IMS Content Packaging XML Binding

Final Specification
Version 1.0

About This Document

Title	IMS Content Interchange XML Binding
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Status	**Final Specification**
Summary	This document describes the IMS Content Packaging XML Binding that implements the IMS Content Packaging Information Model. The XML encoding is based on the W3C XML specification version 1.0.
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Revision History

Version No.	Release Date	Comments
Base 1.0	December 23rd, 1999	The first formally released version of the full IMS Content Packaging Information Model Base Document;
Draft 0.9	February 8th, 2000	Draft of final version 1 specification accepted by IMS Technical Board;
Public Draft 0.91	February 15th, 2000	Updated to address a) More consistent W3C-like handling of external files b) Cleaner way to handle extended resource in the <resources> section c) Element name change: 'url' to 'href';
0.92	March 20th, 2000	Format updated with following changes: a) Move "isvisible" attribute from <resource> element to <item> element b) Add <title> to <tableofcontents> c) Revert back to the <resource type="webcontent"> approach introduced in the v0.9 document d) Rename <organization> to <organizations;
1.0	May 2nd, 2000	Updated version information to 1.0. a) Included examples (new and removed from Best Practice Guide) b) Tweaks to xml-data schema <file> element c) Adopted IMS 1.1 Meta-data DTD and Schema d) Changed meta-data examples to include <record>.
1.0	May 25th, 2000	Updated document to address the following open issues: a) Explained basic differences between DTDs and other Schemas for document validation in both the Best Practice Guide and the Binding document. b) Ensured that the samples provided with the specification are separated into different folders depending on whether a DTD or an XDR file is used as the control document. The samples used in the body of the specification documents are only well-formed and do not rely upon a particular control document. c) Added a URL for where users can download the samples. d) Made an explicit comment that none of the samples provided (wherever they occur) refer to any sort of control document. e) Reordered the Appendices to fit the order they're mentioned in the specification documents.

Table of Contents

1 Introduction

1.1 Overview

This document describes the XML binding for IMS Content Packaging and Interchange specification. This document specifies the binding of the Content Packaging specification in eXtensible Markup Language (**XML Version 1.0**: http://www.w3.org/TR/1998/REC-xml-19980210).

There are some specific rules that have guided the creation of this XML binding document:

- The XML binding will adhere to the XML Version 1.0 specification of the W3C;
- It must maintain the definitional structure of the specification.
- It must permit extensions.

1.2 Scope & Content

This document is the IMS Content Packaging XML Binding Specification. As such it will be used as the basis for the production of the following documents:

- IMS Content Packaging and Interchange XML DTD;
- IMS Content Packaging and Interchange XML XDR;
- IMS Content Packaging and Interchange Best Practice & Implementation Guide document.

This binding has been derived from the agreed IMS Content Packaging Information Model Specification [Content, 00a] and conforms to the XML Version 1.0 specification [XML, 98] of the W3C.

1.3 Structure of this Document

The structure of this document is:

2. XML BASICS	A brief description of the components within an XML schema;
3. NARRATIVE DESCRIPTION OF XML BINDING	The description of the elements and attributes used within the XML binding itself;
4. EXAMPLE XML SCHEMA	Examples of the XML files that conform to the binding, including the meta-data;
APPENDIX A - XML-DATA SCHEMA	A copy of the uncommented XML-Data Schema;
APPENDIX B - DRAFT CONTENT PACKAGING W3C XML SCHEMA	A copy of the uncommented W3C XML schema;
APPENDIX C - CONTENT PACKAGING DTD	A copy of the uncommented DTD;
APPENDIX D - REFERENCE DTD/SCHEMAS	The DTDs and schemas that are referenced within this specification.

1.4 Nomenclature

CDATA	Character Data
CPI	Content & Packaging Interchange
DTD	Document Type Definition
PCDATA	Parsed Character Date
W3C	World Wide Web
XDR	XML Data Representation
XML	Extensible Mark-up Language

1.5 References

[ISO/IEC10646] ISO (International Organization for Standardization). ISO/IEC 10646-1993 (E). Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane. [Geneva]: International Organization for Standardization, 1993 (plus amendments AM 1 through AM 7).

[Unicode, 96] The Unicode Consortium. The Unicode Standard, Version 2.0. Reading, Mass.: Addison-Wesley Developers Press, 1996.

[XML, 98] XML Version 1.0 specification of the W3C: http://www.w3.org/TR/1998/REC-xml-19980210.

[XML, 99] XML Namespace Recommendation of W3C: http://www.w3.org/TR/1999/REC-xml-names-19990114.

[Content, 00a] *IMS Content Packaging Information Model*, T.Anderson, Version 1.0, IMS, May 2000.

[Content, 00b] *IMS Content Packaging Best Practice & Implementation Guide Document*, T.Anderson, Version 1.0, IMS, May 2000.

2 XML Basics

The Content Packaging data model can be defined as a hierarchy. Hierarchical models are convenient for representing data consisting of many elements and sub-elements. XML is perfectly suited for representing hierarchical models. An XML document is a hierarchy comprised of **elements** that have **contents** and **attributes**.

2.1 Elements

An element is a component of a document that has been identified in a way a computer can understand. Each element has a **tag name**. When a tag name is shown as "<TAGNAME>", with less-than and greater-than symbols before and after the tag name, it serves as the **start-tag** to mark the beginning of an element. When that same tag name has a forward slash "/" added, it serves as an **end-tag** such as "</TAGNAME>". An element may have contents between its start and end-tags, and may have one or more **attributes**. When an XML element has a start and end-tag (also called an **opening** and **closing** tag) with a common name, it is considered to be "well-formed" XML. The contents of an element are placed between the start and end-tags as shown below:

```
<TAGNAME>contents</TAGNAME>
```

2.1.1 Element Contents

An element may contain other elements, Parsed Character Data (PCDATA), Character Data (CDATA), or a mixture of PCDATA and elements. The allowable contents of an element are its **content model**. PCDATA really means any character string that does not contain elements. PCDATA is what the bulk of elements will use between their start and end-tags. CDATA is different in that it is a method for adding any character data that should not be processed. For example, you could add some JavaScript code instructions using a CDATA section. A CDATA section tells the parser not to look for any mark-up until after it locates the end of the CDATA section.

2.1.2 Element Attributes

An attribute provides additional information about an element. Attributes are a way of attaching characteristics or properties to the elements of a document. An element may have more than one attribute. Attributes are contained within the start tag of an element. Attributes are represented by an attribute name followed by an equal sign and the attribute value in quotation marks:

```
<timeframe>
<begin restrict="1"> 1999-07-23 </begin>
</timeframe>
```

In this example, the `timeframe` element contains another element, the `begin` element. The `begin` element has one attribute "restrict", with the value "1". The value for the element BEGIN is `"1999-07-23"`. These two elements then make up a `timeframe begin` date.

2.1.3 Element Names

Each element has a unique name, referred to as the tag name. XML is case-sensitive in its processing of tag names. The IMS Content Packaging XML Binding adheres to the following tag name rules:

- All tag names will conform to the rules for element naming as given within the XML Version 1.0 specification.
- Names beginning in "xml" in any case or mix of cases are not permitted.
- The IMS binding will use only lowercase tag and element names.
- Element names may not include words reserved by the XML specification. These include:

  DOCTYPE
  ELEMENT
  ATTLIST
  ENTITY

- Tag names defined by the IMS binding may not be redefined.

2.2 Document Type Definitions

The tag name, content model, and attributes of elements are defined in a **Document Type Definition** (DTD) statement. This may exist as an external file or a block of text internal to an XML document. Internal DTDs are used to override elements defined in external DTD files, so an internal DTD should be used with care. The DTD defines the elements that may be used, and may define the contents of the elements.

This specification defines a DTD (IMSCONTENTv1p1.DTD) as a non-normative reference. Some XML editors may make use of a DTD to help guide the developer in creating the proper elements at the proper locations in an XML file. Other developers will make use of DTDs to validate their XML documents to ensure their document is consistent with all of the element names and locations defined in the DTD. Details of the construction of DTDs are outside the scope of this document, but links to the XML Version 1.0 specification are included in the References section of this document.

2.3 XML Schemas

A schema is a formal specification of element names that indicates which elements are allowed in an XML document, and in which combinations. New schema languages, such as those defined in the XML-Schemas Working Group, provide the same baseline functionality as a Document Type Definition (DTD). However, because these schema languages are extensible, developers can augment them with additional information, such as data types, inheritance, and presentation rules. This makes these new schema languages far more powerful than DTDs. For more information about XML schemas, go to http://www.w3.org/XML/Schema.html.

This specification defines a W3C XML Schema, and a Microsoft XML-Data Schema as non-normative references. Some XML editors may make use of these schemas to help guide the developer in creating the proper elements at the proper locations in an XML file. Other developers will make use of the schemas to validate their XML documents and/or to define extensions to the IMS Content Packaging Binding. Details of the construction of schemas are outside the scope of this document.

2.4 Valid Character Sets

A Content Packaging record must use UTF-8 or UTF-16 encoding of the character sets as defined in ISO 10646. See the XML Version 1.0 for more details on the specification of well-formed XML.

2.5 Special Handling Requirements

2.5.1 XML Reserved Characters

Some characters used in XML must be escaped when used outside of their XML defined usage as found in section 2.4 of the XML 1.0 specification. These characters are ampersand (&), less than (<), greater than (>), apostrophe ('), and the double-quote character (").

These characters may be represented using either numeric character references or the strings "&","<",">","'", and """.

Below is a more complete quote from the W3C XML standards:

Quote from Extensible Markup Language (XML) 1.0
W3C Recommendation 10-February-1998
2.4 Character Data and Markup

"Text consists of intermingled character data and markup. Markup takes the form of start-tags, end-tags, empty-element tags, entity references, character references, comments, CDATA section delimiters, document type declarations, and processing instructions.

All text that is not markup constitutes the character data of the document.

The ampersand character (&) and the left angle bracket (<) may appear in their literal form only when used as markup delimiters, or within a comment, a processing instruction, or a CDATA section. They are also legal within the literal entity value of an internal entity declaration; see "4.3.2 Well-Formed Parsed Entities". If they are needed elsewhere, they must be escaped using either numeric character references or the strings "&" and "<" respectively.

The right angle bracket (>) may be represented using the string ">", and must, for compatibility, be escaped using ">" or a character reference when it appears in the string "]]>" in content, when that string is not marking the end of a CDATA section.

In the content of elements, character data is any string of characters, which does not contain the start-delimiter of any markup. In a CDATA section, character data is any string of characters not including the CDATA-section-close delimiter, "]]>".

To allow attribute values to contain both single and double quotes, the apostrophe or single-quote character (') may be represented as "'", and the double-quote character (") as """."

2.5.2 White Space Handling

Questions often arise as to whether web-based data transmission tools might inadvertently strip off or transform some of the white space characters embedded in data transmitted between systems using XML. To eliminate concern about this issue, refer to the following quote from the W3C XML standards, which indicate that all white space must be preserved where it is part of the data.

Quote from Extensible Markup Language (XML) 1.0
W3C Recommendation 10-February-1998
2.10 White Space Handling

"In editing XML documents, it is often convenient to use "white space" (spaces, tabs, and blank lines, denoted by the non-terminal S in this specification) to set apart the mark-up for greater readability. Such white space is typically not intended for inclusion in the delivered version of the document. On the other hand, "significant" white space that should be preserved in the delivered version is common, for example in poetry and source code.

An XML processor must always pass all characters in a document that are not mark-up through to the application. A validating XML processor must also inform the application which of these characters constitute white space appearing in element content.

A special attribute named xml:space may be attached to an element to signal an intention that in that element, white space should be preserved by applications. In valid documents, this attribute, like any other, must be declared if it is used. When declared, it must be given as an enumerated type whose only possible values are "default" and "preserve". For example:

<!ATTLIST poem xml:space (default|preserve) 'preserve'>

The value "default" signals that applications' default white-space processing modes are acceptable for this element; the value "preserve" indicates the intent that applications preserve all the white space. This declared intent is considered to apply to all elements within the content of the element where it is specified, unless overridden with another instance of the xml:space attribute. "

2.5.3 xinclude

The xinclude mechanism is a powerful way to support the aggregation and disaggregation of resources., and has been included in this specification because we wanted to leverage the emerging standard from the W3C, rather than invent yet another way of including external chunks of xml. However, at the time of publication of this specification, the xinclude specification has not been finalized by the W3C, and no commercial xml parsers support this syntax; thus it is recommended that content described and packaged using this specification do not make use of the xinclude mechanism until it's specification is standardized and/or xml parsers support it.

3 Narrative Description of XML Binding

This specification defines the XML format using narrative. XML DTDs and XML Schemas that implement this 'abstract' format are referenced as non-normative parts of this specification.

3.1 <manifest> elements

Description. The first, outermost <manifest> element in the Manifest encloses all the reference data. Subsequent occurrences of the <manifest> elements within the outermost <manifest> are used to compartmentalize files, meta-data, and organization structure for aggregation, disaggregation, and reuse. The best-practice use of the IMS Content Packaging specification will result in each "learning object" or "atomic unit of learning" being placed within its own <manifest> element.

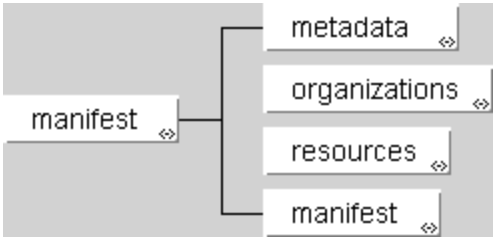

Figure 3.1 <manifest> elements.

Multiplicity. The outermost <manifest> occurs once and only within the IMS Manifest file, (imsmanifest.xml). <manifest> elements within the outermost <manifest> element occur zero or more times.

Attributes

- **identifier (required).** An identifier, provided by an author or authoring tool, that is unique within the Manifest. Data type = string
- **version (optional).** Identifies the version of the Manifest. Is used to distinguish between manifests with the same identifier. Data type = string

Elements

- <metadata>
- <organizations>
- <resources>
- <manifest>

3.1.1 <metadata>

Description. This element contains meta-data that is used to describe the resources described in the Manifest.

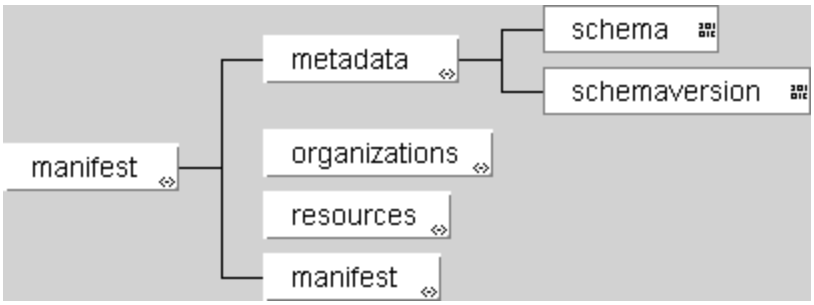

Figure 3.2 <metadata> elements.

Multiplicity. Occurs zero or once within a <manifest> element.

Elements

- <schema>
- <schemaversion>
- IMS Meta-Data: Implementers are free to choose from any of the meta-data elements defined in the IMS Meta-data Specification version 1.1

Example

```
<metadata>
    <schema>IMS Content</schema>
    <schemaversion>1.0</schemaversion>
    <record xmlns="http://www.imsproject.org/metadata">
        <general>
            <title>
                <langstring lang="en_US">Simple Manifest</langstring>
            </title>
        </general>
    </record>
</metadata>
```

3.1.2 <organizations>

Description. Describes one or more structures, or organizations for this package.

Figure 3.3 <organizations> elements.

Multiplicity. Occurs once within a <manifest> element.

Attributes

- **default (required).** Identifies the default organization to use. Data type = idref.

Elements

- <tableofcontents>

Example

```
<organizations default="TOC1">
    <tableofcontents identifier="TOC1" title="default">
        <item identifier="ITEM1" identifierref="RES1" title="Lesson 1">
            <item identifier="ITEM2" identifierref="RES2" title="Introduction 1"/>
            <item identifier="ITEM3" identifierref="RES3" title="Content 1"/>
            <item identifier="ITEM4" identifierref="RES4" title="Summary 1"/>
        </item>
        <item identifier="ITEM5" identifierref="RES5" title="Lesson 2">
            <item identifier="ITEM6" identifierref="RES6" title="Introduction 2"/>
            <item identifier="ITEM7" identifierref="RES7" title="Content 2"/>
            <item identifier="ITEM8" identifierref="RES8" title="Summary 2"/>
        </item>
        <item identifier="ITEM9" identifierref="RES9" title="Lesson 3">
            <item identifier="ITEM10" identifierref="RES10" title="Introduction 3"/>
            <item identifier="ITEM11" identifierref="RES11" title="Content 3"/>
            <item identifier="ITEM12" identifierref="RES12" title="Summary 3"/>
        </item>
    </tableofcontents>
</organizations>
```

3.1.3 <resources>

Description. This element identifies a collection of physical content files.

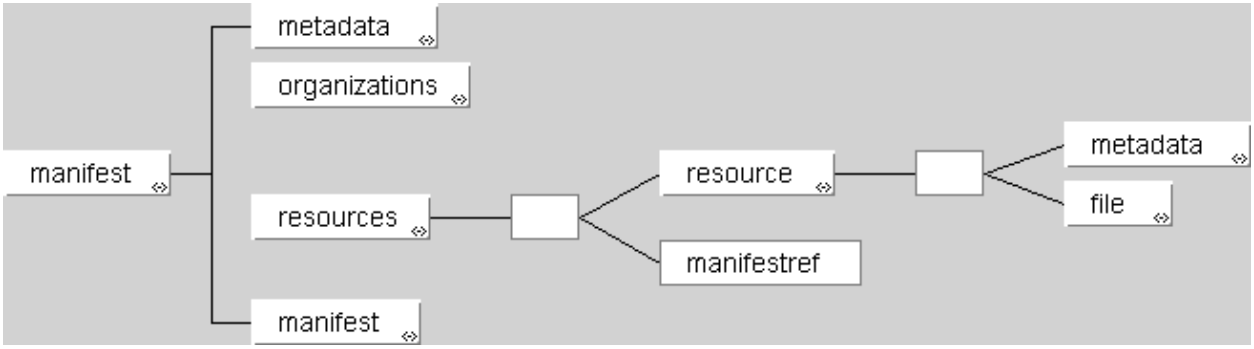

Figure 3.4 <resources> elements.

Multiplicity. Occurs once and only once within a <manifest> element.

Attributes

- **xml:base (optional).** This provides a relative path offset for the content file(s). The usage of this element is defined in the XML Base Working Draft from the W3C. Data type = string.

Elements

- <resource>
- <manifestref>

Example

```
<resources>
    <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
        <file href="lesson1.htm"/>
    </resource>

    <resource identifier="RESOURCE2" type="webcontent" href="intro1.htm">
        <file href="intro1.htm"/>
    </resource>

    <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
        <file href="content1.htm"/>
    </resource>
</resources>
```

3.2 <metadata> elements

3.2.1 <schema>

Description. Describes the schema used – e.g. IMSCONTENT. If no schema element is present, it is assumed to be "IMSCONTENT". Data type = string.

Multiplicity. Occurs zero or once within <metadata>.

Example

```
<schema>IMS Content</schema>
```

3.2.2 <schemaversion>

Description. Describes version of the above schema – e.g. 1,0, 1.1. If no version is present, it is assumed to be "1.0". Data type = string.

Multiplicity. Occurs zero or once within <metadata>.

Example

```
<schemaversion>1.0</schemaversion>
```

3.2.3 IMS Meta-data

Description. See the IMS Meta-data Specification version 1.1 for more detail on the meta-data that are available for describing and cataloguing content packages.

Multiplicity. Defined in the IMS Meta-Data Specification 1.1.

Example

a) Inline meta-data

```
<record xmlns="http://www.imsproject.org/metadata">
    <general>
        <title>
            <langstring lang="en_US">Simple Manifest</langstring>
        </title>
    </general>
</record>
```

b) External meta-data

```
<metadata>
    <xinclude:include href="metadata/manifest1md.xml"/>
</metadata>
```

3.3 <organizations> elements

3.3.1 <tableofcontents>

Description. This element describes a particular hierarchical organization.

Multiplicity. Occurs zero or more times within <organizations>.

Attributes

- **identifier (required).** An identifier, provided by an author or authoring tool, that is unique within the Manifest. Data type = id.
- **title (optional).** Title of the Table of Contents. Data type = string.

Elements

- <item>

Example

```
<tableofcontents identifier="TOC1" title=”Default TOC”>
    <item identifier="TOC1_ITEM1" identifierref="RESOURCE1" title="Title1"/>
    <item identifier="TOC1_ITEM2" identifierref="RESOURCE2" title="Title2"/>
</tableofcontents>
```

3.3.2 <item>

Description. This element describes a node within a structure.

Multiplicity. Occurs zero or more times within <tableofcontents> and zero or more times within <item>.

Attributes

- **identifier(required).** An identifier that is unique within the Manifest. Data type = id.
- **identifierref (optional).** A reference to a <resource> identifier (within same package) or tableofcontents identifier (within a different package) that is used to resolve the ultimate location of the file. If no identifierref is supplied, it is assumed that there is no content associated with this entry in the table of contents. Data type = idref.
- **title (optional).** Title of the item. Data type = string.

- **isvisible (optional) .** Indicates whether or not this resource is displayed when the unit of instruction is rendered. If not present, value is assumed to be "1". Data type = boolean
- **parameters (optional).** Static parameters to be passed to the content file at launch time. Data type = string.

Elements

- <item>

Example

```
<item identifier="TOC1_ITEM2" identifierref="RESOURCE2"
    title="Parsing XML" isvisible="0" parameters="?process.asp">
```

3.4 <resources> elements

A collection of references to resources. There is no assumption of order or hierarchy. Resources can be described inline, or externally using <xinclude:include> syntax.

3.4.1 <resource>

Description. This element describes a specific content file.

Multiplicity. Occurs zero or more times within <resources>.

Attributes

- **identifier (required)** . An identifier, provided by the author or authoring tool, that is unique within the Manifest.
- **type (required).** A string that identifies the type of resource. This specification defines only the base type of "webcontent".
- **xml:base (optional).** This provides a relative path offset for the content file(s). The usage of this element is defined in the XML Base Working Draft from the W3C. Data type = string.
- **href (optional).** A reference to the "entry point" of this resource.

Elements

- <metadata>
- <file>

Example

a) Inline resource

```
<resource identifier="RESOURCE1" type="webcontent" href="topics/course.htm">
    <metadata/>
    <file href="topics/course.htm"/>
    <file href="depfiles/pic1.gif"/>
    <file href="depfiles/pic2.gif"/>
</resource>
```

b) External resource

```
<resource identifier="RESOURCE2a" type="webcontent">
    <xinclude:include href="resource2a.xml"/>
</resource>
```

3.4.2 <metadata>

Description. This element contains meta-data that describes the resource. Implementers are free to choose from any of the meta-data elements defined in the IMS Meta-data Specification version 1.1 or to define their own meta-data schema.

Multiplicity. Occurs zero or once within <resource>.

3.4.3 <file>

Description. Identifies one or more local files that this resource is dependent on. This includes the resource being referenced in the href attribute of <resource>. If the resource references an absolute url (using href), <file> element(s) are not required.

Multiplicity. Occurs one or more times within <resource>.

Attributes

- **href (required).** URL of the file.

Example

```
<file href="topics/course.htm"/>
```

3.4.4 <manifestref>

Description. This element contains a reference to a <manifest> element upon which files in this <resource> element depend.

Multiplicity. Occurs zero or more times within <resource>.

Attributes

- **identifierref (required).** A reference to a package element upon which resources in this package's <resources> depend.

Example

```
<manifestref identifier="MANIFEST4"/>
```

3.5 Extensibility

The IMS Content Packaging XML Binding is extensible through the use of XML Namespaces and XML Schemas. It is expected that the extensibility mechanism will be used to describe additional types of meta-data, organizations, and resources. More information and examples of extensibility are contained in the IMS Content Packaging Best Practice Guide.

4 Samples

The samples referenced by the IMS Content Packaging Specification are available for download from http://www.imsproject.org/specifications.html

4.1 Simple Manifest

Illustrates a simple manifest that makes use of the IMS Content Packaging DTD for document validation.

```
<?xml version="1.0"?>
<manifest identifier="MANIFEST1">
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="http://www.imsproject.org/metadata">
            <general>
                <title>
                    <langstring lang="en_US">IMS Content Packaging Sample - Simple
Manifest</langstring>
                </title>
            </general>
        </record>
    </metadata>

    <organizations default="TOC1">
        <tableofcontents identifier="TOC1" title="default">
            <item identifier="ITEM1" identifierref="RESOURCE1" title="Lesson 1">
                <item identifier="ITEM2" identifierref="RESOURCE2"
                    title="Introduction 1"/>
                <item identifier="ITEM3" identifierref="RESOURCE3" title="Content 1"/>
                <item identifier="ITEM4" identifierref="RESOURCE4" title="Summary 1"/>
            </item>
            <item identifier="ITEM5" identifierref="RESOURCE5" title="Lesson 2">
                <item identifier="ITEM6" identifierref="RESOURCE6"
                    title="Introduction 2"/>
                <item identifier="ITEM7" identifierref="RESOURCE7" title="Content 2"/>
                <item identifier="ITEM8" identifierref="RESOURCE8" title="Summary 2"/>
            </item>
            <item identifier="ITEM9" identifierref="RESOURCE9" title="Lesson 3">
                <item identifier="ITEM10" identifierref="RESOURCE10"
                    title="Introduction 3"/>
                <item identifier="ITEM11" identifierref="RESOURCE11"
                    title="Content 3"/>
                <item identifier="ITEM12" identifierref="RESOURCE12"
                    title="Summary 3"/>
            </item>
        </tableofcontents>
    </organizations>

    <resources>
        <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
            <file href="lesson1.htm"/>
        </resource>

        <resource identifier="RESOURCE2" type="webcontent" href="intro1.htm">
            <file href="intro1.htm"/>
        </resource>

        <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
            <file href="content1.htm"/>
        </resource>
```

```
        <resource identifier="RESOURCE4" type="webcontent" href="summary1.htm">
            <file href="summary1.htm"/>
        </resource>

        <resource identifier="RESOURCE5" type="webcontent" href="lesson2.htm">
            <file href="lesson2.htm"/>
        </resource>

        <resource identifier="RESOURCE6" type="webcontent" href="intro2.htm">
            <file href="intro2.htm"/>
        </resource>

        <resource identifier="RESOURCE7" type="webcontent" href="content2.htm">
            <file href="content2.htm"/>
        </resource>

        <resource identifier="RESOURCE8" type="webcontent" href="summary2.htm">
            <file href="summary2.htm"/>
        </resource>

        <resource identifier="RESOURCE9" type="webcontent" href="lesson3.htm">
            <file href="lesson3.htm"/>
        </resource>

        <resource identifier="RESOURCE10" type="webcontent" href="intro3.htm">
            <file href="intro3.htm"/>
        </resource>

        <resource identifier="RESOURCE11" type="webcontent" href="content3.htm">
            <file href="content3.htm"/>
        </resource>

        <resource identifier="RESOURCE12" type="webcontent" href="summary3.htm">
            <file href="summary3.htm"/>
        </resource>
    </resources>
</manifest>
```

4.2 Full Meta-data

Illustrates a simple manifest with a comprehensive meta-data section that draws from the IMS/IEEE LOM Meta-data specification.

```
<?xml version="1.0"?>
<manifest identifier="MANIFEST1"
  xmlns="http://www.imsproject.org/content">

    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="http://www.imsproject.org/metadata">
            <metametadata>
                <catalogentry>
                    <catalogue>IMS-Test</catalogue>
                    <entry>
                        <langstring>1999.000003</langstring>
                    </entry>
                </catalogentry>
                <catalogentry>
                    <catalogue>ABC123</catalogue>
                    <entry>
```

```
                    <langstring lang="en_US">123A</langstring>
                </entry>
            </catalogentry>
            <contribute>
                <role>
                    <langstring lang="en">Author</langstring>
                </role>
                <centity>
                    <vcard>
                        BEGIN:vCard
                        FN:Chris Moffatt
                        N:Moffatt
                        END:vCard
                         </vcard>
                </centity>
                <date>
                    <datetime>1999-08-05</datetime>
                </date>
            </contribute>
            <metadatascheme>IMS:1.1</metadatascheme>
            <!-- English as default metadata language.  -->
            <language>en_US</language>
        </metametadata>
        <general>
            <title>
                <langstring lang="en_US">IMS Content Packaging Sample – Full
Metadata</langstring>
            </title>
            <catalogentry>
                <catalogue>ISBN</catalogue>
                <entry>
                    <langstring>0-534-26702-5</langstring>
                </entry>
            </catalogentry>
            <language>en_US</language>
            <description>
                <!--English description-->
                <langstring lang="en_US">A sample content packaging record
                </langstring>
                <!--French Description -->
                <langstring lang="fr">Un programme...</langstring>
            </description>
            <keywords>
                <!--English Keywords, unordered list-->
                <langstring lang="en">content interchange</langstring>
                <langstring lang="en">learning objects</langstring>
                <langstring lang="en">e-learning</langstring>
            </keywords>
            <coverage>
                <langstring lang="en">Sample code</langstring>
            </coverage>
            <structure>
                <langstring lang="en">Hierarchical</langstring>
            </structure>
            <aggregationlevel>2</aggregationlevel>
        </general>
        <lifecycle>
            <version>
                <langstring lang="en">1.0</langstring>
            </version>
            <status>
                <langstring lang="en">Final</langstring>
            </status>
```

```
        <!--Contains an unordered list of  contribute-->
        <contribute>
            <role>
                <langstring lang="en">Author</langstring>
            </role>
            <centity>
                <vcard>
                    BEGIN:vCard
                    FN:Chris Moffatt
                    N:Moffatt
                    END:vCard
                     </vcard>
            </centity>
            <date>
                <datetime>2000</datetime>
            </date>
        </contribute>
        <contribute>
            <role>
                 <langstring lang="en">Publisher</langstring>
            </role>
            <centity>
                <vcard>
                    BEGIN:vCard
                    ORG:IMS Global Learning Corporation
                    END:vCard
                     </vcard>
            </centity>
            <date>
                <datetime>2000</datetime>
                <description>
                    <langstring lang="en_US">20th Century</langstring>
                </description>
            </date>
        </contribute>
    </lifecycle>
    <technical>
        <format>
            <langstring lang="en">XML 1.0</langstring>
        </format>
        <size>70306</size>
        <location type="URI">http://www.imsproject.org/content</location>
        <requirements>
            <type>
                <langstring lang="en">Binding</langstring>
            </type>
            <name>
                <langstring lang="en">XML</langstring>
            </name>
            <minimumversion>1.0</minimumversion>
            <maximumversion>5.2</maximumversion>
        </requirements>
        <installationremarks>
            <langstring lang="en">Download</langstring>
        </installationremarks>
        <otherplatformrequirements>
            <langstring lang="en">Requires web browser for rendering
            </langstring>
        </otherplatformrequirements>
        <duration/>
    </technical>
    <educational>
        <learningresourcetype>
```

```
                <langstring lang="en">Samples</langstring>
            </learningresourcetype>
            <interactivitylevel>3</interactivitylevel>
            <semanticdensity>2</semanticdensity>
            <intendededenduserrole>
                    <langstring lang="en">Technical Implementor</langstring>
            </intendededenduserrole>
            <learningcontext>
                <langstring lang="en">Industry</langstring>
            </learningcontext>
            <typicalagerange>
                <langstring lang="en">18-99</langstring>
            </typicalagerange>
           <description>
               <langstring lang="en">Sample code</langstring>
           </description>
           <language>en_US</language>
       </educational>
       <rights>
           <cost>
               <langstring lang="en">no</langstring>
           </cost>
           <copyrightandotherrestrictions>
                <langstring lang="en_US">no</langstring>
           </copyrightandotherrestrictions>
       </rights>
   </record>
</metadata>

<organizations default="TOC1">
    <tableofcontents identifier="TOC1" title="default">
        <item identifier="ITEM1" identifierref="RESOURCE1" title="Lesson 1">
            <item identifier="ITEM2" identifierref="RESOURCE2"
                title="Introduction 1"/>
            <item identifier="ITEM3" identifierref="RESOURCE3" title="Content 1"/>
            <item identifier="ITEM4" identifierref="RESOURCE4" title="Summary 1"/>
        </item>
        <item identifier="ITEM5" identifierref="RESOURCE5" title="Lesson 2">
            <item identifier="ITEM6" identifierref="RESOURCE6"
                title="Introduction 2"/>
            <item identifier="ITEM7" identifierref="RESOURCE7" title="Content 2"/>
            <item identifier="ITEM8" identifierref="RESOURCE8" title="Summary 2"/>
        </item>
        <item identifier="ITEM9" identifierref="RESOURCE9" title="Lesson 3">
            <item identifier="ITEM10" identifierref="RESOURCE10"
                title="Introduction 3"/>
            <item identifier="ITEM11" identifierref="RESOURCE11"
                title="Content 3"/>
            <item identifier="ITEM12" identifierref="RESOURCE12"
                title="Summary 3"/>
        </item>
    </tableofcontents>
</organizations>

<resources>
    <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
        <file href="lesson1.htm"/>
    </resource>

    <resource identifier="RESOURCE2" type="webcontent" href="intro1.htm">
        <file href="intro1.htm"/>
    </resource>
```

```
        <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
            <file href="content1.htm"/>
        </resource>

        <resource identifier="RESOURCE4" type="webcontent" href="summary1.htm">
            <file href="summary1.htm"/>
        </resource>

        <resource identifier="RESOURCE5" type="webcontent" href="lesson2.htm">
            <file href="lesson2.htm"/>
        </resource>

        <resource identifier="RESOURCE6" type="webcontent" href="intro2.htm">
            <file href="intro2.htm"/>
        </resource>

        <resource identifier="RESOURCE7" type="webcontent" href="content2.htm">
            <file href="content2.htm"/>
        </resource>

        <resource identifier="RESOURCE8" type="webcontent" href="summary2.htm">
            <file href="summary2.htm"/>
        </resource>

        <resource identifier="RESOURCE9" type="webcontent" href="lesson3.htm">
            <file href="lesson3.htm"/>
        </resource>

        <resource identifier="RESOURCE10" type="webcontent" href="intro3.htm">
            <file href="intro3.htm"/>
        </resource>

        <resource identifier="RESOURCE11" type="webcontent" href="content3.htm">
            <file href="content3.htm"/>
        </resource>

        <resource identifier="RESOURCE12" type="webcontent" href="summary3.htm">
            <file href="summary3.htm"/>
        </resource>
    </resources>
</manifest>
```

4.3 All Elements

Illustrates a manifest that uses all elements and attributes defined in the IMS Content XML Specification.

```
<?xml version="1.0"?>
<manifest identifier="MANIFEST1" version=”1.0”>
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="http://www.imsproject.org/metadata">
            <general>
                <title>
                    <langstring lang="en_US"> IMS Content Packaging Sample – All
Elements</langstring>
                </title>
            </general>
        </record>
    </metadata>

    <organizations default="TOC1">
```

```
        <tableofcontents identifier="TOC1" title="default">
            <item identifier="ITEM1" identifierref="RESOURCE1"
                title="Lesson 1" isvisible="1">
                <item identifier="ITEM2" identifierref="RESOURCE2"
                    title="Introduction 1" isvisible="1"/>
                <item identifier="ITEM3" identifierref="RESOURCE3"
                    title="Content 1" isvisible="1"/>
                <item identifier="ITEM4" identifierref="RESOURCE4"
                    title="Summary 1" isvisible="1"/>
            </item>
            <item identifier="ITEM5" identifierref="RESOURCE5"
                title="Lesson 2" isvisible="0">
                <item identifier="ITEM6" identifierref="RESOURCE6"
                    title="Introduction 2" isvisible="0"/>
                <item identifier="ITEM7" identifierref="RESOURCE7"
                    title="Content 2" isvisible="0"/>
                <item identifier="ITEM8" identifierref="RESOURCE8" title="Summary 2"
                    isvisible="0"/>
            </item>
            <item identifier="ITEM9" identifierref="RESOURCE9" title="Lesson 3"
                isvisible="1">
                <item identifier="ITEM10" identifierref="RESOURCE10"
                    title="Introduction 3" isvisible="1"
                    parameters="foo"/>
                <item identifier="ITEM11" identifierref="RESOURCE11" title="Content 3"
                    isvisible="1"/>
                <item identifier="ITEM12" identifierref="RESOURCE12" title="Summary 3"
                    isvisible="1"/>
            </item>
        </tableofcontents>
    </organizations>

    <resources>
        <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
            <metadata>
                <record xmlns="http://www.imsproject.org/metadata">
                    <general>
                        <title>
                            <langstring lang="en_US">Resource 1</langstring>
                        </title>
                    </general>
                </record>
            </metadata>
            <file href="lesson1.htm"/>
        </resource>

        <resource identifier="RESOURCE2" type="webcontent" href="intro1.htm">
            <file href="intro1.htm"/>
        </resource>

        <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
            <file href="content1.htm"/>
        </resource>

        <resource identifier="RESOURCE4" type="webcontent" href="summary1.htm">
            <file href="summary1.htm"/>
        </resource>

        <resource identifier="RESOURCE5" type="webcontent" href="lesson2.htm">
            <file href="lesson2.htm"/>
        </resource>

        <resource identifier="RESOURCE6" type="webcontent" href="intro2.htm">
```

```
            <file href="intro2.htm"/>
        </resource>

        <resource identifier="RESOURCE7" type="webcontent" href="content2.htm">
            <file href="content2.htm"/>
        </resource>

        <resource identifier="RESOURCE8" type="webcontent" href="summary2.htm">
            <file href="summary2.htm"/>
        </resource>

        <resource identifier="RESOURCE9" type="webcontent" href="lesson3.htm">
            <file href="lesson3.htm"/>
        </resource>

        <resource identifier="RESOURCE10" type="webcontent" href="intro3.htm">
            <file href="intro3.htm"/>
        </resource>

        <resource identifier="RESOURCE11" type="webcontent" href="content3.htm">
            <file href="content3.htm"/>
        </resource>

        <resource identifier="RESOURCE12" type="webcontent" href="summary3.htm">
            <file href="summary3.htm"/>
        </resource>
    </resources>
</manifest>
```

4.4 Multiple TOCs

Illustrates the use of multiple tables of contents, to provide multiple paths through a course.

```
<?xml version="1.0"?>
<manifest identifier="MANIFEST1">
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="http://www.imsproject.org/metadata">
            <general>
                <title>
                    <langstring lang="en_US"> IMS Content Packaging Sample – Multiple
TOC's</langstring>
                </title>
            </general>
        </record>
    </metadata>

    <organizations default="TOC1">
        <tableofcontents identifier="TOC1" title="All Lessons">
            <item identifier="ITEM1" identifierref="RESOURCE1" title="Lesson 1">
                <item identifier="ITEM2" identifierref="RESOURCE2"
                    title="Introduction 1"/>
                <item identifier="ITEM3" identifierref="RESOURCE3" title="Content 1"/>
                <item identifier="ITEM4" identifierref="RESOURCE4" title="Summary 1"/>
            </item>
            <item identifier="ITEM5" identifierref="RESOURCE5" title="Lesson 2">
                <item identifier="ITEM6" identifierref="RESOURCE6"
                    title="Introduction 2"/>
                <item identifier="ITEM7" identifierref="RESOURCE7" title="Content 2"/>
                <item identifier="ITEM8" identifierref="RESOURCE8" title="Summary 2"/>
            </item>
```

```
            <item identifier="ITEM9" identifierref="RESOURCE9" title="Lesson 3">
                <item identifier="ITEM10" identifierref="RESOURCE10"
                    title="Introduction 3"/>
                <item identifier="ITEM11" identifierref="RESOURCE11"
                    title="Content 3"/>
                <item identifier="ITEM12" identifierref="RESOURCE12"
                    title="Summary 3"/>
            </item>
        </tableofcontents>
        <tableofcontents identifier="TOC2" title="Content Topics">
            <item identifier="TOC2_ITEM3" identifierref="RESOURCE3"
                title="Content 1"/>
            <item identifier="TOC2_ITEM7" identifierref="RESOURCE7"
                title="Content 2"/>
            <item identifier="TOC2_ITEM11" identifierref="RESOURCE11"
                title="Content 3"/>
        </tableofcontents>
        <tableofcontents identifier="TOC3" title="Summary Topics">
            <item identifier="TOC3_ITEM4" identifierref="RESOURCE4"
                title="Summary 1"/>
            <item identifier="TOC3_ITEM8" identifierref="RESOURCE8"
                title="Summary 2"/>
            <item identifier="TOC3_ITEM12" identifierref="RESOURCE12"
                title="Summary 3"/>
        </tableofcontents>
    </organizations>

    <resources>
        <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
            <file href="lesson1.htm"/>
        </resource>

        <resource identifier="RESOURCE2" type="webcontent" href="intro1.htm">
            <file href="intro1.htm"/>
        </resource>

        <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
            <file href="content1.htm"/>
        </resource>

        <resource identifier="RESOURCE4" type="webcontent" href="summary1.htm">
            <file href="summary1.htm"/>
        </resource>

        <resource identifier="RESOURCE5" type="webcontent" href="lesson2.htm">
            <file href="lesson2.htm"/>
        </resource>

        <resource identifier="RESOURCE6" type="webcontent" href="intro2.htm">
            <file href="intro2.htm"/>
        </resource>

        <resource identifier="RESOURCE7" type="webcontent" href="content2.htm">
            <file href="content2.htm"/>
        </resource>

        <resource identifier="RESOURCE8" type="webcontent" href="summary2.htm">
            <file href="summary2.htm"/>
        </resource>

        <resource identifier="RESOURCE9" type="webcontent" href="lesson3.htm">
            <file href="lesson3.htm"/>
        </resource>
```

```
        <resource identifier="RESOURCE10" type="webcontent" href="intro3.htm">
            <file href="intro3.htm"/>
        </resource>

        <resource identifier="RESOURCE11" type="webcontent" href="content3.htm">
            <file href="content3.htm"/>
        </resource>

        <resource identifier="RESOURCE12" type="webcontent" href="summary3.htm">
            <file href="summary3.htm"/>
        </resource>
    </resources>
</manifest>
```

4.5 Using Sub Manifests for Content Aggregation/Disaggregation

Illustrates the use of sub manifests to promote reuse. This example takes the "Simple Manifest" example, and implements it using sub manifests.

```
<?xml version="1.0"?>
<manifest identifier="MANIFEST1">
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="http://www.imsproject.org/metadata">
            <general>
                <title>
                    <langstring lang="en_US"> IMS Content Packaging Sample – Sub-
Manifests</langstring>
                </title>
            </general>
        </record>
    </metadata>

    <organizations default="TOC1">
        <tableofcontents identifier="TOC1" title="default">
            <item identifier="TOC1_ITEM1" identifierref="TOC2" title="Lesson 1"/>
            <item identifier="TOC1_ITEM2" identifierref="TOC3" title="Lesson 2"/>
            <item identifier="TOC1_ITEM3" identifierref="TOC4" title="Lesson 3"/>
        </tableofcontents>
    </organizations>

    <resources>
        <manifestref identifierref="MANIFEST2"/>
        <manifestref identifierref="MANIFEST3"/>
        <manifestref identifierref="MANIFEST4"/>
    </resources>

    <manifest identifier="MANIFEST2">
        <metadata>
            <schema>IMS Content</schema>
            <schemaversion>1.0</schemaversion>
            <record xmlns="http://www.imsproject.org/metadata">
                <general>
                    <title>
                        <langstring lang="en_US">Lesson1</langstring>
                    </title>
                </general>
            </record>
        </metadata>
```

```
    <organizations default="TOC2">
        <tableofcontents identifier="TOC2" title="default">
            <item identifier="TOC2_ITEM1" identifierref="RESOURCE1"
                title="Lesson 1">
                <item identifier="TOC2_ITEM2" identifierref="RESOURCE2"
                     title="Introduction 1"/>
                <item identifier="TOC2_ITEM3" identifierref="RESOURCE3"
                     title="Content 1"/>
                <item identifier="TOC2_ITEM4" identifierref="RESOURCE4"
                    title="Summary 1"/>
            </item>
        </tableofcontents>
    </organizations>

    <resources>
        <resource identifier="RESOURCE1" type="webcontent" href="lesson1.htm">
            <file href="lesson1.htm"/>
        </resource>

        <resource identifier="RESOURCE2" type="webcontent" href="intro1.htm">
            <file href="intro1.htm"/>
        </resource>

        <resource identifier="RESOURCE3" type="webcontent" href="content1.htm">
            <file href="content1.htm"/>
        </resource>

        <resource identifier="RESOURCE4" type="webcontent" href="summary1.htm">
            <file href="summary1.htm"/>
        </resource>
    </resources>
</manifest>

<manifest identifier="MANIFEST3">
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="http://www.imsproject.org/metadata">
            <general>
                <title>
                    <langstring lang="en_US">Lesson2</langstring>
                </title>
            </general>
        </record>
    </metadata>

    <organizations default="TOC3">
        <tableofcontents identifier="TOC3" title="default">
            <item identifier="TOC3_ITEM1" identifierref="RESOURCE5"
                title="Lesson 2">
                <item identifier="TOC3_ITEM2" identifierref="RESOURCE6"
                    title="Introduction 2"/>
                <item identifier="TOC3_ITEM3" identifierref="RESOURCE7"
                    title="Content 2"/>
                <item identifier="TOC3_ITEM4" identifierref="RESOURCE8"
                    title="Summary 2"/>
            </item>
        </tableofcontents>
    </organizations>

    <resources>
        <resource identifier="RESOURCE5" type="webcontent" href="lesson2.htm">
            <file href="lesson2.htm"/>
```

```
            </resource>

            <resource identifier="RESOURCE6" type="webcontent" href="intro2.htm">
                <file href="intro2.htm"/>
            </resource>

            <resource identifier="RESOURCE7" type="webcontent" href="content2.htm">
                <file href="content2.htm"/>
            </resource>

            <resource identifier="RESOURCE8" type="webcontent" href="summary2.htm">
                <file href="summary2.htm"/>
            </resource>
        </resources>
    </manifest>

    <manifest identifier="MANIFEST4">
        <metadata>
            <schema>IMS Content</schema>
            <schemaversion>1.0</schemaversion>
            <record xmlns="http://www.imsproject.org/metadata">
                <general>
                    <title>
                        <langstring lang="en_US">Lesson1</langstring>
                    </title>
                </general>
            </record>
        </metadata>

        <organizations default="TOC4">
            <tableofcontents identifier="TOC4" title="default">
                <item identifier="TOC4_ITEM1" identifierref="RESOURCE9"
                    title="Lesson 1">
                    <item identifier="TOC4_ITEM2" identifierref="RESOURCE10"
                        title="Introduction 1"/>
                    <item identifier="TOC4_ITEM3" identifierref="RESOURCE11"
                        title="Content 1"/>
                    <item identifier="TOC4_ITEM4" identifierref="RESOURCE12"
                        title="Summary 1"/>
                </item>
            </tableofcontents>
        </organizations>

        <resources>
            <resource identifier="RESOURCE9" type="webcontent" href="lesson3.htm">
                <file href="lesson3.htm"/>
            </resource>

            <resource identifier="RESOURCE10" type="webcontent" href="intro3.htm">
                <file href="intro3.htm"/>
            </resource>

            <resource identifier="RESOURCE11" type="webcontent" href="content3.htm">
                <file href="content3.htm"/>
            </resource>

            <resource identifier="RESOURCE12" type="webcontent" href="summary3.htm">
                <file href="summary3.htm"/>
            </resource>
        </resources>
    </manifest>
</manifest>
```

4.6 Using xinclude for Content Aggregation/Disaggregation

Illustrates how to use xmlinclude to support flexible aggregation and disaggregation. See section 2.5.3 regarding the use of xinclude.

```
<?xml version="1.0"?>
<manifest identifier="MANIFEST1" xmlns="x-schema:IMS_CONTENTv1p0.xdr"
  xmlns:xinclude="http://www.w3.org/1999/XML/xinclude">
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <record xmlns="x-schema:IMS_METADATAv1p1.xdr">
            <general>
                <title>
                    <langstring lang="en_US"> IMS Content Packaging Sample -
xinclude</langstring>
                </title>
            </general>
        </record>
    </metadata>

    <organizations default="TOC1">
        <tableofcontents identifier="TOC1" title="default">
            <item identifier="TOC1_ITEM1" identifierref="TOC2" title="Lesson
1"/>
            <item identifier="TOC1_ITEM2" identifierref="TOC3" title="Lesson
2"/>
            <item identifier="TOC1_ITEM3" identifierref="TOC4" title="Lesson
3"/>
        </tableofcontents>
    </organizations>

    <resources>
        <manifestref identifierref="MANIFEST2"/>
        <manifestref identifierref="MANIFEST3"/>
        <manifestref identifierref="MANIFEST4"/>
    </resources>

    <xinclude:include href="lesson1_manifest.xml"/>
    <xinclude:include href="lesson2_manifest.xml"/>
    <xinclude:include href="lesson3_manifest.xml"/>
</manifest>
```

4.7 Implementing Extensions using Namespaces

Illustrates how extensions can be included in a manifest.

```
<?xml version="1.0"?>

<manifest identifier="MANIFEST1" version="1.0"
  xmlns="http://www.imsproject.org/content"
  xmlns:imsmd="http://www.imsproject.org/metadata"
  xmlns:xinclude="http://www.w3.org/1999/XML/xinclude"
    <metadata>
        <schema>IMS Content</schema>
        <schemaversion>1.0</schemaversion>
        <imsmd:metametadata>
           <imsmd:metadatascheme>IMS Metadata 1.1</imsmd:metadatascheme>
```

```
    </imsmd:metametadata>
    <imsmd:general>
         <imsmd:description>This is a sample of an IMS manifest for a package
          identified as MANIFEST1. This example is intended to use all of the
          elements available in the IMS_CONTENT Schema and a few from other
          available schemas including the Dublin Core, ADL, IMS Question and Test,
          and IMS meta-data.  This example will validate using the Internet
          Explorer 5.0 XML parser given that all of the schemas referenced are in
          the same folder as this XML manifest file.
        </imsmd:description>
    </imsmd:general>

     <xinclude:include href="metadata/package1md.xml"/>

</metadata>

<organizations default="TOC1">
    <tableofcontents identifier="TOC1" title="default TOC">
       <item identifier="TOC1_ITEM1" identifierref="RESOURCE1" isvisible="1"/>
       <item identifier="TOC1_ITEM2" identifierref="RESOURCE2" title="Parsing XML"
            parameters="?process.asp">
            <item identifier="TOC1_ITEM2a" identifierref="RESOURCE2a"
                title="Opening the file"/>
        </item>
        <item identifier="TOC1_ITEM3" identifierref="TEST1"/>
    </tableofcontents>

    <course xmlns="urn:schemas-imsproject-org-adl">
       <block id="B1">
            <identification>
                <title>Introduction to Blocks 101</title>
                <description>
                   Simple block of course elements; not much to build with yet.
                </description>
            </identification>
            <au id="A1">
                <identification>
                    <title>Building With Atoms</title>
                </identification>
                <launch>
                    <location>au1.html</location>
                </launch>
            </au>
            <au id="A2">
                <identification>
                    <title>Splitting Atoms With Hairs</title>
                </identification>
                <launch>
                    <location>au2.html</location>
                </launch>
            </au>
        </block>
     </course>
 </organizations>

<resources>
    <resource identifier="RESOURCE1" type="webcontent" href="ch01d.htm">
       <metadata>
          <xinclude:include href="ch01d.md"/>
       </metadata>
         <file href="ch01d.htm"/>
    </resource>
```

```
        <resource identifier="RESOURCE2" type="webcontent" href="topics/index.htm">
            <file href="topics/index.htm"/>
            <file href="images/pic1.gif"/>
            <file href="images/pic2.gif"/>
         </resource>

        <resource identifier="RESOURCE2a" type="webcontent">
            <xinclude:include href="openfile.xml"/>
        </resource>

        <resource identifier="TEST1" type="imsqti" >
            <xinclude:include href="testfiles/IMS_QTIv1BasicEx001a.xml"/>
        </resource>

        <resource identifier="TEST2" type="imsqti"
            xml:base="http://www.imsproject.org/">
            <questestinterop xmlns="x-schema:IMS_QTIv1p0.xdr">
                <qticomment>
                   This is a simple True/False multiple choice example.
                   The rendering is a standard radio button style.
                   No response processing is incorporated.
                </qticomment>
               <item ident="IMS_V01_I_BasicExample001">
                    <presentation label="BasicExample001">
                         <material>
                             <mattext> Paris is the Capital of France ? </mattext>
                         </material>
                         <response_lid ident="TF01" rcardinality="Single" rtiming="No">
                             <render_choice>
                                 <response_label ident="T">
                                     <material><mattext> True </mattext></material>
                                 </response_label>
                                 <response_label ident="F">
                                     <material><mattext> False </mattext></material>
                                 </response_label>
                            </render_choice>
                         </response_lid>
                    </presentation>
                </item>
            </questestinterop>
        </resource>
    </resources>
</manifest>
```

Appendix A - Content Packaging DTD

```
<!ELEMENT schema  (#PCDATA )>
<!ATTLIST schema  e-dtype NMTOKEN  #FIXED 'string' >

<!ELEMENT schemaversion  (#PCDATA )>
<!ATTLIST schemaversion  e-dtype NMTOKEN  #FIXED 'string' >

<!ELEMENT manifestref EMPTY>
<!ATTLIST manifestref  identifierref IDREF  #REQUIRED >

<!ELEMENT file  EMPTY>
<!ATTLIST file  href CDATA  #REQUIRED >

<!ELEMENT resource  (metadata? | file+ )*>
<!ATTLIST resource  identifier ID     #REQUIRED
                    type       CDATA  #REQUIRED
                    href       CDATA  #IMPLIED >
<!ELEMENT resources  (resource* | manifestref* )*>

<!ELEMENT item  (item* )*>
<!ATTLIST item  identifier    ID        #REQUIRED
                identifierref IDREF     #IMPLIED
                title         CDATA     #IMPLIED
                isvisible     CDATA     #IMPLIED
                parameters    CDATA     #IMPLIED
                a-dtype       NMTOKENS  'isvisible boolean' >
<!ELEMENT tableofcontents  (item* )>
<!ATTLIST tableofcontents  identifier ID     #REQUIRED
                           title      CDATA  #IMPLIED >

<!ELEMENT organizations  (tableofcontents* )>
<!ATTLIST organizations default IDREF  #IMPLIED >

<!ELEMENT metadata  (schema? , schemaversion?)>

<!ELEMENT manifest  (metadata? , organizations , resources , manifest* )>
<!ATTLIST manifest  identifier ID     #REQUIRED
                           version    CDATA  #IMPLIED>
```

Appendix B - Content Packaging XML-Data Schema

```
<?xml version='1.0'?>
<Schema  name = "IMS_CONTENTv0p92.xdr" xmlns="urn:schemas-microsoft-com:xml-data"
  xmlns:dt="urn:schemas-microsoft-com:datatypes"
  xmlns:xlink="urn:w3c:xlink">

<!-- ATTRIBUTES standalone -->
  <AttributeType name="href" dt:type="string"/>
  <AttributeType name="identifierref" dt:type="idref"/>
  <AttributeType name="parameters" dt:type="string"/>
  <AttributeType name="identifier" dt:type="id"/>
  <AttributeType name="default" dt:type="idref"/>
  <AttributeType name="source" dt:type="string"/>
  <AttributeType name="version" dt:type="string"/>
  <AttributeType name="resourcetype" dt:type="string"/>
  <AttributeType name="title" dt:type="string"/>
  <AttributeType name="isvisible" dt:type="boolean"/>
  <AttributeType name="type" dt:type="string"/>

<!-- ELEMENTS standalone-->
  <ElementType name="schema" dt:type="string" content="textOnly" model="closed"/>
  <ElementType name="schemaversion" dt:type="string" content="textOnly"
model="closed"/>

<!-- ELEMENT MANIFESTREF -->
  <ElementType name="manifestref" content="empty" model="open">
    <attribute type="identifierref" required="yes"/>
  </ElementType>

<!-- ELEMENT FILE -->
  <ElementType name = "file" content = "empty" model = "open">
      <attribute type="href" required="yes"/>
  </ElementType>

<!-- ELEMENT RESOURCE -->
  <ElementType name="resource" content="eltOnly" model="open" order="many">
    <attribute type="identifier" required="yes"/>
   <attribute type="type" required="yes"/>
    <attribute type="href" required="no"/>
    <element type="metadata" minOccurs="0" maxOccurs="1"/>
    <element type="file" minOccurs="1" maxOccurs="*"/>
  </ElementType>

<!-- ELEMENT RESOURCES -->
  <ElementType name="resources" content="eltOnly" model="open" order="many">
    <element type="resource" minOccurs="0" maxOccurs="*"/>
    <element type="manifestref" minOccurs="0" maxOccurs="*"/>
  </ElementType>

<!-- ELEMENT ITEM -->
  <ElementType name="item" content="eltOnly" model="open" order="many">
    <attribute type="identifier" required="yes"/>
    <attribute type="identifierref" required="no"/>
    <attribute type="title" required="no"/>
    <attribute type="isvisible" required="no"/>
    <attribute type="parameters" required="no"/>
    <element type="item" minOccurs="0" maxOccurs="*"/>
  </ElementType>

<!-- ELEMENT TABLEOFCONTENTS -->
  <ElementType name="tableofcontents" content="eltOnly" model="open" order="seq">
```

```
    <attribute type="identifier" required="yes"/>
    <attribute type="title" required="no"/>
    <element type="item" minOccurs="1" maxOccurs="*"/>
  </ElementType>

<!-- ELEMENT ORGANIZATIONS -->
  <ElementType name="organizations" content="eltOnly" model="open" order="seq">
    <attribute type="default" required="no"/>
    <element type="tableofcontents" minOccurs="0" maxOccurs="*"/>
  </ElementType>

<!-- ELEMENT METADATA -->
  <ElementType name="metadata" content="eltOnly" model="open" order="seq">
    <element type="schema" minOccurs="0" maxOccurs="1"/>
    <element type="schemaversion" minOccurs="0" maxOccurs="1"/>
  </ElementType>

<!-- ELEMENT MANIFEST -->
  <ElementType name="manifest" content="eltOnly" model="open" order="seq">
    <attribute type="identifier" required="yes"/>
    <attribute type="version" required="no"/>
    <element type="metadata" minOccurs="0" maxOccurs="1"/>
    <element type="organizations" minOccurs="1" maxOccurs="1"/>
    <element type="resources" minOccurs="1" maxOccurs="1"/>
    <element type="manifest" minOccurs="0" maxOccurs="*"/>
  </ElementType>

</Schema>
```

Appendix C - DRAFT Content Packaging W3C XML Schema

```
<?xml version="1.0"?>
<!DOCTYPE schema SYSTEM "XML-Schema.dtd" >
<!--Conforms to w3c http://www.w3.org/TR/xmlschema-1/-->
<schema targetNamespace="CONTENT10.xsd"
       xmlns="http://www.w3.org/1999/XMLSchema"
              attributeFormDefault="unqualified"
       elementFormDefault="unqualified" blockDefault="" finalDefault="">

    <annotation>
        <documentation xml:lang="en">
            VERY preliminary.  Needs review and weeding.
        </documentation>
        <documentation>
            2000-04-21, Adjustments by T.D. Wason.  IMS Content XSD with defined
           attributes. Derived from IMS_CONTENTv0p92a.dtd
        </documentation>
        <documentation>
            Import raw IMS meta-data xsd, lower case element names
</documentation>
        <documentation>
            Import IMS version of Dublin Core xsd, lower case element names
</documentation>
    </annotation>

    <!-- Inclusions and Imports -->
    <annotation>
        <documentation>Inclusions and Imports</documentation>
    </annotation>

    <include schemaLocation="IMS-MD01P.xsd"/>

    <!-- Attributes declarations -->
    <annotation>
        <documentation>Attribute Declarations</documentation>
    </annotation>
    <attributeGroup name="att.href">
        <attribute name="href" type="uriReference"/>
    </attributeGroup>
        <attributeGroup name="att.identifierref">
        <attribute name="identifier" type="IDREF"/>
    </attributeGroup>
    <attributeGroup name="att.parameters">
        <attribute name="parameters" type="string"/>
    </attributeGroup>
    <attributeGroup name="att.identifier">
        <attribute name="identifier" type="ID" use="required"/>
    </attributeGroup>
        <attributeGroup name="att.default">
        <attribute name="default" type="IDREF"/>
    </attributeGroup>    <attributeGroup name="att.source">
        <attribute name="source" type="string"/>    </attributeGroup>
    <attributeGroup name="att.version">
        <attribute name="version" type="string"/>
    </attributeGroup>
    <attributeGroup name="att.resourcetype">
        <attribute name="resourcetype" type="string"/>
    </attributeGroup>
```

```
    <attributeGroup name="att.title">
        <!-- What differentiates this from the meta-data title? -->
        <attribute name="title" type="string"/>
    </attributeGroup>
    <attributeGroup name="att.isvisible">
        <attribute name="isvisible" type="string"/>
    </attributeGroup>    <attributeGroup name="att.type">
        <attribute name="type" type="string"/>
    </attributeGroup>
    <attributeGroup name="att.imsmd">
        <attribute name="xmlns:imsmd" use="fixed"
            value="urn:schemas-imsproject-org-metadata"/>
    </attributeGroup>
    <attributeGroup name="att.base">
        <attribute name="xml:base" type="string" use="optional"/>
    </attributeGroup>

    <!-- Elements Declarations -->
    <annotation>
        <documentation>Element Declarations</documentation>
    </annotation>
    <element name="schema" type="string" block="" final="" abstract="false"
nullable="false" minOccurs="1"/>
    <element name="schemaversion" type="string" block="" final="" abstract="false"
nullable="false" minOccurs="1"/>
    <element name="manifestref" block="" final="" abstract="false" nullable="false"
minOccurs="1">
        <complexType content="empty" block="" final="" abstract="false">
            <attributeGroup ref="att.identifierref"/>
        </complexType>

    </element><element name="file" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="empty" block="" final="" abstract="false">
<attributeGroup ref="att.href"/>
        </complexType></element>
  <element name="imslink" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="empty" block="" final="" abstract="false">
      <attributeGroup ref="att.xmllink"/>
      <attributeGroup ref="att.href"/>
    </complexType>
  </element>
  <element name="resource" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
      <choice minOccurs="0" maxOccurs="1">
        <element ref="metadata" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="file" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="imslink" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
      </choice>
      <attributeGroup ref="att.identifier"/>
      <attributeGroup ref="att.type"/>
      <attributeGroup ref="att.base"/>
      <attributeGroup ref="att.href"/>
    </complexType>
  </element>
  <element name="resources" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
```

```
      <choice minOccurs="0" maxOccurs="unbounded">
        <element ref="resource" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="manifestref" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
      </choice>
    </complexType>
  </element>
  <element name="item" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
      <element ref="item" minOccurs="0" maxOccurs="*" block="" final=""
abstract="false" nullable="false"/>
      <attributeGroup ref="att.identifier"/>
      <attributeGroup ref="att.identifierref"/>
      <attributeGroup ref="att.title"/>
      <attributeGroup ref="att.isvisible"/>
      <attributeGroup ref="att.parameters"/>
    </complexType>
  </element>
  <element name="tableofcontents" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
      <element ref="item" minOccurs="0" maxOccurs="*" block="" final=""
abstract="false" nullable="false"/>
      <element ref="extension" minOccurs="0" maxOccurs="*" block="" final=""
abstract="false" nullable="false"/>
      <attributeGroup ref="att.identifier"/>
      <attributeGroup ref="att.title"/>
    </complexType>
  </element>
  <element name="organizations" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
      <element ref="tableofcontents" minOccurs="0" maxOccurs="*" block="" final=""
abstract="false" nullable="false"/>
      <attributeGroup ref="att.default"/>
    </complexType>
  </element>
  <element name="metadata" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
      <element ref="schema" minOccurs="0" maxOccurs="1" block="" final=""
abstract="false" nullable="false"/>
      <element ref="schemaversion" minOccurs="0" maxOccurs="1" block="" final=""
abstract="false" nullable="false"/>
      <choice minOccurs="1">
        <element ref="record" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="dcore" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="extension" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="imslink" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
      </choice>
    </complexType>
  </element>
  <element name="manifest" block="" final="" abstract="false" nullable="false"
minOccurs="1">
    <complexType content="elementOnly" block="" final="" abstract="false">
      <sequence minOccurs="1">
```

```
        <element ref="metadata" minOccurs="0" maxOccurs="1" block="" final=""
abstract="false" nullable="false"/>
        <element ref="organizations" block="" final="" abstract="false"
nullable="false" minOccurs="1"/>
        <element ref="resources" block="" final="" abstract="false" nullable="false"
minOccurs="1"/>
        <element ref="manifest" minOccurs="0" maxOccurs="*" block="" final=""
abstract="false" nullable="false"/>
      </sequence>
      <attributeGroup ref="att.identifier"/>
      <attributeGroup ref="att.version"/>
      <attributeGroup ref="att.identifierref"/>
      <attributeGroup ref="att.imsmd"/>
    </complexType>
  </element>
</schema>
```

Appendix D - Additional Resources

IMS Content Documents

IMS Content Information Model: http://www.imsproject.org/content/packaging/cpinfo10.html

IMS Content XML Binding: http://www.imsproject.org/content/packaging/cpbind10.html

IMS Meta-data Documents

The IMS Meta-data Best Practice and Implementation Guide can be found at:
http://www.imsproject.org/metadata/mdbestv1p1.html

The IMS Learning Resource Meta-data Information Model document can be found at:
http://www.imsproject.org/metadata/mdinfov1p1.html

IMS 1.1 Meta-data DTD: http://www.imsproject.org/metadata

IMS 1.1 Meta-data XML-Data Schema: Bindings\XML-Data Schema\IMS_METADATAv1p1.xdr

ADL/AICC Documents

Shareable Courseware Object Reference Model: http://www.adlnet.org/

Aviation Industry CBT Committee (AICC) API for Web Implementation: http://www.aicc.org/

XML

XML Version 1.0 specification of the W3C: http://www.w3.org/TR/1998/REC-xml-19980210

XML Namespace Recommendation of W3C: http://www.w3.org/TR/1999/REC-xml-names-19990114

XML Inclusion Technical Report: http://www.w3.org/TR/xinclude

XML-Data specification: http://www.w3.org/TR/1998/NOTE-XML-data-0105/

XML Schema specification: http://www.w3.org/XML/Schema.html

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