



# IMS Common Cartridge Profile

## Version 1.0 Final Specification

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## Executive Summary

The Common Cartridge defines an open format for the distribution of rich, web-based content. It is designed to ensure the correct installation and operation of content across any Common Cartridge conformant platforms and tools. The specification defines a profile for the use of the following specifications which are (in the versions adopted here), already widely implemented and in use across the community:

- IEEE LOM encompassing:
  - ISO 15836:2003: Dublin Core Metadata Element Set (mapped to the corresponding elements in LOM) [DC, 03]
  - IEEE 1484.12.1-2002: Learning Object Metadata [IEEE LOM, 02]
  - IEEE 1484.12.3-2005: LOM Schema binding (loose binding) [IEEE LOM, 05]
- IMS Content Packaging v1.2 [CP, 07]
- IMS Question & Test Interoperability v1.2.1 [QTI, 03]
- IMS Authorization Web Service v1.0 [CC, 08b]

The LOM, Content Packaging and Question & Test Interoperability specifications have each been profiled to simplify their use. Thus their scope has been constrained to those features commonly implemented and in use by the community. Experience suggests that interoperability problems that have arisen with implementations of these specifications are frequently the result of differing interpretations of the specs and options being taken that lead to divergence in behavior. A key goal of the Common Cartridge specification therefore has been to provide a tighter definition of their use thus eliminating this divergence. The resulting profile also lends itself to more effective conformance testing of implementations.

Additional features offered by the Common Cartridge include:

- A new resource type for initiating discussion forum interactions.
- Inclusion of a question bank (i.e., a QTI objectbank), offering tutors additional questions to those contained within the pre-configured assessments, which they can configure around the core material.
- Optional authorization to protect either the whole cartridge, or selected cartridge resources (see the accompanying IMS Authorization Web Service v1.0 specification [CC, 08b]).

The present versions of the specifications supported under Common Cartridge have been selected to offer existing implementations a low barrier to adoption of the Common Cartridge. It is to be anticipated that as new versions of these specifications achieve widespread adoption, they in turn will be adopted thus further enhancing the features supported in future versions of the Common Cartridge.

# Table of Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>2</b>
<b>1. INTRODUCTION .....</b>	<b>6</b>
1.1 SCOPE AND CONTEXT .....	6
1.1.1 Approach .....	6
1.1.2 Technology .....	6
1.1.3 Deployment .....	7
1.2 STRUCTURE OF THIS DOCUMENT .....	7
1.3 REFERENCES .....	8
1.4 DEFINITIONS .....	8
<b>2. USE CASES .....</b>	<b>11</b>
2.1 USE CASE SCOPE .....	11
2.1.1 Affected Roles and Definitions .....	11
2.1.2 High-level Use Case Scope .....	11
2.2 CC PACKAGE IMPORT .....	12
2.3 AUTHORIZATION .....	13
2.4 EXECUTION OF STATIC CONTENT .....	14
2.5 EXECUTION OF DYNAMIC CONTENT – CLIENT-SIDE .....	15
2.6 EXECUTION OF DYNAMIC CONTENT – SERVER-SIDE .....	17
<b>3. ARCHITECTURE AND APPROACH .....</b>	<b>19</b>
3.1 IMS COMMON CARTRIDGE RUN-TIME FUNCTIONAL MODEL .....	19
3.2 CONTENT TYPES .....	20
3.3 COMMON CARTRIDGE PACKAGE INTERCHANGE FILE STRUCTURE .....	22
3.3.1 Categories of Resource in a Common Cartridge .....	22
3.3.2 Cartridge Level Web Content .....	24
3.3.3 Learning Application Object Directories .....	24
3.3.4 Example Layout .....	25
3.4 PATHNAMES FOR WEB CONTENT RESOURCES .....	25
3.4.1 Cartridge Web Content .....	25
3.4.2 Learning Application Object Web Content .....	26
3.4.3 Format of Relative Path References within a web content file system .....	26
3.4.4 Format of Relative Path References from Learning Application Object to Cartridge File System .....	27
<b>4. COMMON CARTRIDGE INFORMATION MODEL PROFILES .....</b>	<b>28</b>
4.1 THE CONCEPTUAL MODEL .....	28
4.2 SUPPORTED RESOURCE TYPES .....	28
4.3 COMMON CARTRIDGE INFORMATION MODEL .....	29
4.4 CONTENT PACKAGING .....	31
4.4.1 Overview .....	31
4.4.2 Manifest .....	32
4.4.3 Folder Content Type .....	32
4.4.4 Cartridge Web Content Type .....	34
4.4.5 Associated Content Type .....	34
4.4.6 Discussion Topic Content Type .....	34
4.4.7 Web Link (URL) Content Type .....	34
4.4.8 Assessment Content Type .....	35
4.4.9 Question Bank Content Type .....	35
4.4.10 Common Cartridge Authorization .....	35

4.5	LOM METADATA.....	36
4.5.1	Cartridge Metadata.....	36
4.5.2	Roles Meta-data .....	38
4.6	AUTHORIZATION .....	38
4.6.1	Specifying the Authorization Level.....	39
4.7	DISCUSSION TOPICS.....	40
4.8	WEB LINKS .....	41
4.9	QTI .....	42
4.9.1	Overview.....	42
4.9.2	Further Element/Attribute Restrictions for Common Cartridge .....	45
4.9.3	Root .....	47
4.9.4	Section .....	48
4.9.5	Common .....	49
4.9.6	Assessment.....	50
4.9.7	Item.....	51
4.9.8	Material.....	55
4.9.9	Questions .....	55
4.9.10	Question Bank .....	57
4.10	VOCABULARIES .....	57
<b>5.</b>	<b>IMPLEMENTATION GUIDELINES AND BEST PRACTICES.....</b>	<b>59</b>
5.1	GENERAL BEST PRACTICES .....	59
5.1.1	Extensions to Resources Meta-data .....	59
5.1.2	Accessibility.....	59
5.1.3	Meta-data Rights Management .....	59
5.2	EXAMPLES OF VALID COMMON CARTRIDGE FILE STRUCTURES .....	60
5.2.1	Sample 1 – Web Content and Learning Application Objects Both in Root.....	60
5.2.2	Sample 2 – Web Content in Root and Learning Application Objects in Subdirectory ..	61
5.2.3	Sample 3 – Web Content and Learning Application Objects Both in Subdirectories....	62
5.2.4	Relative Paths.....	63
5.3	CONTENT & ASSESSMENT ISSUES .....	64
5.3.1	Course Essentials.....	64
5.3.2	Course Design.....	64
5.4	LMS ISSUES .....	65
5.5	KNOWN COMMON CARTRIDGE ISSUES .....	66
5.6	FUTURE DEVELOPMENT .....	66
<b>6.</b>	<b>CONFORMANCE.....</b>	<b>67</b>
6.1	CARTRIDGE COMPLIANCE .....	67
6.1.1	Cartridge Authorization .....	67
6.1.2	Cartridge Assessments & Question Banks.....	67
6.1.3	Scope of Cartridge Tests .....	68
6.1.4	Limitations of Cartridge Testing .....	68
6.1.5	Cartridge Additional Constraints.....	68
6.2	LMS COMPLIANCE.....	69
6.2.1	CC Compliance .....	69
6.2.2	CC Lite Compliance .....	69
6.2.3	Cartridge Assessments & Question Banks.....	69
6.2.4	LMS Testing.....	70
6.3	TEST DATA SET .....	70
	<b>APPENDIX A – PROFILE XSDS .....</b>	<b>71</b>



<b>APPENDIX B – PROFILE SCHEMA PACKAGE</b> .....	<b>72</b>
<b>APPENDIX C – CC CHANGES TO PROFILED BASE SCHEMAS</b> .....	<b>74</b>
C1 - APPLICATION PROFILE MODIFICATIONS TO CONTENT PACKAGING V1.2 SCHEMA .....	74
C2 - APPLICATION PROFILE MODIFICATIONS TO THE CONTENT PACKAGING V1.2 EXTENSION SCHEMA.....	80
C3 - APPLICATION PROFILE MODIFICATIONS TO IEEE LOM V1.0 LOOSE SCHEMA FOR CARTRIDGE META-DATA (UNQUALIFIED DUBLIN CORE).....	81
C4 - APPLICATION PROFILE MODIFICATIONS TO IEEE LOM V1.0 LOOSE SCHEMA FOR ROLES META-DATA .....	87
C5 - APPLICATION PROFILE MODIFICATIONS TO QUESTION & TEST INTEROPERABILITY V1.2 SCHEMA .....	88
<b>APPENDIX D – CC SCHEMATRON RULES FOR THE PROFILED CONTENT PACKAGING V1.2 SCHEMA</b> .....	<b>109</b>
<b>ABOUT THIS DOCUMENT</b> .....	<b>112</b>
LIST OF CONTRIBUTORS .....	112
<b>REVISION HISTORY</b> .....	<b>114</b>

# 1. Introduction

## 1.1 Scope and Context

### 1.1.1 Approach

This specification constitutes a profile of the following, existing specifications:

- IEEE LOM encompassing:
  - ISO 15836:2003: Dublin Core Metadata Element Set (mapped to the corresponding elements in LOM) [DC, 03]
  - IEEE 1484.12.1-2002: Learning Object Metadata [IEEE LOM, 02]
  - IEEE 1484.12.3-2005: LOM Schema binding (loose binding) [IEEE LOM, 05]
- IMS Content Packaging v1.2 [CP, 07]
- IMS Question & Test Interoperability v1.2.1 [QTI, 03]
- IMS Authorization Web Service v1.0 [CC, 08b]

The profile has been developed in accordance with the IMS Application Profile Guidelines v1.0, using the IMS SchemaProf tool v1.0.

The driving motivation behind this work has been to communicate clearly and unambiguously how the above collection of specifications can be harnessed to distribute rich web content in a format offering a high degree interoperability across platforms. The approach followed has centered on;

- 1) eliminating implementation options from the adopted base schemas;
- 2) removing unwanted extensibility;
- 3) focusing on commonly used features and eliminating those rarely used;
- 4) further constraining permitted data in supported element (e.g., in terms of type, value ranges, vocabularies).

The resulting Common Cartridge profile should be easier for developers to implement and lends itself to more routine conformance testing of these implementations.

### 1.1.2 Technology

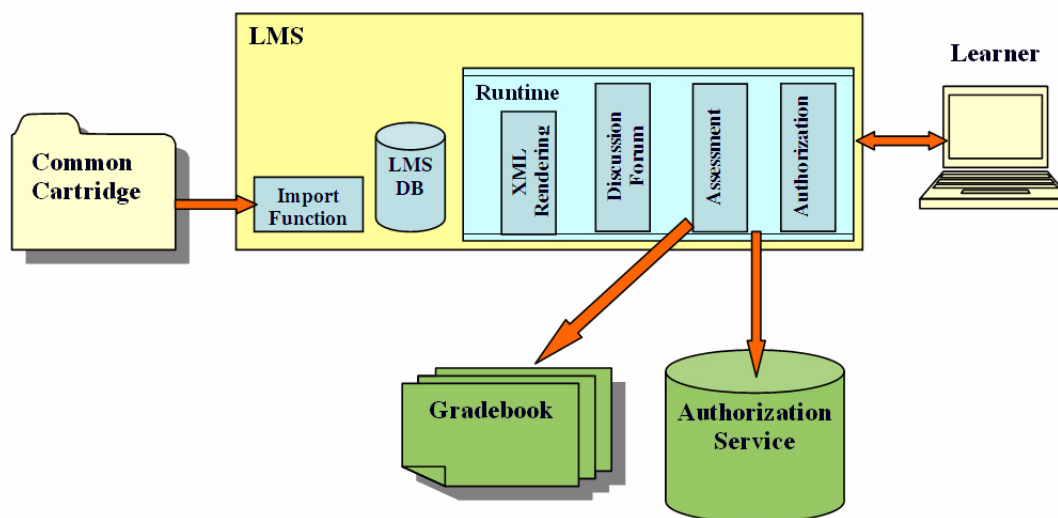
Simplifications applied to the Common Cartridge format include:

- Meta-data is only mandated at the cartridge level by the CC profile (located in the root folder). Optionally, roles meta-data can be applied within the manifest to define which categories of users have access to particular resources.
- Inter-package links are not supported
- Common Cartridge meta-data only uses the 15 elements from DCMI v1.1 (Simple DC)
- Assessments have been simplified to just the six (6) most commonly used QTI question types:
  - Multiple choice (single response)
  - Multiple choice (multiple response)
  - True/false
  - Essay
  - Simple fill in the blank
  - Pattern match

However, the format has also been enriched with the addition of:

- Cartridge support for authorization data (also see the Authorization Web Service specification [CC, 08b])
- Addition of discussion forum initialization

### 1.1.3 Deployment



**Figure 1.1 Common Cartridge Focus.**

The primary focus of the Common Cartridge specification is achieving error-free import of content into any conforming LMS platform (see Figure 1.1). No runtime model is expressed, but any conforming LMS must support (either directly, or via a call-out to a suitable external service) all of the functionality implied by the Common Cartridge schema set. In particular, a conforming LMS must fully implement the Authorization web service. The cartridge can optionally require the following forms of authorization:

- Authorization on import – licensed site
- Authorization of learner runtime access – applied to package or item.

## 1.2 Structure of this document

The structure of this document is as follows:

2. Use Cases	Describes the following use cases which have driven the development: <ul style="list-style-type: none"> <li>• CC package import</li> <li>• Authorization</li> <li>• Execution of static content</li> <li>• Execution of dynamic content – client-side</li> <li>• Execution of dynamic content – server-side</li> </ul>
3. Architecture & Approach	Provides coverage of the cartridge structure and supported resource types.
4. Common Cartridge Information Model Profiles	Documents the UML corresponding to the Common Cartridge profile schema set, along with xml extracts to demonstrate how features are to be implemented...
5. Implementation Guidelines & Best Practice	Offers further advice on implementation issues, in particular addressing examples of valid Common Cartridge file structures.
6. Conformance	Summarizes how conformance of implementations against the specification will be evaluated.

Appendix A – Profile XSDs	The URL for downloading the CC WSDL/XSD files
Appendix B – Profile Schema Package	The full set of files that define the Common Cartridge Application Profile.
Appendix C – CC Changes to Profiled Base Schemas	The changes to the profiled base schemas for Common Cartridge.
Appendix D – CC Schematron Rules for the Profiled Content Packaging v1.2 Schema	The CC documents that describe the schematron rules applied to the CPv1.2 schema for the CC CP profile.

## 1.3 References

[CC, 08b]	<i>IMS Common Cartridge (CC) Authorization Web Service v1.0 Final Specification</i> , K.Riley, D.Mills, <a href="#">IMS GLC</a> , October 2008.
[IEEE LOM, 02]	<i>IEEE Learning Object Metadata</i> (1484.12.1-2002).
[IEEE LOM, 05]	<i>IEEE LOM Schema Binding</i> (1484.12.3-2005).
[DC, 03]	<i>Dublin Core Metadata Element Set, Version 1.1</i> (ISO 15836:2003).
[CP, 07]	<i>IMS Content Packaging (CP) v1.2 Specification</i> , <a href="#">IMS GLC</a> , 2007.
[QTI, 03]	<i>IMS Question &amp; Test Interoperability (QTI) v1.2.1 Final Specification</i> , <a href="#">IMS GLC</a> , March, 2003.

## 1.4 Definitions

Term	Definition
Access Code	A code used to authorize user access to a protected resource, in this case a Common Cartridge or a discrete component thereof.
Associated Content	<p>A resource type that includes a collection of files used by a specific Learning Application Object. Each file referenced must exist in the directory containing the descriptor file of the Learning Application Object with which it is associated or any subdirectory thereof.</p> <p>A resource of the type “associatedcontent” must comply with the following restrictions:</p> <ol style="list-style-type: none"> <li>1. It must contain a <i>file</i> element for each file that exists in the directory that contains the associated Learning Application Object’s descriptor file or any of its subdirectories.</li> <li>2. It must not contain any references to files above the directory containing the associated Learning Application Object’s descriptor file.</li> <li>3. It must not contain any <i>dependency</i> elements.</li> </ol>
Common Cartridge	A content packaging profile agreed between content providers and LMS providers, offering a common format for the distribution of both open and access protected content. The profile harnesses Content Packaging, LOM Metadata, and QTI, augmented with a specification for simple access control.
Content Elements	Discrete content elements within a Learning Activity aggregate as part of a Learning Application Object or module (lesson).

Term	Definition
Course Content Package	A term for any current proprietary LMS specific, publisher developed and sourced, content package that is made commercially available via the publisher or LMS vendor to its customer base. Examples of such cartridges are the WebCT ePack, Blackboard Course Cartridge etc.
Deployment Context	Any one of the LMS deployment and learning contexts made available for online access to learning activity via learning modules, Learning Application Objects and content element interaction.
Descriptor File	The file that serves as the entry point for accessing the information about a Learning Application Object required to import the Learning Application Object into the target system. Generally an XML file meeting an appropriate file specification based on the type of Learning Application Object. However, in some cases, the file may be a zip archive or some other structured file format. The descriptor file is not intended to be displayed within the target system. Rather, it is intended to be processed by the target system upon import of the cartridge. The descriptor file is associated with a Learning Application Object by means of a “file” element.
Directory	A physical folder in a content package archive.
Learning Activity	A general term for describing an online learning experience and interaction with learning modules, Learning Application Objects and content elements typically composed to deliver a particular outcome or experience for the Student.
Learning Application Object	<p>Any one of a number of <i>resource</i> types that require additional processing and interpretation before they can be imported and subsequently represented within the target system. Physically, a Learning Application Object consists of a directory in the content package containing a descriptor file and optionally additional files and subdirectories used exclusively by that Learning Application Object.</p> <p>Each Learning Application Object must have a corresponding <i>resource</i> element in the manifest. Examples of Learning Application Objects include QTI assessments, Discussion Forums, etc. The <i>type</i> attribute of the <i>resource</i> element is prescribed by the type of Learning Application Object being represented. If additional files beyond the Learning Application Object’s descriptor file exist in the Learning Application Object’s directory or any of its subdirectories, these files must be represented in a resource element of type “associatedcontent” which is list as a <i>dependency</i> within the Learning Application Object’s <i>resource</i> element.</p> <p>A resource that represents a Learning Application Object has the following general restrictions:</p> <ol style="list-style-type: none"> <li>1. It must contain a <i>file</i> element that points to the Learning Application Object’s descriptor file.</li> <li>2. It must not contain any other <i>file</i> elements.</li> <li>3. If additional files exist in the directory containing the Learning Application Object’s descriptor file, or any of its subdirectories, the resource must contain a <i>dependency</i> element that references the resource of type “associatedcontent” which contains the references to these files.</li> <li>4. It must not contain any other <i>dependency</i> elements of type “associatedcontent”.</li> <li>5. It may contain any number of <i>dependency</i> elements that reference resources of type “webcontent”.</li> </ol>

Term	Definition
Learning Management System	A Learning Management System (LMS) is a computer application that enables the assignment of content to learners, learning, and the reporting of learning outcomes. This is used interchangeably with Course Management System, Managed Learning Environment and a host of other terms.
Learning Module	An aggregate of content and/or application functionality that represents or is part of a learning activity.
Target System	A Learning Management System (LMS) or similar system into which a package is to be imported.
webcontent	<p>The standard resource type for content packages. Static web resource that is generally supported on the web such as HTML files, GIF images, JPEG images, PDF documents, etc. Resources of the type “webcontent” may reference any number of <i>files</i>. Additionally, “webcontent” resources may include <i>dependencies</i> on other “webcontent” resources.</p> <p>A resource of the type “webcontent” must comply with the following restrictions:</p> <ol style="list-style-type: none"> <li>1. It may contain a <i>file</i> element for any file that exists in the package so long as the file is not in a Learning Application Object directory or a subdirectory of any Learning Application Object directory.</li> <li>2. It may contain <i>dependency</i> elements that reference any other resources of type “webcontent”.</li> </ol> <p>It must not contain any <i>dependency</i> elements to resources whose type is <b>not</b> “webcontent”.</p>

## 2. Use Cases

### 2.1 Use Case Scope

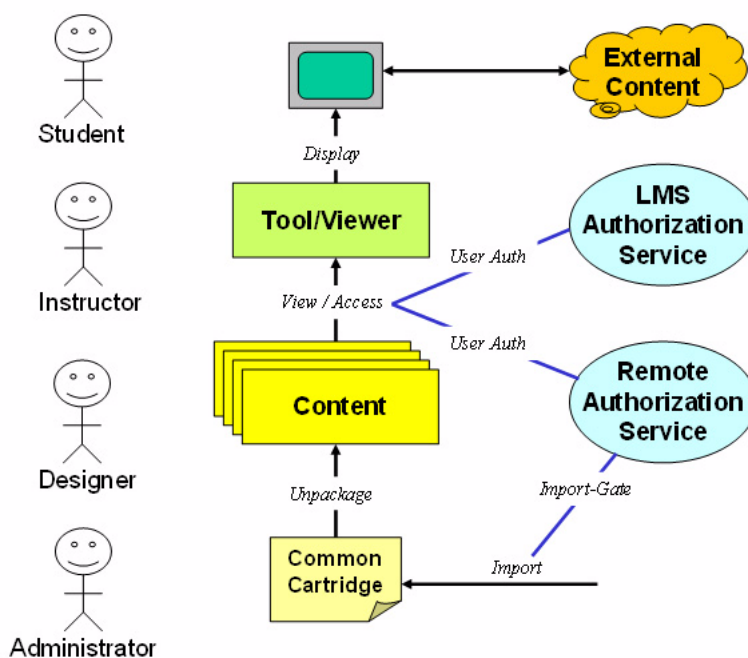
#### 2.1.1 Affected Roles and Definitions

**Table 2.1 Common Cartridge User Roles.**

Role	Definition
Student	LMS Learner
Instructor	LMS Faculty member leading the course/learning activity. Includes Teaching Assistants or equivalent where applicable.
Instructional Designer	LMS course/program designer responsible for creating and maintaining online learning materials/content. Often, the same person has Instructor role.
Administrator	LMS course, program, group administrator with ownership and privileges to access and maintain administrative elements of the LMS within a particular context.
LMS	Learning Management System (LMS) -- as defined in Glossary.

#### 2.1.2 High-level Use Case Scope

The following diagram summarizes the use cases considered for the framework:



**Figure 2.1 Use Case Framework.**

## 2.2 CC Package Import

Use Case 1	CC Package Import
Level	Summary
Primary Actor(s)	Instructor, LMS
Secondary Actor(s)	Administrator
Trigger	Instructor needs to import a cartridge to use its content either wholly or as selective, individual content modules or elements.
Preconditions	<ul style="list-style-type: none"> <li>• Instructor has access to a cartridge.</li> <li>• LMS is Common Cartridge compatible and configured to accept package imports.</li> </ul>
Success Post-condition	<ul style="list-style-type: none"> <li>• Cartridge has been processed and an Instructor-defined subset of the material is installed and ready for LMS User interactions.</li> </ul>
Failure Post-condition	<ul style="list-style-type: none"> <li>• Cartridge material is unprocessed.</li> </ul>
Main Success Scenario	<ol style="list-style-type: none"> <li>1. Instructor obtains a cartridge (the provisioning and acquisition processes are not defined by this specification).</li> <li>2. Instructor accesses the LMS-provided tool for cartridge import.</li> <li>3. LMS reads package and generates private (implementation dependent, proprietary) data structures to store the content and structure defined in the cartridge data.</li> <li>4. Cartridge data is integrated into a deployment context within the LMS.</li> </ol>
Variations	<p>2.1 LMS provides an “import gate” requiring PIN authentication for the cartridge to import. This is independent of the 2.3 Authorization use case, which implies “on learner/item use” authorization. This implies that authorization meta-data in the package has a discriminator for the type and granularity of authorization, e.g., “on import”, “on package use”, or “on item use”.</p> <p>3.1 LMS provides a list of material in the cartridge for selective import. The LMS may or may not provide preview capabilities. Because cartridges and contained resources may contain arbitrarily complex data and dependencies, such preview will be very limited.</p> <p>3.2 Instructor selects items for import.</p> <p>3.3 LMS imports selected items, ensuring that any required dependencies are met. E.g., an assessment that retrieves questions from a question bank must ensure that the question bank is imported, even if the Instructor did not specifically select the question bank.</p> <p>4.1 Import may require an expensive, non-interactive process, so errors that affect the integrity of the cartridge will be logged for review. The format and available end user actions are LMS dependent.</p>
Exception Conditions	<ul style="list-style-type: none"> <li>• Data format errors (e.g., the cartridge is not a .zip file, the manifest is missing or incorrectly named) of the cartridge prevents LMS from reading the package.</li> <li>• Package is properly structured, but individual data elements are poorly formed or unsupported (see Variation 4.1, above).</li> </ul>



## 2.3 Authorization

Use Case 2	Authorization
Level	Summary
Primary Actor(s)	Student
Secondary Actor(s)	Instructor, LMS
Trigger	An actor requests a restricted interaction with the cartridge.
Preconditions	<ul style="list-style-type: none"> <li>• Cartridge is successfully installed.</li> <li>• Cartridge defines one or more “restricted” items (e.g., view any cartridge material vs. view specific cartridge items). The specification must define authorization categories: “on import”, “on package use”, and “on item use”. This use case is for “on package use”.</li> <li>• Actor has not previously been authorized.</li> </ul>
Success Post-conditions	<ul style="list-style-type: none"> <li>• Actor is authorized for requested action, and the results of the authorization transaction potentially stored for future reference.</li> </ul>
Failure Post-conditions	<ul style="list-style-type: none"> <li>• Actor is not authorized for the requested action.</li> <li>• Cartridge material is not displayed.</li> </ul>
Main Success Scenario	<ol style="list-style-type: none"> <li>1. Learner navigates to LMS representation of course populated with Cartridge material.</li> <li>2. LMS checks for record of previous Learner authorization.</li> <li>3. If no record exists, LMS provides a prompt for entry of a simple access control token. The distribution of the tokens is out of scope for this specification.</li> <li>4. LMS processes token, asserting the validity against an authorizing authority. The authorization algorithm is authorization server dependent and out of scope for this specification. The specification only defines “when” authorization is to occur, and at what level (package or for each “protected” item). A valid cartridge must use CC authorization were authorization is stipulated in a cartridge.</li> </ol>
Variations	<ol style="list-style-type: none"> <li>1.1 Learner navigates to a specific item that requires authorization, and is keyed to trigger “per item” authorization.</li> <li>2.1 LMS evaluates any expiration rules for authorization that might be defined in the cartridge or stored with the authorization record.</li> </ol>
Exception Conditions	<ul style="list-style-type: none"> <li>• Learner-provided token is invalid.</li> <li>• Authorization cannot occur due to system errors (network communication to authorizing authority, etc.).</li> </ul>

## 2.4 Execution of Static Content

Use Case 3	Execution of Static Content
Level	Summary
Primary Actor(s)	LMS
Secondary Actor(s)	Instructor, Student
Trigger	Actor accesses LMS navigational context requiring cartridge data to be rendered.
Preconditions	<ul style="list-style-type: none"> <li>• Cartridge is imported into LMS, with static (HTML, image, document) resources.</li> <li>• Actors have LMS-defined authorization to cartridge material (e.g., context-dependent security roles).</li> <li>• Actors have cartridge-defined authorization to cartridge material (use case 2.3, above).</li> </ul>
Success Post-conditions	<ul style="list-style-type: none"> <li>• Cartridge static content is displayed within a navigational context that preserves 1) cartridge flow and 2) LMS flow.</li> </ul>
Failure Post-conditions	<ul style="list-style-type: none"> <li>• LMS-defined error message or status display.</li> </ul>
Main Success Flow	<ol style="list-style-type: none"> <li>1. Learner navigates to LMS context containing cartridge materials.</li> <li>2. LMS renders both LMS defined and cartridge defined navigation elements (links, directories, tree-view, “next” option, etc.).</li> <li>3. Learner activates link requiring display.</li> <li>4. LMS creates a suitable display element (e.g., new window, frameset) that includes a client-accessible moniker for the resource (e.g., a URL to load the resource).</li> </ol>
Variations	<p>4.1 Resource (resource element and associated files) contains links to other components within the same resource. The LMS is responsible for maintaining the file system of the resource so that relative URIs are automatically de-referenced. If the LMS translates the file system, either at cartridge deployment time or content delivery time, it must do so in a way that is transparent to content authors. For this reason, inter-content linking between arbitrary content types is out of scope, because many kinds of resources will require LMS-dependent URI generation. E.g., a QTI XML file will most likely require a LMS-generated URI for launch. For the LMS to parse and replace content references is likely to be extremely fragile, even for common “web” data types, such as PDF or Shockwave data.</p>
Exception Conditions	<ul style="list-style-type: none"> <li>• Static content cannot be read by the client (e.g., no Flash player installed).</li> <li>• Network or protocol errors between the client and the server.</li> </ul>

## 2.5 Execution of Dynamic Content – Client-side

Use Case 4(a)	Execution of Dynamic Content – Client-side
Level	Summary
Primary Actor(s)	Student (LMS Learner)
Secondary Actor(s)	Instructor, Instructional Designer, LMS
Trigger	<p>Student needs to access and complete a Learning Activity that is:</p> <ul style="list-style-type: none"> <li>• comprised in whole or part by learning modules, Learning Application Objects and content elements.</li> <li>• sourced as a learning module or from a discrete collection of Learning Application Objects and content elements, imported into the LMS, and made available via the Instructor/Instructional Designer-developed content and/or imported content cartridge elements.</li> <li>• LMS pre-existing/accessible learning modules, Learning Application Objects, and content elements can be leveraged in combination with any Common Cartridge elements to construct the Learning Activity context.</li> </ul>
Preconditions	<ul style="list-style-type: none"> <li>• Content cartridge learning modules, Learning Application Objects, and content elements are imported into a specific LMS deployment context that is, in turn, accessible to the Instructor/Instructional Designer and, of course, to the Student.</li> <li>• LMS enables import and use/reuse of Content cartridge elements within one or more of its deployment contexts.</li> </ul>
Success Post-conditions	<ul style="list-style-type: none"> <li>• Learner activity launched and user/Learner is directed to interact with the learning module and its component Learning Application Object and content elements.</li> </ul>
Failure Post-conditions	<ul style="list-style-type: none"> <li>• LMS-defined error state and communication to the user.</li> </ul>

Use Case 4(a)	Execution of Dynamic Content – Client-side
Main Success Flow	<ol style="list-style-type: none"> <li>1. Student visits a Deployment Context containing a Learning Activity instance.</li> <li>2. Student initiates a navigation event triggering start of (i.e. sequence beginning) or entry into a specific learning module (e.g., clicks on the learning activity/module table of contents (TOC) element or directly on an embedded link to an element rendered by the LMS).</li> <li>3. LMS learning activity run-time interprets the trigger navigation request and loads/recalls/interprets from internal cache or repository the associated learning module, Learning Application Object or content element instance required.</li> <li>4. LMS learning activity run-time invokes the appropriate client-side viewer/player component and passes to it the context and/or content stream or reference of the learning module to be presented the user/Learner via the client-side viewer/player.</li> <li>5. LMS learning activity run-time passes control with established context to the client-side viewer-player to then control the presentation of and interaction with the learning module to Student.</li> <li>6. LMS authenticates/authorizes any implicit or explicit security assertions required to access or interact with the learning module and any of its contained elements as part of the interaction.</li> <li>7. Student initiates and interacts with learning module and performs the required Learning Application Object interaction and content review so as to complete the activity and derive any outcome expected from the interaction.</li> <li>8. Student completes the interaction with the learning module representing all or part of the original Learning Activity.</li> <li>9. Upon completion of the interaction, any residual outcome is captured by the viewer-player and marshaled back to the LMS learning activity run-time.</li> <li>10. LMS Learning Activity run-time dismisses the viewer-player context for the completed learning module interaction.</li> <li>11. The Student/user is returned to the originating context in a state to proceed with the next Learning Activity interaction based on selective choice by Student and/or automated target based on some predefined sequence or prior outcome affected specific target.</li> </ol>
Variations	
Exception Conditions	<ul style="list-style-type: none"> <li>• LMS cannot reference/obtain required Learning Activity learning module, Learning Application Objects and/or content elements.</li> <li>• Security assertion failure.</li> <li>• LMS Learner Activity run-time delegated viewer-player fails.</li> <li>• LMS Learner Activity outcome response failure.</li> </ul>

## 2.6 Execution of Dynamic Content – Server-side

Use Case 4(b)	Execution of Dynamic Content – Server-side
Level	Summary
Primary Actor(s)	Student (LMS Learner)
Secondary Actor(s)	Instructor, Instructional Designer, LMS
Trigger	<p>Student needs to access and complete a Learning Activity that is:</p> <ul style="list-style-type: none"> <li>comprised in whole or part by learning modules, Learning Application Objects, and content elements.</li> <li>sourced as a learning module or from a discrete collection of Learning Application Objects and content elements, imported into the LMS, and made available via the Instructor/Instructional Designer-developed content and/or imported content cartridge elements.</li> </ul>
Preconditions	<ul style="list-style-type: none"> <li>Content cartridge learning modules, Learning Application Objects, and content elements are imported into a specific LMS deployment context that is, in turn, accessible to the Instructor/Instructional Designer and, of course, to the Student.</li> <li>LMS enables import and use/reuse of Content cartridge elements within one or more of its deployment contexts.</li> <li>LMS pre-existing/accessible learning modules, Learning Application Objects, and content elements can be leveraged in combination with any Common Cartridge elements, to construct the Learning Activity context.</li> </ul>
Success Post-conditions	<ul style="list-style-type: none"> <li>Learner activity launched and user/Learner is directed to interact with the learning module and its component Learning Application Object and content elements.</li> </ul>
Failure Post-conditions	<ul style="list-style-type: none"> <li>LMS-defined error state and communication to the user.</li> </ul>

Use Case 4(b)	Execution of Dynamic Content – Server-side
Main Success Flow	<ol style="list-style-type: none"> <li>1. Student visits a Deployment Context containing a Learning Activity instance.</li> <li>2. Student initiates a navigation event triggering start of (i.e., sequence-beginning) or entry into a specific learning module (e.g., clicks on the learning activity/module table of contents (TOC) element or directly on an embedded link to an element rendered by the LMS).</li> <li>3. LMS learning activity run-time interprets the trigger navigation request and loads/recalls/interprets from internal cache or repository the associated learning module, Learning Application Object or content element instances required.</li> <li>4. LMS authenticates/authorizes any implicit or explicit security assertions required to access or interact with the learning module and any of its contained elements as part of the interaction.</li> <li>5. LMS learning activity run-time establishes the presentation and interaction context for the requested learning module so as to manage and control the end-user Student interaction.</li> <li>6. Student initiates and interacts with learning module and performs the required Learning Application Object interaction and content review so as to complete the activity and derive any outcome expected from the interaction.</li> <li>7. Student completes the interaction with the learning module representing all or part of the original Learning Activity.</li> <li>8. Upon completion of the interaction, any residual outcome is captured by the LMS learning activity run-time.</li> <li>9. LMS learning activity run-time dismisses the presentation context for the completed learning module.</li> <li>10. The Student/user is returned to the originating context in a state to proceed with the next Learning Activity interaction based on selective choice by Student and/or automated target based on some predefined sequence or prior outcome affected specific target.</li> </ol>
Variations	
Exception Conditions	<ul style="list-style-type: none"> <li>• LMS cannot reference/obtain required Learning Activity learning module, Learning Application Objects, and/or content elements.</li> <li>• Security assertion failure.</li> <li>• LMS Learner Activity run-time delegated viewer-player fails.</li> <li>• LMS Learner Activity outcome response failure.</li> </ul>

## 3. Architecture and Approach

### 3.1 IMS Common Cartridge Run-Time Functional Model

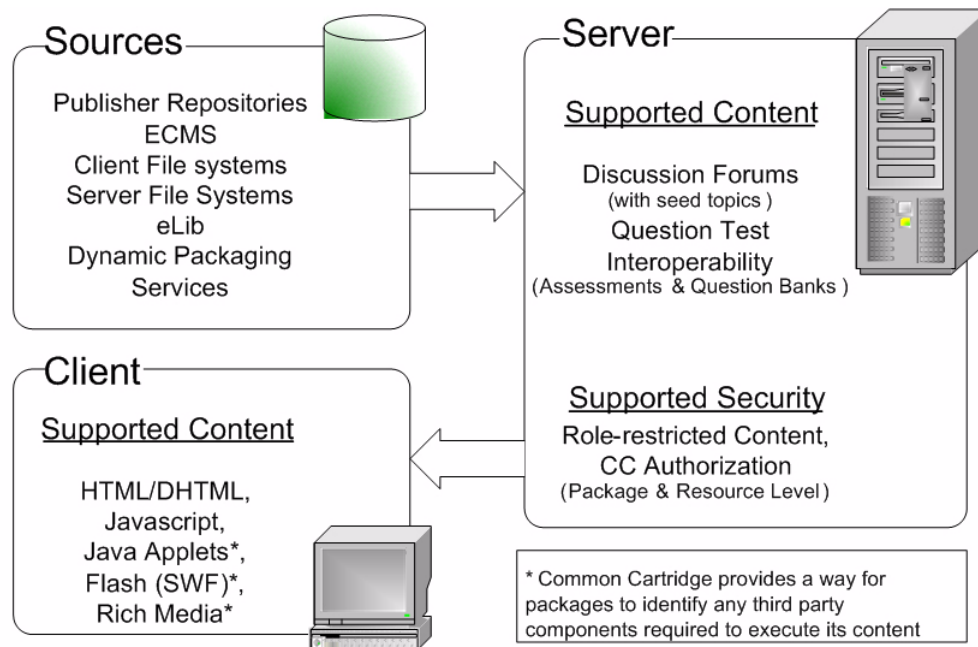
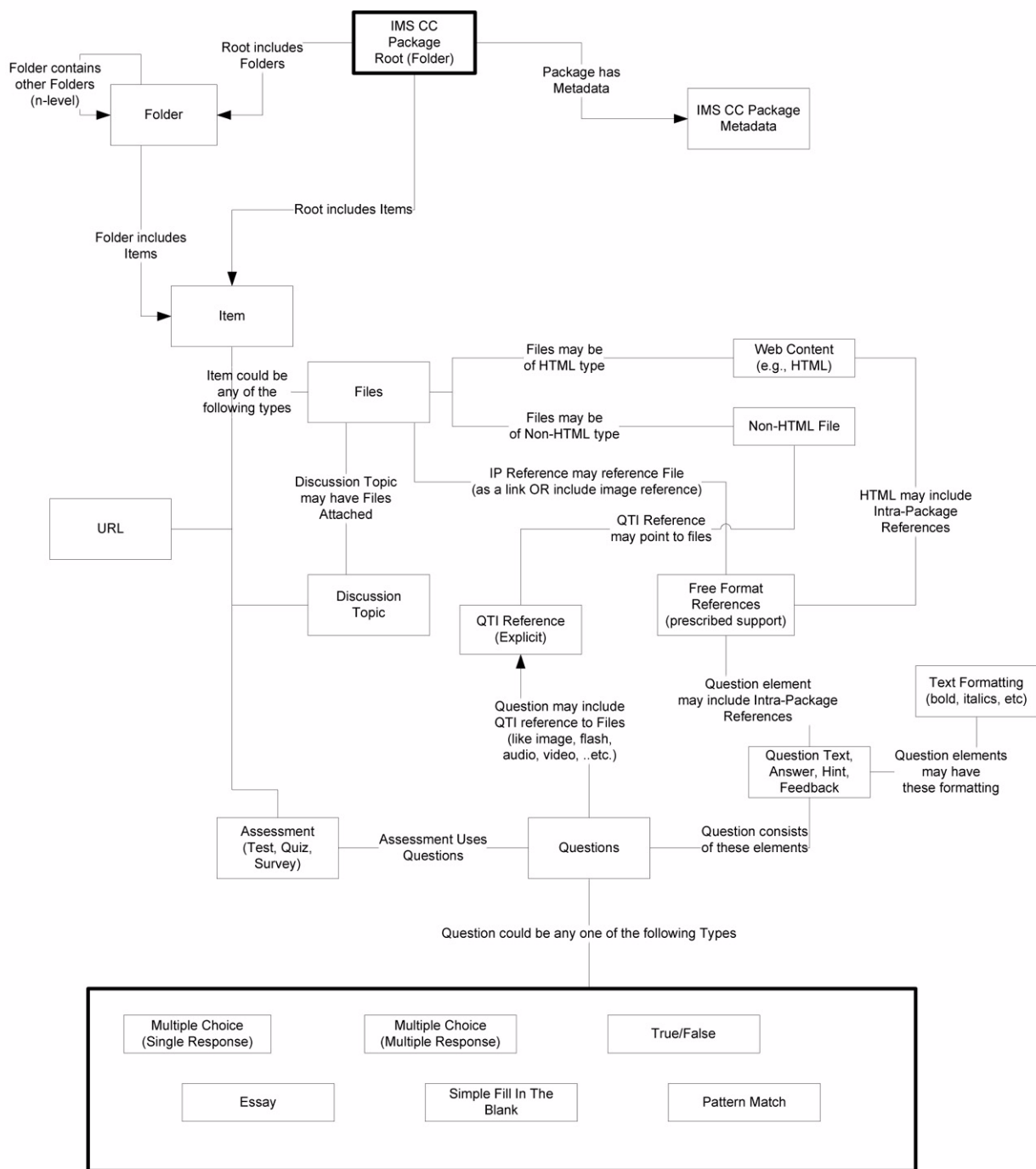


Figure 3.1 Common Cartridge Run-time Model.

## 3.2 Content Types



**Figure 3.2 Common Cartridge Content Types.**

The following describes the content types supported by the Common Cartridge specification v1.0.



**Table 3.1 Common Cartridge Content Types.**

<b>Entity</b>	<b>Description</b>
Item - Folder	A folder represents a unit of organization. A folder is simple collection of items and subfolders that are placed in a specific order (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , etc.). Folders can contain other Folders (n-level nesting). A folder represents a content presentation paradigm and can be used to define how the content should be organized and presented to the learner.
Resource – Web Content	<p>Web Content files include any files that are widely supported for delivery over the web. These could include HTML files, images, audio, video, MS Office, PDF, Flash etc.</p> <p>HTML files may include references to other web content files that are contained within the cartridge or that are external to the cartridge.</p>
Resource – Web Link	A Web Link is a Learning Application Object representation of a standard HTTP link. It extends a standard HTTP link by giving the link a title (which is independent of its usage in any particular folder location). It also includes attributes that describe which window the resource should be opened in and other window open features, such as the dimensions of the window.
Resource - Discussion Topic	A Discussion topic is a Learning Application Object that is used to initiate Discussion activity. This represents a placeholder for a discussion topic and does not represent a link to an existing discussion topic in an external system. The importing LMS is expected to generate a new discussion topic using only its internal tools. It contains the following attributes: title, description, file attachments.
Resource - Assessment	<p>An assessment represents an instance of a QTI assessment. It can embed any of the question types supported by the CC v1.0 profile of QTI.</p> <p>An assessment can contain a number of attributes including number of attempts, time limit and whether late submission is allowed.</p>
Resource – Associated Content	A collection of files used exclusively by an individual Learning Application Object
Intra-Package Reference	Intra-Package References allow Learning Application Objects or files in the package to reference other files within the package.
IMS CC Package Meta-data	This is IMS CC Package level specific meta-data that may include different elements covering licensing, accessibility, description, etc.
Question Bank	A question bank represents an instance of a QTI objectbank. Only one question bank can optionally be included in a cartridge. It can embed any of the question types supported by the CC v1.0 profile of QTI. Questions within a question bank cannot be referenced by any assessments contained in the cartridge.

Common Cartridge v1.0 supports profiled instances of the following question types:

- Multiple Choice – single response
- Multiple Response – like multiple choice but with multiple correct answers
- True/False
- Simple Fill in the Blanks – provides single answer box with single correct answer
- Fill in the Blanks Pattern Match – provides single answer box but supports ‘contains’ and regular expressions
- Essay

Questions can only be included in a cartridge either as components of an assessment resource or a question bank resource.

In general, a question consists of the following elements:

- Question Label/Title

- Question Text (may include HTML, Intra-Packages References, URLs, formatting)
- Question Answer Choices (may include HTML, Intra-Packages References, URLs, formatting, images, video, audio)
- Question Answer Choice Points
- Feedback (may include HTML, Intra-Packages References, URLs, formatting, images, video, audio)
- Question Answer Presentation Settings
- Question Hints (may include HTML, Intra-Packages References, URLs, formatting, images, video, audio)
- Question Settings (e.g., time, etc.)
- Question Meta-data.

### 3.3 Common Cartridge Package Interchange File Structure

The diagram in Figure 3.3 shows the overall layout of the cartridge package interchange file.

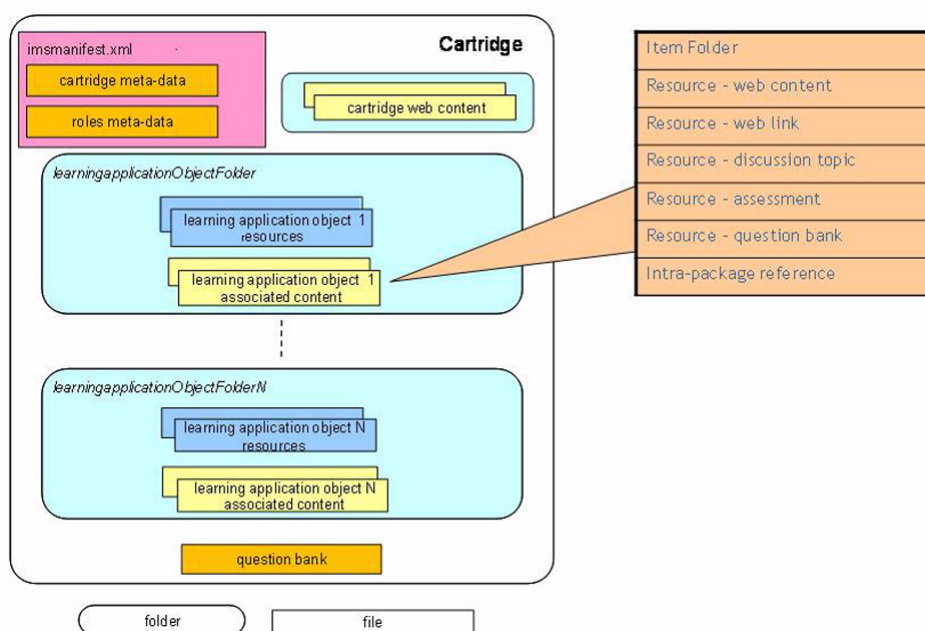


Figure 3.3 Common Cartridge package interchange file.

#### 3.3.1 Categories of Resource in a Common Cartridge

In addition to the imsmanifest.xml file, there are a further three basic categories of resource file in a Common Cartridge.

Table 3.2 Common Cartridge Resource Categories.

Resource Category	Description
imsmanifest.xml	<ul style="list-style-type: none"> <li>This is the standard IMS manifest file.</li> </ul>

Resource Category	Description
Web Content Resources	<ul style="list-style-type: none"> <li>• These include the following resource types: web content, web link or intra-package reference (see table 3.1).</li> <li>• Web Content Resources must reside within the web content folder at the root of the cartridge. The Web Content Resources can here be organized into directories and subdirectories within the web content folder.</li> <li>• Web Content Resources within the web content folder can be referenced by other resources outside of the web content folder directory system.</li> <li>• Web Content Resources within the web content folder can be referenced by other resources also within the web content folder directory system.</li> <li>• Web Content Resources within the web content folder cannot reference other resources outside of the web content folder directory system.</li> <li>• The directory structure within the web content folder will be included in the importing LMS to ensure relative links between and to web content continue to work.</li> <li>• Generally, Web Content Resources do not require additional processing on import into the LMS, although how these are stored and rendered is LMS dependent.</li> </ul>
Learning Application Object Resources	<ul style="list-style-type: none"> <li>• A Learning Application Object is a directory structure used to group together all the files (or file references) that are used to deliver a single instance of one of the following resource types: web content, web link, discussion topic, assessment or intra-package reference (see table 3.1).</li> <li>• The files held within a Learning Application Object directory structure are described as Associated Content Resources.</li> <li>• Associated Content Resources cannot be referenced by other resources outside of the Learning Application Object folder directory system.</li> <li>• Associated Content Resources can reference other resources in subordinate folders of the Learning Application Object directory system.</li> <li>• The directory structure within the Learning Application Object folder will be included in the importing LMS to ensure relative links between and to web content continue to work.</li> <li>• These will generally be parsed on input and transformed into internal data structures in the LMS.</li> </ul>
Using Directories in Package Interchange File	<ul style="list-style-type: none"> <li>• File system directories can be used to organize content within the package interchange file. It is required that the resources specific to a given Learning Application Object are packaged in a distinct directory in the package interchange file.</li> </ul>

Associated Content resources include a collection of files used by a specific Learning Application Object. Each file referenced must exist in the directory containing the descriptor file of the Learning Application Object with which it is associated or any subdirectory thereof. Furthermore, each Associated Content resource must be associated with one and only one Learning Application Object. This association is indicated by use of a dependency reference on the Learning Application Object's resource element.

A resource of the type "associatedcontent" must comply with the following restrictions:

- 1) It must contain a *file* element for each file that exists in the directory that contains the associated learning application object's descriptor file or any of its subdirectories.
- 2) It must not contain any references to files above the directory containing the associated learning application object's descriptor file.
- 3) It must not contain any *dependency* elements.

Web Content resources include any number of references to static web resources that are generally supported on the web such as HTML files, GIF images, JPEG images, PDF documents, etc. Resources of the type “webcontent” may reference any number of *files*. Additionally, “webcontent” resources may include *dependencies* on other “webcontent” resources. However, “webcontent” resources may never contain dependencies on any other resource types including Associated Content resources and Learning Application Object resources.

A resource of the type “webcontent” must comply with the following restrictions:

- 1) It may contain a *file* element for any file that exists in the package so long as the file is not in a learning application object directory or a subdirectory of any learning application object directory.
- 2) It may contain *dependency* elements that reference any other resources of type “webcontent”.
- 3) It must not contain any *dependency* elements to resources whose type is **not** “webcontent”.

**Table 3.3 Restrictions on Resource Categories.**

Dependency Resource Type	Learning Application Resource	Associated Content Resource	Web Content Resource
Web Content	0-N	0-N	0-N
Associated Content	0-1 <sup>a</sup>	Prohibited	Prohibited
Learning Application	Prohibited	Prohibited	Prohibited

a. NB: The files listed in the associated content resource must be in the same directory as the learning application resource file or a subordinate directory.

### 3.3.2 Cartridge Level Web Content

These are web content resources that may be shared between different Learning Application Objects within the cartridge.

References to files in this file system from Learning Application Object files must utilize relative paths e.g.:

“../filename”

### 3.3.3 Learning Application Object Directories

```
(<root>/learningApplicationResourceDirectory1... learningApplicationResourceDirectoryN)
```

These directories organize all the files that logically contribute to the delivery of a single instance of one of the content types supported by Common Cartridge.

The root of the directory should contain the descriptor file for the Learning Application Object such as the QTI file for an assessment Learning Application Object. This directory may also contain additional files and subdirectories that are used exclusively by the Learning Application Object (i.e., associated content).

The name of this directory is not defined by the specification. Care must be taken to ensure that collisions do not occur between this directory name and the names of directories used for other Learning Application Objects and those used for web content.

A cartridge that does not contain any additional Learning Application Objects (e.g., only cartridge level web content) may exclude these directories.

#### 3.3.3.1 Associated Content

Any web content which is logically tied to this Learning Application Object should be contained in the Learning Application Object resource directory.

All references to this content from Learning Application Object resource files e.g. QTI files should use a relative path.

It is the responsibility of the cartridge producer to ensure name collisions do not occur between end user created file/folder names (for web content) and system generated file/directory names (for resource descriptors).

### 3.3.4 Example Layout

An example of the layout described above could be:

#### imsmanifest.xml

```

course-logo.gif
course-overview.html
content1/preTestQti.xml
content1/images/map.gif
content1/movie.swf
content1/background.html
content2/discussionTopic1.xml
content2/overview.html
content2/images/image.gif
content3/webLink1.xml

```

## 3.4 Pathnames for Web Content Resources

To facilitate management of web content resources, in particular utilizing standard html relative path referencing between resources when content is imported into the LMS, web content resources are defined to live in two file systems – a folder for web content used by several resources and a folder for each Learning Application Object’s related content.

The diagram in Figure 3.4 shows how web content may be referenced across these different file systems using relative path semantics.

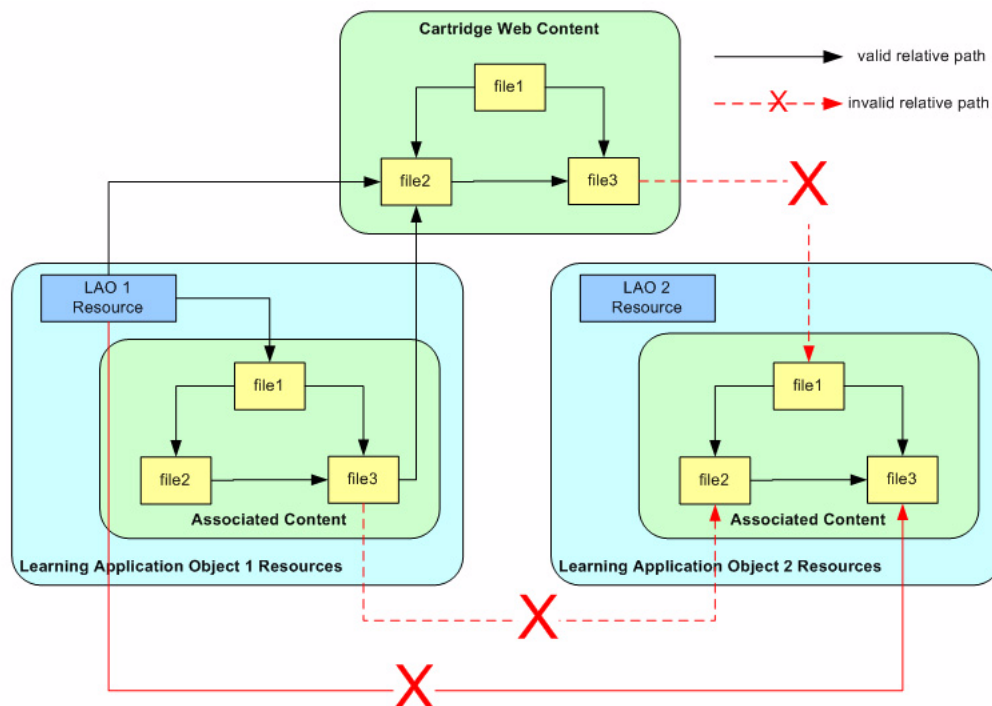


Figure 3.4 Content referencing using relative file paths.

### 3.4.1 Cartridge Web Content

A Cartridge Web Content folder may be included in a Common Cartridge. If present, the Cartridge Web Content folder must appear in the root folder of the cartridge. The name of this folder is not defined by the specification.

Web content included in the Cartridge Web Content folder can be referenced by any of the Learning Application Objects in the cartridge. Relative path referencing is permitted between files in this folder and its subfolders, but files in this folder are not permitted to reference files in a Learning Application Object folder or its associated content folders.

On import, an LMS will usually import this content into a course level file system.

### 3.4.2 Learning Application Object Web Content

There can be 1 to n Learning Application Object web content folders in a Common Cartridge.

Each Learning Application Object in the cartridge has its own associated content file system folder. Files in this folder and its subfolders may reference other files in this associated content file system folder and files in the Cartridge Web Content folder using relative path semantics. However, they must not reference files in other Learning Application Object web content folders or their sub-folders. In addition, Learning Application Object resources (e.g., a QTI xml file) can contain references to files in the Learning Application Object's associated content folder and its subfolders and the cartridge web content folder and its subfolders, but must not contain references to web content in the folders of other Learning Application Objects.

On import, an LMS that only supports a single course level file system may import this web content into the course level file system. In this scenario, the web content in the cartridge represents one big file system scope.

An LMS that supports both course level and Learning Application Object level file systems will import this content into a local file system space that can only be utilized by the associated Learning Application Object.

### 3.4.3 Format of Relative Path References within a web content file system

All html path linking (e.g. `<img src="">`, `<a href="">`) between content contained in a given file system (cartridge or Learning Application Object) should utilize relative path semantics restricted by the rules defined above. Here relative path is defined as relative to the file containing the reference regardless of whether that file is itself web content or some other resource e.g. a QTI file.

#### 3.4.3.1 Referencing Web Content from other Web Content

Within a given file system, paths are relative to the location of the file, e.g., for the files:

```
content1/material/lesson.html
content1/images/icon.gif
```

An image reference to icon.gif from lesson.html would take the form:

```

```

#### 3.4.3.2 Referencing Web Content Directly from other Resources Using a Defined Linking Syntax

Where the linking syntax of a learning application object uses a URI, paths should be relative to the file containing the reference, e.g., for the files:

```
content1/question1Qti.xml
content1/images/icon.gif
```

A QTI matimage element would take the form:

```
<matimage uri="images/icon.gif">icon.gif</matimage>
```

#### 3.4.3.3 Referencing Web Content from Embedded Text in Another Resource

Where a Learning Application Object resource supports free-form text which may contain embedded HTML markup, paths should be relative to the file containing the reference and should in addition contain a special token to make finding and parsing these paths simpler for the importing system, e.g., for the files:

```
content1/question1Qti.xml
content1/images/icon.gif
```

A reference to the image icon embedded in the free format question text should take the form:

```

```

Note: the token \$IMS-CC-FILEBASE\$ is just a flag to facilitate finding the paths. It does not represent a replacement token within the context of the cartridge. However, an importing LMS may choose to store the referenced files in a different location and so is free to insert any path elements needed to make the path work in the LMS.

### 3.4.4 Format of Relative Path References from Learning Application Object to Cartridge File System

All html path linking (e.g. `<img src="">`, `<a href="">`) by content contained in a Learning Application Object file system to content in the cartridge web content file system should use relative paths adhering to similar rules as those defined for references within a file system. Here relative path is defined as relative to the file containing the reference regardless of whether that file is itself web content or some other resource, e.g., a QTI file.

#### 3.4.4.1 Referencing Cartridge Web Content from Learning Application Object Web Content

The key rule is that where a relative path within the Learning Application Object file system is directed above that file system root, this is assumed to be a reference into the cartridge web content file system, e.g., for the files:

```
images/icon.gif  
content1/material/lesson.html
```

An image reference to icon.gif in the cartridge file system from lesson.html in a Learning Application Object file system would take the form:

```

```

#### 3.4.4.2 Referencing Cartridge Web Content Directly from Learning Application Object Resources

Where the information model of another Learning Application Object resource is defined as a URI, paths should be relative to the file containing the reference, e.g., for the files:

```
images/icon.gif  
content1/question1Qti.xml
```

A QTI matimage element reference to a cartridge icon would take the form:

```
<matimage uri="../../images/icon.gif">icon.gif</matimage>
```

#### 3.4.4.3 Referencing Cartridge Web Content from Embedded Text in Another Resource

Where a Learning Application Object resource supports free-form text which may contain embedded HTML markup, paths should be relative to the file containing the reference and should in addition contain a special token to make finding and parsing these paths simpler for the importing system, e.g., for the files:

```
images/icon.gif  
content1/question1Qti.xml
```

A reference to the cartridge image icon embedded in the free format question text should take the form:

```

```



## 4. Common Cartridge Information Model Profiles

### 4.1 The Conceptual Model

The intent of this section is to provide a high-level description of a Common Cartridge. While conceptually similar to “cartridge-like” features found in existing commercial vendor solutions, several of the features of the Common Cartridge are included.

Conceptually, a Common Cartridge is a package of content and meta-data that is integrated into an LMS learning context. At a high level, this may directly correspond to the notion of “course” in the target LMS. There is no guarantee of the cardinality of the relationship from “learning context” to “Common Cartridge”, i.e., the LMS may enforce an arbitrary 1-1 relationship. The data contained in the package breaks down into the following categories:

- “Learner Experience” Data. These are the resources presented directly to the learner, i.e., content resources.
- Supplemental Resources. These are resources that may be optionally integrated into the learning context by an instructor or other facilitator. E.g. question bank.
- Operational Data. Data used to control behavioral aspects of the LMS display/interaction with the cartridge. E.g. authorization.
- Descriptive Meta-data. This is the defined IEEE LOM data, and is represented via existing bindings.

A Common Cartridge is an IMS Content Package conforming to the following basic structure.

- A Common Cartridge may define a single organization, or include no organization. Multiple organizations are not permitted and the default attribute for organizations is not therefore supported. The single organization is used on import to integrate with the learning context, and defines the basic navigation structure for the package. The organization assumes the predefined “hierarchical” structure.
- Only “Learner Experience” resources may be included in the <organization> hierarchy.
- Operational data (authorization, cartridge-level meta-data) are defined via discrete resource types within the package.
- Supplemental resources must not appear in the organization. The LMS provides a way for the instructor/facilitator to inspect/deploy/utilize these resources as they see fit.

Common Cartridge resources must be identified with GUIDs, in order to facilitate proper integration in systems that execute “by reference” content usage.

### 4.2 Supported Resource Types

**Table 4.1 Common Cartridge Supported Resource Types.**

Resource Type	Constraints
Web Content	0 or more
Associated Content	0 or more
QTI Assessment (CC Profiles)	0 or more
QTI Question Bank (CC Profiles)	0 or 1
Authorizations Data	0 or 1
Discussion Topic	0 or more.
Web Links	0 or more



## 4.3 Common Cartridge Information Model

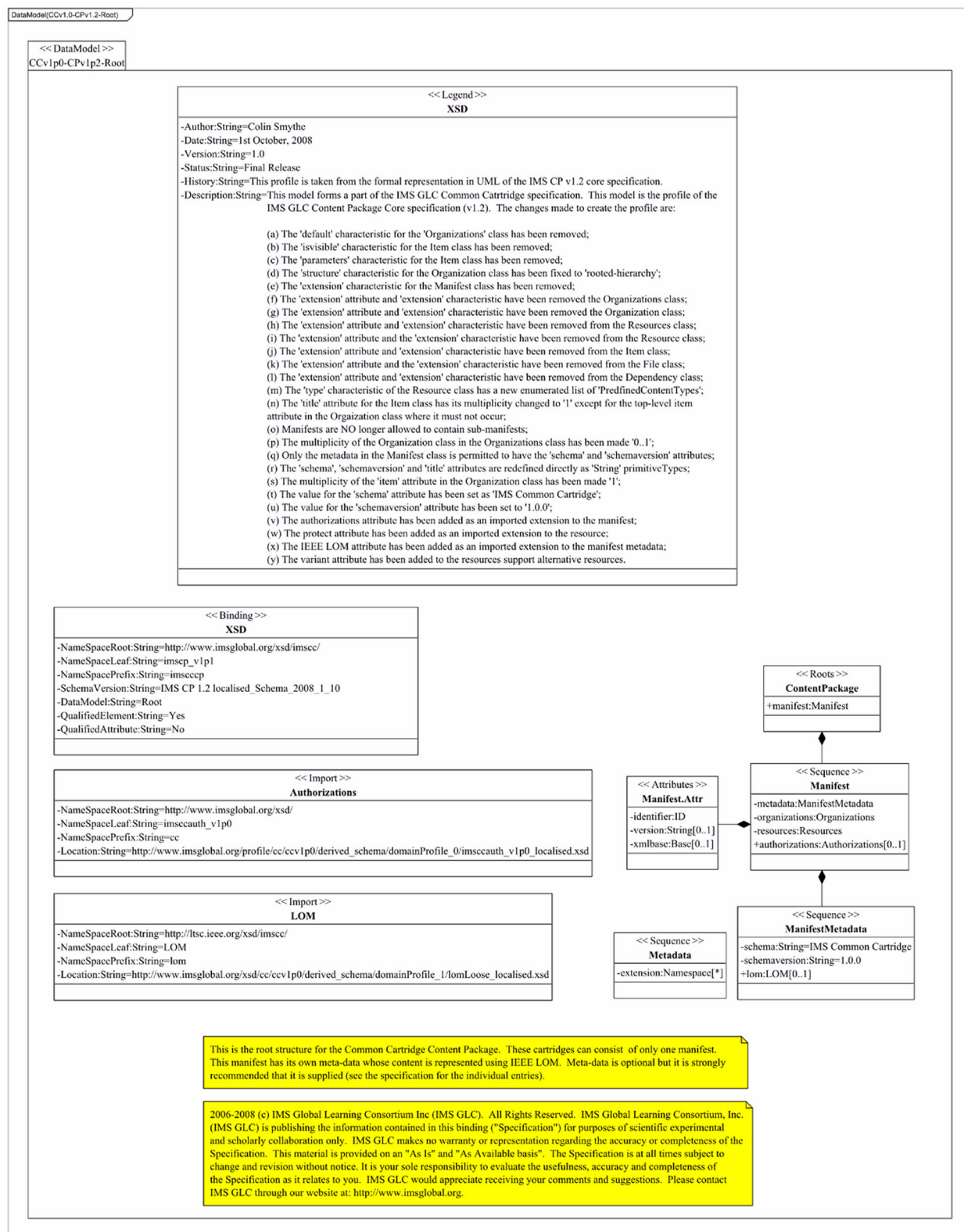


Figure 4.1 CC profile of CP v1.2- Root.

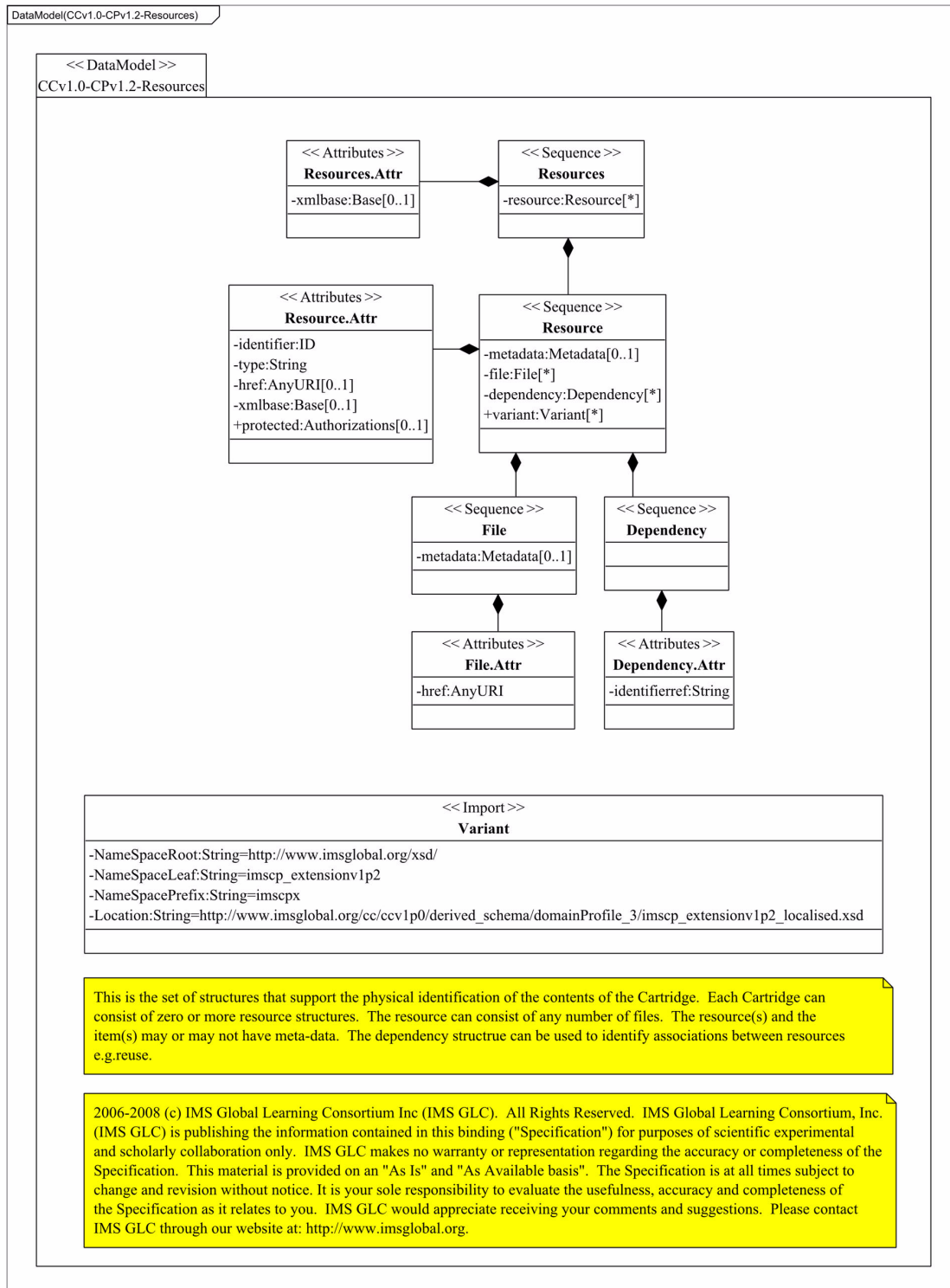


Figure 4.2 CC profile of CP v1.2 - Resources.

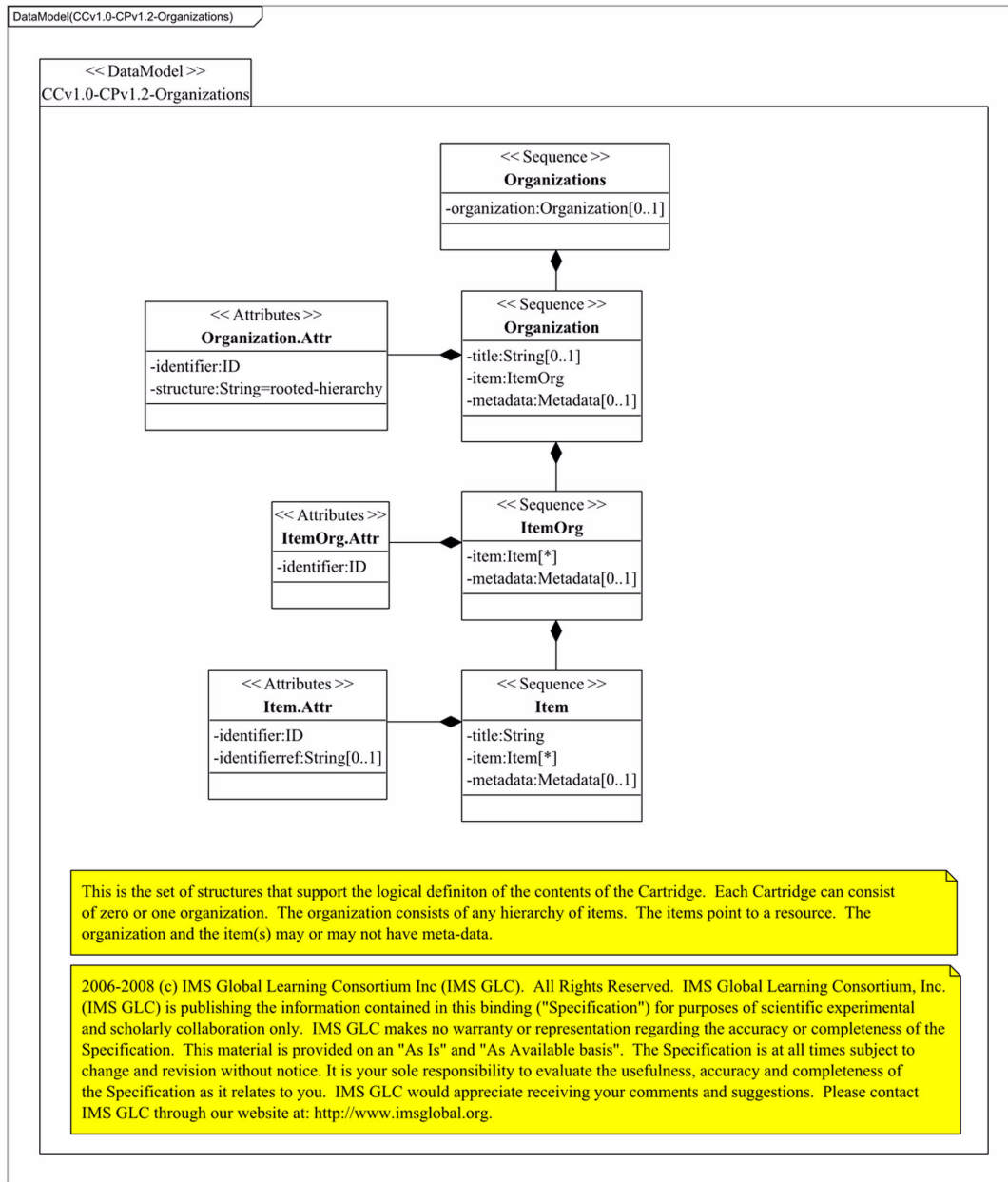


Figure 4.3 CC profile of CP v1.2 - Organizations.

## 4.4 Content Packaging

### 4.4.1 Overview

The Common Cartridge builds upon a profile of Content Packaging. This profile is constructed using the CPv1.2 schema, but currently only harnesses those features previously available in CPv1.1.4. The following provides an overview of the basic usage of IMS Content Packaging

#### 4.4.1.1 Manifests and Sub Manifests

- In the Common Cartridge profile, all content will be captured in a single IMS manifest. Sub manifests will not be used.

#### 4.4.1.2 Meta-data

- LOM Metadata (restricted to DC elements for the cartridge level meta-data) will be used to capture meta-data.

#### 4.4.1.3 Organization

- The Organization will be used to represent the Common Cartridge Folder content type. See the discussion on representing the Common Cartridge Folder Type for the additional profiling applied to this data.

#### 4.4.1.4 Resources

- In general, all additional data required to describe a piece of content which is included in the cartridge, will be included as a separate file and referenced from a Resource object
- The Resource Type characteristic object will be used to identify the type of the external data. New resource types will be defined for each type of content included in the scope of CC. The format of these types should follow the guidelines defined in [CP, 07].
- Where a particular content instance requires multiple resource files of different types to describe itself, these should be included as separate resource elements with a <dependency> element linking them. Resources of different types should not be bundled together under a single <resource> element. E.g., the image files required by a QTI resource should not be directly referenced as <file> elements under the resource of type 'imsqti\_xmlv1p2/imscc\_xmlv1p0/assessment'. They should be included under a separate web content resource element.
- The specifics of using the Resource object to represent different types of learning content are described below.

#### 4.4.2 Manifest

- Manifest object may not contain child Manifest objects.
- The version characteristic object (i.e., version='IMS CP 1.2') for the Manifest is prohibited in the Common Cartridge profile to avoid confusion with the Common Cartridge version number, which by implication, uniquely identifies the version of Content Packaging adopted.

#### 4.4.3 Folder Content Type

- The folder content type described by the CC requirements represents a structural/presentation based approach to organizing content.
- The folder does not imply containment in the sense that a Windows file system folder implies containment (i.e., you delete the folder, you delete everything it contains).
- You cannot use the folder name within file path based semantics to reference content referenced by the folder.
- A distinct Learning Application Object can be referenced multiple times (both within a single folder and across folders). If a particular LMS cannot support this multiple referencing it may choose to make a copy of the Learning Application Object.

The following describes how the folder content type is represented.

##### 4.4.3.1 Usage of Organizations object

- The folder content type is represented by the IMS Organizations container object type. A Common Cartridge may have a single Organization or no Organization.
- The Default characteristic of the Organizations object is prohibited as it has no meaning in Common Cartridge.

##### 4.4.3.2 Usage of Organization object

- A Common Cartridge may have a single Organization or no Organization.
- The Organization object must contain a Structure characteristic object with the value "rooted-hierarchy".
- An Organization object may contain a Title value object. This can be used at the discretion of the LMS taking into account how the LMS renders the organization. For example, if the LMS renders the organization as a Learning Module then the Title of the organization could be used as the title of the module. If the LMS renders the organization as a set of folders below the existing course, then the Title would probably not be used.

<organizations/>

**Or**

```
<organizations>
  <organization identifier="Org1" structure="rooted-hierarchy">
    <title>Mathematics Volume III</title>
    <item>... </item>
  </organization>
</organizations>
```

**4.4.3.3 Root Folder**

A cartridge with a folder Organization should always be rooted on a single Item container object. It is not permissible to have two sibling Item containers below the Organization. The root Item container object just represents the root node of the Organization tree and has no other semantic or presentational meaning. It must not contain a Title value object, e.g., the following is valid:

```
<organization identifier="Org1" structure="rooted-hierarchy">
  <item>
    <item>
      ...
    </item>
  </item>
</organization>
```

The following are not valid:

```
<organization>
  <item>
    ...
  </item>
  <item>
    ...
  </item>
</organization>

<organization>
  <item>
    <title>some text</title>
  </item>
</organization>
```

**4.4.3.4 Usage of Items**

- An Item container object type either represents a folder or a link to a Learning Application Object resource from a folder.
- Parameters characteristic object of Item is not supported by CC.
- Every Item object with the exception of the root Item must contain a Title object.

**4.4.3.5 Item Object Representing Folder**

- An Item object which represents a folder is indicated by the absence of an IdentifierRef characteristic object.
- Folder Items support unlimited nesting of other folder Items and Learning Application Object link Items.

```
<item>
<item>
  <title>Root folder</title>
  <item>
    <title>Subfolder 1</title>
  </item>
  <item>
    <title>Subfolder 2</title>
    <item>
      <title>Subfolder 2 - Sub Folder 1</title>
    </item>
  </item>
</item>
</item>
```

#### 4.4.3.6 Item Object representing Learning Application Object Link

- An Item object representing a link to a Learning Application Object must contain an IdentifierRef characteristic object which references the Resource object describing the linked content.
- Learning Application Object Item objects may be nested by folder Item object but may not nest other folder or Learning Application Object Item objects.
- It is valid for two Learning Application Object Item objects to reference the same Resource object. This is consistent with the idea of the folder references equating to usage rather than containment links.

#### 4.4.4 Cartridge Web Content Type

- Cartridge web content represents web content that may be referenced by any Learning Application Object in the cartridge.
- Cartridge web content is represented as a Resource object.
- It may be directly referenced from a folder Item object.
- The characteristic object Type must be the value 'webcontent'.
- If a cartridge web content resource is linked from a Learning Application Object link Item object it must have an Href characteristic object which represents the launchable resource.

#### 4.4.5 Associated Content Type

- Associated content represents web content that is scoped to a particular resource.
- Associated content is represented as a Resource object.
- It may be directly referenced from a folder Item object.
- The characteristic object Type must be the value 'associatedcontent/imscc\_xmlv1p0/learning-application-resource'
- If the associated content resource is linked from a Learning Application Object link Item object it must have an Href characteristic object which represents the launchable resource.
- The Resource object may contain Dependency objects which reference Resource objects with Type 'webcontent'.

#### 4.4.6 Discussion Topic Content Type

- A Discussion Topic is a Learning Application Object that is used to initiate Discussion activity.
- Discussion topic content is represented as a Resource object.
- Expected default behavior:
  - Upon import, the discussion topic content will be stored by the LMS using its own internal representation.
  - As the cartridge content is added to an actual course, an associated discussion topic will be created in the discussion forum used by the LMS.
  - The location of the discussion topic resource object in the cartridge organization dictates the point in the course at which the learner is directed to the item in the discussion forum.
  - The discussion topic group would be the cohort of learners enrolled on the course and the instructor.
  - If the cartridge were added to more than one course, then each course would have its own discussion topic created, each with its own group of enrolled learners.
- It may be directly referenced from a folder Item object.
- The characteristic object Type must be the value 'imsdt\_xmlv1p0'.
- The Resource object Href characteristic object is prohibited.
- The Resource object must contain a single File object which references the Discussion Topic descriptor XML file which conforms to the [http://www.imsglobal.org/xsd/imsdt\\_v1p0](http://www.imsglobal.org/xsd/imsdt_v1p0) schema (see below).
- The Resource object may contain Dependency objects which reference Resource objects with Type 'webcontent' and/or 'associatedcontent/imscc\_xmlv1p0/learning-application-resource'.

#### 4.4.7 Web Link (URL) Content Type

- A Web Link is a Learning Application Object that represents a URL.



- Web Link content is represented as a Resource object.
- It may be directly referenced from a folder Item object.
- The characteristic object Type must be the value 'imswl\_xmlv1p0'.
- The Resource object Href characteristic object is prohibited.
- The Resource object must contain a single File object which references the Web Link descriptor XML file which conforms to the [http://www.imsglobal.org/xsd/imswl\\_v1p0](http://www.imsglobal.org/xsd/imswl_v1p0) schema (see below).
- The Resource object must not contain Dependency child objects.

#### 4.4.8 Assessment Content Type

- Represented as a Resource object.
- It may be directly referenced from a folder Item object.
- The characteristic object Type must be 'imsqti\_xmlv1p2/imscx\_xmlv1p0/assessment'.
- The Resource object Href characteristic object is prohibited.
- The Resource object must contain a single File object which references the QTI XML file. This file must conform to the IMS CC profile of the QTI 1.2.1 schema which is [http://www.imsglobal.org/xsd/ims\\_qtiasiv1p2](http://www.imsglobal.org/xsd/ims_qtiasiv1p2).
- The Resource object may contain Dependency objects which reference Resource objects with Type 'webcontent' and/or 'associatedcontent/imscx\_xmlv1p0/learning-application-resource'.

#### 4.4.9 Question Bank Content Type

- Represented as a Resource object.
- It must not be directly referenced from a folder Item object.
- If a question bank is included in a cartridge, then it appears as a resource in the imsmmanifest, but it is not included in the organization and reference to the question bank or its question items by any Learning Application Object is prohibited.
- Access to the question bank is restricted to the instructor, to whom it is provided as a resource for constructing customized assessments.
- How the LMS makes the question bank available to an instructor is undefined.
- The characteristic object Type must be 'imsqti\_xmlv1p2/imscx\_xmlv1p0/question-bank'.
- The Resource object Href characteristic object is prohibited.
- The Resource object must contain a single File object which references the QTI XML file. This file must conform to the IMS CC profile of the QTI 1.2.1 schema which is [http://www.imsglobal.org/xsd/ims\\_qtiasiv1p2](http://www.imsglobal.org/xsd/ims_qtiasiv1p2).
- The Resource object may contain Dependency objects which reference Resource objects with Type 'webcontent' and/or 'webcontent/imscx\_xmlv1p0/learning-application-resource'.

#### 4.4.10 Common Cartridge Authorization

- Cartridges support authorization at two levels: either the whole cartridge can be protected or individual resources can be protected.
- Authorization information is specified at two levels within the cartridge information model.
- The overall authorization requirements are specified using the Authorizations object which is an extension to the Manifest object. If the authorizations object is not present, no authorization is required. If the authorizations object is present it must declare Common Cartridge Authorization first, possibly in addition to other authorization mechanisms.
- If authorization is applied to individual resources within the cartridge rather than the cartridge as a whole, this can be specified using the Protected characteristic which is an extension characteristic applied to the Resource object.
- Import authorization is only applicable at the cartridge level.
- If import authorization is specified and it is not granted, then no part of the cartridge should be imported, including resources and files.
- Access authorization only applies to resources contained within a package.
- If access authorization is specified at the cartridge level it cascades down to the resources but not to any files contained within those resources.

- If access authorization is specified for a resource, it covers only access to the resource itself but does not cover access to files contained within the resource.
- When access authorization is specified for a resource, all non-management access points to that resource within a system need to check that authorization.
- Management of resources after a cartridge has been imported is beyond the scope of this authorization scheme, the authorization only applies to accessing the resource in the cartridge player.
- See below for further definition of the Authorization object information model.

## 4.5 LOM Metadata

### 4.5.1 Cartridge Metadata

The Common Cartridge must be described at the manifest level using meta-data according to the Common Cartridge profile of the IEEE LOM (loose binding) [IEEE LOM, 05] which describes the range of a mapping from the core elements of the Dublin Core specification v1.1 [DC, 03] to IEEE LOM. This application profile is restrictive. It uses the namespace <http://ltsc.ieee.org/xsd/imscc/LOM> which differs from the IEEE LOM namespace by the insertion of *imscc*. In contrast, meta-data for resources (see below) need to use the original IEEE LOM namespace.

The meta-data element as well as its schema and schema version element are required at the manifest level. They must be expressed as follows.

```
<metadata>
  <schema>IMS Common Cartridge</schema>
  <schemaversion>1.0.0</schemaversion>
  ... metadata according to Common Cartridge profile of IEEE LOM ...
</metadata>
```

The usage of meta-data at other places in the common cartridge is not restricted. This may change in future versions of the specification.

It should be noted that there are some differences between IMS Meta-data and IEEE LOM with respect to binding. Since the CC meta-data is based upon the IEEE LOM binding, it is not order sensitive.

Any media player, codec, browser plug-in or operating system requirements for the cartridge content must be declared in the cartridge-level meta-data description. Each entry should include details of the tool/product name, version number, supplier name and the URL for their website. Such requirements must be entered in the description element for the cartridge as free text.

#### 4.5.1.1 Mapping of Dublin Core Elements to LOM Metadata Elements:

**Table 4.2 Mapping of Dublin Core to IEEE LOM.**

Dublin Core Element	IEEE LOM Element	Value Type (see documentation of IEEE LOM)
dc:contributor, dc:creator, dc:publisher	lifeCycle.contribute.entity with appropriate value of lifeCycle.contribute.role	The value held by the Entity element shall be a character string literal that is the canonical lexical representation of a valid vCard as defined in IETF RFC 2426:1998.
dc:coverage	general.coverage	LangString
dc:date	lifeCycle.contribute.date	YYYY[-MM[-DD[Thh[:mm[:ss[.s[TZD]]]]]]
dc:description	general.description	LangString



Dublin Core Element	IEEE LOM Element	Value Type (see documentation of IEEE LOM)
dc:format	technical.format	— A literal that is the canonical lexical representation of a Multipurpose Internet Mail Extension (MIME) type value from RFC 2048 — The token <i>non-digital</i>
dc:identifier	general.identifier	Consists of catalog set to e.g. ‘ISBN’ and entry containing the actual ISBN number
dc:language	general.language	Language identifier (as defined in ISO 639-1, ISO 639-2, and ISO 3166-1) Or the token <i>none</i>
dc:relation	Relation	This is a structure consisting of <i>kind</i> and <i>resource</i>
dc:rights	Rights	Structure containing optional <i>cost</i> , <i>copyrightAndOtherRestrictions</i> and <i>description</i>
dc:source	Not mapped	---
dc:subject	general.keyword (see also classification.keyword)	in general.keyword LangString, in classification.keyword choice of purpose, taxonPath, description, and LangString
dc:title	general.title	LangString
dc:type	Educational.learningResourceType	Set to “IMS Common Cartridge”

#### 4.5.1.2 A Number of Elements of IEEE LOM are Unused and are Therefore Prohibited:

- No custom elements are allowed
- interactivityType unused
- interactivityLevel unused
- semanticDensity unused
- intendedEndUserRole unused
- context unused
- typicalAgeRange unused
- difficulty unused
- typicalLearningTime unused
- description is unused in educational context
- language is unused in technical context, it is used only in general context
- structure is not used
- aggregationlevel is not used
- version is not used
- status is not used
- metaMetadata are not used
- annotation is not used
- No size information
- location not used
- requirements not used
- installationRemarks unused
- otherPlatformRequirements unused
- duration unused

### 4.5.2 Roles Meta-data

If meta-data is applied to resources, then it must be based on IEEE LOM. In particular, it must use the IEEE LOM namespace <http://ltsc.ieee.org/xsd/LOM>.

There are situations where resources may need to be specified within the organization, but should not be made visible in player mode upon default import of the cartridge. One such situation is the inclusion of instructor manuals, lesson plans, instructor notes and solution files that should only be visible to instructors. In other situations, publishers may wish to provide additional, optional resources that may be selectively released to students by the instructor at some later date. In both cases, there is a need to indicate where the resources should appear within the organization even though the resources are not initially visible to learners in the cartridge player. These resources must be made visible in cartridge editors so that the settings may be modified when and if appropriate.

To meet these needs, the common cartridge applies optional “roles” meta-data associated with the resource in the manifest file. If not present, then the default behavior is that the resource would be viewable by all users. If present, then it declares the roles for which the resource would be viewable. The roles for which a specific resource is released are declared in the resource meta-data as the content of the elements:

```
lom/educational/intendedEndUserRole/vocabulary/value
```

Currently, the only supported roles are ‘Learner’ and ‘Instructor’ defined in the vocabulary:

```
IMS_GLC_CC_Rolesv1p0
```

The context for which these values are applicable must be identified in:

```
lom/educational/context/value
```

Currently, the only supported context is ‘higher education’. For example:

```
<lom:lom>
  <lom:educational>
    <lom:context>
      <lom:source>LOMv1.0</lom:source>
      <lom:value>higher education</lom:value>
    </lom:context>
    <lom:intendedEndUserRole>
      <lom:vocabulary>
        <lom:source>IMSGLC_CC_Rolesv1p0</lom:source>
        <lom:value>Learner</lom:value>
        <lom:value>Instructor</lom:value>
      </lom:vocabulary>
    </lom:intendedEndUserRole>
  </lom:educational>
</lom:lom>
```

## 4.6 Authorization

The authorization components of the Common Cartridge are designed to support the requirements of the Authorization Web Service as described in IMS Common Cartridge Authorization Web Service [CC, 08b].

However, they also need to contain sufficient information to support legacy authorization mechanisms as it is not expected that all LMSs and publishers will immediately move to using the Web Service, because their current business model is tied to the existing mechanisms.

The authorization model supports the following concepts:

- 1) Requiring authorization on cartridge import
- 2) Requiring authorization on cartridge usage
- 3) Requiring authorization on usage of specific resources in the cartridge

Concepts 2 and 3 are mutually exclusive, i.e., a cartridge can either specify that all resources in the cartridge are protected or just some resources in the cartridge are protected.

The mechanism by which the authorized access to particular resources is enforced by the LMS is not defined by the profile. How the ‘challenge’ mechanism is integrated into the user experience will be determined by the implementation of the LMS. For example, an LMS could challenge for authorization when a user accesses a course that contains any protected resources. Or alternatively, an LMS could just challenge when a user tries to access a protected resource in the context of a course. In some cases this is not easy to do. E.g., if an HTML page uses a protected image, it may not be easy to incorporate a challenge mechanism seamlessly into the display of the HTML page. An LMS could employ some kind of redirection mechanism or return an image requesting user to authorize etc.

#### 4.6.1 Specifying the Authorization Level

The authorization requirements are specified in the manifest as an IMS extension.

If the authorizations element is omitted the cartridge is assumed to be open access. All authorization mechanisms declared in the cartridge must provide the same level of access which has been declared in the authorizations object.

##### 4.6.1.1 Example Instance

```
<manifest>
  <metadata/>
  <organization/>
  <resources/>
  <cc:authorizations access="cartridge" import="false"
    xmlns:cc="http://www.imsglobal.org/xsd/imsccauth_v1p0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.imsglobal.org/xsd/imsccauth_v1p0 imscauth_v1p0.xsd">
    <cc:authorization>
      <cartridgeId>12345</cartridgeId>
      <webservice>http://publisher.com/authme</webservice>
    </cc:authorization>
  </cc:authorizations>
</manifest>
```

- **authorization** - If not provided means cartridge usage requires no authorization.
- **access** - Determines whether authorization must be established when cartridge content is accessed by a learner. Valid values are ‘cartridge’ which means all cartridge resources are protected or ‘resource’ which means only resources which are specifically flagged as protected require authorization.
- **import** - Determines whether authorization must be established when cartridge is imported into LMS
- **cartridgeId** - Global unique identifier for this cartridge
- **webservice** - The address of the web service that supports the IMS Common Cartridge Authorization Web Service [CC, 08b]. If authorization is required, then this element must be present and reference a valid authorization web service.

##### 4.6.1.2 Protecting Individual Resources

If the cartridge access type is set to ‘resource’ then the individual resources which need to be protected are specified by adding the ‘Protected’ characteristic object to each resource.

```
<resource identifier=res001 type=webcontent cc:protected=true href=someFile.html>
  <file href=someFile.html/>
</resource>
```

##### 4.6.1.3 Schema

```
<xs:schema targetNamespace="http://www.imsglobal.org/xsd/imsccauth_v1p0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://www.imsglobal.org/xsd/imsccauth_v1p0"
  xmlns:ims="http://www.imsglobal.org/xsd/imsccp_v1p1" elementFormDefault="unqualified">
  <xs:import namespace="http://www.imsglobal.org/xsd/imsccp_v1p1" schemaLocation =
    "imsccp_v1p1.xsd"/>
  <xs:element name="authorizations" type="authorizationsType"/>
  <xs:complexType name="authorizationsType">
    <xs:sequence>
      <xs:element name="authorization" type="authorizationType"/>
      <xs:group ref="ims:grp.any"/>
    </xs:sequence>
```

```

    <xs:attribute name="access" type="accessType" use="required"/>
    <xs:attribute name="import" type="xs:boolean" default="false"/>
  </xs:complexType>
  <xs:complexType name="authorizationType">
    <xs:sequence>
      <xs:element name="cartridgeId" type="xs:string"/>
      <xs:element name="webservice" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
  <xs:simpleType name="accessType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="cartridge"/>
      <xs:enumeration value="resource"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:complexType name="ResourceType">
    <xs:complexContent>
      <xs:extension base="ims:resourceType">
        <xs:attribute name="protected" type="xs:boolean" default="false"/>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
</xs:schema>

```

## 4.7 Discussion Topics

Discussion topics are described in a descriptor file as follows:

### 4.7.0.1 Example Instance

```

<?xml version="1.0" encoding="UTF-8"?>
<dt:topic
  xmlns:dt="http://www.imsglobal.org/xsd/imsdt_v1p0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <title>Dinosaurs</title>
  <text texttype="text/html">Discuss this history of dinosaurs. &lt;img
src="$IMS-CC-FILEBASE$icons/dinosaurImage.gif"/&gt;</text>
  <attachments>
    <attachment href="icons/dinosaurHistory1.html"/>
    <attachment href="icons/dinosaurHistory2.html"/>
  </attachments>
</dt:topic>

```

- **topic** root element
- **title** Title of this topic
- **text** Text for this topic – if text/html can contain markup and references to both cartridge and Learning Application Object web content.
- **texttype** values(TEXT/HTML or TEXT/PLAIN)
- **attachments** contains one to many attachment objects
- **attachment** Specifies an attachment
- **href** Specifies the relative path of the attachment file – must be to a Learning Application Object web content resource.

### 4.7.0.2 Schema

```

<xs:schema targetNamespace="http://www.imsglobal.org/xsd/imsdt_v1p0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://www.imsglobal.org/xsd/imsdt_v1p0"
  elementFormDefault="unqualified">
  <xs:element name="topic" type="topicType"/>
  <xs:complexType name="topicType">
    <xs:sequence>
      <xs:element name="title" type="xs:string"/>
      <xs:element name="text">

```

```

    <xs:complexType>
      <xs:simpleContent>
        <xs:extension base="xs:string">
          <xs:attribute name="textType" type="textTypeType" default="text/plain"/>
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
  </xs:element>
  <xs:element name="attachments" minOccurs="0">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="attachment" minOccurs="1" maxOccurs="unbounded">
          <xs:complexType>
            <xs:attribute name="href" type="xs:string" use="required"/>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:sequence>
</xs:complexType>
<xs:simpleType name="textTypeType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="text/html"/>
    <xs:enumeration value="text/plain"/>
  </xs:restriction>
</xs:simpleType>
</xs:schema>

```

## 4.8 Web Links

Web links are described in a descriptor file as follows:

### 4.8.0.1 Example Instance

```

<?xml version="1.0" encoding="UTF-8"?>
<wl:webLink
  xmlns:wl="http://www.imsglobal.org/xsd/imswl_v1p0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <title>Dinosaurs</title>
  <url href="http://dino.com/dinosaurs/history.html" target="_self" windowFeatures=width=100,
height=100/>
</wl:webLink>

```

- **webLink** root element
- **title** Title of this web link
- **url** URL which the web link represents
- **href** URL value
- **target** any valid value for the HTML <a> tag target attribute
- **windowFeatures** – an optional string that can be used as the feature parameter for the standard javascript window open function

### 4.8.0.2 Schema

```

<?xml version="1.0"?>
<xs:schema targetNamespace="http://www.imsglobal.org/xsd/imswl_v1p0"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://www.imsglobal.org/xsd/imswl_v1p0"
  elementFormDefault="unqualified">
  <xs:element name="webLink" type="webLinkType"/>
  <xs:complexType name="webLinkType">
    <xs:sequence>
      <xs:element name="title" type="xs:string"/>
      <xs:element name="url">
        <xs:complexType>
          <xs:attribute name="href" type="xs:string" use="required"/>

```

```

        <xs:attribute name="target" type="xs:string" />
        <xs:attribute name="windowFeatures" type="xs:string" />
    </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:schema>

```

## 4.9 QTI

### 4.9.1 Overview

A Common Cartridge may contain either/both of two Learning Object Resource types that are based on the CC QTI Profile: Assessments and Question Banks. Generally Assessments are meant to represent an ordered question set and may include optional attributes that apply to the set as a whole. A CC Question Bank refers to a QTI Object Bank, constrained to hold just those question types supported in the CC profile. Assessments should employ the <assessment> QTI element (see section Assessments vs. Object Banks directly below). Question Banks are meant to represent unordered sets of questions with no associated attributes applying to the set as a whole (though meta-data is permitted). Question banks should use the <objectbank> QTI element. In addition, question banks should have no representation in the organizations section of the manifest and if used, only one question bank can be present in a cartridge.

<questestinterop> is the root element for all CC QTI documents. Directly inside this will be either an <assessment><section> or <objectbank> structure as described in the next section.

The \$IMS-CC-FILEBASE\$ token may be used in any portion of questions, answers or feedback. It is intended to help identify paths that reference media files that are required by the assessment and are included in the common cartridge. If the files are not moved after extraction, the path following the token should be the same directory that contains the qti file itself. The token should ALWAYS be included when making relative references to other files so that import engines can correctly handle any required path translations. Elements or multi-element constructs other than those covered explicitly below are prohibited.

#### 4.9.1.1 Assessments vs. Object Banks

Assessments are represented with a single <assessment> element with required ident and title attributes and optional language attribute. The <assessment> element may contain an optional <presentation\_material> element to represent information to be displayed prior to a student launching the assessment.

A <qtimetadadata> element can be present where CC specific meta-data elements are allowed within <qtimetadadatafield> structures as follows:

```

<qtimetadadatafield>
  <fieldlabel></fieldlabel>
  <fieldentry></fieldentry>
</qtimetadadatafield>

```

fieldlabel	fieldentry
cc_profile	cc.exam.v0p1
qmd_assessmenttype	The type of assessment role. The default is 'Examination'. values: 'Examination', 'Survey', 'Tutorial', 'Self-assessment'.
qmd_scoretype	'Percentage' scoring is always used.
qmd_feedbackpermitted	If 'No' then students should not see any feedback for this assessment. Default is 'Yes'.
qmd_hintspermitted	If 'No' then students should not see any hints for this assessment. Default is 'Yes'.

fieldlabel	fieldentry
qmd_solutionspermitted	If 'No' then students should not see any feedback flagged as Solution for this assessment. Default is 'Yes'.
qmd_timelimit	Time limit is an integer value expressed in minutes. If unspecified there is no time limit.
cc_allow_late_submission	Indicates whether the time limit should be strictly enforced. Should only be provided if the qmd_timelimit was also specified. Allowed values are "Yes" and "No". The default is "Yes"
cc_maxattempts	Allows specifying the maximum allowed user attempts. Allowed values are 1, 2, 3, 4, 5 and "unlimited". The default is 1.

In addition to the optional <presentation\_material> and <qtimetadafield> elements the <assessment> element must contain exactly one <section> element with a required ident and an optional title attribute. The <section> element contains one or more <item> elements only.

Object banks are represented as a single <objectbank> element which can contain one or more <item> elements only.

#### 4.9.1.2 Item

<item> elements represent individual questions in assessments or object banks (i.e. question banks). There is a required ident attribute and an optional title attribute which can be used when providing editors with question lists for selection or editing. It is not presented when question is rendered in the assessment.

#### 4.9.1.3 Itemmetadata

An <itemmetadata> element can contain a <qtimetadafield> element where CC specific meta-data elements are allowed within <qtimetadafield> structures (as in Assessments vs. Object Banks section above) as follows:

fieldlabel	fieldentry
cc_profile	Corresponds to the six supported question types. Can be: cc.multiple_choice.v0p1, cc.multiple_response.v0p1, cc.true_false.v0p1, cc.fib.v0p1, cc.pattern_match.v0p1, or cc.essay.v0p1
cc_question_category	A single keyword value
cc_weighting	cc_weighting specifies the preferred points value for the question. This is useful because the scoring variables are normalized to percentage-based values between 0 and 100. Additionally, this allows for points possible to be specified for manually graded items such as essay questions. Must be an integer value 0 - 99 if provided. Otherwise a default of 1 is assumed.
qmd_scoringpermitted	Yes (Because there is no automated scoring for essays, we use standard qmd meta-data to indicate the item is manually scored.)
qmd_computerscored	No (for essays)

#### 4.9.1.4 Presentation

The <presentation> element contains elements for representing the question text and responses as presented to the student.

A <material><mattext> structure directly inside the <presentation> element is used for the question text. The question text may be presented in either plain text or html format. If the html format is used, the mattext element must have a texttype attribute with a value of "text/html". If plain text is used, the texttype value of "text/plain" is optional as this is the default. Regardless of the format, the question text must occur within a CDATA section.

Multiple\_choice, multiple\_response, and true\_false questions use a <response\_lid> element to contain the individual answers. There is a required ident attribute which should be of the form response\_# to make processing easier, and an rcardinality attribute which should be set to Single for multiple\_choice and true\_false questions and Multiple for multiple\_response questions.

The <response\_lid> element contains a single <render\_choice> element with a shuffle (Yes/No) attribute to indicate whether or not scrambling of answer choices is allowed.

The <render\_choice> element contains one or more <response\_label> elements with a required ident attribute. The <response\_label> elements contain <material><mattext> structures holding the text of the individual answers. Response.rshuffle is not supported here.

Fib and essay questions use a <response\_str> element instead of <response\_lid> with a required ident attribute which should be of the form response\_# to make processing easier. The <response\_str> element contains a single <render\_fib> element. The rows attribute must be set to 1. For fib questions the columns attribute may be set any positive integer but may be ignored.

#### 4.9.1.5 Resprocessing

<resprocessing> is a direct child of the <item> element and is used to indicate correct answers and response scoring.

<resprocessing> should include an <outcomes><decvar> structure that sets varname="SCORE".

<respcondition> elements are used to set the value of SCORE appropriately for each response, and to identify any <itemfeedback> (see next section: Itemfeedback) elements that are applicable. A <respcondition continue="Yes"> can be used for general feedback to be provided unconditionally.

A <setvar action="Set" varname="SCORE"> element is used inside a <respcondition> element to set the score. With simple multiple choice only one correct answer is allowed and it should set SCORE to 100. All other answers should set SCORE to 0. With multiple response only all or nothing scoring is supported.

The <conditionvar> element is used to establish the conditions for each scoring possibility. Simple multiple choice will use a structure like <varequal respident="response\_1">answer\_1</varequal>.

Multiple response questions can represent all-or-nothing scoring as follows:

```
<conditionvar>
  <and>
    <varequal respident="response_1" case="Yes">answer_1</varequal>
    <not>
      <varequal respident="response_1" case="Yes">answer_2</varequal>
    </not>
    <varequal respident="response_1" case="Yes">answer_3</varequal>
    <varequal respident="response_1" case="Yes">answer_4</varequal>
  </and>
</conditionvar>
```

Fill-in-the-blank questions are not case sensitive on grading as indicated by setting the case attribute to "No" in the <varequal> element. Pattern match questions may optionally be case sensitive by setting case="Yes", but the default is NOT case sensitive. To check if a string is contained anywhere in the response we use the varsubstring condition which again may or may not be case sensitive, as follows:

```
<conditionvar>
  <varsubstring respident="response_1" case="No">expected</varsubstring>
</conditionvar>
```

There should be a <displayfeedback> element contained within the <respcondition> element for feedback appropriate to the response. Feedback elements may be feedback for specific answers or feedback for all correct/incorrect answers, as determined by the conditionvar case. However if any feedback is specified, both types of feedback (answer level and correct/incorrect) are required.



#### 4.9.1.6 Itemfeedback

<itemfeedback> elements with required ident attribute, corresponding to any references placed in <rescondition> elements, are used to define the feedback for each case. Feedback text is contained in <material><mattext> structures.

General feedback is given as an unconditional feedback with continue flag on for further processing:

```
<rescondition continue="Yes">
  <displayfeedback feedbacktype="Response" linkrefid="general_fb" />
</rescondition>
```

Feedback can be attached to individual responses as follows:

```
<rescondition>
  <conditionvar>
    <varequal respident="response_1">answer_1</varequal>
  </conditionvar>
  <setvar action="Set" varname="SCORE">0</setvar>
  <displayfeedback feedbacktype="Response" linkrefid="answer_1_fb" />
  <displayfeedback feedbacktype="Response" linkrefid="incorrect_fb" />
</rescondition>
```

Note that answer-specific *and* correct/incorrect feedback must be provided together, or not at all. If one is present, the other must be also.

Hints can be represented as follows:

```
<itemfeedback ident="hint">
  <hint>
    <hintmaterial>
      <material>
        <mattext texttype="text/html"><![CDATA[This is a hint]]></mattext>
      </material>
    </hintmaterial>
  </hint>
</itemfeedback>
```

Essay questions can indicate sample answers as follows:

```
<itemfeedback ident="solution">
<solution>
  <solutionmaterial>
    <material>
      <mattext texttype="text/html"><![CDATA[here is the sample solution]]></mattext>
    </material>
  </solutionmaterial>
</solution>
</itemfeedback>
```

#### 4.9.2 Further Element/Attribute Restrictions for Common Cartridge

The <i>setvar</i> element supports an <i>action</i> attribute with values of Add, Set, and Subtract. In Common Cartridge, only <i>Set</i> is allowed.
---

The <i>MaterialSelection</i> selection should only allow the <i>mattext</i> element. In addition the <i>texttype</i> attribute should only allow values of text/html and text/plain and the element text must be wrapper in CDATA. <i>Additional attributes are not allowed.</i>
--

The <i>rcardinality</i> attribute on the <i>response_lid</i> and <i>response_str</i> elements only allow values of Single and Multiple. The value Ordered is not supported.
---

The <i>rtiming</i> attribute on the <i>response_lid</i> and <i>response_str</i> elements is not supported.
--

The *render\_fib* element allows many attributes.

1. *encoding* – “The coding to be used for the text. The default value of UTF-8 is assumed. *This attribute is not allowed.*
2. *charset* – “The character set that is to be used to represent the text string. Default value is ascii-us. *This attribute is not allowed.*
3. *rows* – The number of rows available for the data entry is optional.
4. *columns* – The number of columns available for the data entry is optional.
5. *maxchars* – The maximum number of characters available for the data entry is optional.
6. *Prompt* – “The type of prompt presented to the participant in which the FIB data is to be entered. This is an enumeration with values of Box, Dashline, Asterisk, and Underline. Default value is Box. This attribute is not allowed as the display format is determined by the LMS.
7. *fibtype* – “The type of data expected. This is an enumeration with values of String, Integer, Decimal, Scientific, and Boolean. This is restricted to the default value of String. All other values are prohibited.
8. *minnumber* – “The minimum number of responses that must be supplied by the participant. This attribute is prohibited. Only one response is allowed.
9. *maxnumber* – “The maximum number of responses that can be supplied by the participant. This attribute is prohibited. Only one response is allowed.

The *render\_fib* element is prohibited from having any children.

The *flow* element is not allowed.

## 4.9.3 Root

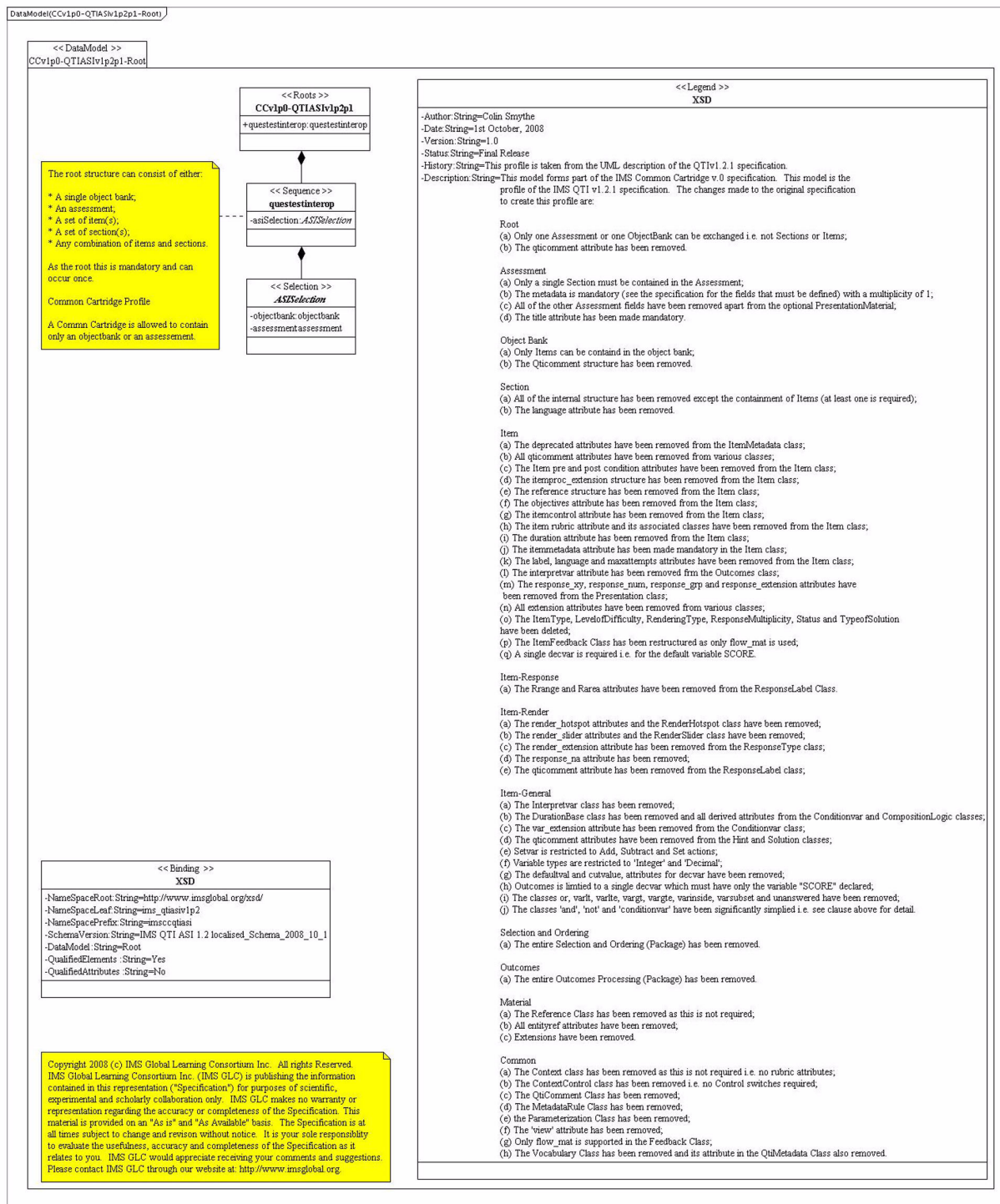


Figure 4.4 CC profile of QTI v1.2.1 - Root.

## 4.9.4 Section

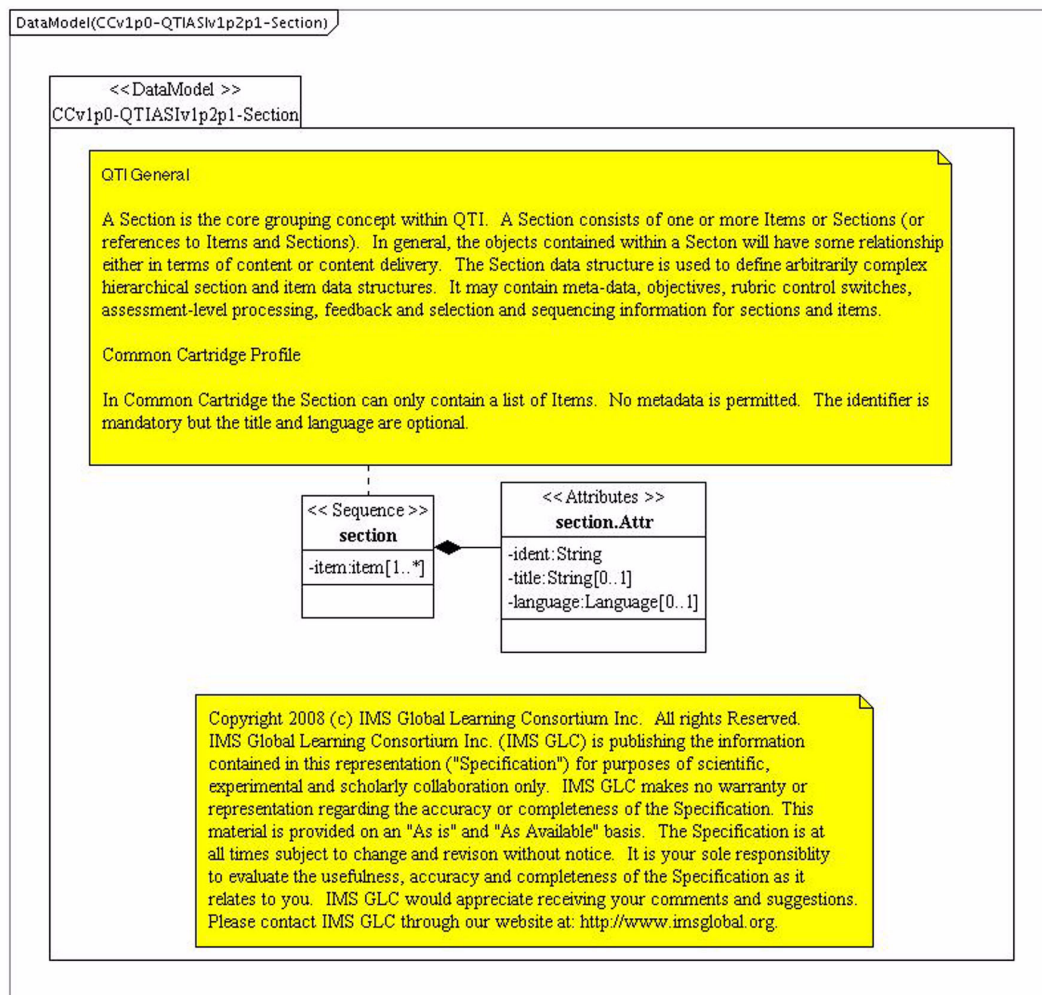


Figure 4.5 CC profile of QTI v1.2.1 - Section.

## 4.9.5 Common

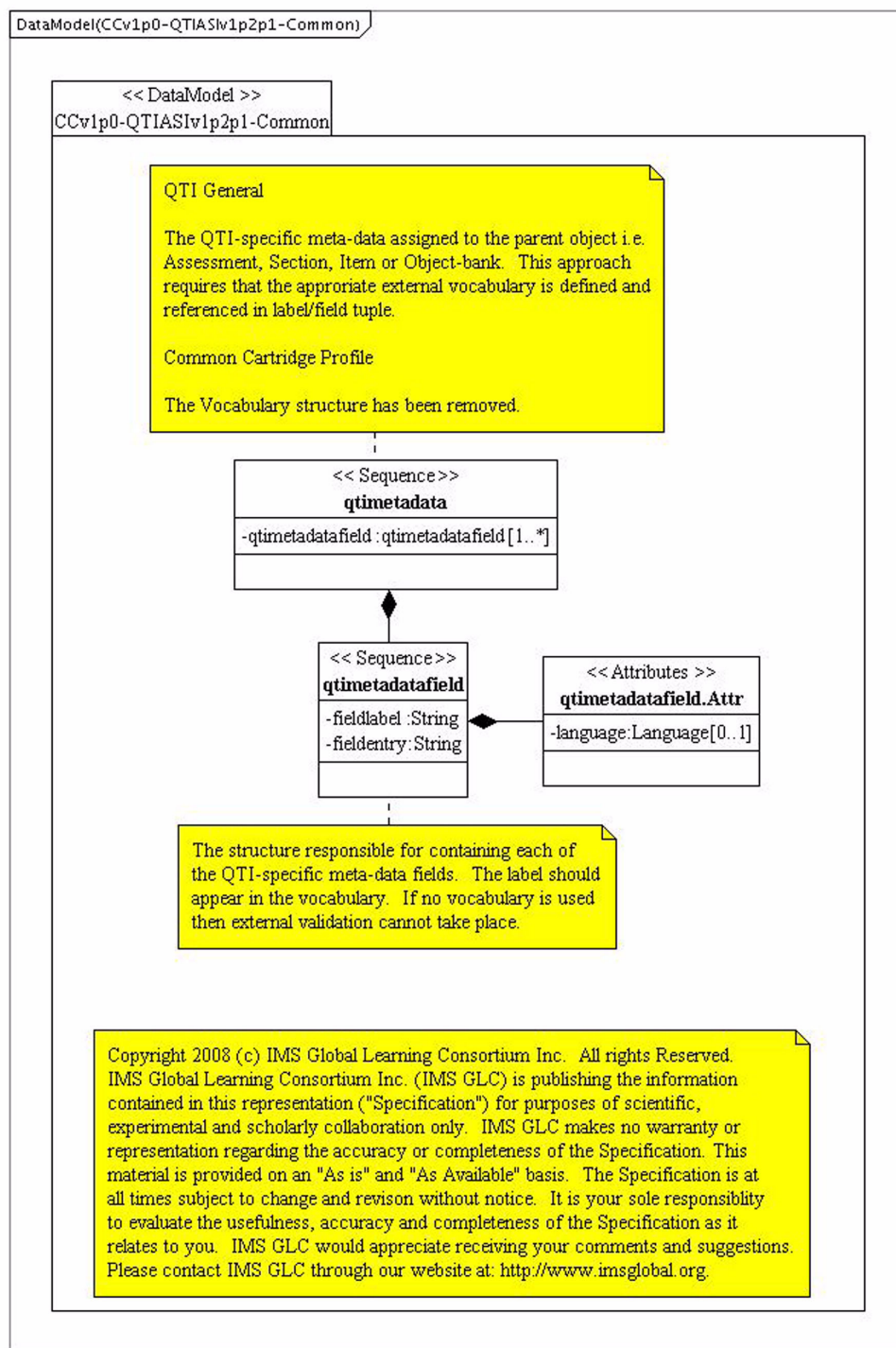
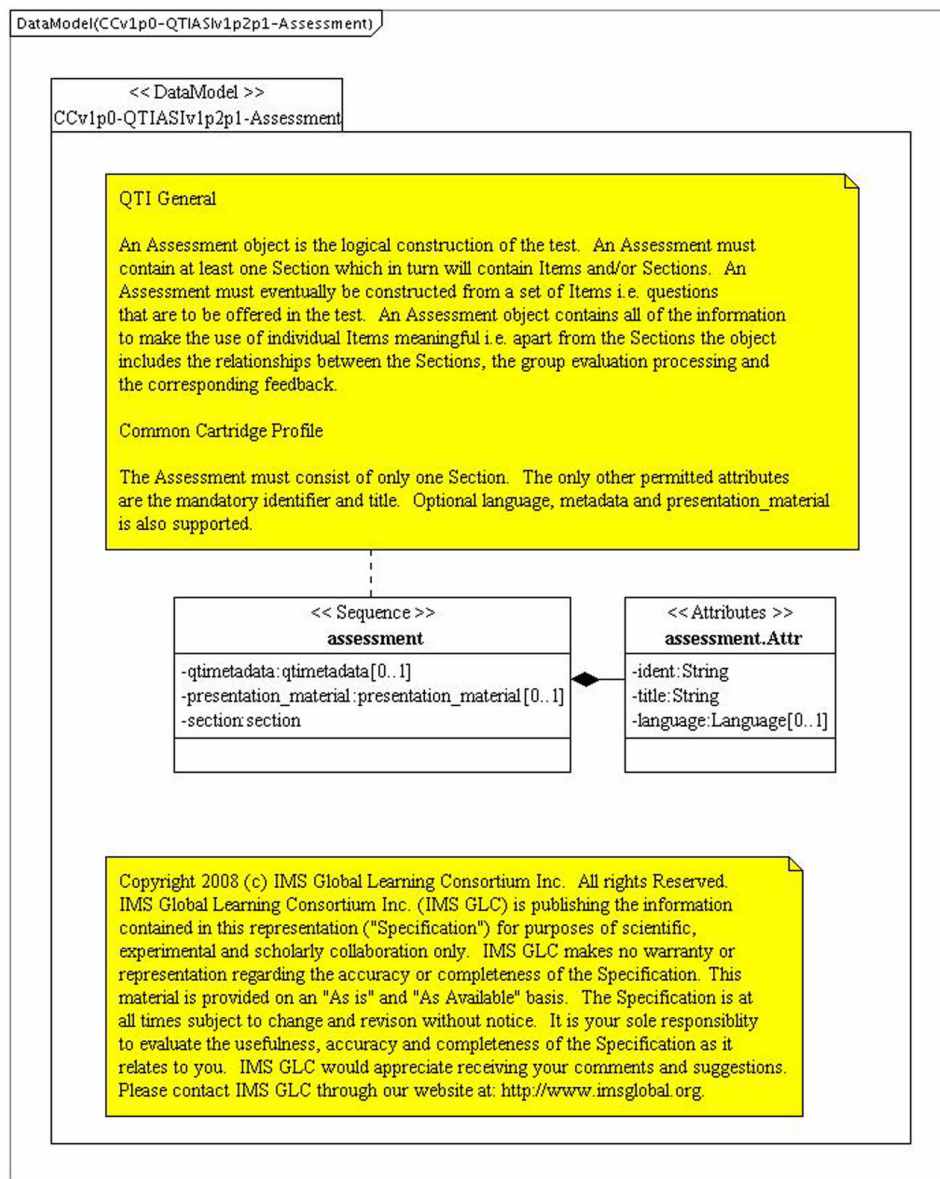


Figure 4.6 CC profile of QTI v1.2.1 - Common.



## 4.9.6 Assessment



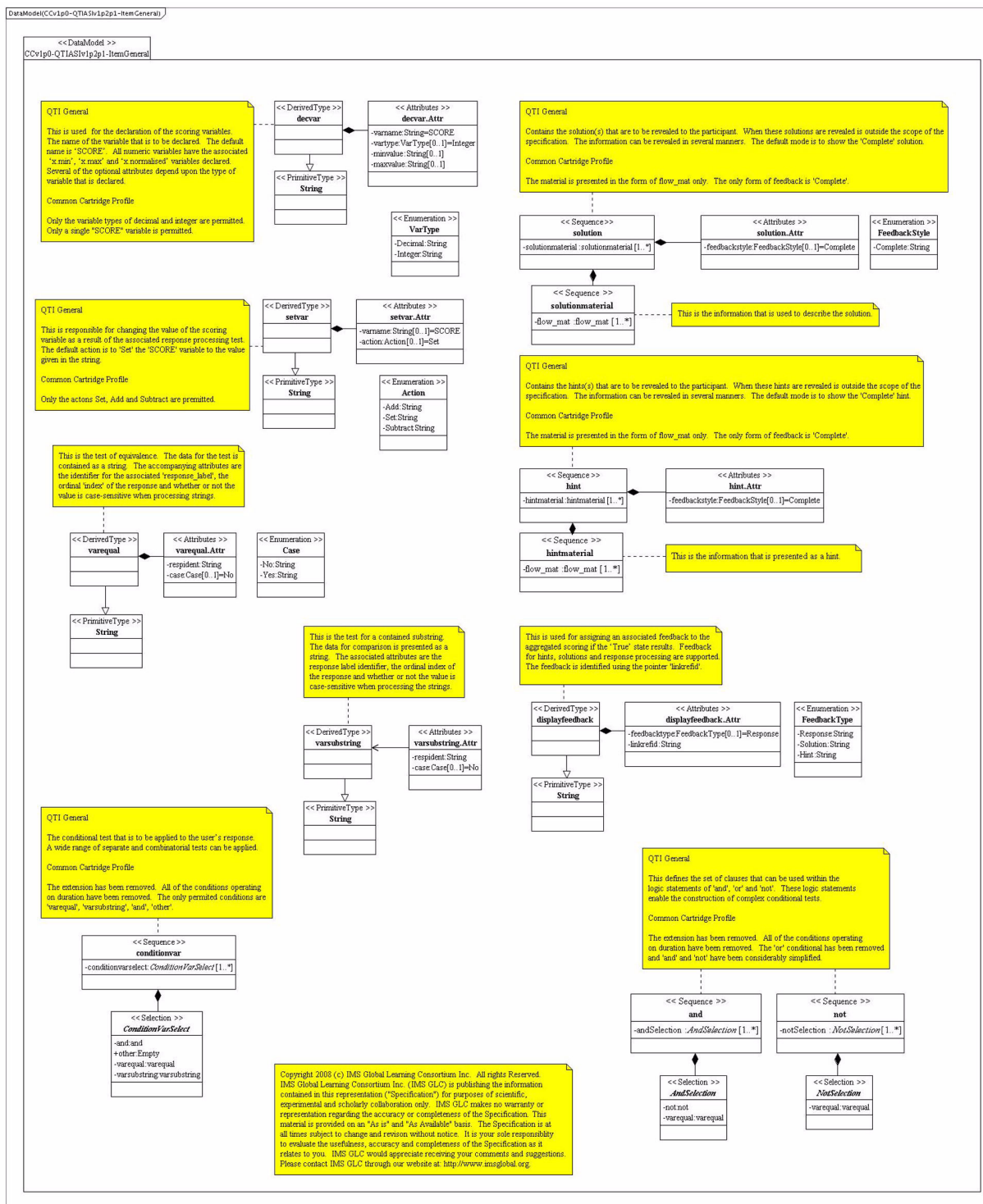
**Figure 4.7 CC profile of QTI v1.2.1 - Assessment.**

Common Cartridge supports only one role of assessment which maps to the IMS concept of 'Examination' (as defined by the QTI meta-data attribute 'qmd\_assessmenttype').

An assessment must contain a single section which contains all questions delivered by the assessment. Multiple sections and references to questions in an object bank are not supported.

An assessment does support the use of a number of meta-data attributes which can carry additional delivery information about the assessment such as maximum attempts and time limit. These are defined in the profile.

#### 4.9.7 Item



**Figure 4.8 CC profile of QTI v1.2.1 – ItemGeneral.**

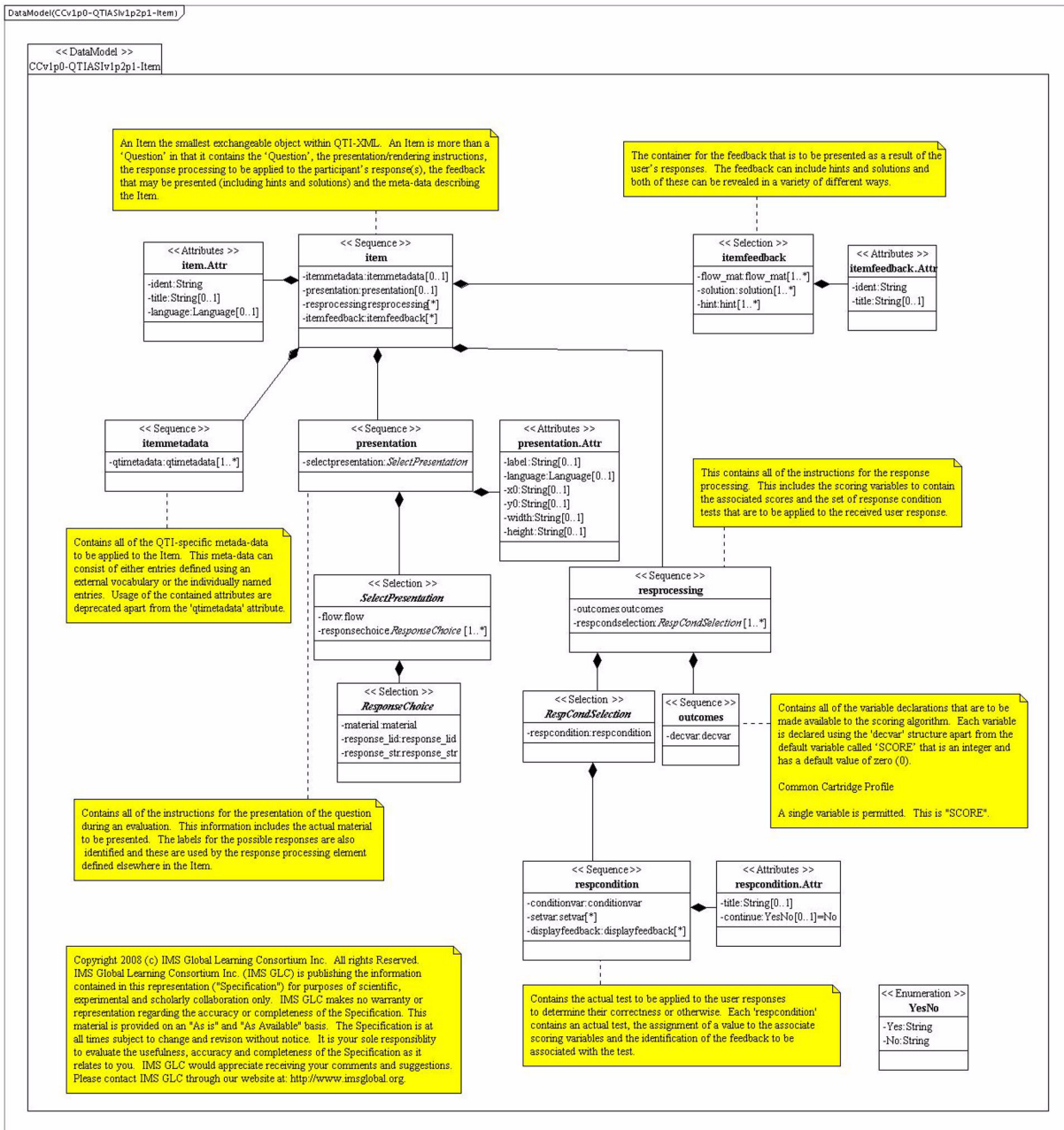


Figure 4.9 CC profile of QTI v1.2.1 – Item



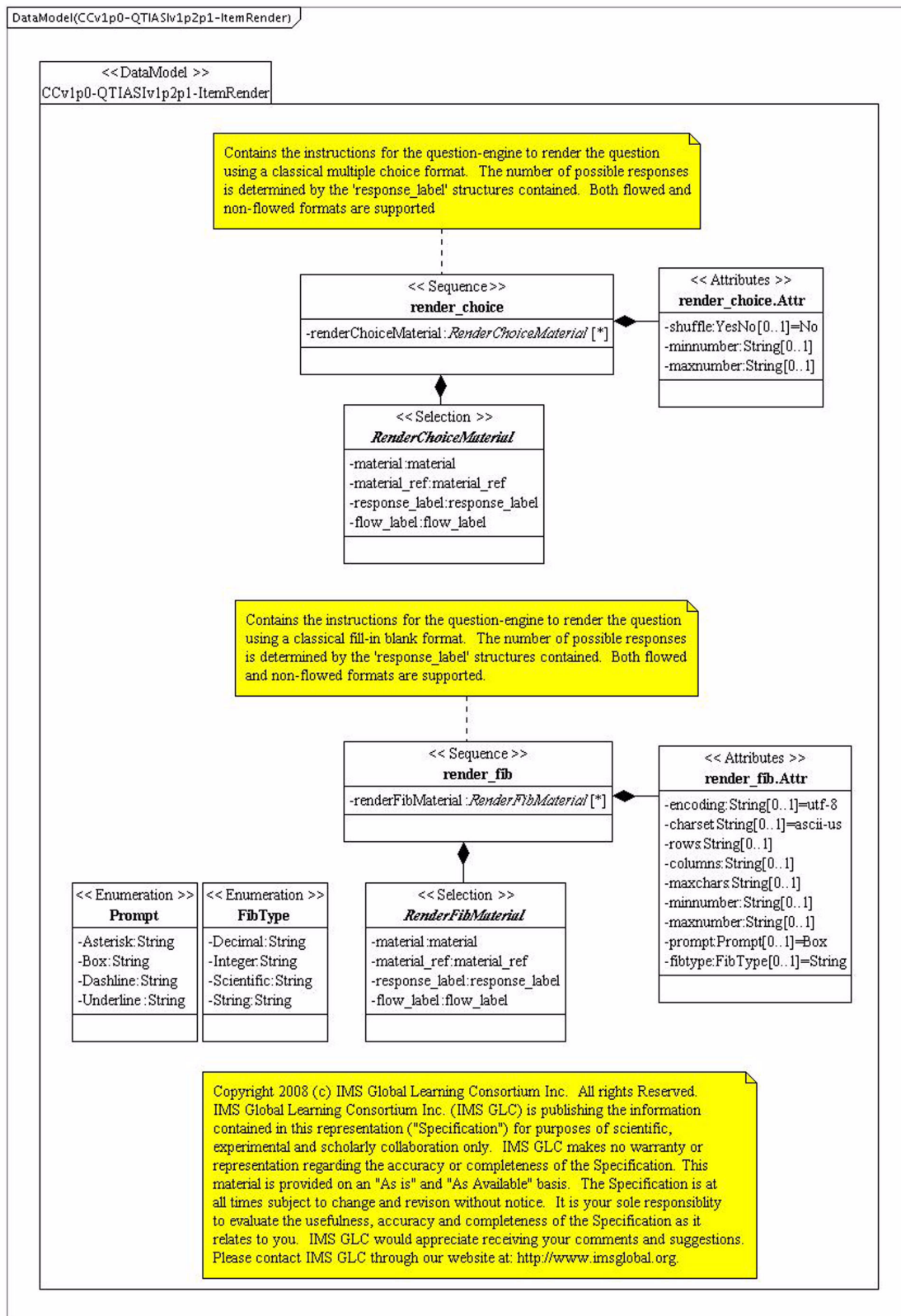


Figure 4.10 CC profile of QTI v1.2.1 – ItemRender

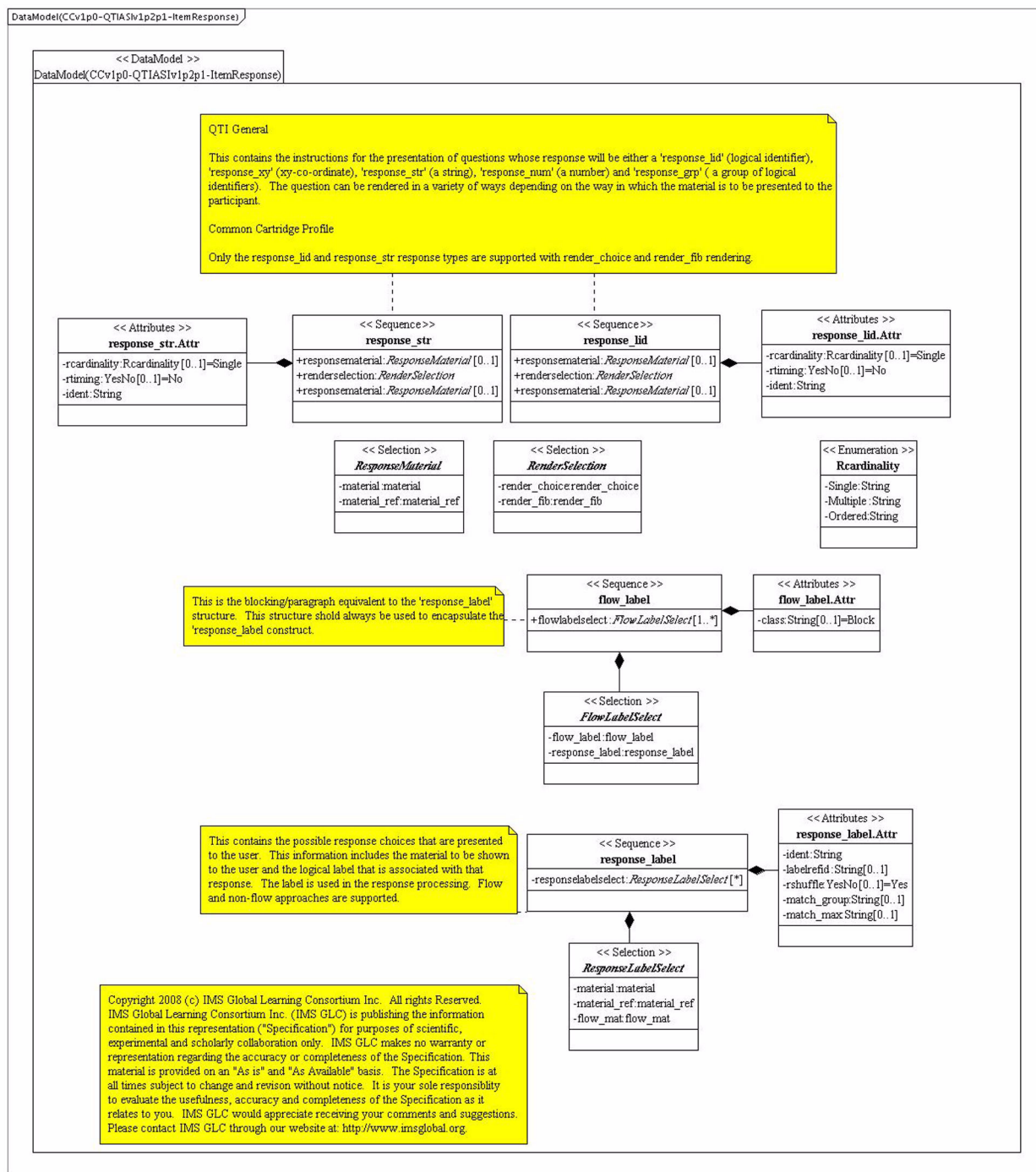
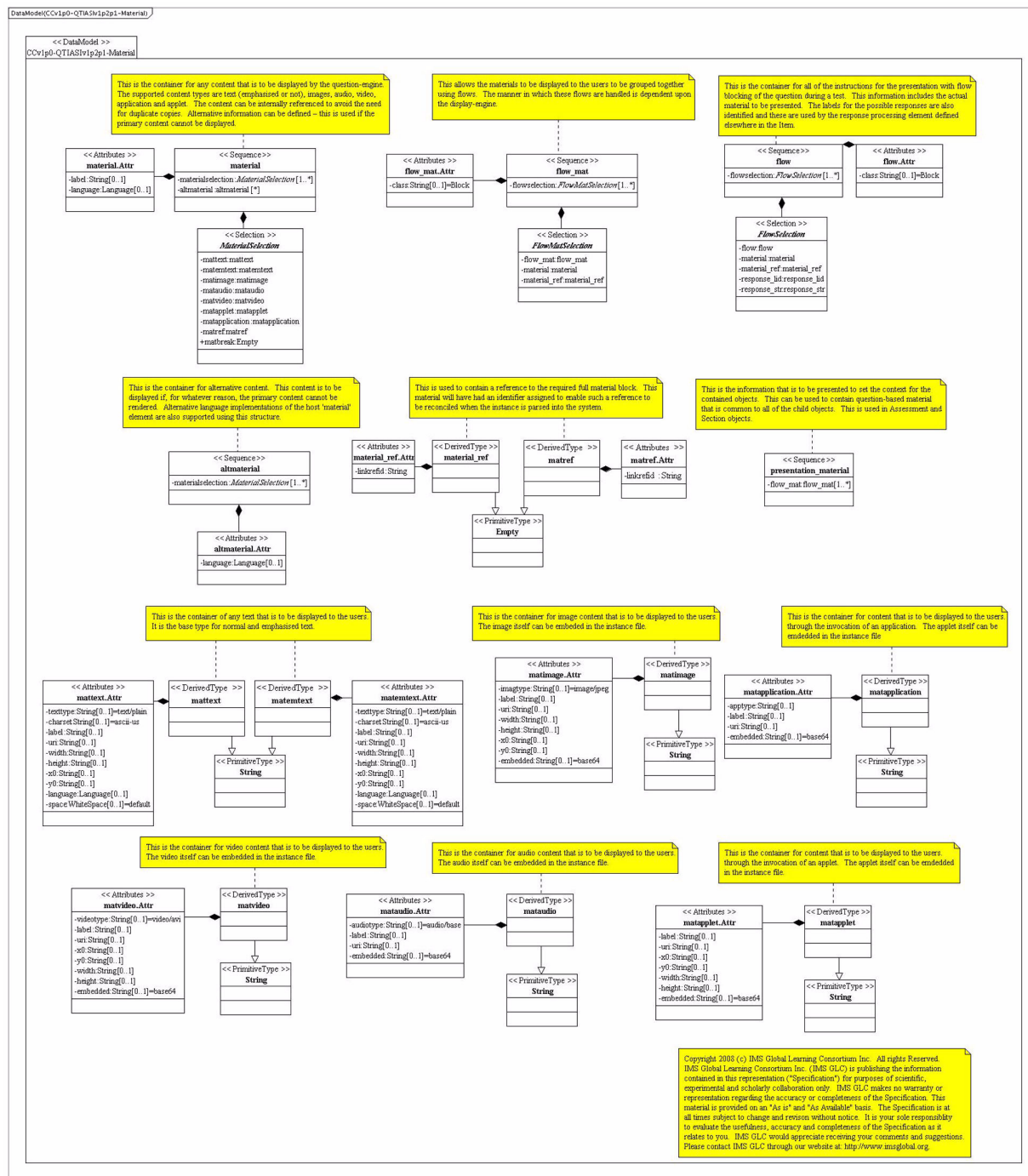


Figure 4.11 CC profile of QTI v1.2.1 – ItemResponse

#### 4.9.8 Material



**Figure 4.12 CC profile of OTI v1.2.1 - Material**

### 4.9.9 Questions

The Common Cartridge supports profiles of the following question types:

- Multiple Choice (Single Response)
- Multiple Choice (Multiple Response)
- True/False

- Essay
- Simple Fill in the Blank – single response box with single correct answer that is processed as an exact match
- Pattern Match – single response box with multiple potential answers that support exact match, containment matching and regular expression matching

The profiles for each of these question types describe how they support:

- feedback
- hints
- sample solutions
- relative scoring

In addition, questions support a number of meta-data attributes which describe:

- a suggested weighting for the question in the assessment
- a category for the question.

Instances of these questions may be included in an assessment or a question bank.

CC supports both Yes/No and Distractor feedback from QTI. Platforms must support one or the other, cartridges can either omit or must provide both.

- Cartridges can include QTI questions without any feedback. If feedback is offered, then the question must include both Yes/No and distractor responses.
- Platforms must implement either Yes/No or distractor responses. If both are supported, then the distractor responses will take precedence.

For full details refer to the profile descriptions.

#### 4.9.10 Question Bank

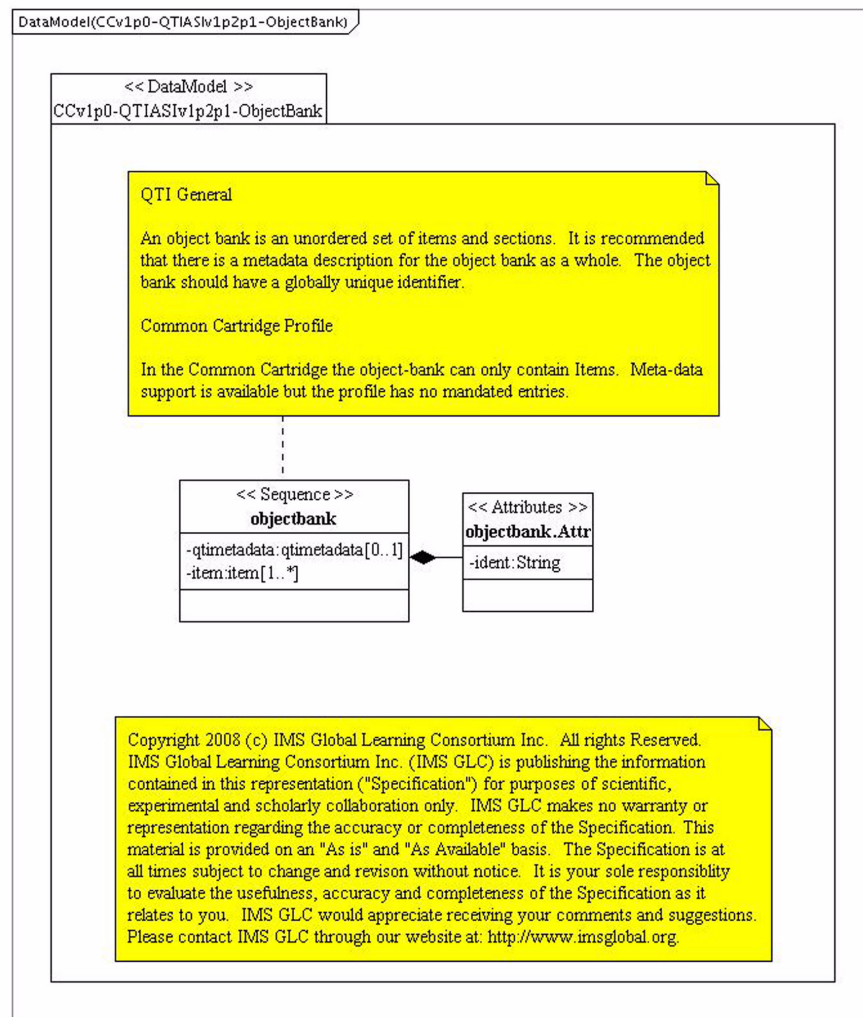


Figure 4.13 CC profile of QTI v1.2.1 – Objectbank.

The CC question bank profiles the use of the QTI object bank. A question bank represents a collection of questions that are associated with a particular learning context, but not used within it. The question bank allows for the exchange of questions to a target LMS. Both the representation of a question bank, and how questions are utilized once the cartridge has been imported into the LMS are LMS specific. Assessments within a package cannot reference questions contained within the question bank.

The behavior of an LMS in handling question banks is undefined.

### 4.10 Vocabularies

Vocabularies refer to a set of string constants used to specify pre-defined values for meta-data elements. Typically these value sets are specified by the document that defines the meta-data element, such as the IEEE Learning Object Metadata or Dublin Core standards. Common Cartridge meta-data elements may extend or replace vocabularies with new sets that describe the content included in the package.

For example, the `lifeCycle.contributor.role` element may be specified to include values from the following set:

- student

- instructor
- administrator

which might be expanded to include:

- designer
- reviewer

Where meta-data vocabularies are extended or replaced for use in Common Cartridge descriptions, an IMS Vocabulary Definition and Exchange (VDEX) document is required to define the new or extend vocabulary. See <http://www.imsglobal.org/vdex/index.html> for information on the IMS-VDEX-1.0 specification.

Common Cartridge vocabularies are fixed and may not be replaced, extended, or modified.



## 5. Implementation Guidelines and Best Practices

### 5.1 General Best Practices

A convention could be utilized based on some form of UID to prevent collisions with user generated web content folder names. Additionally, a subdirectory may be created to contain all Learning Application Object directories to further reduce the risk of collisions between Learning Application Object directories and those in the web content.

#### 5.1.1 Extensions to Resources Meta-data

Compliant systems must at least tolerate any structure attached to extension points.

#### 5.1.2 Accessibility

Extensions for accessibility supported in Content Packaging v1.2 have been incorporated into the schema for Common Cartridge v1.0. However, whilst these extensions are provided for use by those wishing to provide accessibility features, their use and implementation is not mandated for general use and they will not be addressed in any conformance tests developed.

For guidance on use of the accessibility extensions, see the Content Packaging v1.2 specification.

#### 5.1.3 Meta-data Rights Management

Copyright of a cartridge is defined as follows:

```
<rights>
<copyrightAndOtherRestrictions>
<value>yes</value>
</copyrightAndOtherRestrictions>
<description>
<string> 2006-2007 IMS Global Learning Consortium Inc.</string>
</description>
</rights>
```

## 5.2 Examples of Valid Common Cartridge File Structures

### 5.2.1 Sample 1 – Web Content and Learning Application Objects Both in Root

0001 <root>  
 0002 Imsmanifest.xml  
 0003 -----

#### Resource 0001 (Web Content Resource)

0004 Page001.htm  
 0005 Images\  
 0006 Image0001.gif

#### Resource 0002 (Web Content Resource)

0007 Media\  
 0008 Audio001.mp3

0009 -----  
 0010 LO001\  
 -----

#### Resource 0003 (Discussion Forum Resource)

0011 Welcome.forum

#### Resource 0004 (Associated Content Resource for Resource 0003)

0012 Welcome.gif  
 0013 Attachments\  
 0014 Gettingstarted.doc

0015 LO002\  
 -----

#### Resource 0005 (QTI Assessment Resource)

0016 Studymate.qti

0017 LO003\  
 -----

#### Resource 0006 (QTI Assessment Resource)

0018 Quiz1.qti

#### Resource 0007 (Associated Content Resource for Resource 0006)

0019 Sample.doc  
 0020 Images\  
 0021 Ques001.gif  
 0022 Ques002\_a.gif

#### Legend



Web Content Resource



Learning Application Object



Associated Content Resource

----- Empty Line



## 5.2.2 Sample 2 – Web Content in Root and Learning Application Objects in Subdirectory

0001 <root>

0002 Imsmanifest.xml

0003 -----

### Resource 0001 (Web Content Resource)

0004 Page001.htm

0005 Images\

0006 Image0001.gif

### Resource 0002 (Web Content Resource)

0007 Media\

0008 Audio001.mp3

0009 Data

0010 LO001\

### Resource 0003 (Discussion Forum Resource)

0011 Welcome.forum

### Resource 0004 (Associated Content Resource for Resource 0003)

0012 Welcome.gif

0013 Attachments\

0014 Gettingstarted.doc

0015 LO002\

### Resource 0005 (QTI Assessment Resource)

0016 Studymate.qti

0017 LO003\

### Resource 0006 (QTI Assessment Resource)

0018 Quiz1.qti

### Resource 0007 (Associated Content Resource for Resource 0006)

0019 Sample.doc

0020 Images\

0021 Ques001.gif

0022 Ques002\_a.gif

## Legend



Web Content Resource



Learning Application Object



Associated Content Resource

----- Empty Line

### 5.2.3 Sample 3 – Web Content and Learning Application Objects Both in Subdirectories

0001 <root>

0002 Imsmanifest.xml

0003 Content

**Resource 0001 (Web Content Resource)**

0004 Page001.htm

0005 Images\

0006 Image0001.gif

**Resource 0002 (Web Content Resource)**

0007 Media\

0008 Audio001.mp3

0009 Data

0010 LO001\

**Resource 0003 (Discussion Forum Resource)**

0011 Welcome.forum

**Resource 0004 (Associated Content Resource for Resource 0003)**

0012 Welcome.gif

0013 Attachments\

0014 Gettingstarted.doc

0015 LO002\

**Resource 0005 (QTI Resource)**

0016 Studymate.qti

0017 LO003\

**Resource 0006 (QTI Assessment Resource)**

0018 Quiz1.qti

**Resource 0007 (Associated Content Resource for Resource 0006)**

0019 Sample.doc

0020 Images\

0021 Ques001.gif

0022 Ques002\_a.gif

#### Legend



Web Content Resource



Learning Application Object



Associated Content Resource

----- Empty Line

## 5.2.4 Relative Paths

The following table illustrates all valid relative file reference scenarios for each resource.

### 5.2.4.1 Valid Relative File References

Resource	Valid Relative References
Resource 0001	Resource 0001, Resource 0002
Resource 0002	Resource 0001, Resource 0002
Resource 0003	Resource 0001, Resource 0002, Resource 0004
Resource 0004	Resource 0001, Resource 0002, Resource 0004
Resource 0005	Resource 0001, Resource 0002
Resource 0006	Resource 0001, Resource 0002, Resource 0007
Resource 0007	Resource 0001, Resource 0002, Resource 0007

The following three tables illustrate the required relative path to access another file in the root directory of another resource. An X in a box indicates that a relative reference to files in that resource are not allowed.

### 5.2.4.2 Relative Paths for Sample 1

Relative path to file in root of resource #							
Resource	0001	0002	0003	0004	0005	0006	0007
0001	./	./	X	X	X	X	X
0002	./	./	X	X	X	X	X
0003	../	../	X	./	X	X	X
0004	../	../	X	./	X	X	X
0005	../	../	X	X	X	X	X
0006	../	../	X	X	X	X	X
0007	../	../	X	X	X	./	./

### 5.2.4.3 Relative Paths for Sample 2

Relative path to file in root of resource #							
Resource	0001	0002	0003	0004	0005	0006	0007
0001	./	./	X	X	X	X	X
0002	./	./	X	X	X	X	X
0003	../..	../	X	./	X	X	X
0004	../..	../..	X	./	X	X	X
0005	../..	../..	X	X	X	X	X
0006	../..	../..	X	X	X	X	X
0007	../..	../..	X	X	X	./	./

### 5.2.4.4 Relative Paths for Sample 3

Relative path to file in root of resource #							
Resource	0001	0002	0003	0004	0005	0006	0007
0001	./	./	X	X	X	X	X
0002	./	./	X	X	X	X	X
0003	.././content/	.././content/	X	./	X	X	X
0004	.././content/	.././content/	X	./	X	X	X
0005	.././content/	.././content/	X	X	X	X	X
0006	.././content/	.././content/	X	X	X	X	X
0007	.././content/	.././content/	X	X	X	./	./

## 5.3 Content & Assessment Issues

### 5.3.1 Course Essentials

Provide comprehensive information about the course and its content, including, but not limited to:

- Full book title (including edition). If there is no corresponding book, provide the course title.
- Author(s)
- ISBN
- Publisher/Imprint/Business Unit/Discipline.
- Appropriate contact information, including editorial/author/support (email, phone number, etc.).
- Full URLs of any associated websites, along with appropriate access information if protected.
- A list of any special plug-ins or enabling technologies required for satisfactory use.
- Whenever possible, develop content for the broadest base of browser versions and operating systems in current use. Keep in mind that not everyone has the latest and greatest.
- Provide details for content (file types, how it is presented, etc.)
- Provide appropriate copyright information, including any restrictions on the content's use.

### 5.3.2 Course Design

#### 5.3.2.1 Keep it Simple!

Specialized coding, such as custom JavaScript modules, may work beautifully in one LMS/CMS environment, but may not work at all in another. Avoid it.

Use consistent file naming, with shorter file names wherever possible.

Avoid the use of glyphs, such as curly or typographer's quotation marks, which may not render properly in some platforms. Unfortunately, curly quotes is a default setting in MS Word. When this feature is active, straight quotation marks are automatically changed to curly quotes while typing. Disable it when authoring content for the Common Cartridge.

#### 5.3.2.2 Keep it Small!

Always keep course size in mind when designing and building a course. If any modules or features are repeated throughout the course, place them in a section that can hold these common elements. Doing this can dramatically cut down on the size of the cartridge. Optimally, a course should not be larger than 100 MB. Better yet, whenever possible, put larger, commonly-used files on a server, external to the course, and link to them there.

### 5.3.2.3 Use External Servers for Large and Commonly Used Files

Large files (such as PPT, Word/Excel, PDFs, movies and other media) generally should not be included within a course. Anything loaded within the course will tend to enlarge the course size and this will increase the time to download a course. When multiple instances of a course are installed on a server to support multiple sections, significant server space may be needlessly consumed with redundant content. Content stored on external servers will need to be made available to course users, though. For publishers, this will likely mean hosting content on a server that is globally accessible from the Internet. For a locally-produced university course, this may mean hosting content on a server accessible by the intended users – wherever they are, inside or outside of the university firewall.

### 5.3.2.4 Avoid “Platform-Specific” Language/Icons

Sometimes "platform-specific" language appears in assessments and or other pages of a course. This could be anything from instructions on how to submit a quiz for grading to module-specific information. Avoid such platform-specific language and/or icons in your course content.

### 5.3.2.5 Plan for Change

A professor can alter the look/feel of a course within minutes of installing it on a university server, so the design of a course should be kept clean and simple. Provide a simple yet professional banner and icon set for the course. It may be possible to use a generic set of icons for all courses.

### 5.3.2.6 Make it Compatible

Some platforms support multiple correct answers, while others may not. Some CMS support tutorial mode – where questions are presented one at a time – while others may not. Some systems may re-order questions. Some systems may support hints or feedback, but that feedback is generally for right or wrong answers and rarely support individualized feedback for each specific answer. Develop questions that will work on all platforms.

Develop assessments that the Common Cartridge currently supports:

- Multiple choice, single response
- Multiple choice, multiple response
- True/false
- Essay
- Fill-in-the-blank
- Patternmatch

See the Common Cartridge specifications for more information about the individual question types.

An assessment may include a reading, image, hyperlink to another website, or a set of instructions at the top of the quiz that are needed for the student to answer the questions. Decide how to handle these questions. The information can be included in each question, or the question can include a link to it.

Try to keep the quizzes in a course to a reasonable number. Otherwise, an instructor may encounter problems when using the course gradebook.

### 5.3.2.7 Check it

Proofread and QA the course content against the original source materials, ensure that all course elements function properly, and all external resources are appropriately available.

## 5.4 LMS Issues

## **5.5 Known Common Cartridge Issues**

## **5.6 Future Development**

It is planned to include a further Learning Tools Interoperability resource type in CC when the LTI specification has been finalized.

The IMS Content Packaging specification v1.2 is to be augmented with guidance on how to namespace in accessibility meta-data. It is intended that CC practice will follow the same approach, hence users wishing to implement support for accessibility should follow the CPv1.2 guidance.

The IMS CC K12 group is currently compiling recommendations for additional features for CC required by the K12 community. These will be considered for inclusion in the next and subsequent releases of CC.

## 6. Conformance

The Common Cartridge schema which profiles the CPv1.2 schema and the schemas which profile CC usage of LOM Metadata v1.0 and QTI v1.2.1 have been defined using the IMS SchemaProf tool v1.0. The tool produces a set of derived schemas, corresponding to the CC schema and its profiled auxiliary schemas, against which any cartridge must validate.

SchemaProf also allows the application of additional constraints which further constrain how CC may be used. These encompass:

- 1) Static constraints: The parameters (e.g. file names) are fixed in the profile (Example: `imsmanifest.xml` must exist at the root of the package)
- 2) Dynamic constraints: The parameters are taken from an instance document in the package (Example: href of a resource must point to a QTI file)
- 3) Conditional constraints: The constraint depends on a condition (Example: If parameter 'contenttype' is 'question' then attribute 'href' must point to a QTI file).

To be deemed to comply with the CC specification, cartridges must:

- Successfully validate against the CC schema set
- Satisfy all of the additional constraints.

### 6.1 Cartridge Compliance

IMS GLC will distribute a self-test tool to enable implementers to test their cartridges for compliance with the specification. Visit <http://www.imsglobal.org/cc/alliance.html> to access the latest version of the tool and its documentation.

#### 6.1.1 Cartridge Authorization

##### 6.1.1.1 Unprotected Cartridges

Use of CC Authorization for content protection is entirely optional for publishers and content providers. Therefore unprotected cartridges which meet the CC conformance requirements can claim CC compliance.

##### 6.1.1.2 Protected Cartridges

In addition to meeting the other conformance requirements, protected cartridges must also meet the following requirements in order to achieve CC compliance:

- Protected cartridges must include the standard CC Authorization meta-data. Optionally, they may also include proprietary authorization meta-data.
- The web service indicated in the standard CC Authorization meta-data must be a fully functioning standard CC Authorization web service.
- A user with a valid license must be able to obtain permission to access the protected resources in a cartridge by passing a valid access code to the standard CC Authorization web service (i.e. the referenced standard CC Authorization service may not be used simply to block access in the non-proprietary use case).

#### 6.1.2 Cartridge Assessments & Question Banks

The Common Cartridge supports profiles of the following question types:

- Multiple Choice (Single Response)
- Multiple Choice (Multiple Response)
- True/False
- Essay
- Simple Fill in the Blank – single response box with single correct answer that is processed as an exact match

- Pattern Match – single response box with multiple potential answers that support exact match, containment matching and regular expression matching

The profiles for each of these question types describe how they support optional features such as:

- feedback
- hints
- sample solutions
- relative scoring

In addition, questions support optional meta-data attributes which describe:

- a suggested weighting for the question in the assessment
- a category for the question.

Section 4.10 describes the use of these features as they are supported by the CC profile of QTIv1.2.1. Cartridge implementers wishing to use these optional features must adhere to the CC QTI schema and cartridges will be tested for compliance. However, it should be noted that support for these optional features is not mandatory for CC compliant platforms. Thus it cannot be assumed that all optional QTI features harnessed in a cartridge will be supported by a given platform.

### 6.1.3 Scope of Cartridge Tests

The self-test tool will:

- Test unzipping the cartridge.
- Test correctness and completeness of references in imsmanifest.
- Do XML validation of all XML files in the cartridge using namespaces for which profiles are defined in the CC spec (including imsmanifest and all QTI files).
- Report XML files in the package which were not checked (either since they did not concern CC or the namespace given was incorrect).
- Do Schematron validation for all XML files in the package for which the CC spec has defined conditional modifications.
- Enable further Content Packaging specific tests, not currently required by the CC profile (n.b. for inter-package references using xpointer, the test will confirm the existence of the remote package, but will not interrogate its content).
- Add support for additional constraints as created with SchemaProf, including:
  - Checking restriction of Mime types and file size.
  - Validating XML files in the package against arbitrary schemas specified in the domain profile.
  - Check correct use of VDEX vocabularies.
- Perform full validation against auxiliary profiles including an assertions and constraints associated with them.

### 6.1.4 Limitations of Cartridge Testing

- The testing tool will ensure the presence of appropriate media files for a learning application resource (e.g., mpg, jpg), but not verify their internal structure.
- The testing tool will not apply run-time tests to the cartridge content.
- CC requires that the cartridge meta-data identifies any client-side players or web-browser plug-ins required to run the content. This is expressed as free-text and so will not be tested.

### 6.1.5 Cartridge Additional Constraints

Appendix C lists the schema modifications and assertions imposed on the CC profile schema set. Appendix D lists the schematron rules applied to candidate cartridges. Note that these lists may be extended in the future and implementers are advised to access the most current list from: <http://www.imsglobal.org/cc/alliance.html>



## 6.2 LMS Compliance

From an LMS perspective, the CC specification defines:

- The syntax for cartridges which a platform must be able to successfully import.
- A set of features that the LMS must be capable of supporting at runtime.

The criteria for platform compliance are:

- Successful import of compliant cartridges without error.
- Correct runtime delivery of the content and features defined in compliant cartridges.
- Support for CC Authorization, the level of which determines the level of compliance (namely CC or CC lite) that the platform can claim against the CC specification.

No runtime model is defined for Common Cartridge, this being left as an issue for the implementer and therefore runtime behavior (in particular presentation) will differ across platforms.

A test data set of cartridges has been constructed for evaluating platform compliance as is described below.

Platform vendors are required to assess compliance by self-inspection using the available test data set corresponding to the version of CC that they have implemented.

### 6.2.1 CC Compliance

Only platforms which:

- Meet the conformance requirements identified in the CC specification and
- Fully implement the CC Authorization service

can claim CC compliance.

### 6.2.2 CC Lite Compliance

Full implementation of the CC Authorization service is not a requirement for 'CC lite' compliance. However, only platforms which meet the conformance requirements of the CC specification and which either:

- Routinely deny import of protected cartridges and deny any access to protected content, or
- Are able to process the additional proprietary authorization information included in a cartridge

can claim 'CC lite' compliance. It should be noted that systems which only support proprietary authorization will not be able to run cartridges which only include the open CC Authorization meta-data, hence their designation as being 'CC lite' compliant.

All systems must at least respect the implied restrictions placed on content as indicated by the CC Authorization meta-data that may exist in a cartridge. If a system that does not implement the CC Authorization service encounters a common cartridge that includes CC Authorization meta-data, the system must not import the cartridge. Instead the system should abort the import of the cartridge with an indication of the reason provided through an appropriate mechanism. If the import operation is interactive, a message should be displayed directly to the user. If the import operation is a batch or automated process, notification should be logged with any audit data provided.

The CC Authorization service is intended to provide an alternative to existing proprietary models for controlling access to content via an access code redemption model. However, the Common Cartridge specification also allows the inclusion of additional proprietary authorization information so that proprietary authorization models may be implemented alongside the standard CC Authorization model.

### 6.2.3 Cartridge Assessments & Question Banks

Section 4.9 describes the use of optional QTI features as they are supported by the CC profile of QTIv1.2.1. LMS platforms must support the six basic question types, but it is not mandated that an LMS platform must support any of these optional features. Thus when a compliant platform encounters such optional features included in a cartridge, the platform is at liberty to ignore any which it does not implement.

The IMS QTI specification offers great flexibility for implementers to select those features they wish to support or are required by their users. Given the present variability in existing QTI implementations, it is not feasible at this stage to mandate that all platforms must support all optional features associated with the supported question types.

#### 6.2.4 LMS Testing

The LMS vendor will conduct a self-administered test, based on the CC test data set. The platform must correctly import, store and deliver all of the examples in the test data set.

The following guidelines are offered for testing import of Common Cartridges into an LMS:

- 1) On import LMS should confirm that package has imported properly or that there were errors importing the package. Error messages should attempt to direct the user to the problem within the package such as identify a resource that could not be located within the package.
- 2) If the package requires import authorization, the LMS should prompt the user for an authorization key and confirm the authorization through the specified web service. If the LMS does not support authorization, the package should be rejected.
- 3) Verify that each item listed in the manifest appears in the content area for the course. The browsing structure should match that in the manifest.
- 4) Test each media link to confirm that it responds properly. Web content links should direct you to the appropriate site. References to content local to the package should a) find the referenced media and b) open the media with the appropriate device. (It is appropriate to attach a style sheet for html content local to the package. These style sheets should be respected in the display of content.)
- 5) If authorization is required at the content level, confirm that the LMS directs the user through the authorization process (same as above) prior to allowing access to the content. Authorization is not required for administrators or instructors. Again, if authorization is not supported, access to the content should be denied.
- 6) Assessment items: Import will vary depending on the LMS. However, the LMS should support any assessment option (time limit, feedback, question type) that is available for native content.
- 7) Verify that discussion topics import into a discussion forum appropriate for the course. A new topic should be created using the <text> in the xml as the prompt. Check each attachment link. Post to the topic as a test.

### 6.3 Test Data Set

A test data set of cartridges is available to members of the CC Alliance to enable self-testing of platforms for CC compliance. The test data set is comprised of two sets of example cartridges:

- Valid cartridges which exercise the scope of the features supported in the Common Cartridge.
- Known error cartridges which provide coverage of errors liable to occur in cartridges.

Implementers requiring access to the test data set should visit: <http://www.imsglobal.org/cc/jointhealliance.cfm>

## Appendix A – Profile XSDs

The Common Cartridge profile schema and auxiliary schemas are located at:

<http://www.imsglobal.org/profile/cc/ccv1p0>

The following table lists the namespaces applied to the CC profile, each with the corresponding physical location for the actual schema.

**Table A.1: Map of namespaces to schema locations.**

Namespace	Path
<a href="http://www.imsglobal.org/xsd/imscp_v1p1">http://www.imsglobal.org/xsd/imscp_v1p1</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/imscp_v1p2.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/imscp_v1p2.xsd</a>
<a href="http://www.imsglobal.org/xsd/imscv1p1">http://www.imsglobal.org/xsd/imscv1p1</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/imscv1p2_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/imscv1p2_localised.xsd</a>
<a href="http://www.imsglobal.org/xsd/imscv1p0">http://www.imsglobal.org/xsd/imscv1p0</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_0/imscv1p0_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_0/imscv1p0_localised.xsd</a>
<a href="http://ltsc.ieee.org/xsd/imscv1p1">http://ltsc.ieee.org/xsd/imscv1p1</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/lomLoose_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/lomLoose_localised.xsd</a>
<a href="http://ltsc.ieee.org/xsd/imscv1p1/unique">http://ltsc.ieee.org/xsd/imscv1p1/unique</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/loose.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/loose.xsd</a>
<a href="http://ltsc.ieee.org/xsd/imscv1p1/vocab">http://ltsc.ieee.org/xsd/imscv1p1/vocab</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/vocab/loose.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/vocab/loose.xsd</a>
<a href="http://ltsc.ieee.org/xsd/imscv1p1/extend">http://ltsc.ieee.org/xsd/imscv1p1/extend</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/extend/custom.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_1/extend/custom.xsd</a>
<a href="http://ltsc.ieee.org/xsd/LOM">http://ltsc.ieee.org/xsd/LOM</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/lomLoose_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/lomLoose_localised.xsd</a>
<a href="http://ltsc.ieee.org/xsd/LOM/unique">http://ltsc.ieee.org/xsd/LOM/unique</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/loose.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/loose.xsd</a>
<a href="http://ltsc.ieee.org/xsd/LOM/vocab">http://ltsc.ieee.org/xsd/LOM/vocab</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/vocab/loose.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/vocab/loose.xsd</a>
<a href="http://ltsc.ieee.org/xsd/LOM/extend">http://ltsc.ieee.org/xsd/LOM/extend</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/extend/custom.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_2/extend/custom.xsd</a>
<a href="http://www.imsglobal.org/xsd/imscp_extensionv1p2">http://www.imsglobal.org/xsd/imscp_extensionv1p2</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_3/imscp_extensionv1p2_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_3/imscp_extensionv1p2_localised.xsd</a>
<a href="http://www.imsglobal.org/xsd/imsqtiasiv1p2">http://www.imsglobal.org/xsd/imsqtiasiv1p2</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_4/imsqtiasiv1p2_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_4/imsqtiasiv1p2_localised.xsd</a>
<a href="http://www.imsglobal.org/xsd/imswl_v1p0">http://www.imsglobal.org/xsd/imswl_v1p0</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_5/imswl_v1p0_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_5/imswl_v1p0_localised.xsd</a>
<a href="http://www.imsglobal.org/xsd/imstdt_v1p0">http://www.imsglobal.org/xsd/imstdt_v1p0</a>	<a href="http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_6/imstdt_v1p0_localised.xsd">http://www.imsglobal.org/profile/cc/ccv1p0/derived_schema/domainProfile_6/imstdt_v1p0_localised.xsd</a>

## Appendix B – Profile Schema Package

The full set of files that define the Common Cartridge Application Profile are available as *ccv1p0.zip*.

The following files are located in the root directory of the zip-file:

- *imscp\_v1p2.xsd* – the original xsd for Content Packaging v1.2
- *imscc\_c1p2maeV0p15.xml* - defines the modifications made to the CPv1.2 xsd in creating the CC profile.
- *index.xml*
- *license.html*

There are also a number of subdirectories off the root, each containing a zip-file of an auxiliary profile as follows:

/profile_0/imscc_a.zip	Authorization profile
/profile_1/imscc_e.zip	Content Packaging extensions profile
/profile_2/imscc_m.zip	Cartridge meta-data IEEE LOM (loose binding) profile
/profile_3/imscc_mR.zip	Roles meta-data IEEE LOM (loose binding) profile
/profile_4/imscc_q.zip	Question & Test Interoperability profile
/profile_5/imscc_w.zip	IMS weblinks
/profile_6/imscc_d.zip	Discussion topics profile

These profiles are provided for inspection with the IMS SchemaProf tool.

Finally, the */derived\_schema* subdirectory contains the profiled XML schemas and Schematron rules. Only the files within this directory are used by the IMS Common Cartridge Test System. The derived schemas have names of the form *\_localised.xsd* while the files containing the derived Schematron rules have names ending in *\_constraintsDocument.scmf*.

The derived data for the IMS Content Packaging Profile is located immediately in the directory *derived\_schema*. The data for the auxiliary profiles are in the subdirectories named *domainProfile\_0*., *domainProfile\_6*.

The file *derived\_schema/config.xml* maps the namespaces specified in the Common Cartridge profile to the locations of the derived data (i.e. below the */derived\_schema* directory) defining the respective namespace.

**Table B.1 Mappings in */derived\_schemas/config.xml*.**

Namespace	xsd Location in Schema Package
http://www.imsglobal.org/xsd/imscp_v1p1	/derived_schema/imscp_v1p2.xsd
http://www.imsglobal.org/xsd/imscc/imscp_v1p1	/derived_schema/imscp_v1p2_localised.xsd
http://www.imsglobal.org/xsd/imsccauth_v1p0	/derived_schema/domainProfile_0/ imsccauth_v1p0_localised.xsd
http://ltsc.ieee.org/xsd/imscc/LOM	/derived_schema/domainProfile_1/lomLoose_localised.xsd
http://ltsc.ieee.org/xsd/imscc/LOM/unique	/derived_schema/domainProfile_1/loose.xsd
http://ltsc.ieee.org/xsd/imscc/LOM/vocab	/derived_schema/domainProfile_1/vocab/loose.xsd
http://ltsc.ieee.org/xsd/imscc/LOM/extend	/derived_schema/domainProfile_1/extend/custom.xsd
http://ltsc.ieee.org/xsd/LOM	/derived_schema/domainProfile_2/lomLoose_localised.xsd
http://ltsc.ieee.org/xsd/LOM/unique	/derived_schema/domainProfile_2/loose.xsd
http://ltsc.ieee.org/xsd/LOM/vocab	/derived_schema/domainProfile_2/vocab/loose.xsd
http://ltsc.ieee.org/xsd/LOM/extend	/derived_schema/domainProfile_2/extend/custom.xsd

Namespace	xsd Location in Schema Package
http://www.imsglobal.org/xsd/imscp_extensionv1p2	/derived_schema/domainProfile_3/ imscp_extensionv1p2_localised.xsd
http://www.imsglobal.org/xsd/ims_qtiasiv1p2	/derived_schema/domainProfile_4/ ims_qtiasiv1p2_localised.xsd
http://www.imsglobal.org/xsd/imswl_v1p0	/derived_schema/domainProfile_5/ imswl_v1p0_localised.xsd
http://www.imsglobal.org/xsd/imstdt_v1p0	/derived_schema/domainProfile_6/ imstdt_v1p0_localised.xsd

The Common Cartridge schema package defines the file locations for the namespaced profile schemas in the file /derived\_schema/config.xml

The auxiliary profiles are situated in the profile\_0..6 subdirectories of the unzipped profile. They can be directly loaded as zip with SchemaProf for inspection.

The derived schemas and Schematron rules used for testing are in the subdirectory derived\_schema.

/derived\_schema/config.xml maps namespaces to the locations of the derived schemas where they are defined.

# Appendix C – CC Changes to Profiled Base Schemas

## C1 - Application Profile Modifications to Content Packaging v1.2 Schema

In the CC schema package *ccv1p0.zip* the file */imscv\_c1p2maeV0p15.xml* documents the modifications made to the CPv1.2 schema for the CC profile. The contents of the file are reproduced below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<sp:schema_mod baseSchema="imscp_v1p2.xsd" level="restrictive" profileNamespace="http://www.ims-
global.org/xsd/imscv/imscp_v1p1" xmlns="http://www.ims-global.org/xsd/imscp_v1p1"
xmlns:ac="http://iwm.uni-koblenz.de/xsd/tel_addc_v1p1"
xmlns:sp="http://iwm.uni-koblenz.de/xsd/ims_apv1p6"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca-
tion="http://iwm.uni-koblenz.de/xsd/ims_apv1p6 http://iwm.uni-koblenz.de/xsd/ims_apv1p6">
<sp:annotation>
<sp:documentation category="general" xml:lang="en">This profile of IMS Content Packaging is based on
the status of the Common Cartridge Specification as of June 30, 2008. It has been created by Ingo
Dahn.</sp:documentation>
<sp:documentation category="name" xml:lang="en">IMS Common Cartridge Application Profile</sp:docu-
mentation>
<sp:documentation category="scope" xml:lang="en">This profile combines profiles of IMS Content Pack-
aging 1.2 and IEEE LOM. Moreover the IMS Common Cartridge Authorization Schema has been added as
a profile. The IMS Common Cartridge profile of QTI 1.2 has been added manually.</sp:documentation>
</sp:annotation>
<sp:modifications>
<sp:modification element="/xs:schema/xs:complexType[@name='Dependency.Type']">
<sp:assertion cnd="cnd9" subelement="./xs:attribute[@name='identifierref']">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">A Resource object which is a Learning Object
Web Content may contain Dependency objects which reference Resource objects with Type 'webcon-
tent'. (#S03)</sp:documentation>
</sp:annotation>
<sp:test>current() = /manifest/resources/resource[@type='webcontent']/@identifier</sp:test>
</sp:assertion>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='Item.Type']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]/xs:element[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">Every Item object with the exception of the
root Item must contain a Title object.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="unbounded" minOccurs="0" subelement="./xs:sequence[1]/xs:element[2]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">An item which represents a folder must not
have subitems. This is encoded as an assertion at item/@identifierref</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:assertion subelement="./xs:attribute[@name='identifierref']">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">An Item object which represents a folder is
indicated by the absence of an IdentifierRef characteristic object. Folder Items support unlimited nest-
ing of other folder Items and learning object link Items. Learning Application Resource Item objects
may be nested by folder Item object but may not nest other folder or Learning Application resource
Item objects. (#S04)</sp:documentation>
</sp:annotation>
<sp:test>count(.. /item)=0</sp:test>
</sp:assertion>
<sp:attribute_properties subelement="./xs:attribute[@name='isvisible']" type="NoIsVisible" use="prohib-
ited">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The use of the isvisible attribute of the item
```

element is prohibited. Instead, roles should be used to determine resources which are for instructors only.

```

</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
<sp:attribute_properties subelement="./xs:attribute[@name='parameters']" type="NoParameters"
use="prohibited">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">Parameters characteristic object of Item is
prohibited by Common Cartridge</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
<sp:assertion cnd="cnd1" subelement=".">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">If an item is invisible, its descendants must be
invisible too.(#S02)</sp:documentation>
</sp:annotation>
<sp:test>count(./item)=count(./item[@isvisible='false'])</sp:test>
</sp:assertion>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='Manifest.Type']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]/xs:element[1]">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The metadata element must be present at the
manifest level.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[4]">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">A manifest in an IMS Common Cartridge can-
not contain submanifests.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:modification element="./xs:sequence[1]/xs:group[1]">
<sp:element_extension maxOccurs="unbounded" minOccurs="0" profile="profile_0/imscc_a.zip" subele-
ment="./xs:sequence[1]/xs:any[1]" />
</sp:modification>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='ManifestMetadata.Type']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]/xs:element[1]">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The schema element must be present in meta-
data at manifest level.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:modification element="./xs:sequence[1]/xs:element[1]">
<sp:attribute_properties fixed="IMS Common Cartridge" subelement="." type="schemaFixed">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The schema element of the metadata at the
manifest level must have the value 'IMS Common Cartridge'</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]/xs:element[2]">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The schemaversion element of the metadata
at the manifest level must be present.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:modification element="./xs:sequence[1]/xs:element[2]">
<sp:attribute_properties fixed="1.0.0" subelement="." type="schemaversionFixed">
</sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The schemaversion element of the metadata
at the manifest level must have the value '1.0.0'.</sp:documentation>
</sp:annotation>

```



```

</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:sequence[1]/xs:group[1]">
=<sp:element_extension maxOccurs="unbounded" minOccurs="0" profile="profile_2/imscc_m.zip" subelement="/xs:sequence[1]/xs:any[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">At the manifest level, the Common Cartridge profile of IEEE LOM loose must be used, which corresponds to unqualified Dublin Core.</sp:documentation>
</sp:annotation>
</sp:element_extension>
</sp:modification>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='Metadata.Type']">
=<sp:modification element="/xs:sequence[1]/xs:group[1]">
=<sp:element_extension maxOccurs="unbounded" minOccurs="0" profile="profile_3/imscc_mR.zip" subelement="/xs:sequence[1]/xs:any[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">For the metadata at the resource level IEEE LOM must be used. Roles of 'Learner' and 'Instructor' can be used as 'intendedEndUserRole'.</sp:documentation>
</sp:annotation>
</sp:element_extension>
</sp:modification>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='Organization.Type']">
=<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]/xs:element[2]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">A cartridge with a folder Organization should always be rooted on a single Item container object. It is not permissible to have two sibling Item containers below the Organization. The root Item container object just represents the root node of the Organization tree and has no other semantic or presentational meaning.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:modification element="/xs:sequence[1]/xs:element[2]">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The root item element must not contain a Title value object.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:attribute_properties subelement="/xs:attribute[@name='identifierref']" type="NoIdentifierRef" use="prohibited">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The root <item> element must not be a Learning Object Item.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="/xs:attribute[@name='parameters']" type="NoParameter" use="prohibited">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">Parameters characteristic object of Item is prohibited by CC</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:attribute_properties fixed="rooted-hierarchy" subelement="/xs:attribute[@name='structure']" type="rootedHierarchy" use="required">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The Organization object must contain a Structure characteristic object with the value rooted-hierarchy.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>

```

```

=<sp:modification element="/xs:schema/xs:complexType[@name='Organizations.Type']">
=<sp:cardinality maxOccurs="1" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The folder content type is represented by the
IMS Organizations container object type. A common cartridge may have a single Organization or no
Organization. Only 'Learner Experience' resources may be included in the <organization> hierarchy.
Operational data (authentication, cartridge-level metadata) are defined via discrete resource types
within the package. Supplemental resources must not appear in the organization. The LMS provides a
way for the instructor/facilitator to inspect/deploy/utilize these resources as they see fit.</sp:documen-
tation>
  </sp:annotation>
  </sp:cardinality>
=<sp:attribute_properties subelement="/xs:attribute[@name='default']" type="defaultOrganizationPro-
hibited" use="prohibited">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The Default characteristic of the Organizations
object is prohibited as it has no meaning in Common Cartridge.</sp:documentation>
  </sp:annotation>
  </sp:attribute_properties>
  </sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='Resource.Type']">
=<sp:cardinality maxOccurs="unbounded" minOccurs="0" subelement="/xs:sequence[1]/xs:element[2]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The number of files must be 1 for some
resource types. This is defined as an assertion for Resource.Type</sp:documentation>
  </sp:annotation>
  </sp:cardinality>
=<sp:cardinality maxOccurs="unbounded" minOccurs="0" subelement="/xs:sequence[1]/xs:element[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">Dependencies are not allowed or mandatory
for certain resource types. This is defined at the Resource.Type.</sp:documentation>
  </sp:annotation>
  </sp:cardinality>
=<sp:assertion cnd="cnd0" subelement="/xs:sequence[1]/xs:element[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">A Resource object which is a Discussion Topic
associated resource may contain Dependency objects which reference Resource objects with Type 'web-
content' or 'associatedcontent/imscv1p0/learning-application-resource'.(#S12)</sp:documenta-
tion>
  </sp:annotation>
  <sp:test>current()/@identifierref = /manifest/resources/resource[@type='webcontent']/@identifier
or current()/@identifierref = /manifest/resources/resource[@type='associatedcon-
tent/imscv1p0/learning-application-resource']/@identifier</sp:test>
  </sp:assertion>
=<sp:assertion cnd="cnd14" subelement="/xs:sequence[1]/xs:element[3]">
  <sp:test>current()/@identifierref = /manifest/resources/resource[@type='webcontent']/@identi-
fier</sp:test>
  </sp:assertion>
=<sp:assertion cnd="cnd16" subelement="/xs:sequence[1]/xs:element[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">A Resource object which is an assessment may
contain Dependency objects which reference Resource objects with Type 'webcontent' or 'associated-
content/imscv1p0/learning-application-resource'.(#S14)</sp:documentation>
  </sp:annotation>
  <sp:test>(current()/@identifierref = /manifest/resources/resource[@type='webcontent']/@identi-
fier) or (current()/@identifierref = /manifest/resources/resource[@type='associatedcon-
tent/imscv1p0/learning-application-resource']/@identifier)</sp:test>
  </sp:assertion>
  <sp:attribute_properties subelement="/xs:attribute[@name='type']" type="predefinedContentTypes" />
=<sp:attribute_properties subelement="/xs:attribute[@name='href']">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">For some resource types the href attribute is
mandatory or prohibited. This is defined at Resource.Type.</sp:documentation>
  </sp:annotation>
  </sp:attribute_properties>

```

```

=<sp:attribute_extension profile="profile_1/imscc_e.zip profile_0/imscc_a.zip" subelement="./xs:anyAt-
tribute[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">If authorization is applied to individual
resources within the cartridge rather than the cartridge as a whole, this can be specified using the Pro-
tected characteristic which is an extension characteristic applied to the Resource object. At the exten-
sion point of the Resource.Type also the variant element of the content packaging extension schema is
allowed.</sp:documentation>
</sp:annotation>
</sp:attribute_extension>
=<sp:assertion cnd="cnd10" subelement=".">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">If a cartridge web content or associated con-
tent resource is linked from a Learning Application Object link Item object it must have an Href charac-
teristic object which represents the launchable resource.(#S05)</sp:documentation>
</sp:annotation>
<sp:test>count(./@href)=1</sp:test>
</sp:assertion>
=<sp:assertion cnd="cnd2" subelement=".">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">For Discussion Topic Resources the Resource
object must contain a single File object which references the Discussion Topic descriptor XML file which
conforms to the http://www.imsglobal.org/xsd/imsdt_v1p0 schema. It must not have any href
attribute.(#S06)</sp:documentation>
</sp:annotation>
<sp:test>count(./file)=1 and count(./@href)=0</sp:test>
</sp:assertion>
=<sp:assertion cnd="cnd3" subelement=".">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">For Web Link Resources the Resource object
must contain a single File object which references the Web Link descriptor XML file which conforms to
the http://www.imsglobal.org/xsd/imswl_v1p0 schema. It must contain neither Dependency objects
nor an href attribute.(#S07)</sp:documentation>
</sp:annotation>
<sp:test>count(./file)=1 and count(./dependency)=0 and count(./@href)=0</sp:test>
</sp:assertion>
=<sp:assertion cnd="cnd7" subelement=".">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">For Assessment or Question Bank Resources
the Resource object must contain a single File object which references the QTI XML file. This file must
conform to the IMS CC profile of QTI 1.2.1. The profile is contained in the package of this profile as
imscc_q*.xdm. The derived schema of this QTI profile is in the package of this profile with the name
ims_qtiasiv1p2_localised.xsd. The resource must not have an href attribute(#S11)</sp:documentation>
</sp:annotation>
<sp:test>count(./file)=1 and count(./@href)=0</sp:test>
</sp:assertion>
</sp:modification>
=<sp:modification element="/xs:schema/xs:group[1]">
=<sp:element_extension maxOccurs="0" minOccurs="0" namespace="##other" subele-
ment="./xs:sequence[1]/xs:any[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">Deactivating all extension points except where
explicitly allowed.</sp:documentation>
</sp:annotation>
</sp:element_extension>
</sp:modification>
</sp:modifications>
=<sp:definitions>
  <sp:condition id="cnd14" name="InAssociatedContent">../@type='associatedcon-
tent/imscc_xmlv1p0/learning-application-resource'</sp:condition>
  <sp:condition id="cnd16" name="InAssessment">../@type='imsqti_xmlv1p2/imscc_xmlv1p0/assess-
ment'</sp:condition>
  <sp:condition id="cnd11" name="Resource is Web Content or Associated Content">(../@type='webcon-
tent' or ../@type='associatedcontent/imscc_xmlv1p0/learning-application-resource')</sp:condition>
  <sp:condition id="cnd10" name="Referenced Resource is Web Content or Associated Content and is ref-

```

```

erenced from an Item"> (./@type='webcontent' or ./@type='associatedcontent/imscc_xmlv1p0/learn-
ing-application-resource') and ./@identifier = //item/@identifierref</sp:condition>
<sp:condition id="cnd13" name="Resource is Question
Bank">../@type='imsqti_xmlv1p2/imscc_xmlv1p0/question-bank'</sp:condition>
<sp:condition id="cnd12" name="true">true</sp:condition>
<sp:condition id="cnd8" name="Associated Content, Discussion Topic, Assessment or Question
Bank">../@type='associatedcontent/imscc_xmlv1p0/learning-application-resource' or
../@type='imsdt_xmlv1p0' or ../@type='imsqti_xmlv1p2/imscc_xmlv1p0/assessment' or
../@type='imsqti_xmlv1p2/imscc_xmlv1p0/question-bank'</sp:condition>
<sp:condition id="cnd7" name="Assessment or Question
Bank"> (./@type='imsqti_xmlv1p2/imscc_xmlv1p0/assessment') or
(./@type='imsqti_xmlv1p2/imscc_xmlv1p0/question-bank')</sp:condition>
<sp:condition id="cnd3" name="Web Link">../@type='imswl_xmlv1p0'</sp:condition>
<sp:condition id="cnd2" name="Discussion Topic">../@type='imsdt_xmlv1p0'</sp:condition>
<sp:condition id="cnd1" name="Invisible">@isvisible='false'</sp:condition>
<sp:condition id="cnd9" name="Associated Content (context: dependency-element)">../@type='asso-
ciatedcontent/imscc_xmlv1p0/learning-application-resource'</sp:condition>
<sp:condition id="cnd0" name="InDiscussionTopic">../@type='imsdt_xmlv1p0'</sp:condition>
<xs:simpleType name="NoIdentifierRef">
<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="NoIsVisible">
<xs:restriction base="xs:boolean">
<xs:whiteSpace value="collapse" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="NoParameter">
<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="NoParameters">
<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="OptionalHref">
<xs:restriction base="xs:anyURI">
<xs:whiteSpace value="collapse" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="ProhibitedHref">
<xs:restriction base="xs:anyURI">
<xs:whiteSpace value="collapse" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="RequiredHref">
<xs:restriction base="xs:anyURI">
<xs:whiteSpace value="collapse" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="defaultOrganizationProhibited">
<xs:restriction base="xs:IDREF">
<xs:whiteSpace value="collapse" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="isNotVisible">
<xs:restriction base="xs:boolean">
<xs:whiteSpace value="collapse" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="predefinedContentTypes">

```

```

=<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
<xs:enumeration value="imsdt_xmlv1p0" />
<xs:enumeration value="imswl_xmlv1p0" />
<xs:enumeration value="webcontent" />
<xs:enumeration value="imsqti_xmlv1p2/imsc_xmlv1p0/assessment" />
<xs:enumeration value="imsqti_xmlv1p2/imsc_xmlv1p0/question-bank" />
<xs:enumeration value="associatedcontent/imsc_xmlv1p0/learning-application-resource" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="rootedHierarchy">
=<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="schemaFixed">
=<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="schemaversionFixed">
=<xs:restriction base="xs:string">
<xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<ac:fileConstraint constrID="imsmanifest.xml exists">
=<ac:fileURI absolute="false">
=<ac:annotation>
<ac:documentation category="explanation" xml:lang="en">At the top level of the package there must be a
file named imsmanifest.xml.</ac:documentation>
</ac:annotation>
<ac:specific value="imsmanifest.xml" />
</ac:fileURI>
</ac:fileConstraint>
=<ac:fileConstraint constrID="Referenced files must exist">
=<ac:fileURI absolute="false" format="url">
=<ac:annotation>
<ac:documentation category="explanation" xml:lang="en">Referenced files must exist.</ac:documenta-
tion>
</ac:annotation>
=<ac:constraintLocation location="/xs:schema/xs:complexType[@name='Resource.Type']">
<ac:constraintLocation location="./xs:attribute[@name='href']" />
</ac:constraintLocation>
</ac:fileURI>
</ac:fileConstraint>
</sp:definitions>
<sp:mappings />
</sp:schema_mod>

```

## C2 - Application Profile Modifications to the Content Packaging v1.2 Extension Schema

In the CC schema package *ccv1p0.zip* the zip file */profile\_1/imsc\_e.zip* contains the file *imsc\_e.xml* which documents the modifications made to the CPv1.2 extension schema for the CC profile. The contents of the file are reproduced below.

```

<?xml version="1.0" encoding="UTF-8" ?>
=<sp:schema_mod baseSchema="imscp_extensionv1p2.xsd" level="restrictive" profileNa-
mespace="http://www.imsglobal.org/xsd/imscp_extensionv1p2" xmlns="http://www.imsglo-
bal.org/xsd/imscp_extensionv1p2" xmlns:ac="http://iwml.uni-koblenz.de/xsd/tel_addc_v1p1"

```

```

xmlns:sp="http://iwm.uni-koblenz.de/xsd/ims_apv1p6" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca-
tion="http://iwm.uni-koblenz.de/xsd/ims_apv1p6 http://iwm.uni-koblenz.de/xsd/ims_apv1p6">
<sp:annotation>
  <sp:documentation category="general" xml:lang="en">This profile of the extension schema of IMS CP 1.2
restricts extensions to use the variant element only.</sp:documentation>
</sp:annotation>
<sp:modifications>
  <sp:modification element="/xs:schema/xs:element[1]">
  <sp:assertion subelement=".">
  </sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">ipointer ist not allowed in Common Car-
tridges</sp:documentation>
</sp:annotation>
<sp:test>local-name(.) != 'ipointer'</sp:test>
</sp:assertion>
</sp:modification>
<sp:modification element="/xs:schema/xs:element[3]">
<sp:assertion subelement=".">
</sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">lingualTitle is not allowed in Common Car-
tridges.</sp:documentation>
</sp:annotation>
<sp:test>local-name(.) != lingualTitle</sp:test>
</sp:assertion>
</sp:modification>
</sp:modifications>
<sp:definitions />
<sp:mappings />
</sp:schema_mod>

```

## C3 - Application Profile Modifications to IEEE LOM V1.0 Loose Schema for Cartridge Meta-data (Unqualified Dublin Core)

In the CC schema package *ccv1p0.zip* the zip file */profile\_2/imsc\_m.zip* contains the file *imsc\_m.xml* which documents the modifications made to the IEEE Loose schema for the CC Cartridge Metadata profile. The contents of the file are reproduced below.

```

<?xml version="1.0" encoding="UTF-8" ?>
<sp:schema_mod baseSchema="lomLoose.xsd" level="restrictive" profileNa-
mespace="http://ltsc.ieee.org/xsd/imsc/LOM" xmlns="http://ltsc.ieee.org/xsd/LOM"
xmlns:ac="http://iwm.uni-koblenz.de/xsd/tel_addc_v1p1"
xmlns:ag="http://ltsc.ieee.org/xsd/LOM/unique" xmlns:ex="http://ltsc.ieee.org/xsd/LOM/extend"
xmlns:sp="http://iwm.uni-koblenz.de/xsd/ims_apv1p6"
xmlns:voc="http://ltsc.ieee.org/xsd/LOM/vocab" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca-
tion="http://iwm.uni-koblenz.de/xsd/ims_apv1p6 http://iwm.uni-koblenz.de/xsd/ims_apv1p6">
<sp:annotation>
  <sp:documentation category="conformance" xml:lang="en">This profile restricts 'IEEE LOM 1.0 loose' to
the elements needed to cover unqualified Dublin Core. dc:contributor, dc:creator, dc:publisher map to
lifeCycle.contribute.entity with appropriate value of lifeCycle.contribute.role, dc:coverage maps to gen-
eral.coverage, dc:date maps to lifeCycle.contribute.date, dc:description maps to general.description,
dc:format maps to technical.format, dc:identifier maps to general.identifier, dc:language maps to gen-
eral.language, dc:relation maps to Relation, dc:rights maps to Rights, dc:source is not mapped, dc:sub-
ject maps to general.keyword (see also classification.keyword), dc:title maps to general.title dc:type
maps to Educational.learningResourceType</sp:documentation>
  <sp:documentation category="scope" xml:lang="en">This profile is used within the Common Cartridge
specification.</sp:documentation>
  <sp:documentation category="name" xml:lang="en">IMS Common Cartridge profile of IEEE LOM V1.0
loose for unqualified Dublin Core</sp:documentation>
</sp:annotation>

```



```

=<sp:modifications>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='classification']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[5]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='contribute']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[4]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification baseSchema="common/vocabTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='copyrightAndOtherRestrictionsVocab']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification baseSchema="common/vocabTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='costVocab']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='educational']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">interactivityType is unused.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">interactivityLevel is unused.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[4]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">semanticDensity is unused.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[5]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">intendedEndUserRole is unused.</sp:documen-
tation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[6]">

```



```

=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">Context is unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[7]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">typicalAgeRange is unused.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[8]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">difficulty is unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[9]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">typicalLearningTime is unused.</sp:documen-
tation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[10]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">description is unused in educational con-
text.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[11]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">language unused in technical context, only in
general context.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[12]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='general']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[7]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">General.structure is unused.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[8]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">General.aggregationLevel is unused.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[9]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='identifier']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">

```

```

=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
  </sp:annotation>
  </sp:cardinality>
  </sp:modification>
=<sp:modification baseSchema="common/vocabTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='kindVocab']">
  <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
  </sp:annotation>
  </sp:cardinality>
  </sp:modification>
=<sp:modification baseSchema="common/dataTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='LanguageString']">
  <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
  </sp:annotation>
  </sp:cardinality>
  </sp:modification>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='learningResourceType']">
  <sp:modification element="./xs:complexContent[1]/xs:extension[1]">
  <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
  </sp:annotation>
  </sp:cardinality>
  </sp:modification>
=<sp:modification baseSchema="common/vocabTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='learningResourceTypeValue']">
  <sp:attribute_properties fixed="IMS Common Cartridge" subelement="./xs:simpleContent[1]"
type="ImCCType">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">learningResourceType must be 'IMS Common
Cartridge'</sp:documentation>
  </sp:annotation>
  </sp:attribute_properties>
  </sp:modification>
=<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='lifeCycle']">
  <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">liveCycle.version is unused.</sp:documenta-
tion>
  </sp:annotation>
  </sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[2]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">lifeCycle.status is unused.</sp:documentation>
  </sp:annotation>
  </sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[4]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
  </sp:annotation>
  </sp:cardinality>

```

```

</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='lom']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">metaMetadata is unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[8]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">lom.annotation is unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[10]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
= <sp:modification baseSchema="common/vocabTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='purposeVocab']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[1]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='relation']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='resource']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='rights']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[4]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='taxon']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>

```

```

</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='taxonPath']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
= <sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='technical']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[2]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">technical.size is unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[3]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">technical.location is unused.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[4]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">technical.requirement is unused.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[5]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">technical.installationRemarks is
unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[6]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">technical.otherPlatformRequirements is
unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[7]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">technical.duration is unused.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:group[8]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">No custom elements are allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
</sp:modifications>
= <sp:definitions>
= <xs:simpleType name="ImsCCType">
= <xs:restriction base="xs:string">
  <xs:whiteSpace value="preserve" />
  <xs:enumeration value="IMS Common Cartridge" />
</xs:restriction>
</xs:simpleType>
</sp:definitions>
<sp:mappings />
</sp:schema_mod>

```

## C4 - Application Profile Modifications to IEEE LOM V1.0 Loose Schema for Roles Meta-data

In the CC schema package *ccv1p0.zip* the zip file */profile\_3/imscc\_mR.zip* contains the file *imscc\_mR.xml* which documents the modifications made to the IEEE Loose schema for the CC Roles Metadata profile. The contents of the file are reproduced below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<sp:schema_mod baseSchema="lomLoose.xsd" level="restrictive" profileName="
mespace="http://ltsc.ieee.org/xsd/imsccMR/LOM" xmlns="http://ltsc.ieee.org/xsd/LOM"
xmlns:ac="http://iwm.uni-koblenz.de/xsd/tel_addc_v1p1"
xmlns:ag="http://ltsc.ieee.org/xsd/LOM/unique" xmlns:ex="http://ltsc.ieee.org/xsd/LOM/extend"
xmlns:sp="http://iwm.uni-koblenz.de/xsd/ims_apv1p6"
xmlns:voc="http://ltsc.ieee.org/xsd/LOM/vocab" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
http://iwm.uni-koblenz.de/xsd/ims_apv1p6 http://iwm.uni-koblenz.de/xsd/ims_apv1p6">
<sp:modifications>
<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='context']">
<sp:modification element="./xs:complexContent[1]/xs:extension[1]">
<sp:modification element="./xs:choice[1]/xs:element[1]">
<sp:attribute_properties subelement="./xs:simpleContent[1]" type="SourceIEELOM">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The source for a context object is fixed to
'LOMv1.0'</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
<sp:modification element="./xs:choice[1]/xs:element[2]">
<sp:attribute_properties subelement="./xs:simpleContent[1]" type="HEContext">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The value of context is fixed to 'higher educa-
tion'.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
</sp:modification>
</sp:modification>
<sp:modification baseSchema="common/elementTypes.xsd" element="/xs:schema/xs:complex-
Type[@name='intendedEndUserRole']">
<sp:modification element="./xs:complexContent[1]/xs:extension[1]">
<sp:modification element="./xs:choice[1]/xs:element[1]">
<sp:attribute_properties subelement="./xs:simpleContent[1]" type="RoleVocab">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">The vocabulary for intendedEndUserRole is
'IMSGLC_CC_Rolesv1p0'.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
<sp:modification element="./xs:choice[1]/xs:element[2]">
<sp:attribute_properties subelement="./xs:simpleContent[1]" type="RolesValues">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">Possible intendedEndUserRoles are only
'Learner' and 'Instructor'.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
</sp:modification>
</sp:modification>
</sp:modifications>
<sp:definitions>
<xs:simpleType name="SourceIEELOM">
<xs:restriction base="voc:source">
```

```

<xs:whiteSpace value="preserve" />
<xs:enumeration value="LOMv1.0" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="HEContext">
<xs:restriction base="voc:context">
<xs:whiteSpace value="preserve" />
<xs:enumeration value="higher education" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="RoleVocab">
<xs:restriction base="voc:source">
<xs:whiteSpace value="preserve" />
<xs:enumeration value="IMSGLC_CC_Rolesv1p0" />
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="RolesValues">
<xs:restriction base="voc:intendedEndUserRole">
<xs:whiteSpace value="preserve" />
<xs:enumeration value="Learner" />
<xs:enumeration value="Instructor" />
</xs:restriction>
</xs:simpleType>
</sp:definitions>
<sp:mappings />
</sp:schema_mod>

```

## C5 - Application Profile Modifications to Question & Test Interoperability v1.2 Schema

In the CC schema package *ccv1p0.zip* the zip file */profile\_4/imscq.q.zip* contains the file *imscq.q.xml* which documents the modifications made to the QTIv1.2 schema for the CC QTI profile. The contents of the file are reproduced below.

```

<?xml version="1.0" encoding="UTF-8" ?>
<sp:schema_mod baseSchema="ims_qtiasiv1p2.xsd" level="restrictive" profileName="
mespace="http://www.imsglobal.org/xsd/ims_qtiasiv1p2" xmlns="http://www.imsglo-
bal.org/xsd/ims_qtiasiv1p2" xmlns:ac="http://iwm.uni-koblenz.de/xsd/tel_addc_v1p1"
xmlns:sp="http://iwm.uni-koblenz.de/xsd/ims_apv1p6"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca-
tion="http://iwm.uni-koblenz.de/xsd/ims_apv1p6 http://iwm.uni-koblenz.de/xsd/ims_apv1p6">
<sp:annotation>
<sp:documentation category="general" xml:lang="en">This is the profile of QTI 1.2 used for the Common
Cartridge specification. The root element is 'questestinterop'.</sp:documentation>
</sp:annotation>
<sp:modifications>
<sp:modification element="/xs:schema/xs:complexType[@name='altmaterialType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">altmaterial must not contain qticomment ele-
ment.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:choice[1]/xs:ele-
ment[10]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">altmaterial/mat_extension has been
removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>

```

```

=<sp:attribute_properties subelement="/xs:attribute[@ref='xml:lang']" type="xs:language">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In almaterial the lang attribute must be of
type xs:language.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='andType']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[2]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/and has been removed</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/or is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[4]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/unanswered is removed.</sp:documenta-
tion>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[5]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/other is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[7]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/varIt is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[8]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/varlte is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[9]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/vargt is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[10]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">and/vargte is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[11]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element varsubset is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[12]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element varinside is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[13]">

```



```

=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element varsubstring is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[14]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element durequal is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[15]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element durlt is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[16]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element durlte is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[17]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element durgt is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[18]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In and the element durgte is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='assessmentType']">
=<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">The assessment must consist of only one sec-
tion. Optional presentation material is also supported.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[1]" />
=<sp:cardinality maxOccurs="1" minOccurs="0" subelement="./xs:sequence[1]/xs:element[1]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment qticomment is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[2]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment duration is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="1" minOccurs="0" subelement="./xs:sequence[1]/xs:element[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment qtimetadata is optional but
may occur only once.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[4]">
=<sp:annotation>

```

```

    <sp:documentation category="explanation" xml:lang="en">In assessment objectives is not
allowed.</sp:documentation>
  </sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[5]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment assessmentcontrol is not
allowed.</sp:documentation>
  </sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[6]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment rubric is not allowed.</sp:docu-
mentation>
  </sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[8]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment outcomes_processing is not
allowed.</sp:documentation>
  </sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[9]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment assesproc_extension is not
allowed.</sp:documentation>
  </sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[10]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment assessfeedback is not
allowed.</sp:documentation>
  </sp:annotation>
</sp:cardinality>
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[11]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In assessment selection_ordering is not
allowed.</sp:documentation>
  </sp:annotation>
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= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">conditionvar/not is removed.</sp:documentation>
  </sp:annotation>
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  <sp:documentation category="explanation" xml:lang="en">conditionvar/or is removed.</sp:documenta-

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tion>
  </sp:annotation>
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  = <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[4]">
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allowed.</sp:documentation>
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name']" type="ScoreOnlyType">
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SCORE</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
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sion[1]/xs:attribute[@name='vartype']" type="DecimalIntegerOnly">
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ues Integer and Decimal only</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
<sp:attribute_properties subelement="./xs:simpleContent[1]/xs:exten-
sion[1]/xs:attribute[@name='defaultval']" use="prohibited">
<sp:annotation>
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tation>
</sp:annotation>
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sion[1]/xs:attribute[@name='members']" use="prohibited">
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tation>
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<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[8]" />
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removed.</sp:documentation>
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</sp:modification>

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=<sp:modification element="/xs:schema/xs:complexType[@name='hintmaterialType']">
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allowed.</sp:documentation>
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  <sp:documentation category="explanation" xml:lang="en">In hint the element qticomment is not
allowed.</sp:documentation>
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=<sp:attribute_properties subelement="/xs:attribute[@name='feedbackstyle']" type="CompleteOnly">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">hint@feedbackstyle: The material is presented
in the form of flow_mat only. The only form of feedback is 'Complete'.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='itemfeedbackType']">
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=<sp:annotation>
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flow_mat only. material, solution and hint have been removed.</sp:documentation>
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  <sp:documentation category="explanation" xml:lang="en">In itemfeedback material is not
allowed.</sp:documentation>
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=<sp:attribute_properties subelement="/xs:attribute[@name='view']" type="AllOnlyValue">
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  <sp:documentation category="explanation" xml:lang="en">In itemfeedback the view attribute is fixed to
'All'.</sp:documentation>
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</sp:attribute_properties>
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=<sp:modification element="/xs:schema/xs:complexType[@name='itemmetadataType']">
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=<sp:annotation>
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data.</sp:documentation>
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=<sp:cardinality maxOccurs="unbounded" minOccurs="1" subelement="/xs:sequence[1]/xs:element[1]">
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data</sp:documentation>
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allowed.</sp:documentation>
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=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In itemmetadata qmd_feedbackpermitted is

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not allowed.</sp:documentation>
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not allowed.</sp:documentation>
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=<sp:annotation>
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allowed.</sp:documentation>
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allowed.</sp:documentation>
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sensation, resprocessing and itemfeedback.</sp:documentation>
</sp:annotation>
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<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[5]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[6]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[7]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[10]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[12]" />
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ited.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="./xs:attribute[@name='label']" use="prohibited">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In item the attribute label is prohib-
ited.</sp:documentation>
</sp:annotation>

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</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='matappletType']">
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='entityref']" use="prohibited">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In matapplet the attribute entityref is prohibited.</sp:documentation>
</sp:annotation>
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</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='matapplicationType']">
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=<sp:modification element="/xs:schema/xs:complexType[@name='matemtextType']">
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  <sp:documentation category="explanation" xml:lang="en">matemtext@lang must be of type xs:language.</sp:documentation>
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</sp:cardinality>
=<sp:attribute_properties subelement="/xs:attribute[@name='label']" type="string256">
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=<sp:attribute_properties subelement="/xs:attribute[@ref='xml:lang']" type="xs:language">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In material the attribute lang must be of type language.</sp:documentation>

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</sp:annotation>
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</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='matimageType']">
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</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='mattextType']">
=<sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@ref='xml:lang']" type="xs:language">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In mattext the value of attribute lang must be of type xs:language.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='entityref']" use="prohibited">
=<sp:annotation>
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</sp:annotation>
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</sp:modification>
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  <sp:documentation category="explanation" xml:lang="en">In matvideo the entityref attribute is prohibited.</sp:documentation>
</sp:annotation>
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</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[2]">
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</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[3]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">not/not is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[4]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">not/unanswered is removed.</sp:documentation>
</sp:annotation>
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=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[5]">
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=<sp:annotation>
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</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[9]">
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  <sp:documentation category="explanation" xml:lang="en">not/vargt is removed.</sp:documentation>
</sp:annotation>
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=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[10]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">not/vargte is removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[11]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is varsubset not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[12]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is varinside not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[13]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is varsubstring not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[14]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is durequal not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[15]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is durlt not allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[16]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is durlte not allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[17]">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In element not is durgt not allowed.</sp:docu-
mentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[18]">
=<sp:annotation>

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<sp:documentation category="explanation" xml:lang="en">In element not is durgte not allowed.</sp:doc-
umentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='objectbankType']">
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<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:choice[1]/xs:ele-
ment[1]" />
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='orType']">
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[11]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element varsubset is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[12]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element varinside is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[13]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element varsubstring is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[14]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element durequal is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[15]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element durIt is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[16]">
=<sp:annotation>
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allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[17]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element durgt is not
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</sp:annotation>
</sp:cardinality>
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[18]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In or the element durgte is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='outcomesType']">
=<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]">
=<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">Outcomes: A single variable is permitted. This

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is "SCORE".</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]" />
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]/xs:sequence[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In outcomes there is a single variable 'SCORE'
declared.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:sequence[1]/xs:ele-
ment[2]" />
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='presentation_materialType']">
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]" />
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='presentationType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">presentation has only subelements flow,
material, response_lid, response_str.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subele-
ment="/xs:sequence[1]/xs:choice[1]/xs:choice[1]/xs:element[3]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subele-
ment="/xs:sequence[1]/xs:choice[1]/xs:choice[1]/xs:element[5]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subele-
ment="/xs:sequence[1]/xs:choice[1]/xs:choice[1]/xs:element[6]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subele-
ment="/xs:sequence[1]/xs:choice[1]/xs:choice[1]/xs:element[7]" />
<sp:attribute_properties subelement="/xs:attribute[@ref='xml:lang']" type="xs:language">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">presentation@lang must be of type xs:lan-
guage.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='qtimetadataType']">
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In qtimetadata the vocabulary element has
been removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='questestinteropType']">
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">qticomment is not allowed in questestint-
erop.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subele-
ment="/xs:sequence[1]/xs:choice[1]/xs:choice[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">questestinterop can contain only an object
bank or an assessment, no sections or items.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='render_choiceType']">
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]" />

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</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='render_fibType']">
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">render_fib/response_na has been
removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='respconditionType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">respcondition can contain only conditionvar,
setvar and displayfeedback.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:element[5]" />
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='response_labelType']">
<sp:cardinality maxOccurs="unbounded" minOccurs="0" subelement="/xs:choice[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_label can contain only material,
material_ref and flow_mat.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:choice[1]/xs:element[1]" />
=<sp:attribute_properties subelement="/xs:attribute[@name='rarea']" type="EclipseOnlyType">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_label@rarea must not be used. Will
default to 'Eclipse'.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="/xs:attribute[@name='rrange']" type="ExactOnlyType">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_label@rrange must not be used. Will
default to 'Exact'.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='response_lidType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_lid supports only render_choice,
render_fib and render_extension, material and material_ref.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:choice[2]/xs:ele-
ment[2]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:choice[2]/xs:ele-
ment[3]" />
=<sp:cardinality maxOccurs="0" minOccurs="0" subelement="/xs:sequence[1]/xs:choice[2]/xs:ele-
ment[5]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_lid/render_extension has been
removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='response_strType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="/xs:sequence[1]">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_str can have only subelements
render_choice, render_fib and render_extension, material and material_ref.</sp:documentation>

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</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[2]/xs:ele-
ment[2]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[2]/xs:ele-
ment[3]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[2]/xs:ele-
ment[5]" />
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">response_str/render_extension has been
removed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='resprocessingType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]" />
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">resprocessing can have only outcomes and
resprecondition.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[1]/xs:ele-
ment[2]" />
<sp:attribute_properties subelement="./xs:attribute[@name='scoremodel']" use="prohibited">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In resprocessing the scoremodel attribute is
prohibited.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
<sp:modification element="/xs:schema/xs:complexType[@name='sectionType']">
<sp:cardinality maxOccurs="1" minOccurs="1" subelement="./xs:sequence[1]" />
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">In section can only contain items. qticomment,
duration, qtimetadadata, objectives, sectioncontrol, sectionpostcondition, sectionprecondition, rubric,
presentation_material, outcomes_processing, sectionproc_extension, sectionfeedback,
selection_ordering, reference, itemref, sectionref, section are not allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[2]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[3]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[4]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[5]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[6]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[7]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[8]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[9]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[10]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[11]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[12]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[13]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[14]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[1]/xs:ele-
ment[1]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[1]/xs:ele-
ment[3]" />
<sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:choice[1]/xs:ele-
ment[4]" />
<sp:attribute_properties subelement="./xs:attribute[@ref='xml:lang']" type="xs:language">
<sp:annotation>
<sp:documentation category="explanation" xml:lang="en">lang must be of type xs:language.</sp:docu-
mentation>

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</sp:annotation>
</sp:attribute_properties>
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='setvarType']">
= <sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='action']" type="SetAddSubtractOnly">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In setvar the action attribute can have only
the values Set, Add and Subtract.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='solutionmaterialType']">
  <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:choice[1]/xs:element[1]" />
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='solutionType']">
= <sp:cardinality maxOccurs="0" minOccurs="0" subelement="./xs:sequence[1]/xs:element[1]">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In solution qticomment is not
allowed.</sp:documentation>
</sp:annotation>
</sp:cardinality>
= <sp:attribute_properties subelement="./xs:attribute[@name='feedbackstyle']" type="CompleteOnly">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In solution the feedbackstyle attribute can
have only the value Complete.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='unansweredType']">
= <sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='respidient']" type="string32">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In unanswered the length of the respident
attribute is limited to 32.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='varequalType']">
= <sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" use="prohibited">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">varequal@index is prohibited.</sp:documenta-
tion>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='vargteType']">
= <sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='respidient']" type="string32">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In vargte the length of the respident attribute
is limited to 32.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
= <sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" type="string2">
= <sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In vargte the length of the index attribute is
limited to 2.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
= <sp:modification element="/xs:schema/xs:complexType[@name='vargtType']">

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=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='respident']" type="string32">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In vargt the length of the respident attribute
is limited to 32.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" type="string2">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In vargt the length of the index attribute is
limited to 2.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='varlteType']">
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='respident']" type="string32">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In varlte the length of the attribute respident
is limited to 32.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" type="string2">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In varlte the length of the attribute index is
limited to 2.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='varlType']">
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='respident']" type="string32">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In varlt the length of the respident attribute is
limited to 32.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" type="string2">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In varlt the value of the index attribute is lim-
ited to 2.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='varsubsetType']">
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='respident']" type="string32">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In varsubset the length of the respident
attribute is limited to 32.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
=<sp:attribute_properties subelement="/xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" type="string2">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">In varsubset the length of the index attribute
is limited to 2.</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modification>
=<sp:modification element="/xs:schema/xs:complexType[@name='varsubstringType']">

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=<sp:attribute_properties subelement="./xs:simpleContent[1]/xs:extension[1]/xs:attribute[@name='index']" use="prohibited">
=<sp:annotation>
  <sp:documentation category="explanation" xml:lang="en">varsubstring@index is prohibited</sp:documentation>
</sp:annotation>
</sp:attribute_properties>
</sp:modifications>
</sp:modifications>
=<sp:definitions>
=<xs:simpleType name="AllOnlyValue">
=<xs:restriction>
=<xs:simpleType>
=<xs:restriction base="xs:NMTOKEN">
=<xs:enumeration value="All" />
<xs:enumeration value="Administrator" />
<xs:enumeration value="AdminAuthority" />
<xs:enumeration value="Assessor" />
<xs:enumeration value="Author" />
<xs:enumeration value="Candidate" />
<xs:enumeration value="InvigilatorProctor" />
<xs:enumeration value="Psychometrician" />
<xs:enumeration value="Scorer" />
<xs:enumeration value="Tutor" />
</xs:restriction>
</xs:simpleType>
<xs:whiteSpace value="collapse" />
<xs:enumeration value="All" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="CompleteOnly">
=<xs:restriction>
=<xs:simpleType>
=<xs:restriction base="xs:NMTOKEN">
=<xs:enumeration value="Complete" />
<xs:enumeration value="Incremental" />
<xs:enumeration value="Multilevel" />
<xs:enumeration value="Proprietary" />
</xs:restriction>
</xs:simpleType>
<xs:whiteSpace value="collapse" />
<xs:enumeration value="Complete" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="DecimalIntegerOnly">
=<xs:restriction>
=<xs:simpleType>
=<xs:restriction base="xs:NMTOKEN">
=<xs:enumeration value="Integer" />
<xs:enumeration value="String" />
<xs:enumeration value="Decimal" />
<xs:enumeration value="Scientific" />
<xs:enumeration value="Boolean" />
<xs:enumeration value="Enumerated" />
<xs:enumeration value="Set" />
</xs:restriction>
</xs:simpleType>
<xs:whiteSpace value="collapse" />
<xs:enumeration value="Integer" />
<xs:enumeration value="Decimal" />
</xs:restriction>
</xs:simpleType>

```

```

=<xs:simpleType name="DummyType">
=<xs:restriction base="xs:string">
  <xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="ScoreOnlyType">
=<xs:restriction base="xs:string">
  <xs:whiteSpace value="preserve" />
  <xs:enumeration value="SCORE" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="SetAddSubtractOnly">
=<xs:restriction>
=<xs:simpleType>
=<xs:restriction base="xs:NMTOKEN">
  <xs:enumeration value="Set" />
  <xs:enumeration value="Add" />
  <xs:enumeration value="Subtract" />
  <xs:enumeration value="Multiply" />
  <xs:enumeration value="Divide" />
</xs:restriction>
</xs:simpleType>
  <xs:whiteSpace value="collapse" />
  <xs:enumeration value="Set" />
  <xs:enumeration value="Add" />
  <xs:enumeration value="Subtract" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="string1024">
=<xs:restriction base="xs:string">
  <xs:maxLength value="1024" />
  <xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="string16">
=<xs:restriction base="xs:string">
  <xs:maxLength value="16" />
  <xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="string2">
=<xs:restriction base="xs:string">
  <xs:maxLength value="2" />
  <xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="string256">
=<xs:restriction base="xs:string">
  <xs:maxLength value="256" />
  <xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="string32">
=<xs:restriction base="xs:string">
  <xs:maxLength value="32" />
  <xs:whiteSpace value="preserve" />
</xs:restriction>
</xs:simpleType>
=<xs:simpleType name="string4">
=<xs:restriction base="xs:string">
  <xs:maxLength value="4" />
  <xs:whiteSpace value="preserve" />

```

```
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="EclipseOnlyType">
  <xs:restriction>
    <xs:simpleType>
      <xs:restriction base="xs:NMTOKEN">
        <xs:enumeration value="Ellipse" />
        <xs:enumeration value="Rectangle" />
        <xs:enumeration value="Bounded" />
      </xs:restriction>
    </xs:simpleType>
    <xs:whiteSpace value="collapse" />
    <xs:enumeration value="Ellipse" />
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="ExactOnlyType">
  <xs:restriction>
    <xs:simpleType>
      <xs:restriction base="xs:NMTOKEN">
        <xs:enumeration value="Exact" />
        <xs:enumeration value="Range" />
      </xs:restriction>
    </xs:simpleType>
    <xs:whiteSpace value="collapse" />
    <xs:enumeration value="Exact" />
  </xs:restriction>
</xs:simpleType>
</sp:definitions>
<sp:mappings />
</sp:schema_mod>
```

## Appendix D – CC Schematron Rules for the Profiled Content Packaging v1.2 Schema

The CC schema package *ccv1p0.zip* contains the file */derived\_schema/imscp\_v1p2\_constraintsDocument.scm* which documents the schematron rules applied to the CPv1.2 schema for the CC CP profile. The contents of the file are reproduced below.

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.ascc.net/xml/schematron">
  <ns prefix="xs" uri="http://www.w3.org/2001/XMLSchema" />
  <ns prefix="xsd" uri="http://www.w3.org/2001/XMLSchema" />
  <ns prefix="xsi" uri="http://www.w3.org/2001/XMLSchema-instance" />
  <ns prefix="ac" uri="http://iwm.uni-koblenz.de/xsd/tel_addc_v1p1" />
  <ns prefix="ims" uri="http://www.imsglobal.org/xsd/imscv1p1" />

<!-- *****
*****-->
  <!--** Constraints document - this document holds Schematron rules that have been generated from **-->
  <!--** AP condition and assertion elements. IMPORTANT: If this document exists, it MUST be **-->
  <!--** used in the validation of instances derived from the resultant schema - failure to do so **-->
  <!--** can result in an instance that does not conform to either the base schema or the **-->
  <!--** Application Profile. **-->

<!-- *****
*****-->

  <pattern name="pattern_3">
    <rule context="ims:manifest/ims:resources/ims:resource/ims:dependency">
      <assert test="(not(../@type='associatedcontent/imscv1p0/learning-application-resource')) or (current()/@identifierref = /ims:manifest/ims:resources/ims:resource[@type='webcontent']/@identifier)">Assertion
failed for pattern_3. A Resource object which is a Learning Object associated resource may contain Dependency
objects which reference Resource objects with Type 'webcontent'. (#S03)</assert>
    </rule>
  </pattern>

  <pattern name="pattern_4">
    <rule context="ims:manifest/ims:organizations/ims:organization//ims:item">
      <assert test="count(../@identifierref)=0 or count(../ims:item)=0">Assertion failed for pattern_4. An Item object
which represents a folder is indicated by the absence of an IdentifierRef characteristic object. Folder Items support
unlimited nesting of other folder Items and learning object link Items. Learning Application Resource Item objects
may be nested by folder Item object but may not nest other folder or Learning Application resource Item
objects. (#S04)</assert>
    </rule>
  </pattern>

  <pattern name="pattern_5">
    <rule context="ims:manifest/ims:resources/ims:resource">
      <assert test="not((../@type='webcontent' or ../@type='associatedcontent/imscv1p0/learning-application-resource') and ../@identifier = //ims:item/@identifierref) or count(../@href)=1">Error: Assertion failed for
pattern_5: If a cartridge web content or associated content resource is linked from a Learning Application Object link
Item object it must have an Href characteristic object which represents the launchable resource. (#S05)</assert>
    </rule>
  </pattern>

  <pattern name="pattern_6">
    <rule context="ims:manifest/ims:resources/ims:resource">
      <assert test="not(../@type='imsdt_xmlv1p0') or (count(../ims:file)= 1 and count(../@href)=0)">Error: Assertion
failed for pattern_5: For Discussion Topic Resources the Resource object must contain a single File object which ref-
erences the Discussion Topic descriptor XML file which conforms to the http://www.imsglobal.org/xsd/imsdt_v1p0
schema. Discussion Topic resources must not contain href (#S06)</assert>
    </rule>
  </pattern>

  <pattern name="pattern_7">
    <rule context="ims:manifest/ims:resources/ims:resource">
      <assert test="not(../@type='imswl_xmlv1p0') or (count(../ims:file) = 1 and count(../ims:dependency)=0 and
```

count(./@href=0)">Error: Assertion validation failed for pattern\_7: For Web Link Resources the Resource object must contain a single File object which references the Web Link descriptor XML file which conforms to the [http://www.imsglobal.org/xsd/imsdl\\_v1p0\\_schema](http://www.imsglobal.org/xsd/imsdl_v1p0_schema). It must contain neither Dependency objects nor an href attribute. (#S07) </assert>

</rule>  
</pattern>

<pattern name="pattern\_11a">  
  <rule context="ims:manifest/ims:resources/ims:resource">  
    <assert test="not(./@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/assessment') or (count(./ims:file) = 1 and count(./@href=0)">Error: Assertion validation failed for pattern\_11a: For Assessment resources the Resource object must contain a single File object which references the QTI XML file. This file must conform to the IMS CC profile of QTI 1.2.1. The profile is contained in the package of this profile as imscx\_q\*.zip. The derived schema of this QTI profile is in the package of this profile with the name imscx\_qtisiv1p2\_localised.xsd. The resource must not have an href attribute (#S11a) </assert>

</rule>  
</pattern>

<pattern name="pattern\_11b1">  
  <rule context="ims:manifest/ims:resources/ims:resource">  
    <assert test="not(./@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/question-bank') or (count(./ims:file) = 1)">Error: Assertion validation failed for pattern\_11b1: For Question Bank resources the Resource object must contain a single File object which references the QTI XML file. (#S11b1) </assert>

</rule>  
</pattern>

<pattern name="pattern\_11b2">  
  <rule context="ims:manifest/ims:resources/ims:resource">  
    <assert test="not(./@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/question-bank') or (count(./@href=0)">Error: Assertion validation failed for pattern\_11b2: A Question Bank Resource must not have an href attribute. (#S11b2) </assert>

</rule>  
</pattern>

<pattern name="pattern\_11b3">  
  <rule context="ims:manifest/ims:resources/ims:resource">  
    <assert test="not(./@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/question-bank') or ( not(//ims:item[@identifier-ref]=./@identifier) )">Error: Assertion validation failed for pattern\_11b3: A Question Bank Resource must not be referenced from an item. (#S11b3) </assert>

</rule>  
</pattern>

<pattern name="pattern\_11b4">  
  <rule context="ims:manifest/ims:resources/ims:resource">  
    <assert test="not(./@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/question-bank') or (count(//ims:resource[@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/question-bank'])=1)">Error: Assertion validation failed for pattern\_11b4: There can be only one Questionbank Resource in a cartridge. (#S11b4) </assert>

</rule>  
</pattern>

<pattern name="pattern\_12">  
  <rule context="ims:manifest/ims:resources/ims:resource/ims:dependency">  
    <assert test="(not(./@type='imsdt\_xmlv1p0')) or (current()/@identifierref = /ims:manifest/ims:resources/ims:resource[@type='webcontent']/@identifier) or (current()/@identifierref = /ims:manifest/ims:resources/ims:resource[@type='associatedcontent/imscx\_xmlv1p0/learning-application-resource']/@identifier)">Assertion failed for pattern\_12. A Resource object which is a Discussion Topic associated resource may contain Dependency objects which reference Resource objects with Type 'webcontent' or 'associatedcontent/imscx\_xmlv1p0/learning-application-resource'. (#S12) </assert>

</rule>  
</pattern>

<pattern name="pattern\_14">  
  <rule context="ims:manifest/ims:resources/ims:resource/ims:dependency">  
    <assert test="(not(./@type='imsqti\_xmlv1p2/imscx\_xmlv1p0/assessment')) or (current()/@identifierref = /ims:manifest/ims:resources/ims:resource[@type='webcontent']/@identifier) or (current()/@identifierref = /ims:manifest/ims:resources/ims:resource[@type='associatedcontent/imscx\_xmlv1p0/learning-application-resource']/@identifier)">Assertion failed for pattern\_14. A Resource object which is an assessment may contain Dependency objects which reference Resource objects with Type 'webcontent' or 'associatedcontent/imscx\_xmlv1p0/learn-



```
ing-application-resource'. (#S14) </assert>
</rule>
</pattern>

<pattern name="pattern_15">
  <rule context="ims:manifest/ims:resources/ims:resource/ims:dependency">
    <assert test="(not(../@type='imsqti_xmlv1p2/imsc_xmlv1p0/question-bank')) or (current()/@identfierref =
/ims:manifest/ims:resources/ims:resource[@type='webcontent']/@identifier) or (current()/@identfierref =
/ims:manifest/ims:resources/ims:resource[@type='associatedcontent/imsc_xmlv1p0/learning-application-resourc
e']/@identifier)">Assertion failed for pattern_15. A Resource object which is a Question Bank may contain Depen-
dency objects which reference Resource objects with Type 'webcontent' or 'associatedcontent/imsc_xmlv1p0/learn-
ing-application-resource'. (#S15) </assert>
  </rule>
</pattern>

</schema>
```

## About This Document

<b>Title</b>	IMS Common Cartridge Profile
<b>Editor</b>	Kevin Riley
<b>Co-Leads</b>	Erik Unjhem, David Mills
<b>Version</b>	v1.0
<b>Version Date</b>	1 October 2008
<b>Status</b>	Final Specification v1.0
<b>Summary</b>	This document contains the profile information for Common Cartridge, an open format for the distribution of rich, web-based content.
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## Revision History

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*Date: 1 October 2008*