testing the implementation:
• Hosted mode: Running the code within a Java Virtual Machine (JVM). This mode makes use of a built-in customized version of the Apache Tomcat servlet container to test client/server RPC (Remote Procedure Call). This mode is best used for development.

• Web mode: Running the code purely in JavaScript and HTML, compiled from the Java source. Allows the user to test the code directly in the preferred web browser, where client/server communication runs over the Apache Tomcat servlet container in GWT. This mode is best used for deployment.

GWT also comes with the possibility of debugging the Java code directly while running the program in JavaScript in the browser. It uses RPC for server-client communication and has added browser history support.

A short evaluation of how well the technology used has performed is given in Chapter 4.4: Conclusions of this thesis, and Figure 4.4 shows how the technologies are integrated in the showcase.
4.2 Architecture and implementation

Figures 4.5-4.7 are color-coded as follows: the blue blocks symbolizes packages the reference software and the showcase share, red blocks symbolizes the Open Access reference software packages, purple blocks the packages of the showcase and the orange blocks the classes of the showcase.

The showcase has been implemented to be integrated with the current reference software of Open Access. As shown in Figure 4.4, the classes of the showcase are embedded in the org.ldv package. The org.ldv.oa-classes all belong to the reference software developed for OA, and have not been altered since beginning of implementation.

Thus, the showcase classes are packaged in the org.ldv.showcase-package. The classes are divided into two new packages, client and server. The classes in the server package executes during startup of the showcase, the other classes handles the user input, when the server has responded and the GUI has been presented to the user.
4.2.1 Structure of server/client classes

As shown in Figure 4.6, the server consists of two classes, `DataServletOA` and `M21FileFilter`. `DataServletOA` acts as servlet when the showcase starts up. It is called by the `ShowcaseOA`-class (The main class) and starts a search for the .M21-files (Open Access released files) in the specified directory by filtering out the relevant files. The filtering is handled by the class `M21FileFilter` which returns a list of the files to `DataServletOA`.

`DataServletOA` makes use of several classes from the reference software. It parses the digital items contained in each .M21-file, reads the appended metadata and stores the information in `DigitalItem`s, a class part of the `org.ldv.showcase.client.items`-package. As the server-side code finishes its execution, an `DigitalItem`-array is returned to the client. The client reports within the showcase that server-side code execution was successful and shows the initial `Sink` to the user.

Figure 4.6: Architecture of Server / Client packages
The client’s base lies in the ShowcaseOA-, the DataServiceOA- and the DataServiceOAAASync-classes. The two latter classes handles the server communication, telling the client what functions are available to call on the server. As all server-side code is executed during the startup of the showcase, the only used function is getDataitems() which prepares the digital items to the client. The structure of the client and its packages are presented in Figure 4.7.

4.2.2 Structure of the sink-classes

The sink-package contains the framework for the GUI and is written by Google. It was originally developed for the KitchenSink-application, a showcase for Google Web Toolkit which is attached to GWT as it is downloaded [36] and installed. The main reason for this was its flexibility (it is easy to style the widgets within, across different browsers), its expandability (adding new sinks to the showcase is easily done) and its compatibility (all widgets available from Google are consistently rendered within the sink).
The sink framework consists of two classes: the Sink-class and the SinkList-class. The GUI renders with a list of sinks on the left side of the screen and an initial sink on the right-hand side. This is shown in Figure B.1 in Appendix B.

The sinks are “lazily instantiated”. This means that each sink has a init()-method which is not called until the user actually clicks the appropriate link in the list on the left of the GUI. This results in a faster startup performance of the showcase but adds some time between the request from the user until the actual sink is shown.

Several views are available in the showcase and each view is represented by a sink. The classes of these sinks are stored in the sinks-package and are presented here.

The LoadingView-class is presented to the user during startup of the showcase and is replaced with the initial sinkList and sink when the server has returned the array of DigitalItem:s.

The InfoView-class is a simple sink that supplies the initial welcome-text to the user presenting the showcase and informing the user of its purpose. It is depicted in Figure B.1, in Appendix B.

The DataBaseView-class provides the user with a more classical structure of items made available online. The items are structured in a table presenting information such as the name of the item, a small preview icon if available and a description. Clicking directly on the filename lets the user download the package containing the digital item. Additional information presented in the table are the different rights that apply to each item, as well as the license tag/s associated with it. A preview of this view is available in Appendix B, Figure B.2.

The LicensesView-, the RightsView- and the RelationsView-classes have some things in common: they all present the digital items to the user within a tree structure and clicking on an item within the tree updates a table on the right hand side of the GUI. This table provides the metadata from each digital item and depending on how the tree is sorted, also information on each license, right or type of relationship.

The LicensesView-class presents the user with the digital items sorted by what license are applied to them. The licenses implemented are presented in Figure 4.1
in the *Functionality of Open Access showcase* section of this chapter. Each license is represented as a parent node and the items with the license applied as child nodes to it. Clicking the license directly updates the table with the title and a brief description of the license. This class is provided with a screenshot in Appendix B, Figure B.3.

The **RightsView**-class provides the user with the digital items sorted by what rights apply to each item. Rights available are presented in Figure 4.2 in the *Functionality of Open Access showcase* section of this chapter. Each right is represented as a parent node and the items with the right applied as child nodes to it. Clicking the right directly updates the table with the title and a brief description of the right. This class is provided with a screenshot in Appendix B, Figure B.4.

The **RelationsView**-class provides the user with the digital items sorted by what relationships they have to the other digital items. This is currently only supported in 2 levels; icon that are both originals and derived items are not implemented in the showcase. This would clutter up the tree structure and has therefore been left out. Each icon is therefore represented as an original item, a derived item or an item without known relationships to other items. Derived items to original items or original items to derived items are represented as child nodes to the items in the tree structure. This is exemplified in Appendix B: Figure B.5.

The relationships between items are to a certain extent implemented in the two previous mentioned sinks: the **RightsView**- and the **LicensesView**-sink:s. Each item with an relationship has an original or a derived item attached as a child node. Examples of this can be viewed in Appendix B: Figures B.3 and B.4.

### 4.2.3 Structure of the item-classes

The **item**-package contains five classes all representing different kinds of items used within the showcase. The most important one is the **DigitalItem**-class where each instance of it contains the metadata from one digital item within a released Open Access file. The information are stored as **String**:s or in **ArrayList**:s of **String**:s, the metadata easily accessible via getter- and setter-methods.
The TreeItems-class creates custom widgets to place within the tree structure of the digital items. It concatenates HTML code to deliver each TreeItem as a small preview of the item presented, along with the filename of the item.

The LicenseItem-, the RelationshipItem- and the RightItem-classes are all representations of the treeitems that are not digital items. These items contain a description of the license, relationship or right that the instance of the class is associated with. This is done to be able to present the information simple to the user in the table of the GUI as he / she clicks on the appropriate item in the tree structure.

4.2.4 Secondary classes

The iconset-package contains three classes; the Bundle-, the IconSetsFinal- and the ItemTreeRelationshipCreator-classes. Bundle and IconSetsFinal creates previews for the digital items if they are image items. This is then used by the previously mentioned TreeItems-class to create the tree items.

The task of the ItemTreeRelationshipCreator-class is to read through the metadata of the digital items, determine if a relationship between two items exist and create a tree structure between them if this is true. This way, the relationships between the digital items can be presented to the user in the tree structure.

The last package, the infopanel-package, contains one class. The InfoPanelGUI-class receives the information from the DigitalItem currently selected in the tree and updates the table within the sink with the metadata that comes with it. It also renders download links to the .M21-file the item is packaged in.

4.3 Conclusions of showcase development

The showcase has been under development for over 3 months. The main issue during implementation has been the lack of documentation available online for Google Web Toolkit. The documentation on how to develop an application that uses the RPC functionality of GWT is very thorough. The documentation on how to deploy the developed application to a web server has been very poor. Several forums,
especially under http://groups.google.com, has been very helpful, and at the time of writing this thesis, a new version of GWT has been released. To this, Google has updated their own tutorials and documentation of deployment together with several known servlet containers which has been very helpful during the last stages of implementation.

To conclude how well the requirements from Section 4.1.2 Requirements of functionality of this chapter have been met in the developed showcase:

- **Simple website with the digital items presented to the user**

  The showcase gives the impression of a website more than an application. This has been easy to achieve with the use of Google Web Toolkit, which was able to provide the components of a web interface. The digital items used together with the showcase are presented in different views to the user.

- **Digital items read in from Open Access-released files**

  Achieved, as the metadata of the digital items are read in to the showcase on the server during startup. This was also possible by using GWT and its functionality of translating Java classes to JavaScript, thus providing the functionality of the reference software to the showcase which could interpret the metadata of the released packages provided.

- **Downloadable released files with digital items**

  Each digital item in every view of the showcase provides the user with a direct link to download the packaged content associated.

- **Items presented with attached metadata, such as name of the item, author of the item and the applied rights to the item**

  As each item is clicked, the table on the right hand side of the GUI updates with the metadata connected to the item. The metadata presented comprises of the item name, a simple description of the item, the attached rights, license-tags and copyright notice.
Present the user with the digital content sorted by what licenses applies to it as well as presenting the licenses themselves to the user

Achieved, as the LicensesView-sink provides this to the user. Clicking the licenses within the tree structure of the class brings up a simple explanation of the license.

Present the user with the digital content sorted by what rights applies to it as well as presenting the rights themselves to the user

Achieved, as the RightsView-sink provides this to the user. Clicking the rights within the tree structure of the class brings up a simple explanation of each right.

Present the user with the digital content sorted by what relationship the item has with other digital items as well as describing the types of relationships to the user

Achieved, as the RelationsView-sink provides this to the user. The relationships are briefly described when clicked on.

The use case does also fit well into the current version of the showcase. Mark would be able to use the showcase as a portfolio, packaging his set of icons with the Open Access reference software and deploy the showcase with them. As long as Mark knows how to apply the metadata, describe the licenses and rights he wishes the icons to be associated with, this showcase would help him to achieve this goal.

A potential more complex use case would be creation of an MP3-file, where parts of the file are created by several different composers. Since audio files are made up of tracks; one for bass, one for chorus, one for guitar etc., these could be provided in a content database. Using the current reference software to publish the tracks in the showcase with applied licenses that allow derivation, composers could download different versions of tracks provided, mix them on their own computers, add their own tracks or material and upload the final audio file to the showcase. Each new audio file would, with the help of the metadata of relationships point to each separate used track within the showcase, and thus make it easier for other users to create similar yet different mixes themselves.
4.4 Suggested improvements

The use case used as a basis for this showcase has been developed with a possibility of extending it in mind. The focus of this showcase has been on new ways of delivering the content to the user, meaning presenting the attached license or rights in a simple way to the user. The possibility of viewing relationships between items directly in the showcase is also new, and the content to be downloaded is available in its released packages.

One feature that the showcase would benefit from, would be the implementation of Event Reports. The possibility for the content author to receive information directly when the user downloads the content, in the form of e.g. an email, would improve functionality. The content author would then be aware of if the digital items downloaded from the showcase would be used in a way the rights or the attached license do not allow. The information provided from the Event Reports could also be used to generate statistics about how many times the content has been extracted or derived. These events are defined [3] when new rights are exercised on the items (Play, Print, Execute, Adapt, GovernedAdapt and GovernedCopy).

Another interesting feature would be the packaging and creation of content directly within the showcase. The possibility of choosing digital items directly in the showcase from a local storage, attach metadata to the items and release them as a signed Open Access File would improve the showcase by showing new users to the standard how easy it is to create their own packaged content ready to be released online.

The feature of being able to directly download digital items instead of the signed packaged content would also be a nice update to the showcase. In this case, the user should be presented with the license, the rights, the copyright notice or a chosen combination first to ensure that the user are aware of what he /she is allowed and not allowed to do with the digital item.
Appendix A

Patents search results

ISO/IEC 21000-2 Digital Item Declaration

Matsushita Electric Industrial Co., Ltd.


ISO/IEC 21000-3 Digital Item Identification

Matsushita Electric Industrial Co., Ltd.

• Shen, S. M., Huang, Z., Ji, M., Ueno, T. 2003. MPEG-21 DIGITAL CONTENT PROTECTION SYSTEM, US 2005/0271205 A1, found with esp@cenet

ISO/IEC 21000-9 File Format

Apple Computer Inc.

ISO/IEC 15938-5 Multimedia Description Schemes

Ericsson
• Abdeljaoud, Y., Ebrahimi, T., Christopoulos, C., Mas Ivars, I. 2000. METHOD AND A SYSTEM FOR GENERATING SUMMARIZED VIDEO, US 6,690,725 B1, found with Google Patents

ETRI (Electronics and Telecommunications Research Institute)
• Kim, M., Kim, J. W., Ro, Y. M., You, K. W. 2000. EXTRACTING TEXTURE FEATURE VALUES OF AN IMAGE AS TEXTURE DESCRIPTOR IN A TEXTURE DESCRIPTION METHOD AND A TEXTURE-BASED RETRIEVAL METHOD IN FREQUENCY DOMAIN, US 6,803,919 B1, found with esp@cenet


• Kim, J. G., Chang, H. S., Kim, M., Kim, J. W. 2000. VIDEO SUMMARY DESCRIPTION SCHEME AND METHOD AND SYSTEM OF VIDEO SUMMARY DESCRIPTION DATA GENERATION FOR EFFICIENT OVERVIEW AND BROWSING, US 2007/0101266 A1, found with esp@cenet

France Telecom


Hyundai Electronics Industries

• Park, C-S., Kim, J-D., Kim, N-K., Kim, H-K. 2000. METHOD FOR INDEXING AND SEARCHING MOVING PICTURE USING MOTION ACTIVITY DESCRIPTION METHOD, US 6,973,257 B1, found with Google Patents

IBM Corporation


Kabushiki Kaisha Toshiba


LG Electronics Inc.


Matsushita Electric Industrial Co., Ltd.


Mitsubishi Electric Research Laboratories, Inc.


Philips Electronics North America Corporation

Ricoh Company, Ltd.


Robert Bosch GmbH


Sharp Laboratories of America, Inc.


- Errico, J., Van Beek, P. 2000. METHOD FOR INTERPRETING AND EXECUTING USER PREFERENCES OF AUDIOVISUAL INFORMATION, US 7,055,168 B1, found with Google Patents

Sony Corporation


ISO/IEC 21000-6 Rights Data Dictionary

Contecs:DD LLC


Rights Expression Language

Contentguard Holdings, Inc.


• Ta, T., Chen, E., Lao, G., Valenzuela, E. 2006. METHOD AND SYSTEM FOR PROCESSING GRAMMAR-BASED LEGALITY EXPRESSIONS, US 7,299,171 B2, found with esp@cenet


Microsoft Corporation


- Brewster Dillaway, B., LaMacchia, B., Paramasivam, M., Rose III, C. F., Nath Pandya, R. 2005. DELEGATING RIGHT TO ACCESS RESOURCE OR THE LIKE IN ACCESS MANAGEMENT SYSTEM, US 2006/0206925 A1, found with esp@cenet


Appendix B

Screenshots of the Open Access Application Format Showcase
Figure B.1: Showcase: Startpage
Figure B.2: Showcase: Items sorted in table
Figure B.3: Showcase: Items sorted by license
Figure B.4: Showcase: Items sorted by rights
Figure B.5: Showcase: Items sorted by relationships to other items
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