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ASPECT

Conformance Testing Tools

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e*Content*plus

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[1] OJ L 79, 24.3.2005, p. 1.

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1 Executive Summary

Conformance testing is a major way to ensure interoperability of systems. In this document we are concerned with testing the conformance of data with respect to profiles of specifications. The basics of data conformance testing are described in the first Section. This includes an introduction to profiling possibilities, to application profiles and domain profiles. The following major part explains how the LRE Metadata Domain Profile has been encoded in a machine-readable form. This profile is used by the Learning Resource Exchange (LRE) and by Workpackages 2 and 5 of the ASPECT project. The value of this encoding is that it enables us to create a conformance testing tool that is specifically built for this profile. This takes up a development initiated by the earlier TELCERT project (IST-507128) under the European Union's Framework Programme 6). The use of the test system is then described. Finally, a number of test systems for other specifications, available from third parties, are described.

2 Testing for Standards

The major objective of introducing technical standards is to improve interoperability. Interoperability problems occur at a variety of levels.

- Humans (users, developers, providers) need to share approximately the same understanding of intended interactions and of the meaning of the data they need to exchange in order to interoperate.
- Systems need to agree on the format of the data they send and receive in order to interoperate.
- Services need to agree on the sequences of messages which they can accept and send in order to interoperate.

While in practice all these levels occur simultaneously, they exhibit quite different characteristics when it comes to conformance testing. Agreement of users on important characteristics of documents is normally achieved as a result of an iterative communication process involving the exchange of narrative documents. These documents are not machine-processable and they are not guaranteed to be unambiguous. Hence, testing for conformance with such documents has to be carried out by humans. Committees are set up to resolve cases of dispute and to augment the specifying documents where needed. In connection with the semantic web, initiatives have been made to encode semantics in standard formats. These require extensive efforts to agree on the semantics of data and services. Currently (2009) these have not yet proven to be feasible for major standardization initiatives in the field of e-learning.

For syntactic data interoperability, the situation is much more mature. XML Schema, Schematron, Relax NG and RDF are available to precisely specify which data is considered conformant and which is not. Specifications, defined formally using these languages, can be used to build tools for automated conformance testing. These languages also have different expressive power and, therefore, can provide different sets of conditions to be tested. Of course, some conformance conditions exist in real use cases that are not expressible in any of those languages and for which specification languages have to be defined in an ad hoc way.

For XML Schemas a broad range of tools – commercial as well as open source – is available (W3C, 2008). XML Schemas as well as Relax NG are well-suited to express complex data structures. Unlike XML Schemas, Schematron rules (Schematron, 2009) can express conditions where the admitted values in one part of a document under test may depend on the content of other related parts. Schematron validators are available commercially as well as open source (Jellife, 2006). RDF has its strengths in supporting a seamless link with semantic web technologies. It emphasizes the specification of relations between data. While RDF can be easily used to specify sets of name-value pairs, as used for Dublin Core metadata, it makes it hard to specify complex, deeply nested data structures as those used by the IEEE LOM specification.

When designing conformance test tools, the language in which conformance is specified, plays a crucial role. The available tool support for those languages limits the tools that can be provided by a Best Practice Network like ASPECT. Fortunately, the data and metadata formats used in the project are specified using XML Schemas. This opens up a set of opportunities to adapt available tools to the needs of the project with limited development efforts as will be described below.

For the sake of completeness, let us shortly discuss the situation for testing conformance of services. For the purpose of the project, web services that communicate using the REST or SOAP protocols are of interest. REST uses name-value-pairs as parts of URLs. Values may point to complex structures but this is outside the scope of the REST specification. REST leaves agreement on the admissible name/value pairs largely to the user and it is therefore unsuitable to base complex testing procedures on it. For SOAP-based services, the Web Service Description Language WSDL (W3C, 2001) allows precise specification of service interfaces and of their expected request/response behaviour. XML Schema is used to specify the formats of the data that can be exchanged. Therefore, testing data for XML Schema defined structural conditions, as described in this document, is a necessary prerequisite for testing WSDL specified web services. Beyond specification of stateless request/response acts, there is relatively little agreement on ways to specify the behaviour of web services on a complex service-oriented architecture.

In the public discussion, conformance testing is often understood in different ways. In the commercial world, conformance to a standard has a legal meaning. Standards are controlled by international or national bodies like ISO, CEN or DIN. Only these bodies can set up conformance programs, appoint conformance agencies that test for conformance and issue conformance certificates to products and services which apply for them. Vendors who get their products or services certified accept a legal obligation to respect the standard and to correct their production process should some non-conformance be detected in the future. Often, such conformance certificates are important for a vendor's marketing activities. Conformance agencies can also resolve disputes on the interpretation of standards. Clearly, the ASPECT project is neither entitled nor empowered to set up such a conformance program. Nevertheless, as will be described below, it can make an important contribution to the practical use of standards and specifications of data formats.

In the field of e-learning, no strict conformance program exists in the sense described above. SCORM certification, nevertheless, comes close to it. A discussion held in 2007 among IMS members, as well as the survey carried out by the ASPECT project (Heckmann, 2009), has indicated that tools and content providers in the e-learning sector have little interest in investing in the establishment of new certification programs. There is, however, a remarkable

interest in having conformance testing tools available for self testing. This has led a number of IMS Global Learning members to provide funding for the development of flexible test tools that can now be adapted and re-used by members of ASPECT thanks to a Memorandum of Understanding concluded with the IMS Global Learning Consortium.

The key practical problem here is the difficulty for content providers to deliver content to a variety of learning management systems that are beyond their control. This implies the need for extensive tests before products can be released. Better support for testing provides a clear added value in this situation.

In the next section we describe some typical problems of conformance testing. In particular we discuss the role of application profiles in the e-learning domain and its effect on conformance testing. Then the LRE Metadata Application Profile version 4 (LRE METADATA) will be described as a case for developing a specific test system. Sections 4 and 6 explain the technological approach taken to provide that test system. Working with the LRE METADATA test system will be explained in Section 6. Section 7 discusses limitations of this system and the need for further development. The last Section introduces a number of related test systems available from third parties.

3 Specifying Data Conformance

A data specification generally consists of an information model that defines the structure and semantics of data and from which different bindings can be derived (e.g., an XML schema).

Information models also define which data elements are mandatory, optional, and recommended. Note that the existence of mandatory elements is suitable for automated verification as well as the non-existence of elements which are neither mandatory nor optional. However, declaring an element as recommended has no other consequence for conformance testing than declaring it as optional – the element may be present but may as well be omitted. It is, however, possible to define a “recommended application profile” (see below in this Section) where each recommended element is made mandatory. In this case, testing for conformance with this application profile would issue a message for each recommended data item that has not been used in the item under test.

Information models are technology-neutral. The same information model can be implemented in a variety of data structures. The precise data structures to be used are defined in so-called ‘bindings’. Usually these bindings bind the elements of the information model to XML elements and attributes (XML Binding).

Different languages can be used for the definition of these data structures. For example, data structures defined using RDF will normally considerably differ from data structures defined using XML Schema, even if they utilise the same information model. Using different data structures disturbs data exchange and interoperability. In such situations, translation programs, based on the joint information model, must be developed to re-establish interoperability.

Particular communities or contexts of use may require different data. A specification may have been built to cover a broad range of very different use cases. In contrast, for a particular

community, it may neither be feasible nor necessary to support all those use cases. In this situation, the community may agree on an application profile that describes exactly which parts of the general specification must be supported. The following explanation of the fundamentals of application profiling is quoted from ASPECT Deliverable D3.1 (Heckmann, 2009).

> *Each data specification describes the set of documents that are compliant with this specification. But for particular communities slightly different sets of documents may be relevant. A description of how this specific set deviates from the set of documents described in the specification is called an application profile.*
>
> *For example, some elements which are optional in the specification may be mandatory or prohibited in the specific profile. There may be also the need to include data which are only of interest for this particular community and which have not been foreseen in the specification. Or, for particular fields, only a community specific set of values is allowed.*
>
> *In practice, applications often use several specifications simultaneously. For example, a specification for packaging content may be used together with a specification for the metadata which describe the content. When several specifications, together with a description of how they are to be combined, are adapted to the needs of a community, this is called a domain profile.*

Further explanations can be found in Deliverable D3.1 (Heckmann, 2009) and in the IMS Application Profiling Guidelines (IMS, 2009). The LRE METADATA application profile, for which we provide a test system, is a domain profile based on the specifications IMS ILOX (EUN, 2009) and IEEE LOM loose (IEEE, 2005).

Application profiles provide particular challenges for conformance testing. They often reflect the current need of a community which is bound to change as practice in this community develops and as the community engages in dialogues and exchanges with other communities. Every change of the application profile needs to be reflected in an adaptation of the tools used to test for compliance with this profile. However, making such adaptations and developing a tailor-made test system requires competencies which are beyond the potential of most communities.

The TELCERT project addressed this challenge from 2004-2006 (Telcert, 2006). Among its results was the SchemaProf tool, developed by IWM Koblenz, to capture application profiles in a machine-readable format. The TELCERT vision was to automatically create a test system for each application profile captured by SchemaProf. TELCERT duly achieved this objective for some sample profiles. After the end of the project, IMS Global Learning took up the TELCERT results and a group of IMS members funded the further development of an IMS Approved SchemaProf tool and a Generic Test System. The IMS Common Cartridge Test System, made freely available by IMS to members of the Common Cartridge Alliance in 2008 (IMS, 2009), was the first test system to be released for a domain profile.

The ASPECT project and the development of the LRE METADATA application profile test system, described in this document, will benefit from these developments based on a Memorandum of Understanding of the ASPECT Consortium with IMS Global Learning. At the same time, the work described here feeds back to the development of IMS tools by being

part of the beta test phase for Version 2.0 of the IMS Approved SchemaProf Tool and the IMS Generic Test System.

It should be noted that the TELCERT technology is applicable to any specification with an XML binding using XML Schemas. It does not presuppose any particular features of the specifications of IMS Global Learning. It should also be noted, that test systems for profiles of IMS specifications, like the one described in this document, must not be distributed without permission of IMS Global Learning.

The next two sections describe the SchemaProf Application Profiling Tool and the Generic Test System as far as it is necessary to understand the features of the LRE METADATA application profile test system. For a full explanation, the reader is referred to the documentation of the respective software.

4 The SchemaProf Application Profiling Tool

Application profiles describe changes made to a specification. In practice, several specifications are often used together. Consequently, there arises the need to profile several specifications simultaneously, as well as the need to define the ways in which they are used together. Such application profiles of a number of specifications are called *domain profiles*. In particular the LRE Application Profile, which is used to produce the test system described in this document, is a domain profile.

The domain profiles produced with the help of the SchemaProf tool are machine-readable. When such a profile is saved, SchemaProf produces a number of files that can be directly or indirectly used for testing the conformance of data with respect to the given domain profile. The SchemaProf tool captures domain profiles for specifications based on XML Schemas. Apart from saving the domain profile in an XML format, it produces

- XML Schemas that can be used to validate instance documents with any XML validator
- A set of Schematron rules (Schematron, 2009) that can be used to validate requirements which depend upon particular situations in the instance document under test. Instance documents can be validated against such a set of Schematron rules using Schematron validators which are freely available on the web (Jellife, 2006). It is important to note that Schematron rules can express requirements that cannot be expressed in XML Schemas.
- Definitions of further tests that do not concern the structure of individual XML files but the structure of zipped packages of files. These are not relevant for the LRE Domain Profile Test System and are therefore not further discussed in this document.

The machine-readable application and domain profiles produced by SchemaProf can be used to create specific Test Systems to test the conformance of data with respect to these profiles. This IMS-Approved SchemaProf tool has been free to download since 2007 from the web site of IMS Global Learning (IMS, 2007).

For the work described in this document, Version 2.0 of the SchemaProf tool has been used. This new version has additional features for configuring domain profile tests. It is currently under Beta-Testing. Its public release by IMS is expected for October 2009.

In the next section we shall describe the use of the IMS-Approved SchemaProf Tool to define the LRE Metadata Application Profile.

5 Profiling the LRE METADATA Specification

The "Learning Resource Exchange Metadata Application Profile Version 4.0 (Beta 2)" (Massart, et al., 2009) (LRE-MD) was developed by David Massart and Frans Van Assche from European Schoolnet in May 2009. It aims to support exchange of new distribution models and new types of educational content.

LRE-MD is a domain profile. It consists of two application profiles.

1. A profile of the loose version of the Learning Objects Metadata Specification IEEE LOM (IEEE, 2005) and
2. A profile of an early version of the IMS Learning Objects Discovery and Exchange Specification (IMS LODE) Results Item Specification 1.0 Draft 2.0 (EUN, 2009)

It is worth noting that both profiles are restrictive, i.e. any document conforming to the profile will also conform to the respective base specification. For both these base specifications, XML Schemas are available. The IMS LODE specification has a number of extension points where data specified in other schemas can be inserted. The LRE-MD domain profile uses one of these extension points and requires that, at these places, metadata conforming to its profile of IEEE LOM must be used. Hence the instance documents to be tested against the LRE-MD profile are single XML files with the IMS LODE namespace http://www.imsglobal.org/xsd/imslorsltitm_v1p0 with embedded parts from the IEEE LOM namespace http://ltsc.ieee.org/xsd/LOM.

Following this structure of the domain profile, capturing the LRE-MD profile starts with capturing its profile of IEEE LOM. The IEEE LOM Binding XML Schema, as published by IEEE (IEEE, 2005), is one of the most complex schemas in use. In fact, it combines two schemas (version "strict" and version "loose") with one template for a schema (version "custom"). To enable this, the binding relies on the parser to guess the right location of the auxiliary schemas used for each namespace. In fact, the IEEE LOM binding is distributed over a number of files and directories. Another complication arises from the fact that the IEEE LOM binding uses the same names for elements, types and attribute groups which confuses the generation of new schemas by SchemaProf. Therefore the following changes had to be made to the IEEE LOM loose XML binding which is used in the LRE-MD profile.

- SchemaLocation attributes have been added
- Names of types and attribute groups have been distinguished from element names by appending Type respectively Grp to the names used in the binding.

It is known that the modified schemas are semantically equivalent with the IEEE schemas, i.e. they define the same set of conformant documents.

The LRE-MD profile makes the following types of modifications to the IEEE LOM specification.

1. Requesting that some elements occur at most once, for example *general* within *lom*.
2. Introducing specific vocabularies, for example for *lifeCycle/contribute/role*.

In the IEEE LOM binding schema, the *lom* element is allowed to contain an unbounded number of *choice* constructs which may select from a variety of elements, for example *general*. It is not possible to allow only one general element within lom without essential changes to this structure of the base IEEE schema. Such changes would bear the risk of unintentionally changing the set of conformant documents. Therefore, they are not supported by SchemaProf. Instead, SchemaProf provides assertions as a powerful means to express such restrictions.

Assertions are XPATH expressions attached to specific elements or types of the base schema. For example, the first requirement above can be expressed by the XPATH expression "count(./lom:general) <= 1" attached to the type of the *lom* element. Moreover, a comment can be added explaining the meaning of this assertion.

SchemaProf will convert such an assertion into a Schematron rule to be validated by the test system. This Schematron rule will be executed whenever an element lom is met. If the assertion XPATH expression evaluates to false, an error will be flagged and the comment for this assertion will be displayed as an error message.Figure 1 shows how such assertions are displayed in SchemaProf.

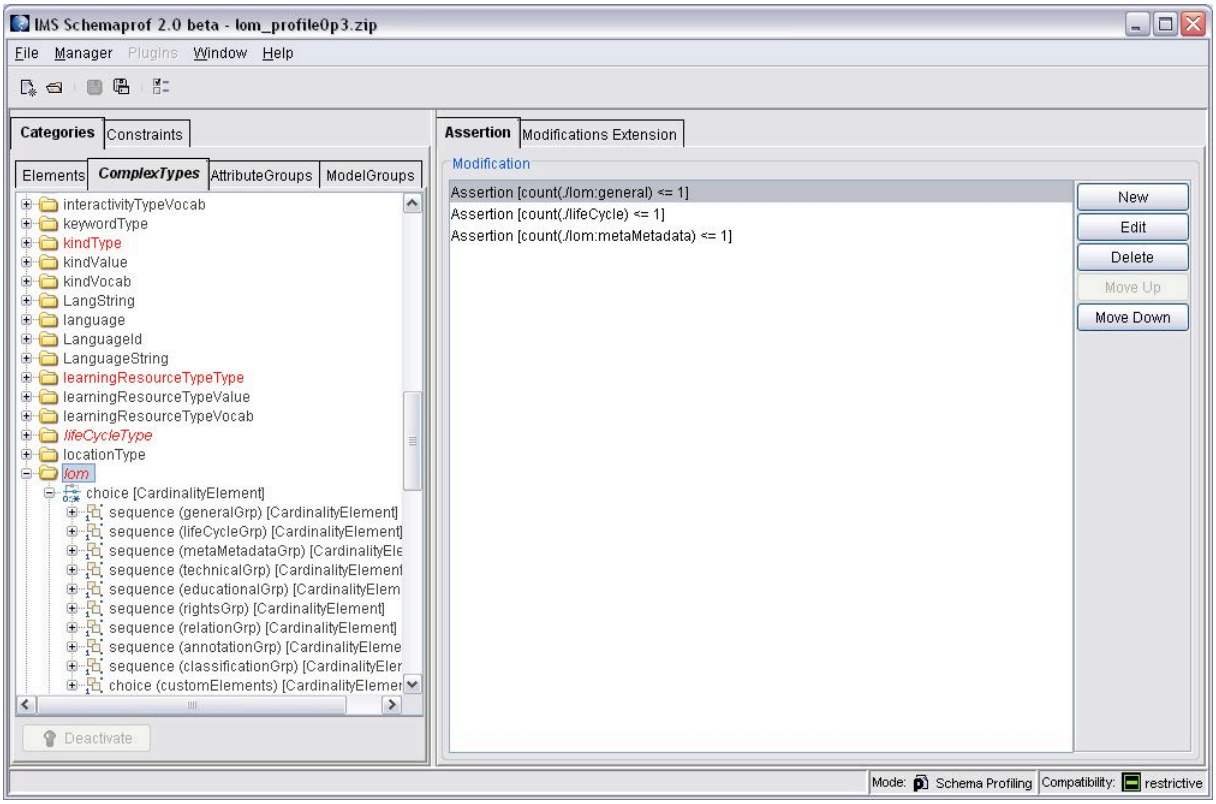


Figure 1 Limiting the number of occurrences by assertions

The second type of modification of the IEEE LOM binding – requesting use of a particular vocabulary – requires changes at two places. For example, *lifecycle/contribute/role* has a sub-element *source*, defining the vocabulary to be used, and a sub-element *value* containing items from the specific vocabulary.

SchemaProf allows the capture of such vocabulary constraints. However, at the time of writing this document, no vocabulary usage test system is available. In fact ,only in May 2009 has a standard way for handling vocabularies in application profiles been agreed.

Nevertheless, testing the correct use of vocabularies can still be obtained alternatively by defining in SchemaProf new simple types, enumerating the values allowed for the source and value elements. Figure 2 shows how a new enumeration type for a vocabulary is defined using SchemaProf's Type Manager and how this type is assigned to limit the potential values of the *value* element.

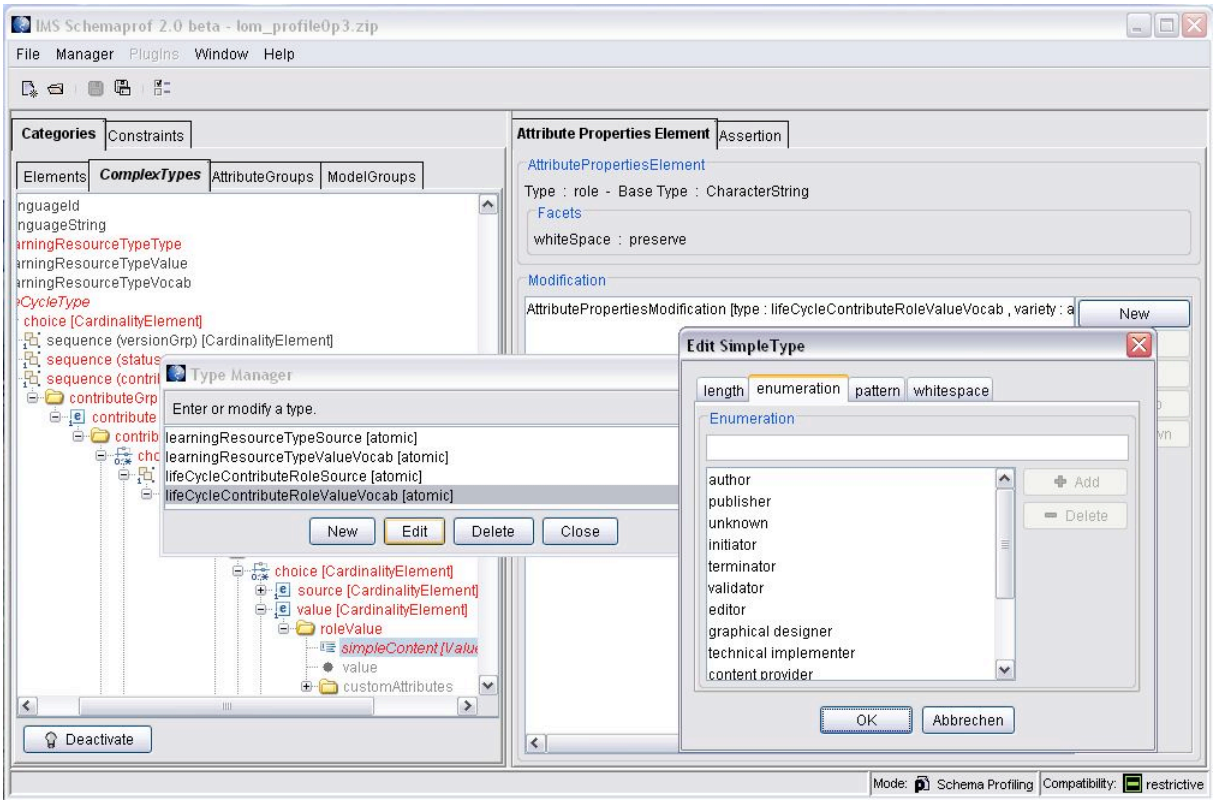


Figure 2 Defining a simple type for a vocabulary

It should be noted that, in the IEEE LOM base specification, the same *source/value* construct is re-used in many places but the profile wants to request the use of this specific vocabulary only in the specific context of the *contribute/role* element. In SchemaProf, this is achieved by *activating* the respective local copy in this context with a mouse-click. As a consequence, SchemaProf will create a copy of the *role* type within the *contribute* element and a new simple type for the *value* element in this local copy. In this way the modification does not affect the use of *source/value* in other places.

The LODE XML binding is much simpler than the IEEE LOM binding – it consists of a single XML schema only. The LRE-MD profile makes the following types of modifications to this schema.

1. Some optional elements are made mandatory, for example catalog within identifier.
2. It requests the use of specific vocabularies depending on the values of some elements in the instance document. For example *manifestation/parameter/value* should be an image mime type if *manifestation/name/value* is *"thumbnail"*.

The first type of these modifications is achieved by requesting that an element occurs at least once (see Figure 3).

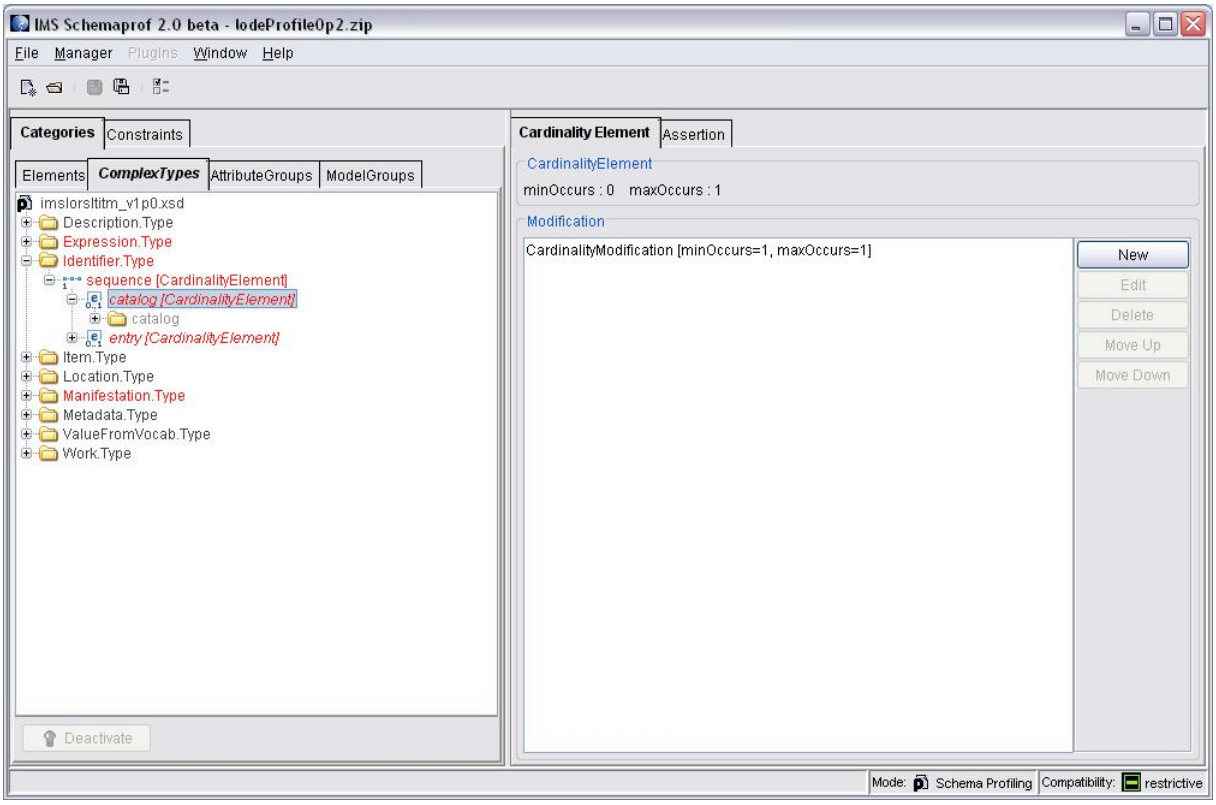


Figure 3 Changing the multiplicity of an element

SchemaProf translates this directly into new values for the *minOccurs/maxOccurs* attributes in the schemas derived for the profile.

The second kind of modification is more complex. In a first step, the set of values of the vocabularies is defined in a new simple type. In this example a regular expression is given to allow mime type values starting with *image/* (see Figure 4).

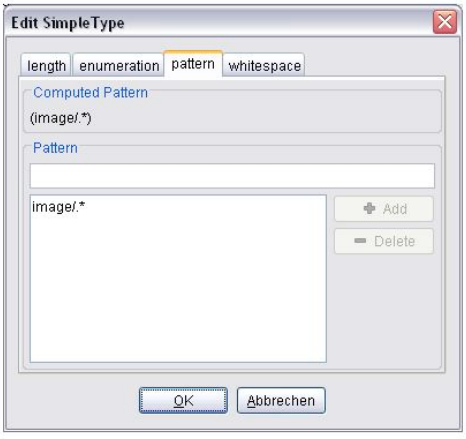


Figure 4 Defining a set of values with a regular expression

Next a condition is defined through an XPATH expression which holds if and only if *manifestation/name/value* is *"thumbnail"* (see Figure 5).

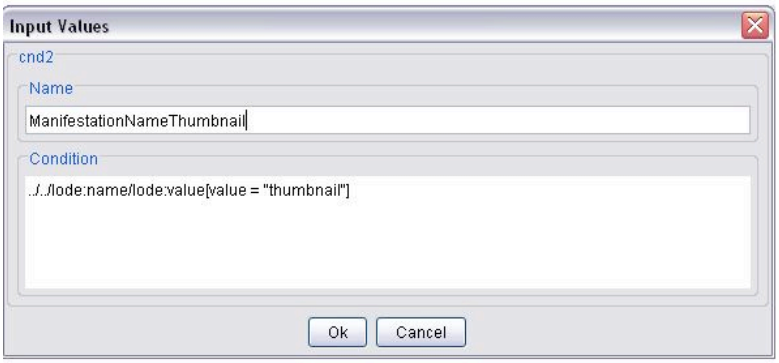


Figure 5 Defining a condition with an XPATH expression

Note that the condition uses an XPATH to be evaluated relative to the position of the *manifestation/parameter/value* element whose values are to be restricted. Then the condition must be applied to control the type restriction and an explanation can be entered (Figure 6).

Figure 6 Adding a condition to a type modification

This completes the description of the second type of modifications to be made to IMS LODE (see Figure 7).

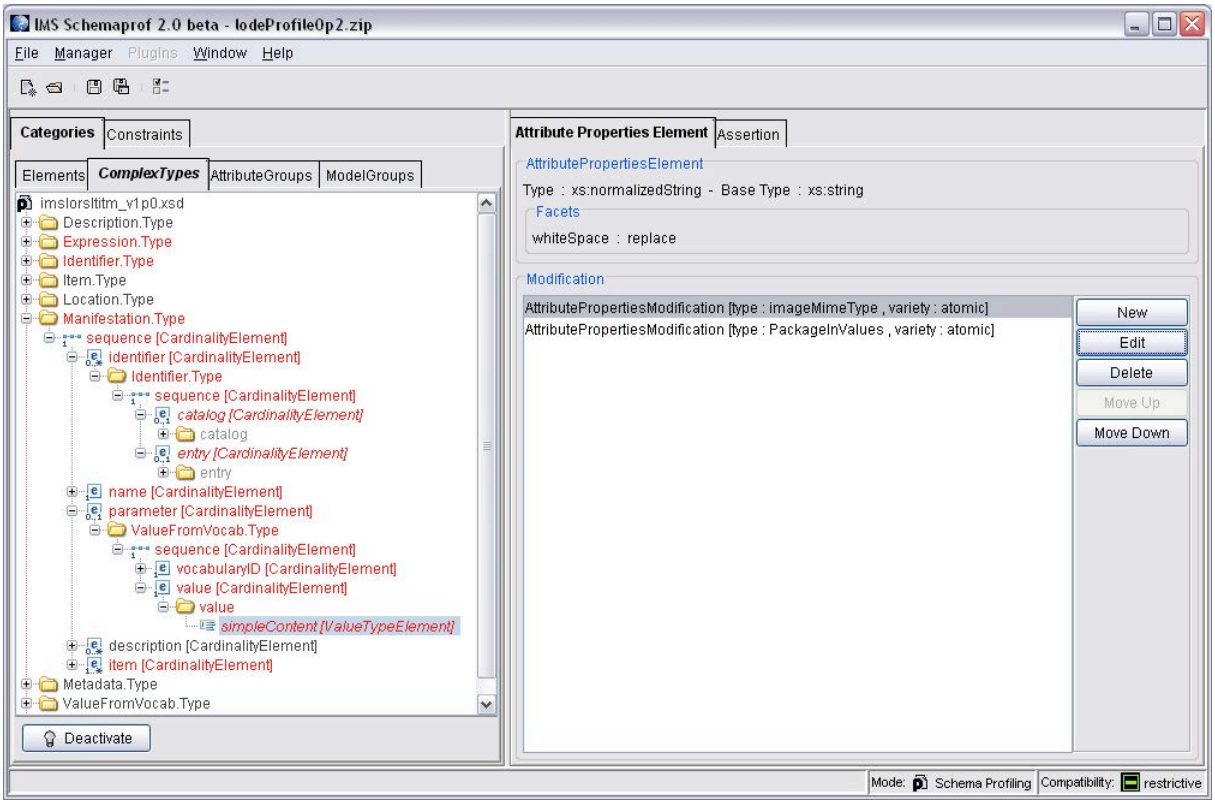


Figure 7 Modifying a value type

This type of modification – checking for simple types dependent on values at other places in the instance document – is not supported by XML Schema or Schematron validators. SchemaProf converts them into Schematron rules which issue messages that can be used to trigger the call of other validation systems, in particular of type checkers (see next Section). Now, having the profiles of the IEEE LOM and the ILODE specification, both must be glued together. This is done through the use of an extension point (see Figure 8).

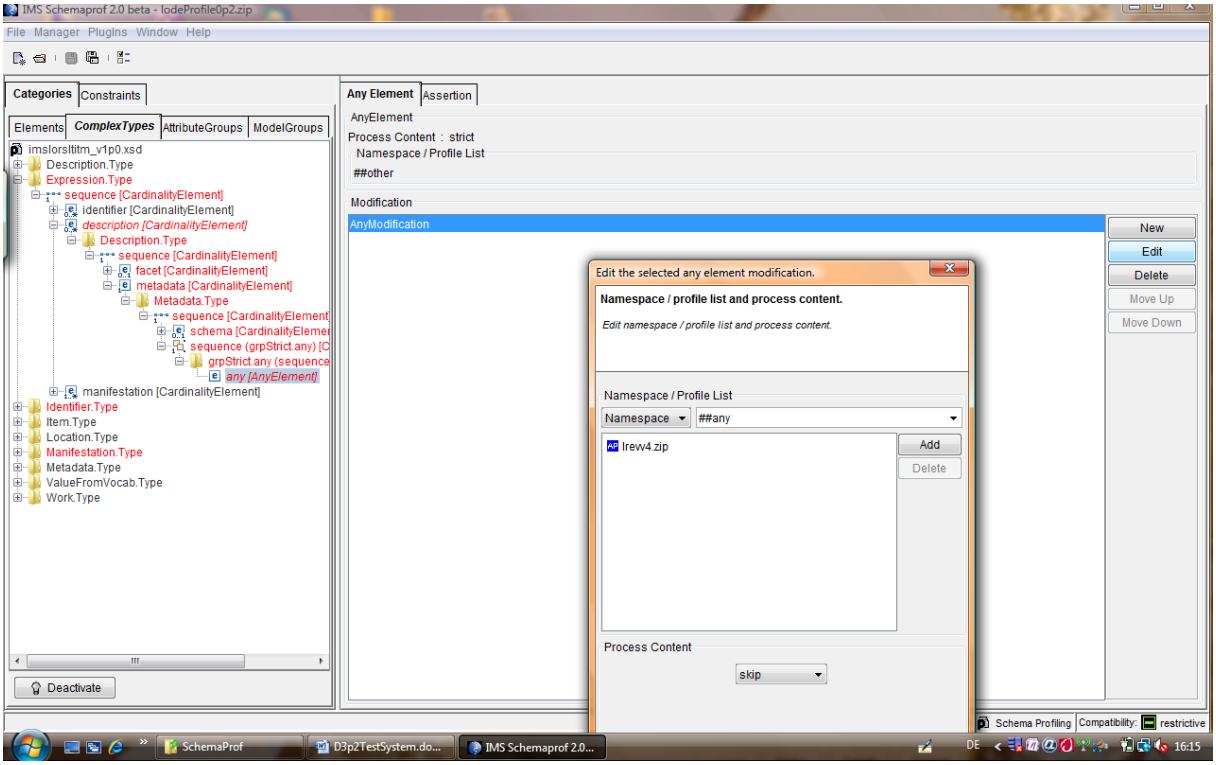


Figure 8 Connecting LOM profile lrevv4.zip with LODE profile

As a final step, it remains to check which tests will be called for XML files of which namespaces. In our case we can confine ourselves to XML Schema validation and Schematron tests (see Figure 9).

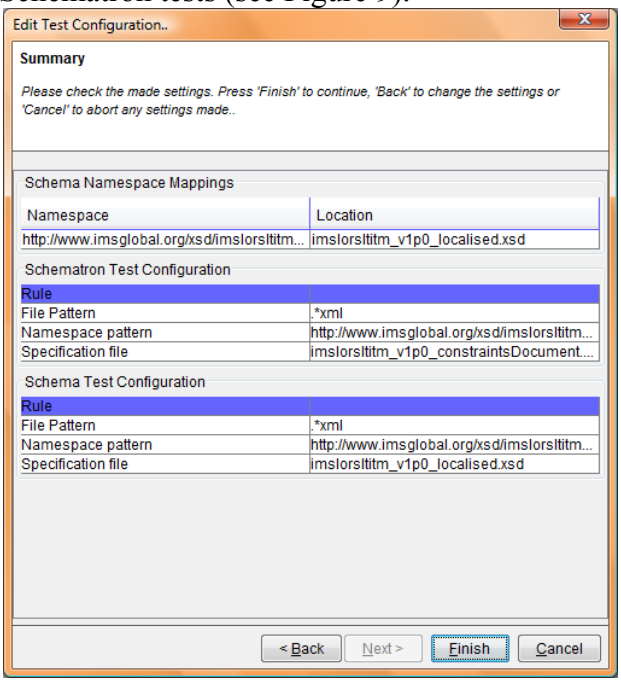


Figure 9 Configuration of LRE-MD Test System

The IMS Approved SchemaProf Tool is copyright protected by IMS Global Learning which has funded its development. Version 1 of this tool can be downloaded for free from the IMS Website at (IMS, 2007) by anyone interested. Version 2 of this tool, which was used for the work described here, is currently available for IMS Members for beta testing. This ASPECT

work provided valuable insight during the beta test phase. Following its release, planned for October 2009, IMS will make also SchemaProf Version 2 available to the public for free.

6 The IMS Generic Test System and the ASPECT LRE Metadata Test System

Building test systems for data conformance is a demanding and costly task. Most communities, that have an interest in profiling specifications, cannot afford this. The IMS Generic Test System provides a solution to this problem.

Given a domain profile as provided by SchemaProf, a command line tool – the Packager – is called to automatically build test systems for Microsoft Windows, Linux and Apple Macintosh for this particular profile. Such a test system can be used to test conformance of data or data packages for conformance with the respective profile. In this sense, the ASPECT LRE Metadata Test System is an instantiation of the IMS Generic Test System built according to the SchemaProf LRE Metadata Domain Profile which was described above.

The Test System is easy to use. It is sufficient to set the directory to indicate which test reports should be written (see Figure 10) and to select the data that should be tested (see Figure 11). Further options allow for controlling the level of detail provided in the test reports.

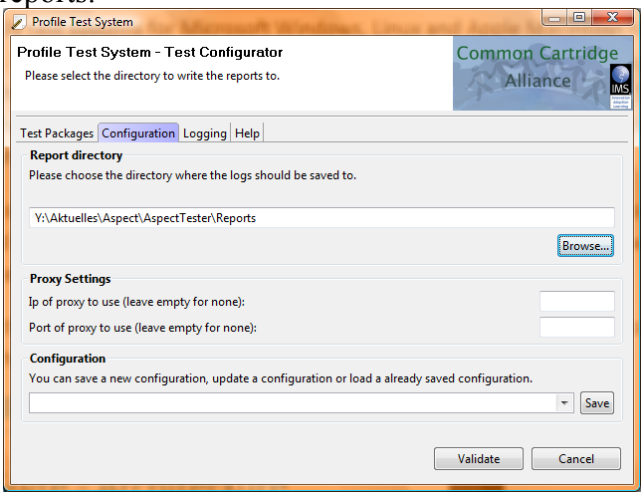


Figure 10 Configuring the Test System

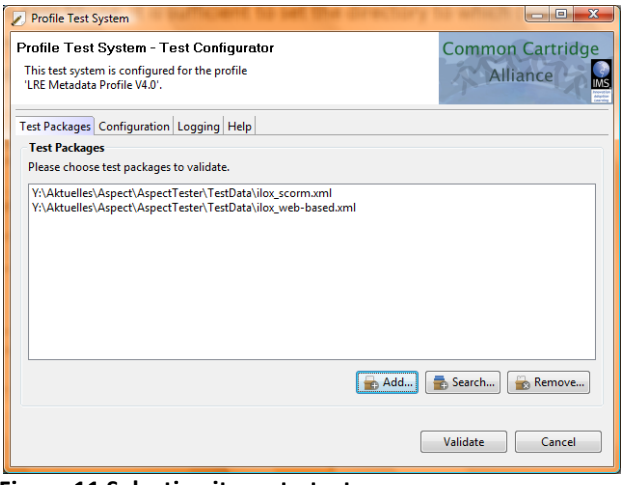


Figure 11 Selecting items to test

When launched, the Test Control System calls particular Test Systems (see Figure 12) to execute the tests defined in the profile.

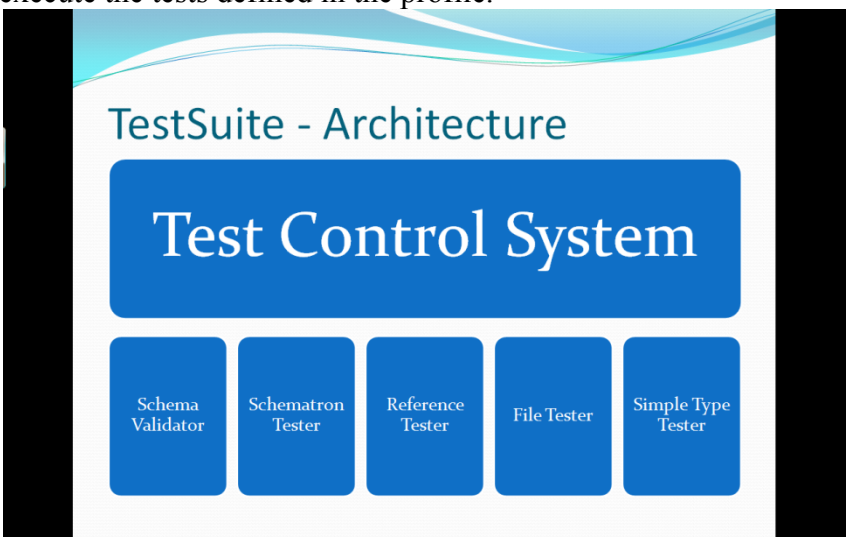


Figure 12 Test Suite Architecture

Some of these tests may result in additional test requests for which further test systems are called by the Test Control System (see Figure 13). In the case of the ASPECT LRE-MD profile, the main test loop will trigger additional calls to simple type testers.

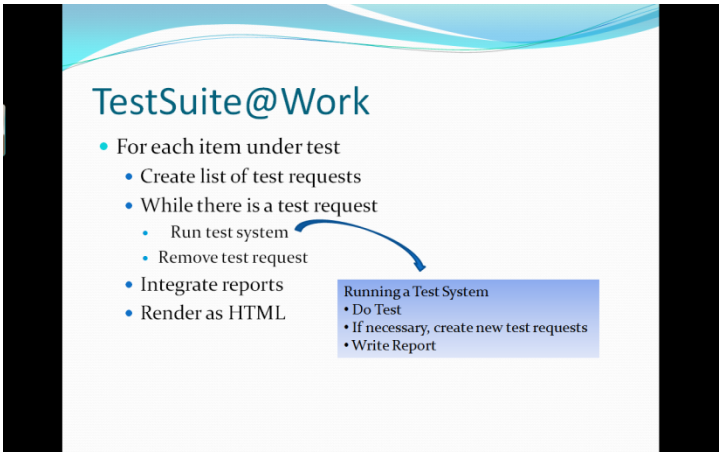


Figure 13 Test System Control Flow

The Test System allows batch processing of sets of files (see Figure 13). After a successful run, it produces a set of HTML pages in the specified test report directory. These contain a summary page from which the detailed reports of the individual test systems for the specific items under test can be accessed. Test reports give error messages, either from external validators or these are defined as explanations in the SchemaProf profiles, and connect them with the numbers of the specific lines in the specific files or XPath positions tested to ease location of errors. Figure 14 and Figure 15 show sample test report pages.

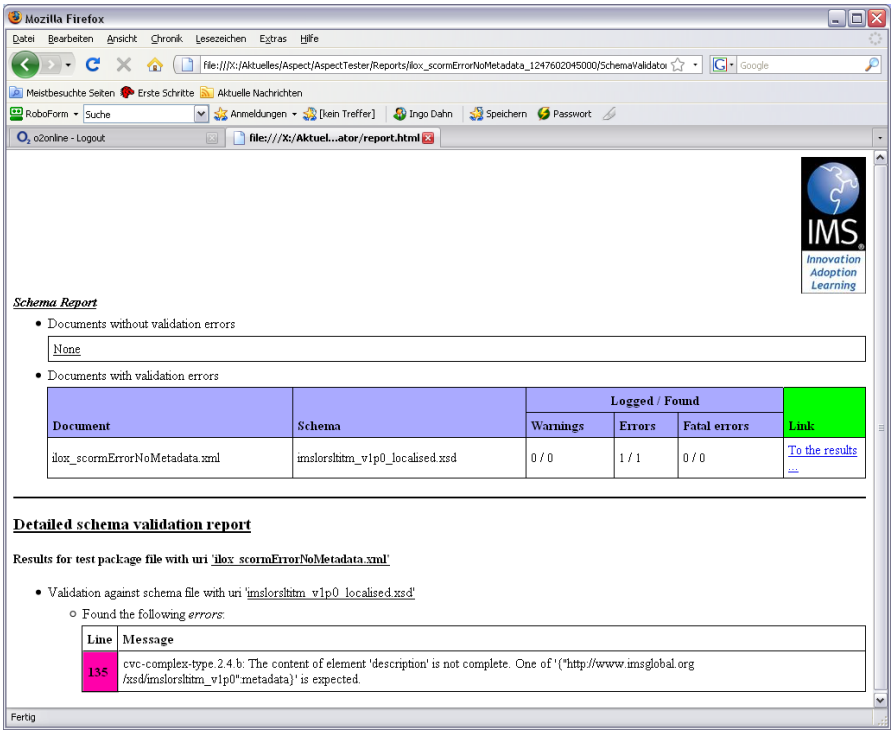


Figure 14 Schema Validation Report

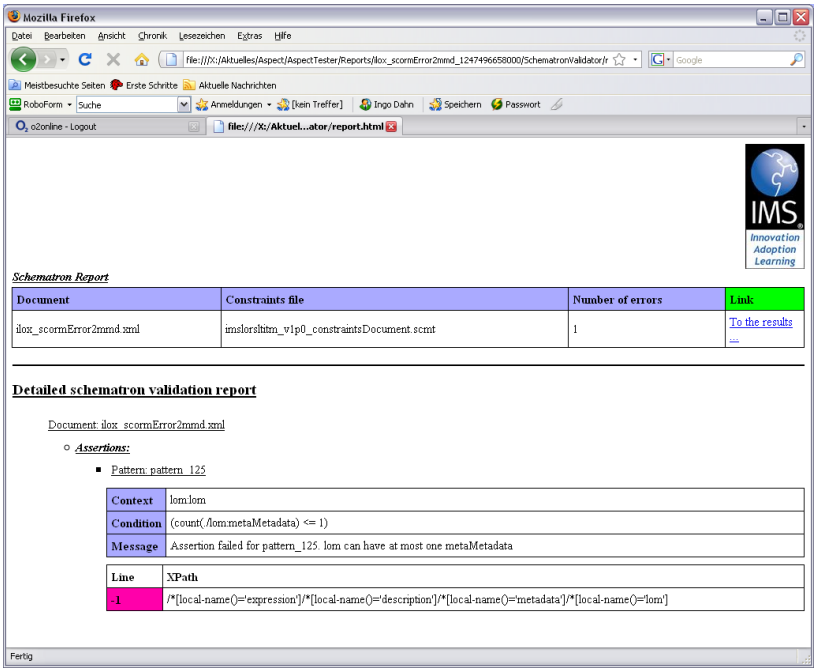


Figure 15 Schematron Validation Report

The development of the Generic Test System is funded by IMS Global Learning which also retains the copyright. It has been developed at the Knowledge Media Institute of the University Koblenz-Landau.

The Generic Test System is currently under beta testing. The ASPECT development of the LRE-MD test system contributed to this beta test. It is planned that, after the release of the Generic Test System, IMS will register SchemaProf Domain Profiles and will offer their authors specific test systems for their profiles. Based on a Memorandum of Understanding,

which the ASPECT Project concluded with IMS Global Learning, this service is currently available for the project to use.

The Aspect Test System that allows for testing xml files for compliance with the "Learning Resource Exchange Metadata Application Profile Version 4.0 (Beta 2)" can be downloaded from the tools section of the ASPECT wiki (http://wiki.aspect-project.org/).

7 Outlook

The LRE-MD Test System still needs further testing. More sample data – correct as well as incorrect – and practical use of the test system are needed to verify that the LRE-MD profile captures correctly what is intended. This will also contribute to beta testing of the IMS Generic Test System. As use of the IMS Generic Test System is not confined to building testers for IMS Specifications, this work is of considerable general value.

The ASPECT project has clearly indicated a need for a vocabulary tester using external vocabularies. During a meeting in Barcelona, it was agreed between the ASPECT project and IMS Global Learning to attempt to collect the vocabularies used for a profile in a specific directory of the profile.

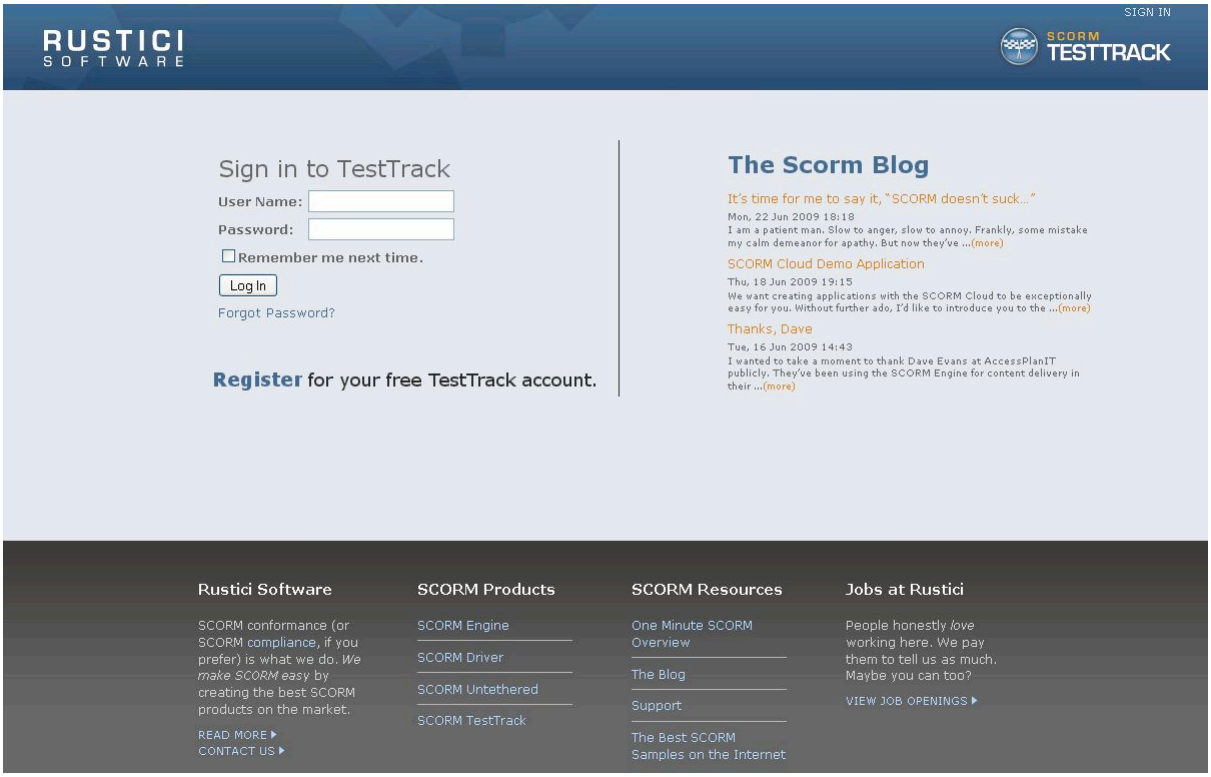
Each vocabulary can be referred to from instance documents by an identifier. A vocabulary test system would probably get from the Test Control System an XML file and a list of XPath expressions which describe the places where vocabularies are used and determining where the vocabulary identifier and the vocabulary entry are stored in the XML document. Then the vocabulary test system would extract the vocabulary identifier, determine the respective vocabulary file and test whether the entries are in fact permitted by the respective vocabulary. The SchemaProf profiling system has already implemented a way to specify locations of vocabulary usages. It still needs to be extended by a vocabulary manager that allows adding vocabularies to application profiles.

The Vocabulary Tester needs to be implemented anew. It needs to get its input as parameters from the Generic Test Control System. It needs to write its reports in a specified XML format and report completion of work as requested by the Test Control System. It seems that no change in the Generic Test System is required.

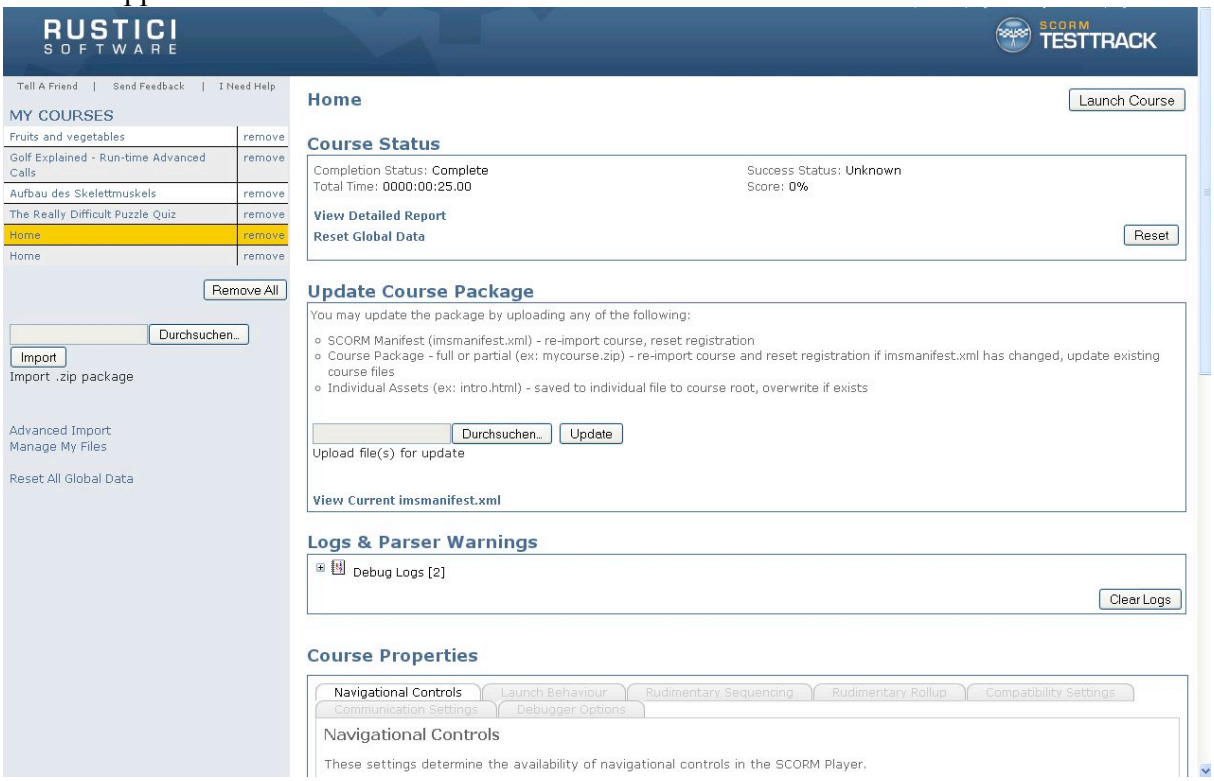
8 Third Party Test Systems

8.1 RUSTICI Software "TestTrack" for SCORM content packages

The SCORM TestTrack from RUSTICI Software is an online tool to test SCORM packages and validate them. TestTrack has complete support for SCORM 1.1, 1.2 and SCORM 2004(2nd and 3rd edition). The use of the tool is free with some space and support limitations.



First step is to create an account and log in to the homepage. After login, the following window appears.



On the left-hand side is a list of all uploaded courses and the possibility to remove them. The right hand side reports the status of the current course after launching it.

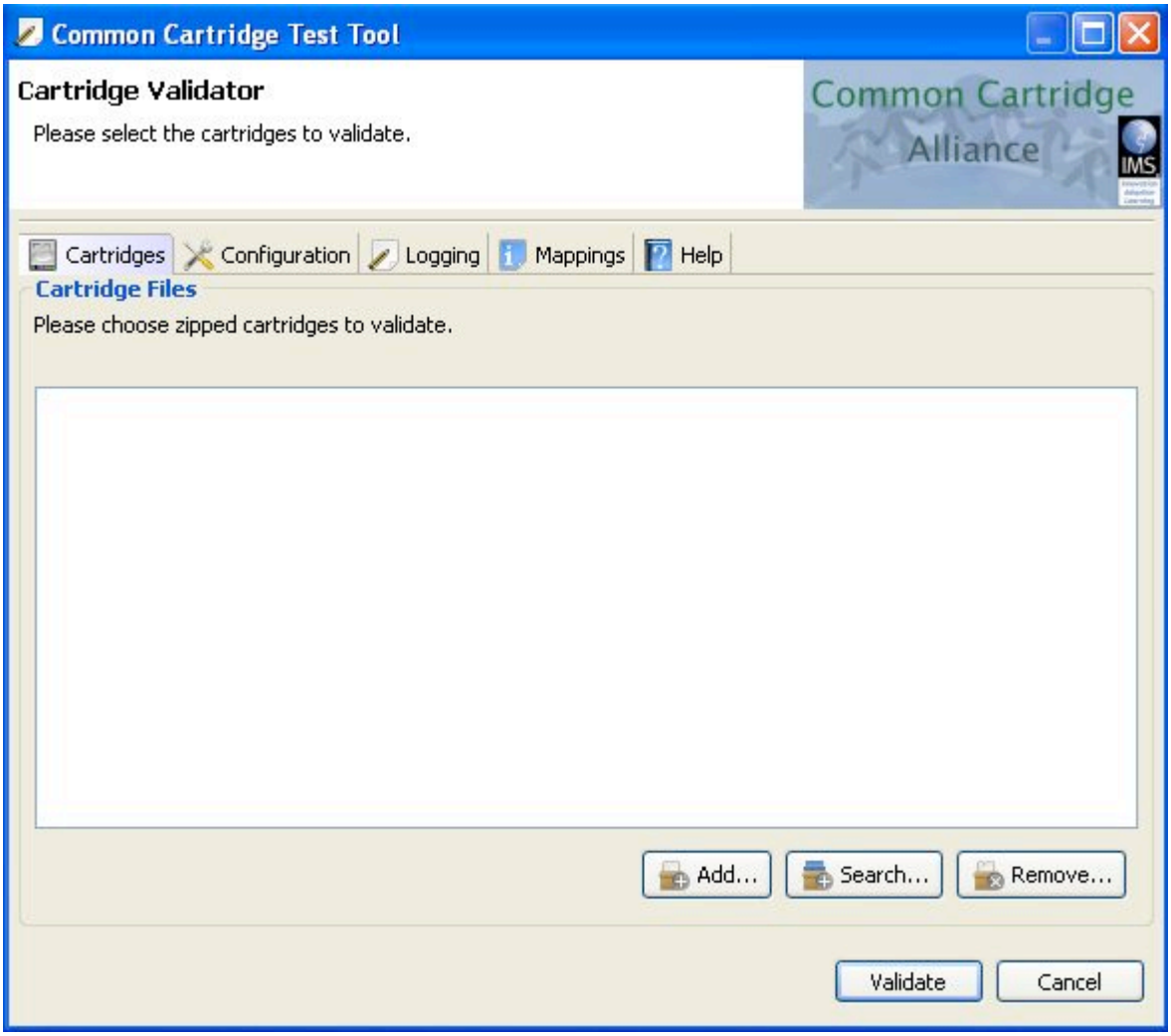
Here the SCORM packages can be uploaded. If the content is valid, TestTrack will upload the file and parse the manifest file. Now one of the uploaded courses must be selected. With

TestTrack it is possible to launch course and play it with all options like a player or LMS. Just one click on “Launch course” will start the course. The SCORM package properties on the right makes it possible to launch courses in a frameset with a menu on the left and other courses being launched in a new window. It is possible to apply settings for navigation, compatibility and communication or use it with default settings. Debugger options allow users to control how much information is persisted (i.e., saved) about every course.

If there is a need for using TestTrack on a local machine or network, Rustici sells special versions to install with the same features as the online version. Pricing varies depending on the user’s situation, but generally falls between $800 and $1,000 per named user. This might be useful for large content items. http://testtrack.scorm.com.

8.2 Common Cartridge IMS testing tool

The CC testing tool is for validating cartridges. It is easy to use and can be installed locally. After extracting the zip-file, there are versions for Mac Linux and Windows operating systems in the folder. Choose the right version and start the application.



The following window shows the cartridge tab. Now cartridges can be added and validated. For every validation an html report will be generated. The window that appears shows the progress and state of the validation. Choosing the "show report" button opens a browser window with the result overview.

Koblenz Common Cartridge Test System Reports

Date:
2009-07-14+02:00
Time:
13:58:49.151+02:00

IMS Innovation Adoption Learning

Overview

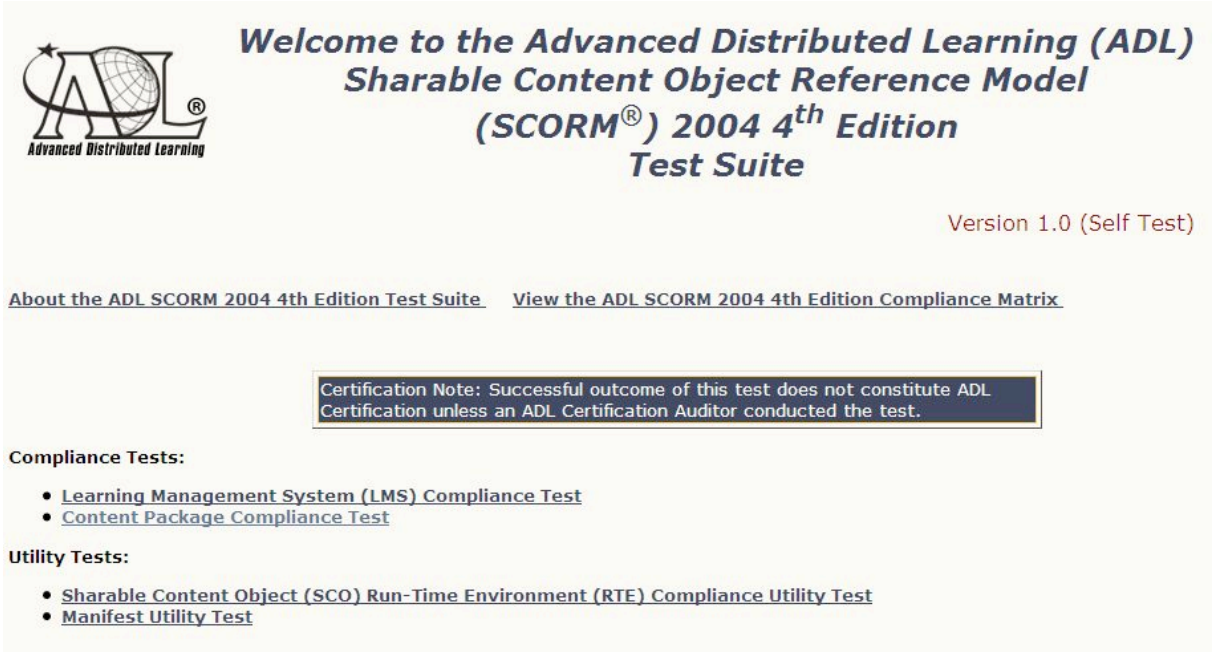
Cartridge	Logged / Found			Link
	Fatal Errors	Errors	Warnings	
ccente	0 / 0	2 / 2	0 / 0	To the Results...

On the right hand side is a link to the results. Detailed information on cartridge documents that are not validated and some reports about schema, reference and schematron follow. General configurations are possible. In the configuration tab the log directory, proxy settings and the configuration can be saved. The logging tab allows users to set flags for error reports and messages. The namespaces and Schemas are listed at the mapping tab.

Common Cartridge Alliance Members are allowed to download the tool. There is an offer for ASPECT partners to participate in the CC Alliance with a 50% reduction on the cost of the membership contribution.
(http://www.imsglobal.org)

8.3 ADL Test Suite

The SCORM 2004 4th Edition Test Suite (Self Test) contains the compliance testing software, procedures and supporting documents for organizations to perform self-testing on LMSs, SCOs and Content Packages. This tool is for local installation.
Users install the Test Suite is in the folder "ADL" under programs. Starting the Test Suite will open a browser window with two compliance tests and two utility tests.



Learning Management System (LMS) Compliance Test
The purpose of this test is to verify the compliance of an LMS to the Run Time Environment specification described in the SCORM 2004 4th Edition.

There are two options for a test: Choosing a new test or loading a saved previous test beginning at the last step it completed. For saved tests a page appears with a list of them.

Content package Compliance Test
The purpose of this test is to verify compliance of SCORM 2004 4th Edition Content Packages. The type of the test subjects include Package in the form of a .zip extension and Package in the form of an imsmanifest.xml located at the root of the package.

In the first step a name can be given to the content package to identify it. The second step is to select the type of the content package. Zip files or unpacked content packages can be run. Now the type of SCORM application profile must be selected. Then the package can be selected and the test can start.

Sharable Content Object (SCO) Run-Time Environment (RTE) Compliance Test
The purpose of this test is to verify compliance of individual Sharable Content Objects

(SCOs) to the Run-Time Environment specification described in the SCORM 2004 4th Edition.

The test is done by following step by step instructions the test. While testing, messages report on the state of the progress in the Test Suite Lot to the right side. Any call to the API and tracking data encountered will be recorded.

Manifest Utility Test
The purpose of this test is to verify compliance of SCORM 2004 4th Edition IMS Manifest only. The type of test subjects includes Packages in the form of a .zip extension and Package in the form of an imsmanifest.xml located at the root of the package.

In four steps it is possible to test content aggregation manifest or resource manifest. Users just choose the options and load the file in the last step.

It is a comprehensive tool for experts/developers to test SCORM packages. Developers mostly use it in combination with RELOAD Editor.
(http://www.adlnet.gov/Technologies/scorm/SCORMSDocuments/2004%204th%20Edition/Test%20Suite.aspx)

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