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 totally free software based application, the platform is deployed to build courses on learning free software materials. In this article, we present the architecture, features, and functionality of the Platform. The main components of the platform are authoring and managing the learning materials. Various functions are integrated as as collection manager, course manager, organizer, file manager, version manager, etc. The SELF Platform is live and presently has a collection of around 50 learning materials on free software which are developed by the community.**

Areas--- e-Learning, Knowledge Management, Collaboration Technologies, Content Management, collaborative authoring system, free knowledge creation.

I. INTRODUCTION

The current state of the art collaborative elearning technologies caters to student-centric applications. Whereas there exists no applications that focus on teachers' or author's collaborative requirements. 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 collaboratively for authoring courses. In this paper, we present the features of the SELF Platform and its implications for education.

II. SELF PLATFORM

Science, Education and Learning in Freedom (SELF) emphasizes on---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. Thus the Platform [11] is a web-based collaborative and distributed authoring system for specially crafted keeping teachers and authors in view on the one hand and the guiding principles of free software and free knowledge on the other[2] .

The most important inspiration for developing such a system comes from collaborative authoring platform, the Wikipedia [15]. 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. The learning materials in the SELF Platform are exportable in the form of LOM [5], SCORM [9], which are the current open standards for e-learning .

Free softwares currently available focus on the learning management systems (LMS) such as Moodle [6], Atutor [1]. The widely used application Moodle, for example, is used effectively to create online elearning sites helping in the delivery of lessons, assignments, and conducting and planning the courses collaboratively. LMS are developed by focussing the delivery mechanism and not building learning material and thus their focus is on the learner and not the teacher. To draw parallel, SELF Platform is to free CourseWare, what Wikimedia [14] is to encyclopedia.

Although, currently the SELF Platform [11] is catering 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.

III. TECHNOLOGY OF THE SELF PLATFORM

SELF Platform is entirely build on free software based applications such as a secure web server, a content management system, a networking and knowledge management system:

A. Secure Web Server

ZOPE [16] is an object-oriented web application server. It provides web service infrastructure for publishing the knowledge base generated by the SELF Platform. ZOPE 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 ZOPE's object database, but also with relational database allowing for strong data integrity.

B. A Content Management System

Plone [8] is used for providing the user interface, accessibility, internationalization. The platform is implemented as a plone archetype product.

C. Distributed Knowledge Management System

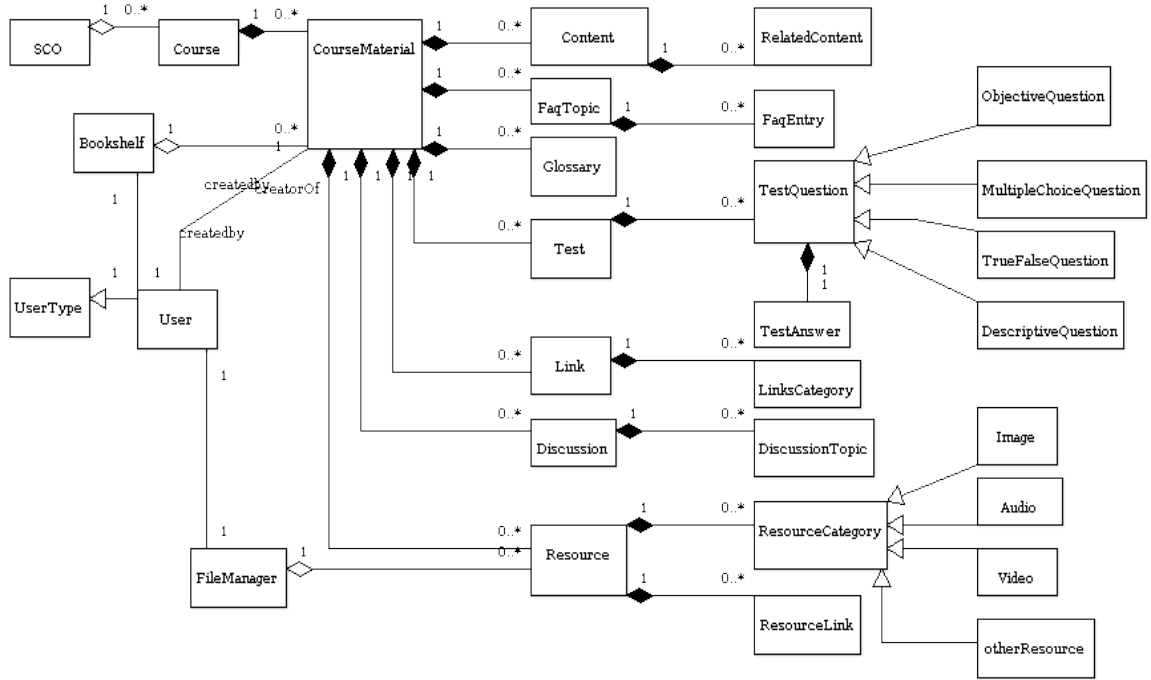GNOWSYS (Gnowledge and Networking Organizing SYStem) [3] is a distributed knowledge

Figure 1: A consolidated UML diagram showing the relations between the various components of the SELF Platform.

management system. GNOWSYS publishes proxy objects as nodes in a distributed database. Each node is provided by a unique URI. Each node stands for a learning object. 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. 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 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.

IV. 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 [4]. The SELF Platform also

adheres to the criteria of Open Standards [7] and designed keeping in mind SCORM 2004 [9]. Figure 1 shows the various components of the SELF Platform. In the following sections, we elaborate the features of the SELF Platform.

A. *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 as seen in Figure 2.

1) 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.

2) Course Manager: The course manager is the most important component of the platform. It enables to provide a structure to any given course keeping in mind the metadata creation as per LOM standard and agregation, sequencing of learning materials for ease of distribution as per SCORM standard. Apart from authoring the content of the lessons, the focus of building the course consists in fragmenting the course into several activities, often nested to create a hierarchical structure. As the Platform, uses GNOWSYS, the activities can also be linked (networked) to other courses
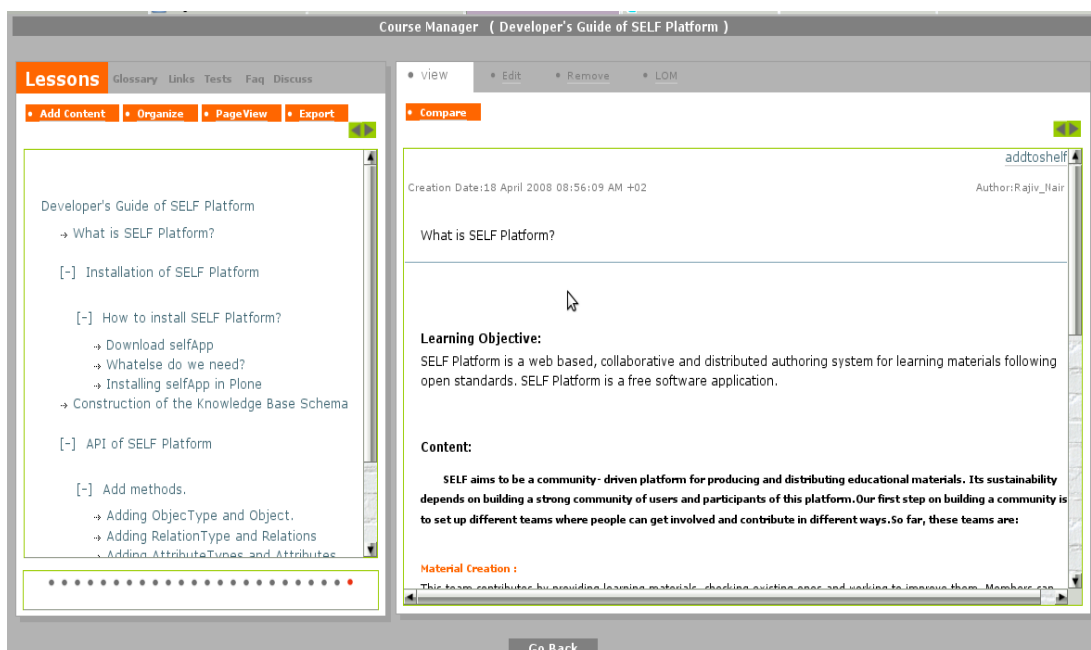
Figure 2: Screenshot of the SELF Platform highlighting the collection, course, versions. The left pane shows the contents of a course "What is SELF Platform?". Below it one can see the dots which represent different versions and the dot in the extreme right (colored) displays the current version of the lesson. In the right pane, we can get a view of the description and content of each learning object. In addition to this, it also displays the author name and creation date, and a link to addtoshelf.

elsewhere in the platform. There are several actions that the author can access 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.

3) Course Organizer: It is normally preferred to deliver lessons in a learning sequence, one after the other. The lessons or activities delivered later are normally said to depend on the former. The platform offers the possibility to create the learning objects in any order, and then the resources can be reordered not only as a sequence of activities, but can be hierarchically organised. One or several objects can be selected and moved into a component of another complex node. Thus the Organiser helps in distinguishing learning objects that are like leaves of a node.

4) Atomizer: Keeping in mind one specific learning objective a learning material is composed as an atomic resource. The atomized resources also enhance the possibility of reusability in several other courses. An author can choose a course material like an existing text book or an encyclopedic article and atomize it for easy delivery and consumption.

B. *Managing the Learning Materials*

Once the learning materials are created, these can be managed collaboratively by the community.

1) File Manager: 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 to be linked or used within the courses, or source files, reference resources that can be made part of the courses, audio, video, etc. The file manager can be used to upload and download files that are useful by the authors while working. 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. The selected files can also be deleted temporarily, provided it is not networked with other node. The deleted files can be restored by searching and adding to the pool again. The feature to permanently remove the resource are reserved only for the files that are uploaded by the same user, and for those which do not have any relations with others.

2) Shelf Management: Shelf Manager is one of the unique features of SELF 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
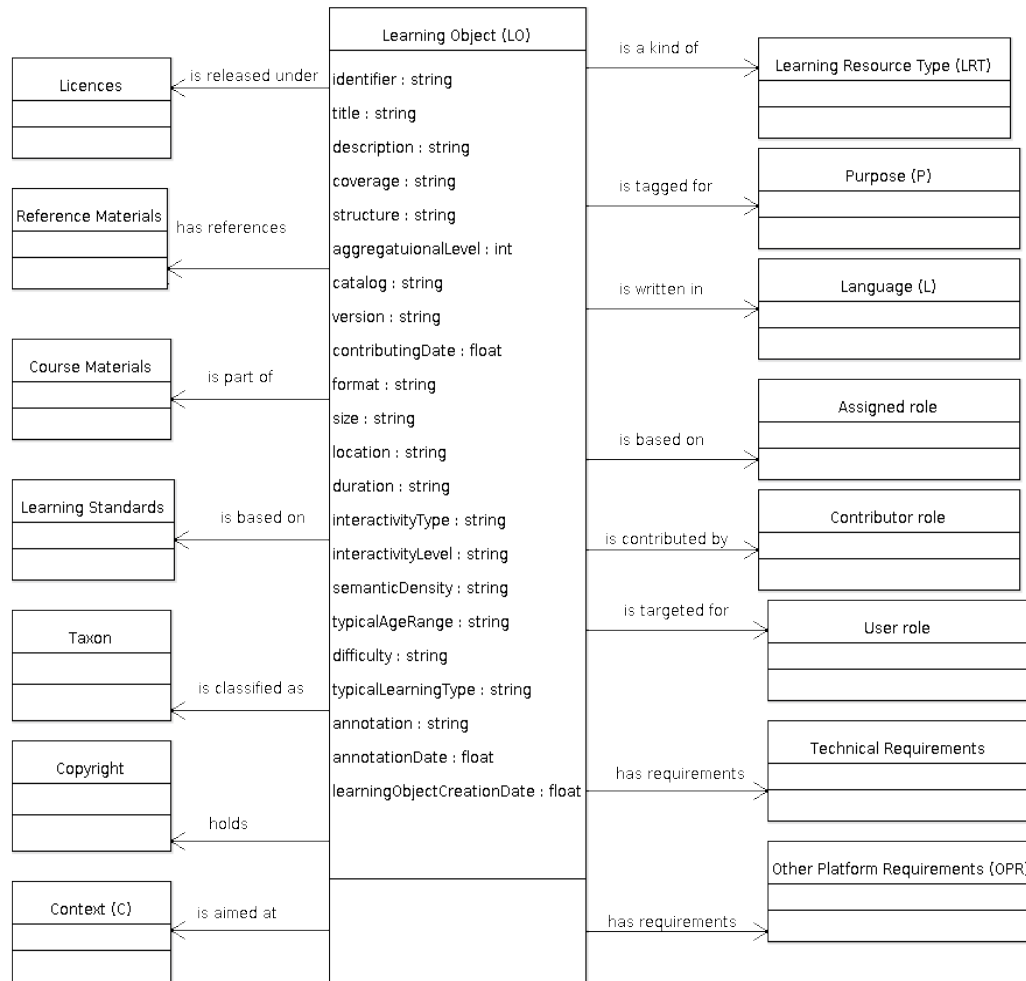
Figure 3: Mapping of LO with LOM applied in the SELF Platform. A LO is shown with its attributes (centre). Relations are the aggregate elements of LOM. The relations are used to link LO and its subelements. These are used to map with the subelements of the LOM (left and right).

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.

3) 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 manager, enabling to reuse the resources in other courses.

C. 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) [5]. The representation of a learning object in the SELF Platform is based on Learning Object Meta-data (LOM) Standard defined in IEEE 1484.12.3—2005 [5]. Figure 3 shows the mapping of LO and its relation to the elements of LOM. The major elements in the LOM are categorised into---general, lifecyle, meta-metadata, technical, educational, rights, relational, annotation, classification. The LOM model describes the aggregate elements, subelements, data types of an learning object. The elements and subelements and the datatypes of a LO are mapped in the form of classes (object types) in GNOWSYS for the SELF Platform.

V. DYNAMICS OF THE SELF PLATFORM

Any kind of collaborative web-based learning is dynamic in nature. The dynamics of the SELF Platform is being illustrated for creating teaching sequence, recording history, comparing and replacing versions of the LO.

A. Version Manager

In a collaborative environment, it becomes necessary to keep track of the changes to an object, to preserve the history of the object, to compare any
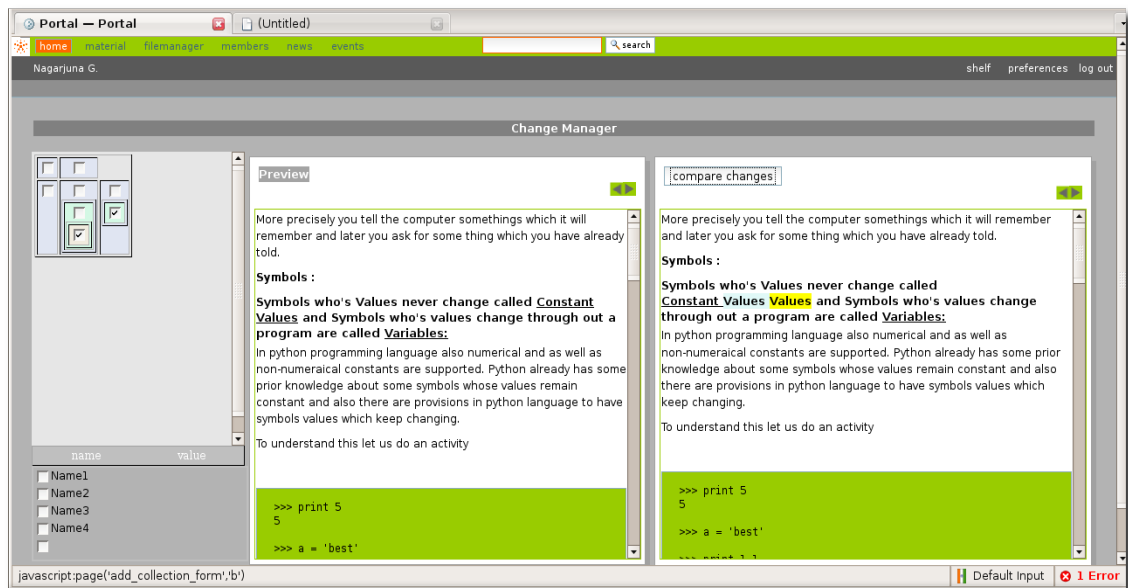
Figure 4: Screenshot of the version manager in the SELF Platform. In the left pane one can view the history of the learnign object arranged hierarchically or linearly. Note that two learning objects are selected in the check boxes. Depending on the selection, the preview of both the Los is displayed in the right panes. The versions can be compared and the changes (addition or deletion) are displayed in the form of highlighted text.

two versions of the objects. The version management system of GNOWSYS helps to keep the SELF Platform dynamic. SELF Platform is unique for the feature of keeping snapshots of each 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, a feature it inherits from GNOWSYS. The version management is a crucial feature of any collaborative authoring systems. 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 shown in Figure 4. It is possible to merge and save different versions to create a new learning object.

B. *Internationalization*

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 in Figure 5 shows a partially internationalised registration form. As and when the translated messages are made available, the messages automatically appear in the default language set by the browser.

C. *Course Organization, Sequencing and Navigation*

SELF Platform can cater to the need of creating a teaching sequence, and navigating a learning course based on the SCORM [9]. This is the core of an authoring system for e-learning. By appropriately

and dynamically tagging the resources using the metadata standards mentioned, it is possible to put together whatever is required to deliver a course. The learning management systems interpret the metadata associated to the resources and perform the automatic delivery to the students based on the configurable features available by the delivery mechanism.

VI. How to Use the SELF Platform

As any online content management system, one can join the SELF platform [10] 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 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. Thus the design itself is a unique feature of the Platform. 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 the right side shows the description on the learning object. Several actions such as add, organize, export, view, edit, or delete, become active or inactive depending on the context. The dots that appears 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 detailed tutorial guide on how to use the SELF Platform is available on the Platform itself [10].

Figure 5: Screenshot of the UI of SELF Platform in Hindi language.

VII. Future Directions

As described above, the SELF Platform is built to provide the basic collaborative online authoring system for e-learning material. Most core features are up and live on the platform, and the software is ready for deploying in any e-learning infrastructure. 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., peer to peer 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. The SELF Platform is managed from Savannah [13]. The source code can be obtained from the CVS repositories and a developer's guide is available on the SELF Platform [10].

VIII. 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 hacker is free 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.

IX. Conclusions

A fully free software based collaborative authoring system---the SELF Platform with its architecture, and its unique features are presented. 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.

X. Acknowledgements

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