

SELCONT: SYNCHRONIZED E-LEARNING CONTENT TOOLKIT

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Abstract

SeLCont (Synchronized eLearning Content) is a toolkit which provides synchronized e-learning content (video and slides) from lectures, with minimal or zero post-processing effort and no special installation requirements from lecture rooms. The final output is dynamically adjusted to any browser regardless of the end-user device or Operating System. SeLCont will be provided as a service in the Up2U (Up2University) ecosystem. Up2U Learning Platform will be implemented with Moodle and SeLCont is integrated on this platform as a WordPress Multisite (a network of sites) via the LTI (Learning Tools Interoperability) standard

Keywords: Synchronized E-Learning Content, Lectures Material, Video Editors, Learning Management Systems, LTI, Up2University

1 INTRODUCTION

On-demand provision of multimedia educational material is an integral part of e-learning management systems and on-line course delivery services. However, the effort to produce such lecture recordings may require significant post-processing effort and special equipment. In this paper, we present SeLCont (Synchronized eLearning Content) [1] that we developed at the Network Management & Optimal Design (NETMODE) laboratory of the National Technical University of Athens (NTUA) [2].

SeLCont is a simple toolkit for the synchronization, storage and web access of presentation slides and lecture videos with minimal post-processing and no special installation requirements from lecture rooms. Video-audio streams are stored and retrieved from a widely available video cloud provider (e.g. YouTube or Vimeo) avoiding the need for dedicated video-on-demand servers. Accompanying lecture material (slides and screenshots), synchronized with the cloud provided video stream, compose a lecture web-page accessible via a Web Server at the lecturer's organization.

End-users (students) can easily retrieve pre-recorded lectures over the Internet via any browser in his/her Laptop or Tablet or Smartphone running Windows, Android and iOS without any add-ons. This way they have online access to lectures, emulating what the lecturer did in the classroom for a second view and to revisit them in studying for exams.

A demo of a SeLCont synchronized presentation (video, audio, slides) that introduces its basic features can be played back by clicking <http://webvm.netmode.ntua.gr/courses/?lectures=introduction-to-selcont-english>

2 SELCONT (SYNCHRONIZED E-LEARNING CONTENT)

SeLCont provides adjustable HTML5 Web pages of lecture material (ppt's with or without annotations, PDF's, Internet screens etc.) synchronized with video-audio (stored in YouTube or any video provider) and reproduced via the JWPlayer.

The end-user plays-back in any device browser a lecture with video, audio and accompanying screens, synchronized and displayed on a side-window of their screen. If desired, selection can be triggered from the end-user browser via thumbnails related to the screenshots and displayed under the video frame. SeLCont requires zero or minimum post-processing effort from the presenter, as timestamps are being recorded automatically during a lecture when new slides or screenshots are presented.

Online lectures include:

- Video

- Slides (PowerPoint/PDF)
- Desktop screenshots (e.g. Internet web-pages)
- Annotations on slides

2.1 Steps of Synchronization Process

The synchronization process consists of three steps as depicted in Figure 1:

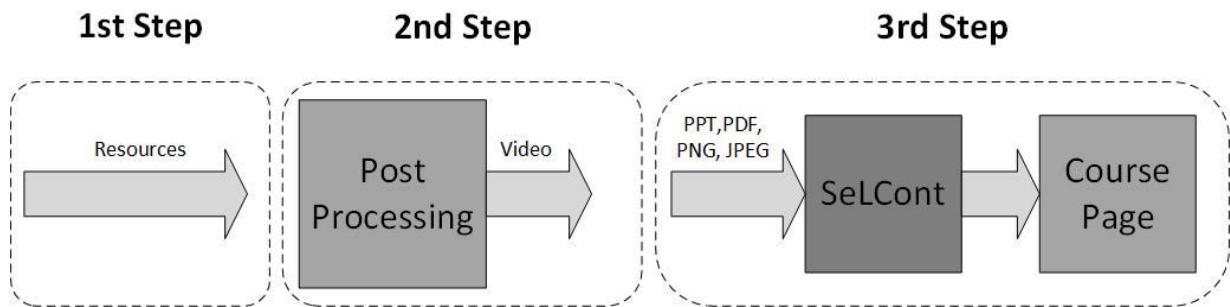


Figure 1:SeLCont Steps

1st Step: Lecture Delivery & Recording

The first step of the process is the recording of a lecture which includes the video and synchronized screenshots from the presenter's laptop. Video recording can be easily produced by using common lecture hall equipment. The additional learning material on the presenter's laptop can be slides (PDF/PowerPoint), Internet web-pages or other desktop screenshots. Screenshots, tagged with Timestamps for the synchronization with the video stream, are created by pressing "Ptr Sc" or "Space Bar" or a navigation key (←, ↑, ↓, →). This is enabled via a light portable Python SeLCont application (SeLCont app) that the presenter has to download to his/her Windows laptop.

2nd Step: Post-processing

The second step is the Post-Processing step. This may include an optional video editing of the recorded video. If the instructor does not feel comfortable on storing whatever was recorded directly in an open video service like YouTube or Vimeo, then he/she can perform some corrective actions during the post processing phase. This can be done by using widely available video editing tools like Camtasia and Wondershare or Open Source Tools (e.g. OpenShot). The video file is then uploaded to a video provider cloud in an .MP4 format.

3rd Step: Publishing the Final Result

The final step is to publish the final synchronized multimedia outcome in a Web server. A Web-literate person (the instructor or an administrator) has to create a lecture Web-page, preferably via a Content Management System (CMS) like WordPress. In this page, the instructor enters lecture-specific information, such as the title of the lecture, keywords, the presenter's name and affiliation, the URL that should point to the video file of the lecture (uploaded to a video cloud service), the presentation file itself (PowerPoint or pdf) and the screenshots synchronized with timestamps for the video stream. These are oblivious to the presenter.

2.2 SeLCont Lecture Web-page

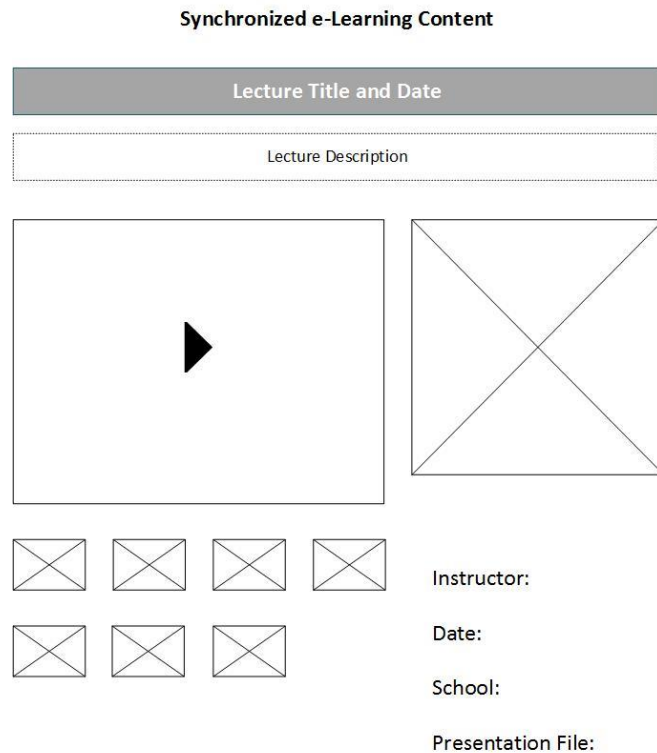


Figure 2: SeLCont Wireframe

The final result is displayed as a Web screen in the actual user's device, that is the student's Laptop, Tablet or Smartphone (Figure 2). This screen is dynamically adjusted so that it can be displayed in any kind of user device. The end-user screen is partitioned to a video window, with the screenshot timed to a corresponding video-audio instance displayed next to it. As the video is being played back, screenshots are automatically displayed, in sync with the lecture stream. At the bottom of the screen, thumbnails can be used to select a specific screenshot and move the video-audio to its synchronized instance. The .ppt or .pdf file can be downloaded by selecting the Presentation File link.

2.3 SeLCont Usage Options

SeLCont can be used in two ways:

- As a product to be used by:
 - Professors
 - Teachers
 - Presenters
 - Web site owners requiring add-ons for on-line synchronized multimedia content
- As a service to lecture-providing organizations like:
 - Schools
 - Universities
 - Research Institutes
 - Companies organizing lectures, seminars, presentations

Because of the fact that SeLCont was developed on top of a WordPress CMS (Content Management System) platform, it can be a part of a WordPress based LCMS (Learning Content Management System). Such LCMS based installations are preferable in cases where institutions have a large amount of learning content to be used in several courses and various formats [3]. SeLCont was developed using state of the art Web standards such HTML5, CSS3 and JavaScript together with the Bootstrap framework.

3 UP2U ARCHITECTURE

Up2U is a collaborative innovation project which tries to bridge the gap effectively between secondary and higher education and improve integration between formal and informal learning for secondary school students. The project needs to draw together a wide range of tools and infrastructures to present an integrated platform, in the service of appropriate pedagogical models and learning outcomes. The proposed architecture for Up2U is based on NGDLE (Next Generation Digital Learning Environment) conclusion that any Learning Management System (LMS) for secondary and postsecondary education needs to be supplemented by additional components and resources, resulting in an integrated digital learning environment [4]. In accordance, Up2U is designing an application toolbox depicted in Figure 4, mostly using a variety of open source tools [5].

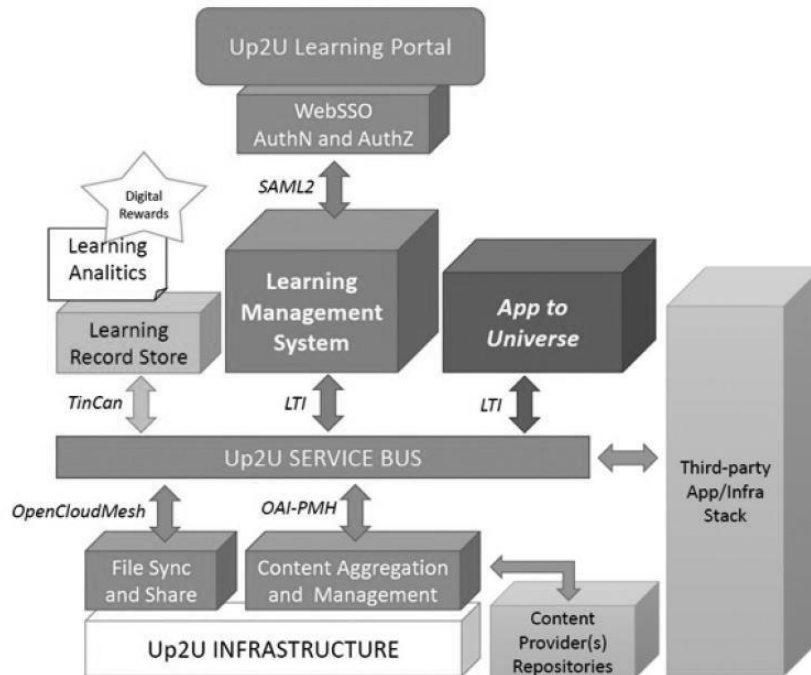


Figure 3: Up2U Architecture

The widely and actively supported Moodle platform [6] was selected for the core LMS. Moodle supports most of the interoperability standards such as LTI (Learning Tools Interoperability) [7] or xAPI (Experience API) [8]. LTI prescribes a way to easily connect learning applications and tools with LMS platforms, portals and learning object repositories on user's premises or in the cloud, in a secure and standard manner and without the need for expensive custom programming. The Up2U ecosystem is based on LTI. It also provides federated access and externalized group management, enhanced file sync and share capabilities, Open Education Resource (OER) aggregation, and integrated learning analytics.

4 SELCONT ON UP2U

SeLCont will be used as a service in the Up2U ecosystem. It is integrated within the Up2U platform as a WordPress Multisite Network. On the deployed Multisite platform (Figure 4), teachers can create on demand their own WordPress instances running SeLCont Plugins.

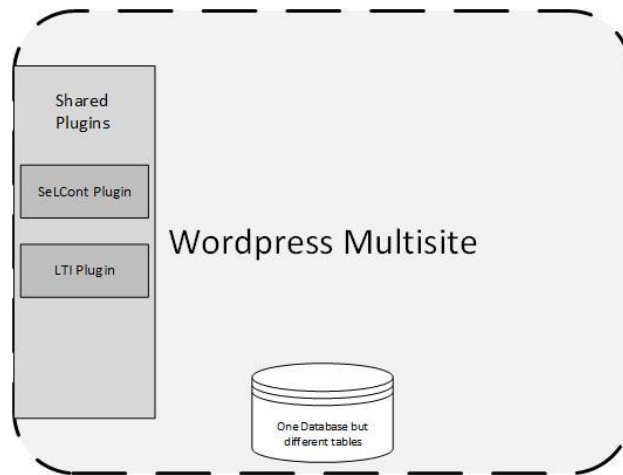


Figure 4: WordPress Multisite Platform

A multisite network is a collection of sites that all share the same WordPress installation and can also share plugins or themes. The individual sites in the network are virtual sites as they do not have their own directories on the server, although they do have separate media directories and tables in the database [9].

Each WordPress SeLCont site is integrated with Up2U Learning Platform via the LTI standard. Shared plugins on the first stage of implementation are: a) the SeLCont Plugin for WordPress under GNU General Public Licence [10] and b) the LTI Plugin, which is essential for the interoperability between WordPress Multisite and Up2U Learning Platform [11].

The Up2U Moodle Instance and the LTI WordPress Multisite integration, use a consumer and a secret key. The basic LTI workflow begins when the user (instructor or LMS administrator) gains access to the externally-hosted learning tool. The platform's administrator provides to the user (instructor) the necessary information: URL, key and secret (password) for the external tool [12].

In general, instructors add a SeLCont LTI tool into their course structure as a resource link, using the LMS control panel. Then he/she enters the information needed (URL, key, secret) as meta-data for the resource link. When end-users (students) select the tool, the LMS uses the provided information to seamlessly launch an iframe or new browser window assigned to the student.

In most cases, administrators add a "virtual tool" to the LMS, entering the same information as the instructors above. Once this is done, instructors see the newly configured LTI tool as another tool or activity to be placed as a resource link in their course structure. Instructors and students simply select and use the tool like any other tool that is built into the LMS.

When instructors or students select the SeLCont LTI tool, a launch request is issued that includes user identity, course information, role information, the key and signature. This is sent via an HTTP form generated in the user's browser; the LTI data in hidden form fields are automatically submitted to the external tool using JavaScript. The data in the HTTP form is signed using the OAuth (www.oauth.net) security standard. Thus, the external tool (SeLCont) can be assured that the launch data were not modified between the LMS and the tool. The LTI SeLCont integration is depicted in Figure 5

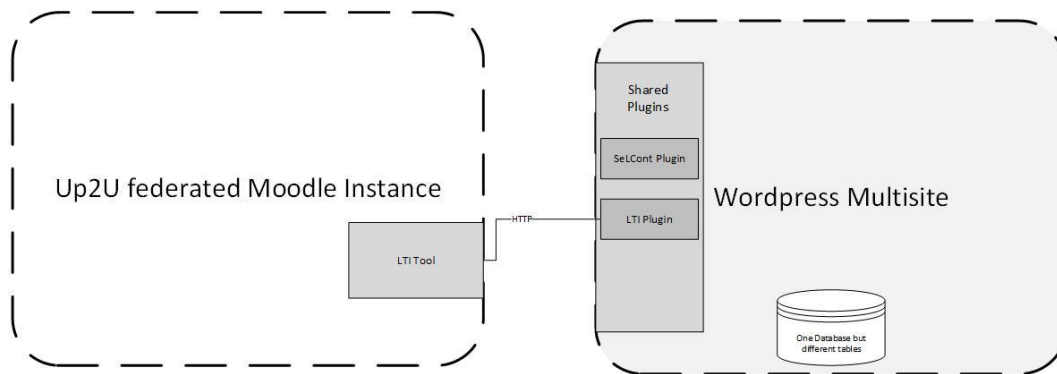


Figure 5: LTI SeLCont Integration

5 CONCLUSIONS

SeLCont is an open source, user friendly lecture recording toolkit that stores and reproduces synchronized multimedia content: Lecture streams and accompanying material (slides, desktop screenshots). It enables end-users (students) to retrieve on demand via the Internet pre-recorded lectures from a Web browser in her/his Laptop or Tablet or Smartphone without any add-ons. This way they have online access to lectures, emulating what the lecturer did in the classroom for a second view and to revisit them in studying for exams. It requires no special equipment by instructors for lecture delivery, nor dedicated video-on-demand servers as it relies on widely available video cloud providers.

SeLCont is an easy to use toolkit, which provides significant degrees of freedom in indexing, selecting and editing of recorded lectures. Unlike multimedia content delivery toolkits that combine within an integrated stream video-audio with online computer screen capturing, it treats separately video-audio and screenshots. Thus, synchronized multimedia content is driven by individual screenshots that can be easily indexed, modified, displayed and selected.

Finally, due to its implementation as a WordPress plugin, SeLCont can be easily integrated to any LMS that implements the LTI standard. It can be used as a standalone platform or integrated within a learning ecosystem like Up2U so that end-users can further profit from digital advances in education.

ACKNOWLEDGEMENTS

SeLCont was developed at the Network Management & Optimal Design (NETMODE) laboratory of the National Technical University of Athens (NTUA), partially supported by its Institute of Communication & Computer Systems (ICCS) [13] and by the Up2U H2020 European Commission project [14].

Up2U is a three-year EU innovation project under Grant Agreement No. 732049. The authors of this article would like to give special thanks to all the participants of the project for their support and their feedback.

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