

SELF Platform: A Teacher - Centric Collaborative Authoring System

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Abstract: *SELF Platform is a collaborative authoring system for creating online courses. A free software to build courses on any subject. In this article, we present the architecture, features, and functionality of the Platform. The main components of the Platform are integrated as a collection manager, course manager, organizer, file manager, bookshelf, version manager, etc. The Platform uses LOM, and SCORM metadata for interoperability providing import and export options in SCORM.*

Keywords: *e-learning, collaboration content management, collaborative authoring system, free knowledge creation, SCORM, LOM, open standards.*

1. Introduction

The currently available collaborative elearning technologies caters to student-centric applications mostly focussing on learning management system. Whereas there exists no collaborative applications that focus on teachers' or author's requirements for developing learning objects. SELF Platform is built to bridge this gap in the available applications within free software. SELF Platform can be briefly described as a teacher-centric system developed to provide collaborative authoring of courses. The SELF Platform is live and presently has a collection of around 50 learning materials on free software. In this article, we present the features of the SELF Platform.

2. SELF Platform

The title SELF stands for a short acronym for “Science, Education and Learning in Freedom” emphasizing science as a body of knowledge, education and learning signifying the two cultural and cognitive processes, and freedom signifying the need to liberate the knowledge as well as the delivery mechanisms. The SELF Platform [1] is a web-based collaborative and distributed authoring system specially crafted keeping teachers and authors in view on the one hand [2] and the guiding principles of free software and free knowledge on the other [3]. The most important inspiration for developing such a system comes from the collaborative authoring platform, the Wikimedia used by Wikipedia [4]. While Wikipedia caters to all possible knowledge, the SELF Platform focusses on creating a support system for collaboratively authoring and networking learning materials in an organized manner keeping in mind the teaching and learning process. The learning materials in the SELF Platform are exportable in the form of SCORM [6], which is a widely used open standard for distributing and packaging online learning resources.

SCORM (Shareable Content Object Reference Model) is an e-learning standard developed by the ADL (Advanced Distributed Learning) consortium. SCORM plays an important role in web-based learning technologies. It provides a standardization for the contents that are used and distributed over the Internet using any Learning Management Systems (LMS). The ease of portability and reusability of learning objects are the fundamental

Platform is to free courseware, what Wikimedia [11] is to an Encyclopedia. Although, currently the SELF Platform [1] is mostly used to build learning materials on free software, it may be noted that the system can also be used for developing course materials in other domains as well.

The design of the Platform, as illustrated in Figure 1, takes into account the the three processes: the collection of the required resources (harvesting), constructing the knowledge base into an organized and networked resources and distribution of the constructed knowledge in a standard format for delivery of the courses.

The figure shows the main modules and the subdivisions of each module to give a glimpse of the features taken into account in the design.

3. Technology of the SELF Platform

SELF Platform is built exclusively using free software based applications such as a secure web server (ZOEPE), a content management system (Plone), a networking and knowledge management system (GNOWSYS). The elaboration follows.

3.1. Secure Web Server

ZOEPE [12] is an object-oriented web application server. It provides web service infrastructure for publishing the knowledge base generated by the SELF Platform. ZOEPE allows to store content and custom data, dynamic HTML templates, scripts, catalogue, and connections to relational databases. It features a strong web development model, allowing to update the website from anywhere in the world alongwith powerful integrated security model. It is possible for connecting not only to ZOEPE's object database, but also with relational database allowing for flexibility and strong data integrity.

3.2. A Content Management System

Plone [13] is an open source content mangament system (CMS) built o top of ZOEPE. It is used for providing the user interface, accessibility, internationalization. Plone can be deployed for creating websites, or publishing documents. The SELF Platform is implemented as a Plone Archetype product. The archetype enables to develop content objects based on schemas in a standardized way [14].

3.3. Distributed Knowledge Management System

GNOWSYS (Gnowledge and Networking Organizing SYStem) [15] is a distributed knowledge networking system. GNOWSYS publishes proxy objects as nodes in a distributed database. Each node is provided by a unique URI. Each node in the Platform stands for a learning object (LO). Objects' relationships with others can be represented by special nodes called relations. Unlike in other databases, in GNOWSYS relations are also represented as nodes and therefore also have a unique URI. Each node can have attributes and relations. Thus an object's classification, its relations and its attributes are published as a distributed networking and organizing system. Given such a network, when we invoke any one object, its description is provided by its neighbourhood. GNOWSYS specification suggests to have 20 storage classes (tables) of which 19 of them provide core knowledge representation scheme. But as a distributed networking database, all the 19 core classes are specified as nodes of the networking model. For the implementation of the SELF Platform, we use only

10 of the regular classes, for the data model of SELF Platform does not need the procedural representation and process modelling. These may be used when learning management system (LMS) module of SELF Platform is developed in future.

4. Functional Requirements

The SELF Platform is characterized by the following: authoring model, lifecycle of materials, and a user reputation system. The minimum requirement for authoring is that of registration process. Any person with a valid email id is qualified to become a registered member on the SELF Platform. Once the members are registered, they are visible as authors on the contents that they contribute to.

Participation in creating new learning materials is one of the key aspects of the SELF Platform. In the print media, the authors first have to submit their work which is subject to editorial review before publishing. In electronic media, such as Connexions [16], authors can create new learning materials either individual or collectively. Only when it gets published the other users have access to these materials, can make suggestions, however but cannot edit directly. In Wikipedia [3], there exists an open channel wherein any user can edit any material. In SELF Platform, there is no such moderator or editor for reviewing the content. A registered user can author and contribute towards the creation of the learning materials. The SELF Platform provides a free channel for content creation.

5. Features of the SELF Platform

The main components of the SELF Platform are: (i) collection of courses, (ii) atomizing of courses; (iii) organizing courses; (iv) versioning of content. The above features have been used to create around 50 learning materials which are available at the <http://selfplatform.eu>. We follow the Wikipedia model for licencing all the learning materials under the GNU FDL licence [17]. The SELF Platform also adheres to the criteria of Open Standards [18] As the SELF Platform is a community based and free-software based project, it is equally available to public without constraints conforming to the Open Standards. It is free from legal or technical clauses that can limit its utilisation [19]. The SELF Platform is designed keeping in mind SCORM 2004 [5]. The specifications of SCORM have been modelled for the SELF Platform include Content Aggregation Model, Sequencing and Navigation and Run Time Environment. Based on the standard schemes suggested by LOM, SCORM, the components of a course are represented using part-whole relationship as illustrated in Figure 2.

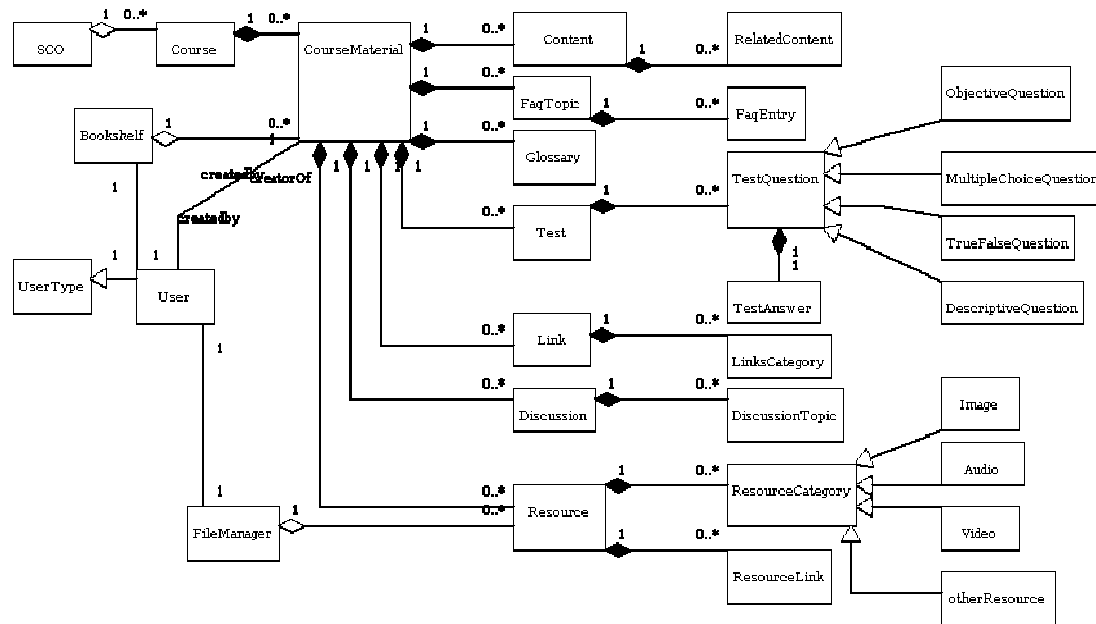


Fig. 2. A consolidated UML diagram showing the relations between the various components of the SELF Platform.

SCORM 2004 document is a complex and full of technical information facilitating the packaging of courses in an electronic form. We have studied the SCORM specification and summarized the essentials into three easily understandable diagrams (presented as mind maps) related to lom, manifest and sequencing. These diagrams are appended at the end of the document.

In the following sections, we elaborate the features of the SELF Platform.

5.1. Authoring Learning Materials

SELF Platform enables the authoring of the learning material in a systematic way by providing tools to: (i) add collections under which the courses can be grouped, (ii) add course materials in the form of lessons, FAQ, glossary, test questions, references within courses, and (iii) a course organizer, (iv) a book shelf for networking and reuse, (v) a file manager to manage other media. The Platform provides flexibility in creating the learning material. The users can begin by creating content or directly by manually harvesting and atomizing already available document using the Platform.

5.2. Collection Manager

The initial step of building knowledge base starts with defining the collections under which the courses can be classified. The collection manager can also be used as the site map, most of the resources are organized through the collections. It is possible to organize a course in more than one collection.

5.3. Course Manager

The course manager is the most important component of the Platform where authors spend most of their time. It provides a structure to any given course keeping in mind the

metadata as per the LOM standard and agregation, sequencing of the learning objects (LO) for ease of distribution as per the SCORM standard. Apart from authoring the content of the lessons, the focus of building the course consists in fragmenting the course into several activities (atoms), often nested to create a hierarchical structure. As the Platform, uses GNOWSYS, the activities can also be linked (networked) to other courses elsewhere in the Platform. There are several actions that the author can perform from the course manager, the most often used being to add and edit a lesson, the others being to add and edit glossary, FAQ, test questions and references. A brief classification of courses complaint with SCORM can be seen as depicted in Figure 3.

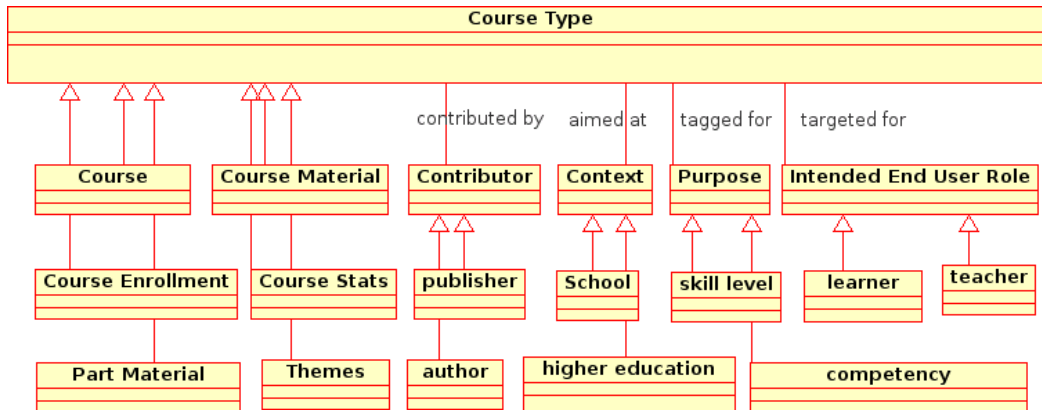


Fig. 3. A class diagram depicting the classification of courses and their criteria

5.4. Course Organizer

It is normally preferred to deliver lessons in a learning sequence, one after the other, and grouping similar level items together. The lessons or activities delivered later are normally said to depend on the former. Apart from sequencing the Platform offers a feature to explicitly mention dependency relation (inverse of pre-requisite) so that the LOs present in other courses can also become part of the current course being weaved. One or several objects can be selected and moved into a component of another complex node making organization easy and economical.

5.5. Shelf Management

Shelf Manager is one of the unique features of the Platform. This does more than one thing in the Platform. Some of the things that can be done are: It is a place where interesting learning objects can be dropped or removed from the knowledge base. User can actively give rating for authors as well as the courses they build, but the mere act of dropping into the Shelf enhances the materials' passive rating and the authors who created it. It is a place from where one learning object from one course can be used in another. A facility to search for the resources from the entire knowledge base and add them to their personal shelf.

5.6. File Manager

Once the learning materials are created, these can be managed collaboratively by the community. The File Manager is a place where the user stores files of various kinds, which then can be used in the courses. It includes the files to be imported, images, audio or video files to be linked or used within the courses, or source files, reference resources that can be

made part of the courses etc. The file manager can be used to upload and download files that are useful by the authors while working. In a collaborative networked environment it is likely that different authors may find the same resource (say an image) and may be uploaded into the Platform several times. Therefore a feature is implemented in the file manager to prevent the same file (identified by the checksum of the file) from being uploaded twice even if the file has a different name. Selected files can also be added to the bookshelf. If the file is a SCORM file, it can be imported directly into the knowledge base as a course. Images and other multi-media files can be either inserted or linked while editing lessons. This can only be done once such files are uploaded in the File Manager as shown in Figure 4.

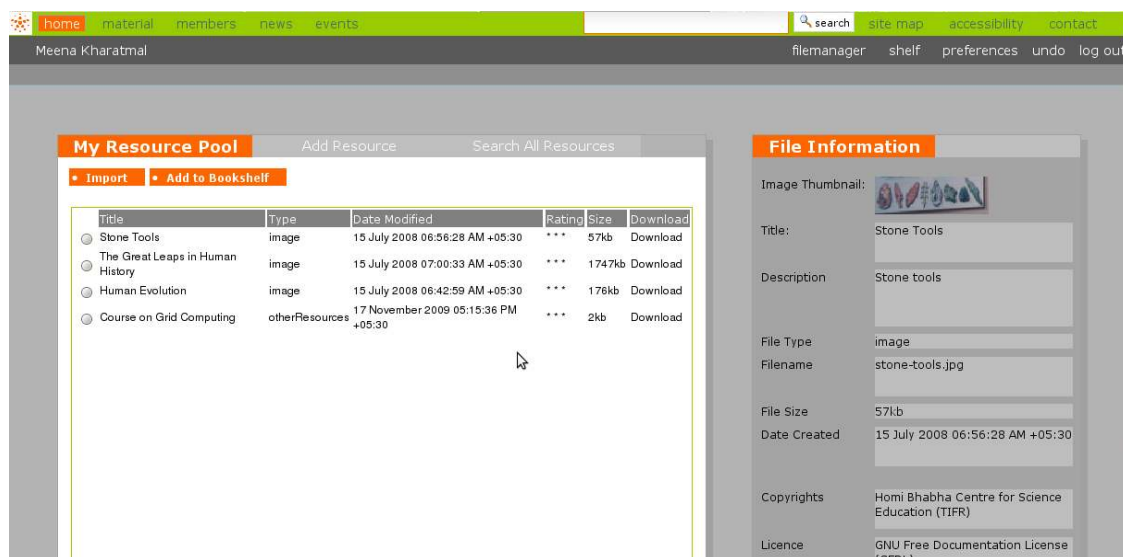


Fig. 4. Adding resources using File Manager

Using the add resource tab, an user can upload files, images to one's own resource pool. The metadata of the file can be seen on the right pane. (Please use the zoom function of the document reader to read the details in the figure).

The selected files can also be delinked from the Shelf, provided it is not networked with other nodes. The delinked files can be restored by searching and adding into the Shelf again. The feature to permanently remove the resources are reserved only for the files that are uploaded by the same user, and for those which do not have any links with others.

5.7. Import and Export

The courses that are exported and imported are SCORM compliant. To begin with one selects a course that is to be exported from the course view. The file gets exported in the form of a single zip file which can be saved/opened. The export contains files in xml format alongwith resources and images.

Inorder to import any course the resource (in the form of a zip file) has to be added as a resource using the file manager. Once the resource is added, it can be selected for importing using the 'Import' tab from the file manager. After the course gets imported the SELF Platform gives a message of successful import. The imported course can be viewed which is the same as the original form without any loss of content and with the changes in the dates of creation by authoring and importing.

Not only the course is SCORM compliant, but the courses can also be exported to HTML format using the "Page View" tab.

5.8. Search Management

A basic search of all the resources in the knowledge base is implemented. The result indicates whether the resource is a collection, course, lesson, image, etc. The search feature enables to search for resources that are uploaded by other users. The selected items from the search results can also be added to the Shelf, to facilitate reuse of the resources in other courses.

5.9. Version Manager

In a collaborative environment, it is necessary to keep track of the changes to every object, to preserve the history of the object, to compare any two versions of the object. The in-built version management system of GNOWSYS helps to keep the dynamic properties of the LOs in the Platform. The Platform is unique for keeping snapshots of the *structure* of the course as it is evolving or as it is being modified. Thus the Platform not only implements versioning for the data but also for the metadata of learning objects and the course as a whole, a feature it inherits from GNOWSYS. Currently, when an object is selected to compare its history or versions, the version manager provides with the history of the learning object as a tree indicating the linear as well as branching that often happens while multiple authors are working in a distributed environment. The selected versions of any node can be previewed and compared as seen in Fig. 5. It is possible to merge and save different versions to create a new learning object.

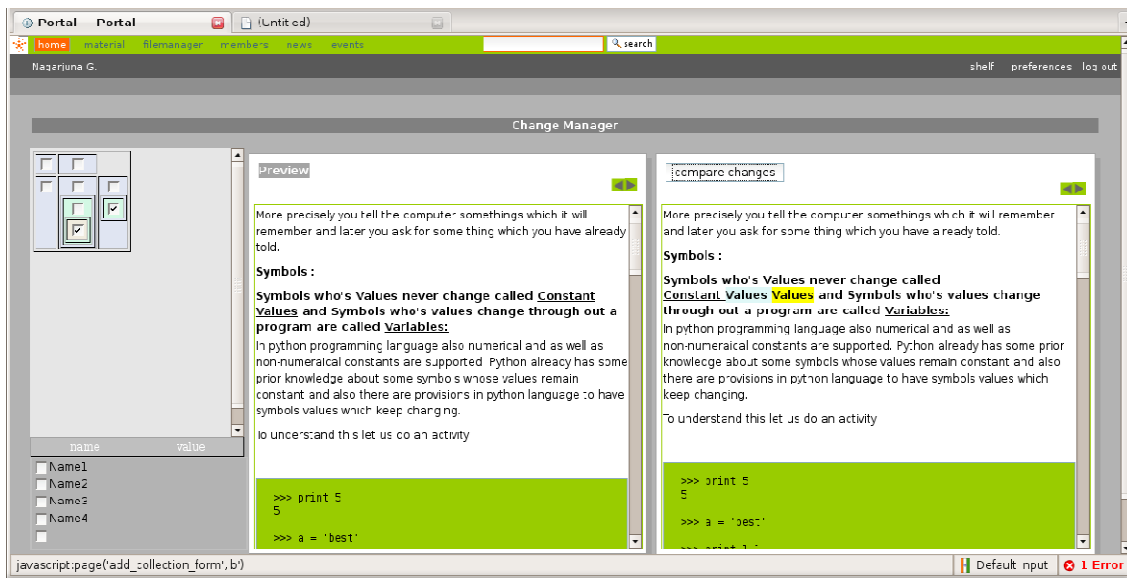


Fig. 5. Screenshot of the version manager in the SELF Platform.

In the left pane one can view the history of the learning object shown as a branch. Note that two learning objects are selected in the check boxes from different branches. Depending on the selection, the preview of both the LOs is displayed in the right panes. The versions can be compared and the changes (addition or update or deletion) are visually displayed. (Please use the zoom function of the document reader to read the details in the figure)

5.10. Internationalisation

The Platform is made using the widely used de-facto standard of internationalisation (i18n) for free and open source software using the interface message identification system. The screenshot of Fig. 6 shows a partially internationalised form. As and when the translated messages are made available, the messages automatically appear in the default language set by the browser.

The image shows two side-by-side screenshots of a registration form. The left screenshot is in Romanian, titled 'Formular de inregistrare', and the right is in Spanish, titled 'Formulario de Registro'. Both forms have a navigation bar at the top with links like 'prima pagina' / 'inicio', 'material', 'members', 'news', and 'events'. The forms include fields for 'Numele complet' / 'Nombre Completo', 'Nume Utilizator' / 'Nombre del Usuario', 'Email', 'Parola' / 'Contraseña', and 'Confirma parola' / 'Confirmar contraseña'. A 'registrare' / 'registrar' button is at the bottom of each form.

Fig. 6. Screenshots of SELF Platform showing the UI in international languages

In these screenshots the registration form is shown in Romanian and Spanish languages.

6. Metadata for Learning Objects

A learning object (LO), according to LOM Standard, is any entity, digital or non-digital, that may be used for learning, education, or training (IEEE 1484.12.3.--2005) [4]. The major elements in the LOM are categorised into---general, lifecycle, meta-metadata, technical, educational, rights, relational, annotation, classification. The LOM model describes the aggregate elements, sub-elements, datatypes of an LO. The elements and sub-elements and the datatypes of an LO are mapped in the form of classes (object types) in GNOWSYS for the SELF Platform as shown in Figure 7.

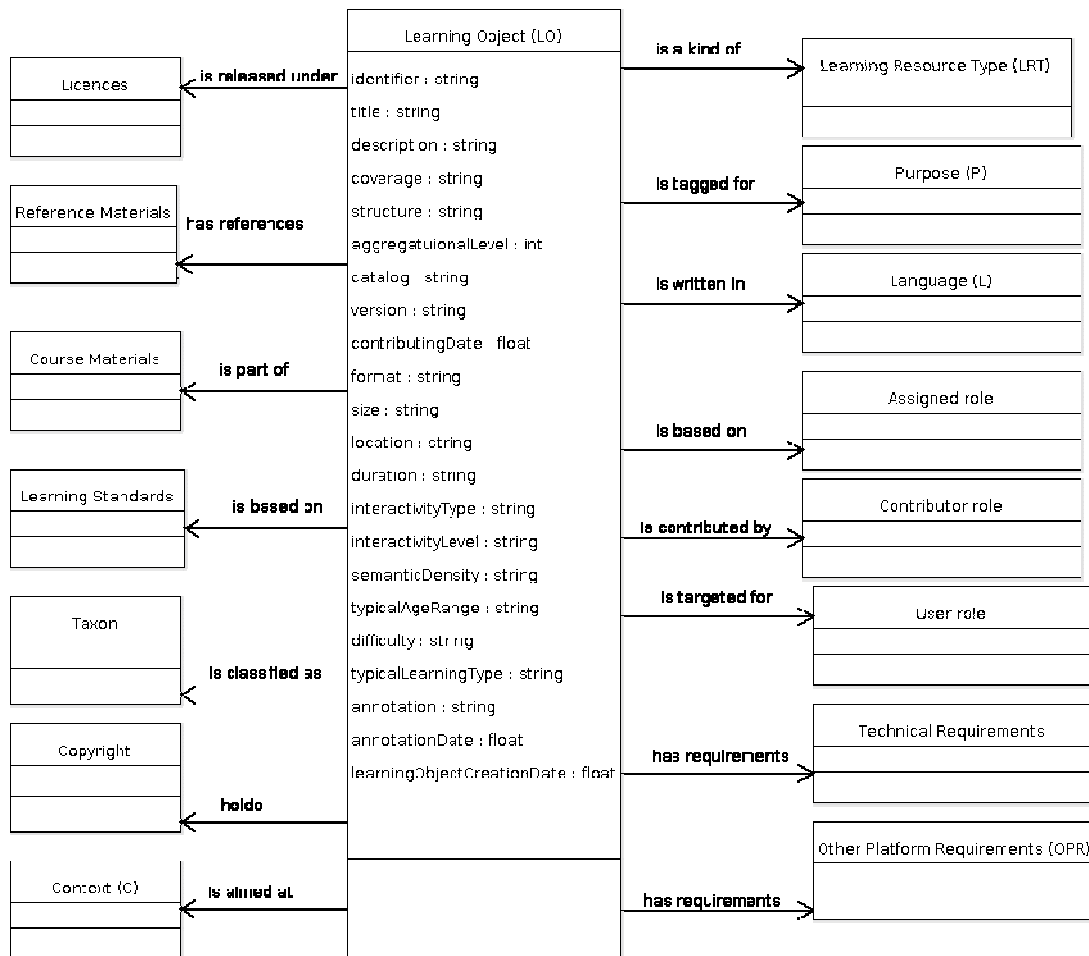


Fig. 7. Mapping of LO with LOM applied in the SELF Platform

A LO is shown with its attributes (centre). Relations are the aggregate elements of LOM. The relations are used to link LO with other object types. The link name is marked on the arrow.

7. How to Use the SELF Platform

As any online content management system, one can join the SELF Platform by registering themselves at <http://selfplatform.eu> or by installing another instance on a server. The existing material can be accessed either by using the search facility or by opening the collection manager. The Platform's user interface is specially designed to mask the underlying complexity of the knowledge base, and make it appear easy for teachers who are not used to sophisticated applications. Initially the Platform presents the view of collections as a site map. On the left side pane appears the list of course collections, and on the right the details or description about the collections. One can select any collection from the left pane. This will show the list of courses on the right pane. By selecting the course material the view changes to course manager. It is at this stage that one can find the details of a course. Now the left side pane shows the learning objects of the course and how they are organized, while the right side shows the description of the learning object. Several actions such as add, organize, export, view, edit, or delete, become active or inactive depending on the context. The dots

seen below the course page on the left pane denotes the versions of the learning material. On the right side pane, the view shows the creation date and the author's name on the top of the page. By choosing add, or edit from the tab, one can author the learning material. A typical view of the SELF Platform while authoring a learning material is depicted in Figure 8. A detailed tutorial guide on how to use the SELF Platform is available on the Platform itself.

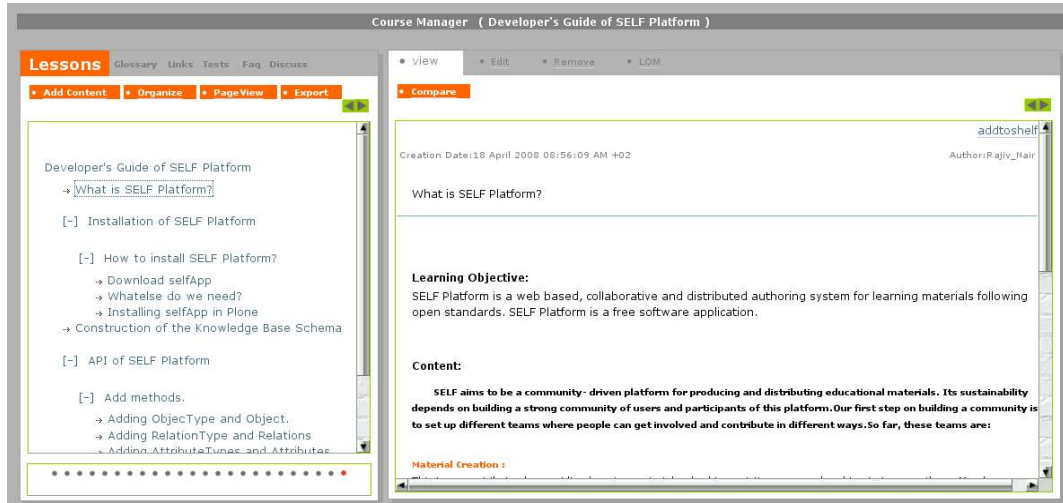


Fig. 8. A typical view of the SELF Platform while authoring learning materials showing various features

The left pane shows the contents of a course "What is SELF Platform?" organized into various learning objects. Below it the dots represent the number of versions that the course has, the latest being the last dot. In the right pane, we can get a view of the learning objective and content of each learning object. In addition to this, it also displays the author name and creation date, and a link to addtoshelf. The features such as edit, remove and the LOM metadata also form a part of the view of the SELF Platform.

8. Future Directions

As described above, the SELF Platform is built to provide the basic collaborative online authoring system for e-learning material. Most of the core features are up and live on the Platform, and the software is ready for deploying in any e-learning infrastructure. The Platform is currently undergoing several bug-fixes and performance tuning and optimization. As a free software project it is open for community participation for further advancing the SELF Platform. Some features that are being considered in the future road map are: making metadata editing more user-friendly, exchange of documents in other standard formats that of mediawiki, LaTeX, texinfo, DocBook, etc. A p2p communication between multiple SELF Platforms, translation interface, advanced semantic search, distribution and packaging of knowledge base, learner's interface for delivering the courses, and many more features are in the roadmap. The SELF Platform is managed from Savannah [20]. The source code can be obtained from the CVS repositories and a developer's guide is available on the SELF Platform [21].

9. Relevance for the Community

The SELF Platform developed to fill the gap in the free software for online education and therefore it is of immense relevance to institutions that are planning to deploy e-education, distance learning. Since the Platform has many more features to be implemented, any interested free software hacker is invited to contribute to the development of the Platform.

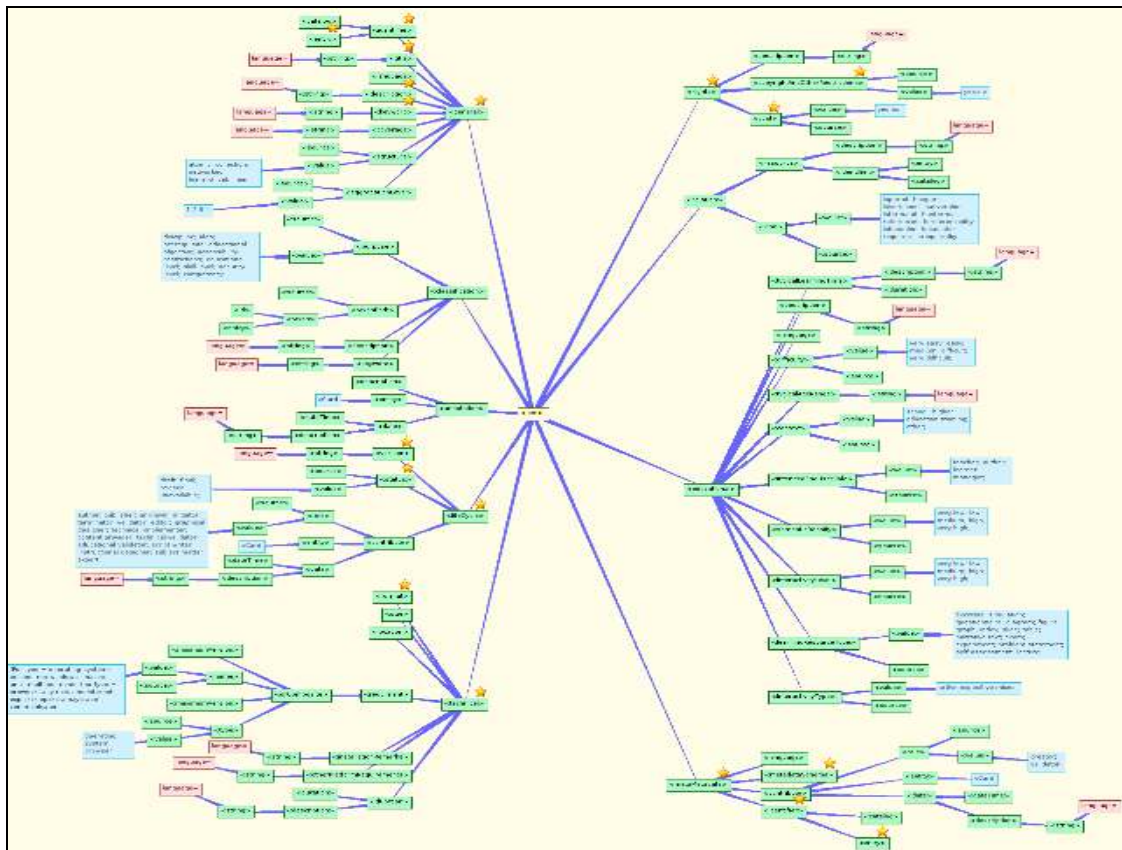
As this is a teacher-centric Platform, any teacher can visit the Platform and create the courses and share it with others. The creator of learning materials gets the authorship for their courses. The authors can also promote their work by sharing. The SELF Platform can be implemented at the professional degree level of education, and for distance learning programs. It is already being implemented for distance learning in Masters Level Program in Europe supported by the European Commission's Life Long Learning Program.

To sum up, a fully free software based collaborative authoring system---the SELF Platform with its architecture, and its unique features are presented in the article. The Platform is open for further development for developers on the one hand and is open for contributions from authors to build courses on the other.

Appendix

The appendix features drawings of lom, manifest and sequencing based on the SCORM specifications (Please use the zoom function of the document reader to read the details in the diagrams).

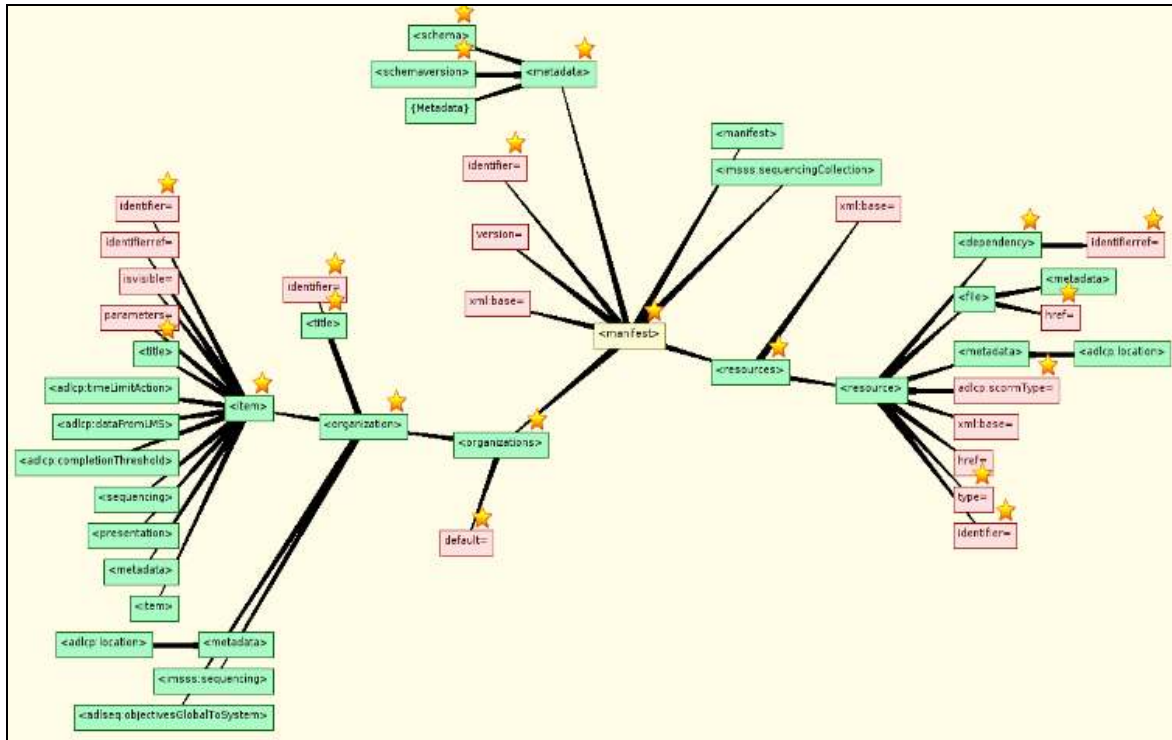
Lom



Drawing 1. Every resource in the platform could have the metadata as defined by the LOM standard.

The metadata is grouped into nine different categories: General, Rights, Relations, Educational, Technical, Lifecycle, Annotations, Classification and MetaMetadata.

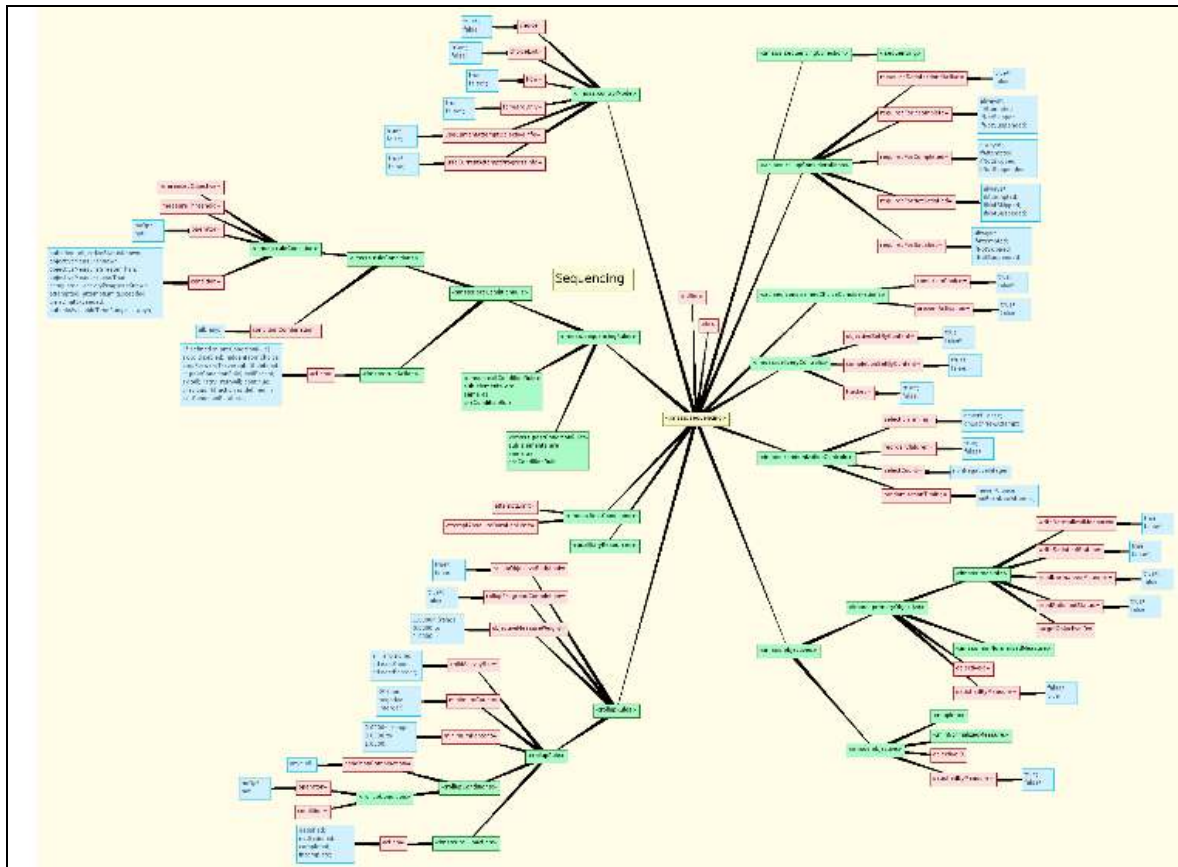
Manifest



Drawing 2. The metadata to be defined for each course collection.

This metadata provides the information and the structure of the package

Sequencing



Drawing 3. Sequencing metadata informs an LMS how to deliver the learning objects, and in what order

This metadata includes conditions, control, objectives to be met, and the sequence to be followed while delivering the content. This metadata is read and implemented by a SCORM player such as Moodle, for example.

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