

ANSI/AIIM 73-200X

**Standard for Information
and Image Management —**

**Standard Recommended Practice —
eXtensible Markup Language (XML)
for the Interchange of Document
Images and Related Metadata**

Association for Information and Image Management International

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Abstract

This document provides technical information on the AIIM standard data format for the interchange of images and their associated resources. The format is XML (eXtensible Markup Language), Version 1.0. The XML is based upon a domain-specific DTD (Document Type Definition) and Schema defined herein.

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Document History

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Draft Three

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Draft Four

Produced by Bernard Chester, 10 January 2003, based upon feedback to draft 3, more conformance to AIIM Standards layout, and addition of Schema and DTD.

1 Foreword

The Association of Information and Image Management (AIIM) initiated work on this standard in April 2001.

Scanned (bitmap) images of paper documents have become a common method of storing and sharing information in the public and private sectors. The increasing growth of the Internet and sharing of images demands an efficient standardized method of exchanging images and the metadata associated with them. This will enable not just the sharing of images but the critical index and other values needed to store, retrieve, and distribute them. The use of XML data as a method of sharing data is experiencing rapid growth. This standard specifies ways to accomplish the interchange of images using XML documents.

While the assigned goal of the committee (see Scope below) is to address the use of XML with document images, it is the belief of the working group that this standard can be extended to cover the sharing of all electronic documents.

2 Scope and Purpose

2.1 Scope

This draft standard specifies methods for using eXtensible Markup Language (XML) for the interchange of metadata about image files, and the image files themselves. If accepted by the AIIM working group, it will be proposed as the seed for an International Standard project within ISO TC171. This initial standard does not address XML for text files or any vertical industry XML definitions. It is limited to document image files and will not address digital still images¹.

2.2 Purpose

The purpose of this document is to define standards for data in a way that benefits both the consumers and vendors of imaging systems. Some possible benefits are:

- Data can be both exported from and imported to one standards-compliant imaging system to another.
- Disparate imaging systems within an enterprise (due to autonomous selection, replacement, or merger/acquisition) will be able to exchange or consolidate imaging data.

To this end, the standards are defined with the goal of striking a balance between being either too restrictive or too general. They should be broad enough to encompass all common image data types, as well as ones that might be expected in the future, and all common uses of imaging systems, as well as ones that might be expected in the future. On the other hand, the standards should be restrictive enough so imaging vendors do not have inordinate difficulty complying with the standards.

¹ NISO has proposed a Draft Standard “*Data Dictionary – Technical Metadata for Digital Still Images*” which is addressing this case.

3 References

3.1 Referenced international standards

- eXtensible Markup Language (XML) Standard
- XML Schema
- XML Namespace
- AIIM Standard Terminology
- Dublin Core Metadata
- ISO 639: “Codes for the representation of names of languages”
- ISO 8601: “Representation of dates and time”

3.2 Referenced American national standards

- IETF RFC 1766

3.3 Referenced publications

- Tagged Image File Format (TIFF) Standard
- The official W3C Recommendation that defines XML and DTDs is available at <http://www.w3.org/TR/REC-xml>.

4 Terms and Definitions

For the use of this document, the following definitions will be used:

4.1 *Repository*

A repository is a computer system used to file and organize electronic documents. Typically, these systems associate metadata with each document held, to permit effectively locating and managing the documents.

4.2 *Content*

Content is a data stream that provides a representation of an electronic image file. The data encoding is not restricted, however it must be describable using the required metadata attribute, *Encoding*, as described below. Typically, the data stream, if instantiated as a computer file, can be interpreted by one or more viewing applications.

4.3 *Document*

Each Content is embedded in an XML stream that provides information as to the encoding and provides metadata that describes the content and its context. The XML stream that acts as a carrier for the content is referred herein as the *Document*.

4.4 *Page*

Content is broken into discreet units, referred to as *pages*. While this may be expected to relate directly to the content required to represent one side of a sheet of paper, this specification does not mandate that relationship.

4.5 *Rendition*

A *rendition* is the electronic encoding of a page. This specification provides for multiple different renditions of a page to be included in document. An example of multiple renditions would be the Tiff G4 Fax encoding, and the bitmap thumbnail of the same page.

4.6 *Annotation*

An *annotation* is content intended to carry comment, markup, or other information that is connected to a page. Annotations are associated with a specific rendition of a page, and may be tied to a specific spot or area on the page.

4.7 *Property*

Each metadata element provided in the package is referred to as a *property*. Properties may be selected from the set described by this specification, and are therefore, *well known*, or they may be user defined according to the rules supplied in this document, in which case they are referred to as *custom*. The use

of custom properties to assist in interpreting packages is a topic not covered by this standard.

4.8 Attribute

Metadata elements (Properties) may have modifiers that describe the representation of the element – for example, the encoding being used. These modifiers are labeled “attributes”.

5 Abbreviations

DTD – Document Type Definition

IETF – Internet Engineering Task Force

ISO – International Standards Organization

W3C – World Wide Web Consortium

WWW – World Wide Web

XML – eXtensible Markup Language

6 Application of the Standard

This standard may be used anytime an image is transferred between users, either within an organization or between organizations. The standardization of metadata permits the interchange to operate independently of the usage and storage on either side.

Scenarios for its use are:

- Introduction to a repository.
Delivery of new images from an image capture system formatted according to this specification should be easy to introduce into a repository system.
- Exchange between repositories.
There are occasions when images need to be moved or copied between image repositories. Today, this is usually supported by using custom scripts or tools, each designed to support a specific pair of implementations. If repositories support the import and export of images in this format, then this standard will enable source and target independent transferal.
- Transmission or use outside of its home repository
Often there exists a need to convey images to others who do not have access to the image repository. The current practice is to transfer the image file on magnetic media, or using the Internet. This separates the image from its metadata, and complicates the ability later to connect the image with the metadata for that image.
- Display of images using Internet technologies.
By using XML transformations, such as XSLT, an image and its metadata may be easily displayed in an Internet browser if it is formatted using this standard.
- The standard can also be used when archiving images outside of a repository, to maintain the link between the metadata and the image.

This standard is not intended to dictate the storage of images within a repository (although it may be applied), nor is it intended to restrict the use of image content independent of the metadata.

7 Localization Issues

7.1 Language

This standard has no preference for any human language or dialect. This standard provides a mechanism whereby a property may be provided with values for multiple languages within the same document. All tag names are based upon US English (en-US) consistent with the XML specification.

Language encoding is indicated by an attribute of the element tag which apply, unless overridden, to all child elements.

Language (more specifically, dialect, since it may be necessary to handle regional spellings and terminology) is handled by the XML attribute of "Xml:lang" where the value is taken from the IETF RFC 1766. This specification extends ISO 639 and provides a greater ability to specify dialects. The default language is US English.

7.2 Numbers

All numeric values are conveyed as left-to-right numbers, without any formatting characters. A non-decimal base is shown by prefixing a character:

- B Base 2 (binary)
- H Base 16 (hexadecimal)
- O Base 8 (octal)

If a fraction is appropriate, a period is used to indicate the decimal point. Scientific notation is also permitted.

7.3 Dates and Time

Dates and time values are to be formatted consistent with ISO 8601.

8 Overall Architecture

The document interchange format for images will be an application of the XML. XML is an extensible, flexible, platform-independent format, and has been adopted by the W3C as a standard (officially, a "recommendation," in W3C terminology).

8.1 Reasons for Using XML for Document Interchange

Advantages of using XML for document interchange are:

- XML was designed as a way to enable WWW transmission of data and processing instructions.
- XML's is inherently extensible – it allows new elements and attributes to be added to the Schema to accommodate unforeseen interchange requirements, without "breaking" previously valid XML documents.
- Software, both public-domain and commercial, for reading (parsing) and writing (creating) XML exists today, and is being produced at an ever-increasing rate.
- The AIIM XML standards committee may standardize, through W3C channels, the Schema presented here.

8.2 Use of XML for Image Data

8.2.1 Overview of XML Structure

XML consists of *markup* and *data*. The markup consists of (usually paired) tags called *elements*, which may contain descriptive data called *attributes*. Data is the non-markup content residing between element pairs. The elements can be nested, so that one element may contain sub-elements, which can in turn contain sub-sub-elements, and so on.

Our purpose here is to define the elements, element structure, and element attributes suitably, so that the various forms of imaging data, resources, index values, etc., can be clearly and unambiguously described and included as data. The model which describes this is an XML Schema. The precise Schema is the essential content of this report.

8.3 Wrapper

XML is used to wrap the document content together with metadata that describes the package and the semantics of the contained image. This wrapper is referred to as a document.

Documents are fully compliant XML 1.0 documents (<http://www.w3.org/TR/2000/REC-xml-20001006>). The wrapper must be well-formed and must be in accordance with the DTD. Reserved characters that appear in values are escaped into entity references.

A document contains one and only one unique document. That is to say, there is only one set of metadata provided, and it is expected to be indexed as an independent entity when introduced into a repository.

An XML document package has five major components:

- Basic XML Tags
- Document Description
- Document Metadata
- Page Rendition Content Description
- Page Rendition Content

The *Basic XML Tags* include those required by the XML specification.

The *Document Description* contains information about the entire document, such as signatures, encryption, and document-wide settings and defaults.

The *Document Metadata* contains all of the metadata properties that describe the document (versus the content being packaged) and its context.

A document must have one or more Pages. Each Page must have one or more renditions. Each rendition is composed of two sections:

- The *Page Rendition Content Description* contains all tags related to the content portion of the Rendition. This includes the content encoding, content placement (within the document or only referenced), and content signatures.
- The *Page Rendition Content* is the actual image data stream. The standard provides for both embedded and linked data streams, single sheet and multi-sheet streams, and multiple choices for encoding the rendition.

A Rendition may have additional content description and content pairs which represent annotations to the rendition. Annotations are not independent of a rendition.

Figure 1 below describes the high-level model:

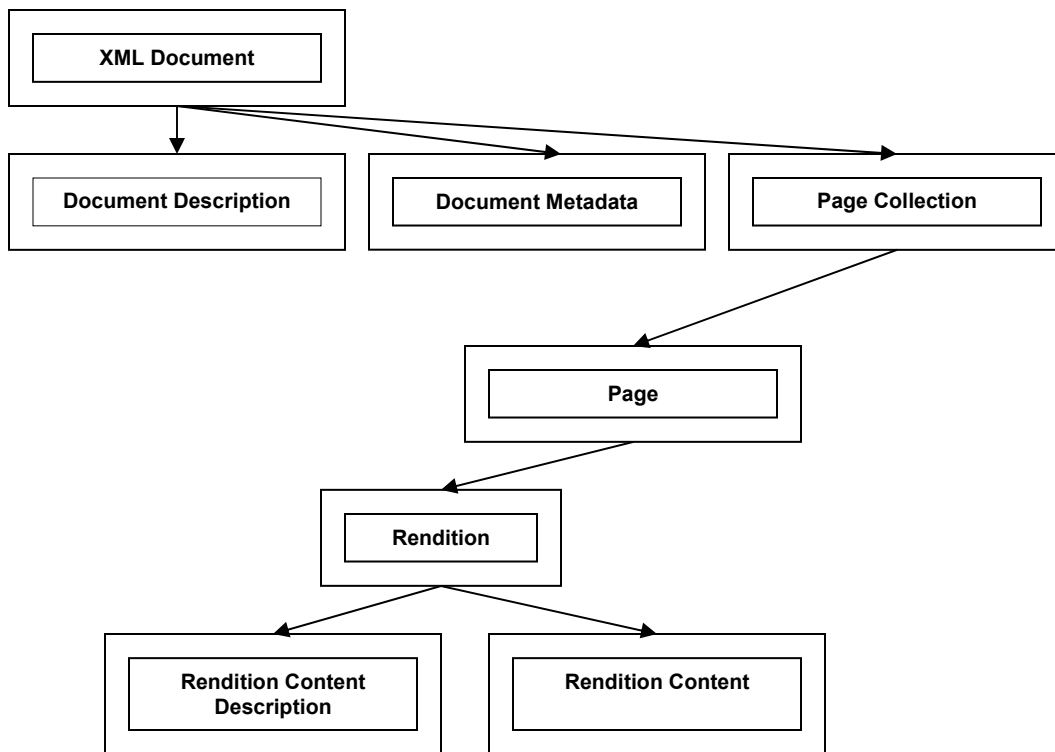


Figure 1:

8.4 Conformance to Existing Standards

This standard is written to conform to the latest Internet standards, specifically:

- eXtensible Markup Language (XML) 1.0 (Second Edition) W3C Recommendation 6 October 2000 (<http://www.w3c.org/TR/2000/REC-xml-20001006>)
- XMLSchema (XSD) 1.0 W3C Recommendation May 2001 (<http://www.w3c.org/TR/xml-schema>)

9 Document Structure

9.1 Basic XML Tags

The following XML tags are required by our use of the XML 1.0 specification. They are stated here for completeness.

9.1.1 XML Namespace

Whenever needed for locality of use, this standard defines the namespace "XIT" with a URI <<to be supplied>>.

9.1.2 XML Version Declaration

This heading is required by the XML standard, and has the form:

```
<?xml version="1.0"? [encoding="char set"]>
```

Where the optional encoding attribute indicates the encoding used for the XML tags.

9.1.3 Referencing the XML DTD or XML Schema

This standard supports the use of either a DTD or a Schema with documents. The Schema is the preferred approach. If either is provided, then validation is required. If the DTD is used, there will be an entry in the form:

```
<!DOCTYPE XIT PUBLIC "xitfile.dtd">
```

If the Schema is used, there will be an entry in the form:

```
<< open >>
```

9.1.4 Declaring the use of the XIT namespace

```
<XIT xmlns:xit="XIT namespace">
```

This tag forms the root node of the document.

9.2 Document Description

The Document Description contains information that is document-wide. It is enclosed in the tags <DocumentDescription></DocumentDescription>

9.2.1 Default Value Encoding

To permit simplifying the XML stream, XML tags that set the attribute assumptions for any metadata element value can be provided. The only tag currently identified is:

- (1) The language dialect that is intended.

If not provided, the default is US English.

This element is entered as:

```
<Defaults Xml:lang=en-US/>
```

9.2.2 Digital Signature

A Document may be digitally signed, to permit the receiver to be confident that the content, including the metadata, has not been changed since its creation.

This standard looks to the XML Signature standard (<http://www.w3c.org/TR/xmlsig-core/>) to provide this capability.

9.2.3 Encryption

The entire document (with the exception of the basic XML framework) may be encrypted for security.

This standard looks to the XML Encryption standard (<http://www.w3c.org/TR/xmlenc-core/>) to provide this capability.

9.3 Document Metadata

The Document Metadata contains properties that describe the document, its history and context.

Properties may be well known or custom. This standard specifies the semantics and structure of the well-known set, and a scheme for including custom properties.

9.3.1 Property Structure

Properties provide their name and their value. Multiple values may be provided for a property, each value potentially having a different dialect. If the dialect matches the document default, it does not need to be explicitly provided.

```
<property name=xxx [xml:lang=]>value</property>
```

9.3.2 Well-Known Properties

The definitions and identifiers for the well-known properties will be supplied by reference to the Dublin Core Metadata Initiative efforts to develop XML schemas. The 15 simple elements from DCMI as currently described in <http://dublincore.org/schemas/xmls/simpledc20021212.xsd> are considered well-known.

9.3.3 Custom Properties

It is understood that vendors and users may have metadata that they wish to include in a package that are not from the well-known set. This standard provides a mechanism for including these proprietary metadata, by referencing a vendor specific namespace.

Each metadata property taken from the vendor independent space must be explicitly cited, in accordance with the XML standard, with the originating namespace. Multiple namespaces may be referenced in specifying custom properties. Each element must be described in a manner identical to that used for well-known attribute values, thereby providing for standardized parsing and dialect issues. An example is:

```
<property name=Acme:widget lang=en-UK>round</property>
```

9.4 Page

A Document must have at least one page. A page is indicated by the XML tag:

```
<Page> ... Rendition information ... </Page>
```

Additional pages follow immediately after.

9.5 Rendition

Each page of the document contains one or more Renditions. A Rendition is comprised of document content (it is possible for a page in this respect to contain information that, if printed, would cover more than one sheet side), and, optionally, annotations. A Rendition is a representation of a page in a particular encoding. Examples of renditions that might be contained within a page might be it's TIFF Group 4 Facsimile encoding, it's JPEG encoding, and it's bitmap thumbnail. A page must contain at least one rendition. A rendition is indicated by the XML tag:

```
<Rendition>
Rendition Content
[optional Annotations]
</Rendition>
```

9.6 Rendition Content

A rendition has one and only one content representation inside it. A rendition's content is comprised of descriptive tags and the content stream (or a reference to the content stream). A rendition's content is indicated by the tag:

```
<Content>
```

9.7 Rendition Content Description

The Content Description contains properties that describe the rendition content, rather than the document context.

9.7.1 Content Access Method

This tag indicates whether the content is embedded in the package, or is only referenced.

9.7.2 Content Packaging

This tag specifies the method used to package the rendition content. In the case of embedded content, it can indicate:

- (1) Base 64
- (2) UUEncode

In the case of linked content, it can indicate:

- (1) URI

- (2) Media pointer
- (3) Microsoft UNC
- (4) Other proprietary reference

9.7.3 Content Encoding

This element determines the encoding used for the image content. It specifies the format of the content. Examples are:

- (1) TIFF
- (2) CCITT TIFF-FAX
- (3) JPEG
- (4) JPEG 2000
- (5) LizardTech DjVu™
- (6) Adobe Acrobat™

The content encoding value is taken from IETF RFC on Multipurpose Internet Mail Extensions (MIME) (2045)

9.7.4 Compression

This element describes any compression technique used to reduce the size of the content. Examples are:

- (1) ZIP
- (2) Lev-Zempel
- (3) GZ

Assignment of strings to compression techniques is a future task.

9.8 Content

The Content section contains the data stream for the rendition. Content may be embedded, or there may be a URL or URI reference to the content (linked).

9.8.1 Embedded Tag

Embedded content is a PCDATA element, so as not to be interpreted by XML parsers. It is carried as an inert item within the package.

<image>.... Binary image file</image>

9.8.2 Linked Tag

A content link is represented by a Link element, which contains a valid URL. The Type attribute is optional, but provided to permit extension of the standard with other types of link descriptions.

<link type=URL><ftp://ftp.aiim.org/pub/sampleimage.jpg></link>

9.9 Annotation

In addition to a Content, a rendition may contain one or more Annotations. An annotation is described exactly like a Content, with alternate tag of Annotation and the addition of the several descriptive tags:

```
... </Content><Annotation> ... annotation information </Annotation>
```

9.9.1 Location

This is a content specific piece of information that is used to position the annotation relative to the content. The default location for an annotation is assumed to be the upper left corner of the first sheet. Since content in this document may represent multiple sheets, an annotation may, validly, also represent multiple sheets. The tag takes the form:

```
<location>
```

9.9.2 Transparency

This tag indicates whether or not the content may be seen through the annotation. It is provided as a value from 0 to 100, where 0 is hidden and 100 is completely opaque. The default transparency for an annotation is 100. The tag takes the form:

```
<transparency>
```

10 DTD

```

<?xml version='1.0'?>

<!-- The following elements and attlist definitions, including
  capitalization, constitute a literal translation of the draft spec.
-->

<!DOCTYPE XIT SYSTEM "xitfile.dtd">

<!-- The default value of "xml:lang" is "en", pursuant to IETF RFC
3066. -->
<!ENTITY % lang-attr "xml:lang CDATA #IMPLIED">

<!ENTITY % content-desc-elt
"accessMethod|packaging|encoding|compression">
<!ENTITY % annotation-desc-elt "location|transparency">

<!ELEMENT XIT (DocumentDescription, DocumentMetadata, Page+)>

<!ELEMENT DocumentDescription (Defaults?)>

<!ELEMENT Defaults EMPTY>
<!ATTLIST Defaults
  %lang-attr;
>

<!ELEMENT DocumentMetadata (property*)>

<!ELEMENT property (#PCDATA)>
<!ATTLIST property
  %lang-attr;
  name CDATA #REQUIRED
>

<!ELEMENT Page Rendition+>
<!ELEMENT Rendition (Content, Annotation*)>

<!ELEMENT Content (%content-desc-elt; | image | link)>

<!ELEMENT accessMethod (#PCDATA)>
<!ELEMENT packaging (#PCDATA)>
<!ELEMENT encoding (#PCDATA)>
<!ELEMENT compression (#PCDATA)>

<!ELEMENT image (#PCDATA)>

<!ELEMENT link (#PCDATA)>
<!ATTLIST link
  type CDATA #IMPLIED
>

<!ELEMENT Annotation (%content-desc-elt; | %annotation-desc-elt; |
#PCDATA)>

<!ELEMENT location (#PCDATA)>

```

<!ELEMENT transparency (#PCDATA)>

11 XML Schema

```

<?xml version="1.0"?>

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:group name="content-desc-elt">
    <xs:choice>
      <xs:element ref="accessMethod" />
      <xs:element ref="packaging" />
      <xs:element ref="encoding" />
      <xs:element ref="compression" />
    </xs:choice>
  </xs:group>

  <xs:group name="annotation-desc-elt">
    <xs:choice>
      <xs:element ref="location" />
      <xs:element ref="transparency" />
    </xs:choice>
  </xs:group>

  <xs:attributeGroup name="lang-attr">
    <xs:attribute ref="xml:lang" />
  </xs:attributeGroup>

  <xs:element name="XIT">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="DocumentDescription" />
        <xs:element ref="DocumentMetadata" />
        <xs:element maxOccurs="unbounded" ref="Page" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="DocumentDescription">
    <xs:complexType>
      <xs:sequence>
        <xs:element minOccurs="0" ref="Defaults" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="Defaults">
    <xs:complexType>
      <xs:attributeGroup ref="lang-attr" />
    </xs:complexType>
  </xs:element>

  <xs:element name="DocumentMetadata">
    <xs:complexType>
      <xs:sequence>
        <xs:element minOccurs="0" maxOccurs="unbounded" ref="property" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

</xs:element>

<xs:element name="property">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attributeGroup ref="lang-attr" />
        <xs:attribute name="name" type="xs:string" use="required" />
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>

<xs:element name="Page">
  <xs:complexType>
    <xs:sequence maxOccurs="unbounded">
      <xs:element ref="Rendition" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="Rendition">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="Content" />
      <xs:element minOccurs="0" maxOccurs="unbounded" ref="Annotation" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="Content">
  <xs:complexType>
    <xs:choice>
      <xs:group ref="content-desc-elt" />
      <xs:element ref="image" />
      <xs:element ref="link" />
    </xs:choice>
  </xs:complexType>
</xs:element>

<xs:element name="accessMethod">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:enumeration value="embedded" />
      <xs:enumeration value="referenced" />
    </xs:restriction>
  </xs:simpleType>
</xs:element>

<xs:element name="packaging">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:enumeration value="base64" />
      <xs:enumeration value="uuEncode" />
      <xs:enumeration value="URI" />
    </xs:restriction>
  </xs:simpleType>
</xs:element>

```

```

        <xs:enumeration value="mediaPointer" />
        <xs:enumeration value="UNC" />
        <xs:enumeration value="proprietary" />
    </xs:restriction>
</xs:simpleType>
</xs:element>

<xs:element name="encoding" type="xs:string" />

<xs:element name="compression" type="xs:string" />

<xs:element name="image" type="xs:string" />

<xs:element name="link">
    <xs:complexType>
        <xs:simpleContent>
            <xs:extension base="xs:string">
                <xs:attribute name="type" type="xs:string" />
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
</xs:element>

<xs:element name="Annotation">
    <xs:complexType mixed="true">
        <xs:choice>
            <xs:group ref="content-desc-elt" />
            <xs:group ref="annotation-desc-elt" />
        </xs:choice>
    </xs:complexType>
</xs:element>

<xs:element name="location" type="xs:string" />

<xs:element name="transparency">
    <xs:simpleType>
        <xs:restriction base="nonNegativeInteger">
            <xs:maxExclusive value="100"/>
        </xs:restriction>
    </xs:simpleType>
</xs:element>

</xs:schema>

```

12 Appendix A: Related Standards and Industry Efforts

The following standards and industry projects may be of interest to those reading this document.

12.1 Document Management Alliance (DMA)

12.2 Dublin Core Metadata Initiative (DCMI)

12.3 Information Content Exchange (ICE)

12.4 Multifunction Products Association Standards Project

12.5 OASIS Docbook

12.6 Open Source Metadata Framework (OMF)

12.7 Publishing Requirements for Industry Standard Metadata (PRISM)

12.8 XML Topic Maps (XTM)

12.9 W3C Resource Description Framework (RDF)

12.10 Web Document Authoring and Versioning (WebDAV)