Peer Reviewed Papers

The experience of L2L (Live to e-learning) at the University of Turin

Manuela Caramagna[1], Cristina Giraudo[1], Angelo Saccà[1], Marilena La Placa[2], Franca Fiumana[2], Matteo Bertazzo[2]

[1]Università degli studi di Torino, Torino (TO)
[2]Cineca, Casalecchio di Reno (BO)

This paper describes the experience of introducing new technological services within the e-learning activities of the University of Turin, in collaboration with CINECA. Specifically it describes the design choices, the technology implementation and integration of new tools and new types of content with the activities and e-learning platform already in use at the University.
The service L2L (Live to e-Learning) has allowed to meet the University of Turin's need to create educational digital content from lecture recordings with little expenditure of time and costs. Turin was the first university of the CINECA consortium to adopt the L2L solution. The experience of these two years confirms the validity of the service and opens perspectives for further development. L2L allows live lectures to be semi-automatically transformed into e-learning activities ready for publication and delivery through an e-learning platform. It has been realized using a Digital Asset Management (DAM) system based on the open source platform MediaMosa,

for citations:
Caramagna M., Giraudo C., Saccà A., La Placa M., Fiumana F., Bertazzo M. (2012), *The experience of L2L (Live to e-learning) at the University of Turin,* Journal of e-Learning and Knowledge Society, v.8, n.1, 33-41. ISSN: 1826-6223, e-ISSN:1971-8829

which has been integrated into Moodle with a special plug-in. The overall architecture is open and modular, allowing both the deployment of different service models and the seamless re-use of digital content in different contexts (e.g.: e-learning platforms, web portals, WebTV).

1 Introduction

In recent years, the University of Turin has felt the need to improve and better integrate the in the e-learning activities the capture, transformation and delivery of live lectures. The need was to make video lectures reducing as far as possible the cost and time needed to make them.

CINECA, Interuniversity Consortium which includes 50 universities, according to an analysis of the requirements of the universities consortium and the analysis of available technologies about lecture capture, deployed the L2L service, which allows a semi-automatic creation of multimedia learning objects based on classroom lectures.

The introduction of L2L in University e-learning services allowed to reduce the elapsed time from live lectures to the publication of a digital object "consistent" on the e-learning platform.

The service uses a centralized system of Digital Asset Management (DAM) which includes the components of management, post-production and delivery. The L2L recorder simplifies the capture and the lesson metadata management, while publication and delivery have been completely automated. The centralization of both the e-learning system and the DAM as ASP services ensured a low start-up cost for the adoption of L2L by the university.

2 The e-learning service Athenaeum of the University of Turin

The multi-polar and complex nature of the University of Turin (13 Faculties, 55 Departments, about 70,000 students, and around 5,000 professors and technical/office staff) requires paying attention to the specific demands and needs of each faculty as well as implementing system solutions that ensure and optimize the efficiency of all services. The didactics support solutions made available to the Athenaeum include legacy, custom and open source programs (besides the Moodle platform, another open-source software package, Shibboleth, is used for single sign-on authentication).

Back in 2006 the Athenaeum implemented a global requirements definition process to capture, analyze and address the needs of each faculty through a central location, the University's Integrated Web Services Division. In response to the Faculties' extremely high level of interest in didactic support tools, the University implemented integrated technology solutions with several features worthy of mention, such as:

1. the authentication method, which foresees using Athenaeum unified access credentials (for professors, technical-administrative personnel, graduate and undergraduate students) for logging into the portal and accessing online services. The unified credentials-based access feature serves as an authentication engine for the management of authorization logistics (who may access the service and role-based functionality); it also allows for managing local and "federated" access. The authentication method is integrated with the central vital records databases, which serve as prerequisites for the authorization logistics;
2. the divisions' adoption is driven by a consolidated process named "Start-up plan" which basically requires the person in charge to file a formal system adoption request, indicating the names of reference individuals for specific service information (RIF), and the organization of system administration and management training sessions;
3. the Integrated Web Services Division has a dedicated support department, a reference point that provides the RIF with information on "federated" services via structured meetings, email or over the phone;
4. the Athenaeum model also applies to each faculty, where the RIF serves as a reference point for its specific service (adding content, professors and students support, etc.).

By proposing unified solutions, the Athenaeum intends to enhance the value of each specific faculty and establish a common substrate upon which to build additional services.

The University of Turin embraces the concept of e-learning services in its broadest sense, meaning through the integrated and modular use of a wide range of tools:

1. CampusNet – a proprietary platform that allows for creating a website (pages, documents, professors and course lists, notifications, etc.), which professors can effectively use as a didactics support tool (for publishing educational materials, course information, notifications, etc.);
2. Moodle – Open Source platform for the management of e-learning curricula. Within the context of the Athenaeum, most e-learning activities are of the blended type;
3. Unito/Media – Athenaeum multimedia channel (WebTV and WebRadio), integrated with other didactics support services;
4. Streaming Servers – servers dedicated to the management of multimedia content, which RIF may access to autonomously manage materials available through the Moodle and Unito/Media platforms.
5. Virtual Room – the CISCO-Webex proprietary product integration with the Athenaeum's portal. It is a "live" Collaboration solution that may be

used, among other things, as a virtual classroom for student interactive activities, like an online reception area.

3 The L2L solution introduction project

The L2L project fits perfectly in the organic design of the Athenaeum's platforms: the e-learning service is the result of a rationalization effort through which the vast and precious experience of different actors (Faculties, Departments, Centres, individual professors, etc.) were channelled to form a common organizational and technological system that fully integrates all of them.

In 2008 the University of Turin adopted the Moodle platform for its Athenaeum, creating a common substrate for e-learning activities. The Moodle platform's evolution, in terms of additional modules, uses the specific requirements as the starting point for generalization. Some of these requirements regard the multimedia content generation support capabilities of both software and hardware designed to prepare materials for publication in e-learning environments.

In 2011, the above described integration process (technology, authentication, users database) was deemed to have been suitably established, and the L2L solution was introduced to record videos of professor lessons for subsequent publication of the course in multimedia format on Moodle (using a specific application), and the forthcoming Unito/Media platform (which represents another multimedia distribution channel for Athenaeum productions). The addition of L2L to the multimedia content already produced by individual professors allows for their being seamlessly integrated into the Athenaeum e-learning service solution (which, under optimal conditions, allows professors to autonomously record and publish audio/video resources for their course on Moodle), and the Athenaeum's streaming servers.

The introduction of the L2L service to the Faculties is not merely meant to deliver a product: a support figure (trainee) has been associated with the initiative to facilitate and promote utilization of the solution. This last has helped professors record their lessons (providing assistance regarding the use of recording devices, starting and ending the recording session), and shared knowledge to enable the RIF to use the solution in an autonomous manner.

A total of 14 "full stations and 14 "light stations" (these last to be available in May 2011) have been reserved for the Faculties L2L solution introduction project. This provides one station for each of the Athenaeum's 13 Faculties, and one for technical-administrative staff training. The "full stations", which include a desktop pc, monitor, keyboard, mouse and audio/video recording devices (video camera, microphone and receiver) are intended to be set-up in a classroom (in the case of classrooms shared with other faculties, the content

may fall within different Moodle instances); "light stations" are laptops with integrated audio/video recording devices for greater mobility, and are meant to be used by a single professor or a group of professors.

4 The architecture of the L2L service

The L2L service architecture has been designed after careful analysis of available systems for automated lecture captures adopted by the most technologically advanced universities.

The analysis of the state of the art showed that the main criticism of such systems was the integration between the components of the lecture capture system with the e-learning platform for the presentation and delivery; also showed that the modular approach by introducing an intermediate digital asset management system (adopted by many universities including Osnabrück) allowed to have more flexible systems and better integration of the parties.

When implementing L2L, it was decided to further extend the modular approach so that the different phases (recording, storage and delivery) are more independent of each other: for example enabling the lecture recording in offline mode.

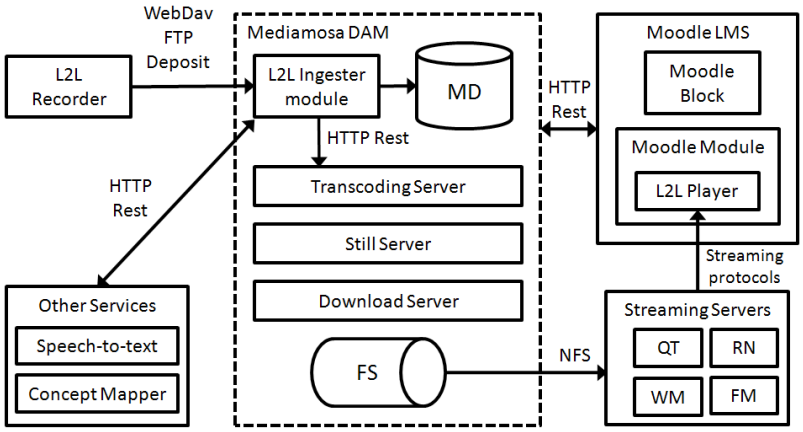

Fig. 1 - Architecture of MediaMosa platform

The MediaMosa platform has been extended by implementing an ingestion service (L2L Ingester module) in order to open, validate and process all the packages coming from remote L2L stations (FTP or WebDav deposits).

The ingestion module uses the REST API services exposed by MediaMosa to store, analyse and transcode all the contents inside a L2L package. The ingester also deals with storing descriptive metadata (the DAM supports an

extensible Qualified Dublin Core (QDC) schema) and invokes the Concept Mapper service developed by Cineca in the context of the European funded project Papyrus. The Concept Mapper enriches the lesson with the concepts identified by analyzing the texts taken from the MS-PowerPoint slides so that L2L lessons provides a table for concepts browsing.

According to the REST calls coming from the ingester module, the DAM performs a set of related jobs on each mediafile. Once that the mediafile analysis and the technical metadata extraction are completed, the mediafile is processed by the Transcoding Server. This Server is based on FFmpeg and is responsible to perform necessary transcoding jobs, according to a set of predefined transcoding profiles and the type of the L2L lesson.

The Moodle module allows the integration of the DAM with the Learning Management System (LMS): by using this module the Moodle platform becomes a MediaMosa authenticated client and uses the exposed REST API services to manage and access the digital assets according to users profiles. The Moodle block allows teachers and administrators to control and manage their lessons both at activity-level and DAM-level.

5 Components and technology

The three main components of the L2L service are the L2L Recorder, the DAM platform and the Moodle module (which implements the integration with the e-learning management system).

The L2L recorder is the system able to record and synchronise an audio source and two video sources: the teacher's video plus the screen capture or the external video source like an interactive whiteboard. The L2L station is based on a PC, with a video capture card, a Pan tilt zoom camera (PTZ) camera, a VGA2USB capture device and a lavalier microphone. The L2L software is a MS Windows.NET application and the audio/video streams are encoded in high quality Windows Media Video format.

The lecture capture process involves the following steps:

- teacher's authentication based on Security Assertion Markup Language (SAML);
- web services (SOAP) retrieval of teacher's personal information from Moodle;
- web services retrieval of descriptive information about e-learning courses
- specific metadata about the teacher and the taught subjects are collected and automatically associated to the recording;
- selection of the capture mode: the L2L client supports different recording types (audio only, teacher's audio-video, screencast, teacher's audio-

video and a secondary video) in order to best suit the teacher's needs;
- attachments insertion into the lesson;
- description of the lesson: title, abstract and tags;
- recording phase;
- quality control: the teacher is able to check the recording quality using a preview player;
- load to the repository: transparently to the teacher,
- an upload manager process schedules the upload in the repository where the ingestion process takes place.

Thanks to a specific L2L MS Office 2007 plug-in, it's possible to capture the presentation slide change events. The same plug-in includes in the L2L package the slide snapshots and an XML containing the slides' texts.

The L2L Recorder supports the offline recording in order to address common scenarios where the lectures take place in a room not connected to a network or a teacher prefer to record a complete set of lectures before uploading to the DAM.

The Digital Asset Management platform integrated into L2L is based on the MediaMosa platform. MediaMosa is free and open source software to build a web service oriented media management and distribution platform, providing multimedia content delivery.

A MediaMosa-based DAM platform offers functionality for searching, playing, uploading, transcoding, as well as a fine granularity media access control system towards its users.

MediaMosa implements the four main system functionalities - ingest, store, manage and publish – through a large set of REST calls.

MediaMosa content model relays on assets and mediafiles: an asset is omposed by a set of mediafiles (the original one and all the transcoded versions). This allows the same asset to be delivered using a number of different protocols and formats.

The Integration between the Repository and the Learning Management system allows to manage, publish and deliver the L2L lessons. A Moodle interface to the DAM has been developed and, according to the Moodle paradigm, a module implementing a L2L Moodle e-learning activity has been realized.

The L2L module can be used among other resources and activities in a course and the same lecture can be used in different courses and Moodle installations that are coupled with the repository.

The L2L module and block implement the communication flow with the repository using the REST API services. The module enables the teacher to define the learning activity within the course. The teacher can search a lecture browsing all the recordings stored in the repository (MediaMosa assets); role

and profile based rules restrict the visibility of the assets to different users. According to the metadata associated to each lecture the teacher can filter the search in the repository. The L2L module enables students to access the digital lessons.

Finally, to meet distance learning universities' needs, the lesson delivery has been enhanced to be compliant with Sharable Content Object Reference Model (SCORM).

In fact, in Italy distance learning universities have to respect specific rules about e-learning courses delivering and preservation: they have to track and preserve information about students activities.

Conclusions

As of November 2011, with the help of interns, 7 faculties of the University of Turin are using the L2L to record lectures, seminars and meetings. So far the university produced more than 1,000 hours of recordings, meaning over 600 video lessons.

L2L has been introduced following the same management model as the existing university services: an RIF is the first support contact point for teachers. The RIF can escalate the requests, report users feedback to the Web Services Division and collect requirements for further development.

As stated above, the modularity of the solution enabled the seamless integration of the new service into the e-learning platform Moodle from the technical, organizational and educational standpoints.

The next developments in the L2L service include the Concept Mapper, which enables browsing the lesson through a video indexed list of concepts extracted from the slides presented and the times they were shown. The Concept Mapper, a tool based on Wikipedia Miner, will be used to get Wikipedia as a source of metadata but also as a linguistic resource to disambiguate keywords, or provide synonyms of keywords (anchor, or the text users utilize to link to Wikipedia) and translations (using information on interwiki links).

Another further development is the Mosaic service, which generates a single audio/video stream (Mosaic) by mixing the different L2L flows (slides, video, teacher). This unified flow will be available to mobile devices in streaming or offline mode (video podcasts) via a specific application.

REFERENCES

Barry D. K. (2003), *Web services and service-oriented architectures: the savvy manager's guide*, San Francisco, Morgan Kaufmann.

Paci G., Pedrazzi G., Turra R. (2010), *Wikipedia-based approach for linking ontology concepts to their realisations in text*. URL: http://www.lrec-conf.org/proceedings/lrec2010/pdf/132_Paper.pdf. (verified on November 24th 2011).

Milne D. (2009), *An open-source toolkit for mining Wikipedia*, URL: http://www.cs.waikato.ac.nz/~dnk2/publications/AnOpenSourceToolkitForMiningWikipedia.pdf (verified on November 24th 2011).

AAVV (2008), Advanced Distributed Learning. *ADL guidelines for creating reusable content with SCORM 2004*. Technical report, 7 URL: http://www.adlnet.gov/wp-content/uploads/2011/07/ADL_Guidelines_Creating_Reusable_Content.pdf (verified on November 24th 2011)

Birnbaum N., Ketterl M., Mertens R., Rolf R., (2008), *Integrating lecture recording with an lms: An implementation report*. University of Osnabr¨uck, URL: http://www.inf.uos.de/papers_pdf/2008_06.pdf. (verified on January 10th 2012)

Ziewer. P. (2006), *Flexible and Automated Production of Full-Fledged Electronic Lectures*, PhD thesis, Technischen Universit at Munchen, URL: http://deposit.ddb.de/cgi-bin/dokserv?idn=985300469&dok_var=d1&dok_ext=pdf&filename=985300469.pdf (verified on January 10th 2012)

WEBSITES

Moodle, URL: http://www.moodle.org (verified on November 24th 2011).

Università degli studi di Torino - Piattaforma Campusnet, URL: http://www.unito.it/campusnet (verified on November 24th 2011).

Università degli studi di Torino - Elearning URL:, http://www.unito.it/unitoWAR/page/istituzionale/didattica/e_learning9 (verified on November 24th 2011).

Università degli studi di Torino - Media – Event Channel, URL: http://www.unito.it/media/ (verified on November 24th 2011).

Cisco Webex Web Conferencing, URL: http://ww.webex.com/ (verified on November 24th 2011).