EAGLE: An Accessible Platform for Delivery of Learning Materials

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Abstract

Employment opportunities for persons with disabilities are very much hampered by inaccessible software. This is particularly true when those who are employed must engage in Continuous Personal Development (CPD) but the online training platforms they must use are inaccessible. This paper describes the platform developed by the members of the Enhanced Government Learning (EAGLE) project team to produce a training platform for workers in rural municipalities. It outlines efforts made to ensure the platform, and associated content, are accessible and usable by as wide a range of people as possible.

Keywords

Accessibility, EAGLE, Open Educational Resources, Technology-enhanced Learning, WCAG

Introduction

When the topic of online learning is considered, the context of learners outside formalised educational settings such as those provided by universities is often completely ignored. However, continuing professional development (CPD) can, and often does, require the use of online resources. Failure to participate in CPD-related activities, can frequently be a barrier to promotion, or indeed prevent it entirely. It is therefore of grave importance that any system which provides access to online training materials, or community-supported knowledge exchange, be accessible to as wide a range of users as possible. Failure to do so can, and does, result in the exclusion of many employees and unnecessary barriers to career-advancement being created.

This paper presents a discussion of the EnhAnced Government LEarning (EAGLE) project, which has been funded under the seventh Framework Programme of the European Union to provide an accessible platform for the provision of Open Educational Resources (OERs), and to foster communities of knowledge-sharing. In the sections which follow, the philosophy, concepts and technologies underpinning the platform will be discussed. The paper further presents and discusses the main components of the platform, and also details strategies which aim to ensure that both the software components and sample content are universally usable.

Background

Open Educational Resources (OER) are materials which are freely available online for use by everyone irrespective of whether the person seeking to access them is a student, self-learner or indeed an educator. Such materials are useful not only in the context of formal education (for example primary, second or third level courses) but also in the context of professional development and/or other training scenarios. Use of OER also provides an

interesting avenue for disseminating accessible learning materials. Recent research by members of the universal design for learning (UDL) community acknowledge that "Access to OER is growing, but, not for all. Not only do the online educational materials need to be freely available and with permission to use, OER need to be designed so individuals with disabilities can use them for their teaching and learning." To achieve these goals necessitates a variety of technological and organisational components to work together. Some of these are: i) A platform capable of producing accessible OER; ii) Resources which guide personnel in the production of accessible OER; iii) Organisational policies which ensure compliance with criteria guaranteeing accessible OER.

Technology-enhanced learning (TEL) represents thus a sensible option for the provision of online training materials to public employees who need to keep up with such changing environments, but do have limited access to training courses. EAGLE's main objective is to equip employees in local governments with a holistic training solution based on Open Educational Resources (OER) and Open Source tools, supporting learning of critical transferrable skills such as ICT literacy and professional management of change situations.

It is one of the key project goals that all artefacts are accessible. For example, the platform currently under development is being thoroughly tested to ensure compliance with all relevant standards (e.g. Web Content Accessibility Guidelines (WCAG), Authoring Tool Accessibility Guidelines (ATAG) and Accessible Rich Internet Applications (WAI-ARIA). All project partners are committed to ensuring that not only this platform is accessible, but that the OER produced are also universally usable by as wide a demographic as possible.

Overview of the EAGLE Platform

The EAGLE platform has been built using the principles of user-centred design (UCD). To that end, stakeholders in four countries (Ireland, Luxembourg, Germany and Montenegro) have been involved and consulted at all stages in the development process. The first involvement with users took place early in the lifecycle of the platform, when workshops were held with representatives of local government organisations (municipalities) in the four countries previously mentioned. The outcome of these workshops was a detailed analysis of barriers to the adoption of a learning platform such as EAGLE in a Public Administration setting. Amongst the barriers to emerge from these exercises were: i) A lack of relevant ICT knowledge; ii) A lack of awareness of the advantages of online training/learning; iii) A lack of trust in any learning platform and associated content; iv) An unwillingness to share/impart knowledge lest it be seen as reducing the employee's usefulness.

Following on from this, a workshop specifically focussed on defining accessibility requirements for a platform such as EAGLE was held. Here, invited experts from diverse sectors of the accessibility landscape gathered and contributed to the discussion. The topics on the agenda were: i) How to ensure the platform itself was accessible; ii) How to ensure that all content produced on the platform was accessible.

The most tangible output from this workshop was the production of a persona which depicted Seamus, a vision-impaired worker in a rural office of an Irish municipality. This persona captured the personality, ambition, and most importantly technological capabilities and needs of this fictitious gentleman. This persona complemented others produced within the project which described other employees in Public Administrations in various countries, and in various contexts. These personas were then given to developers, and along with a scenario

detailing how the EAGLE platform could/would be used, assisted in the generation of early-stage mock-ups, and the subsequent development of the portal.

What is important to note here is that accessibility was considered right from the beginning of the project, and not retro-fitted as a well-meaning afterthought. The importance of this approach cannot be overstated. Had considerations of accessibility not been included at the very earliest design phase, it is unlikely that the solution would have been as accessible as it is.

High-level System Architecture

The EAGLE Platform is built on Liferay (liferay.com) which is a free and open source portal platform distributed under LGPL. The EAGLE Knowledge Backend System (Figure 1) incorporating the EAGLE Ontology for Local Governments (EAGLE Knowledge Base). The EAGLE Knowledge Base represents the backbone of the EAGLE Platform. It manages the metadata of the information collected in the EAGLE Platform. Knowledge management plays a central role in the EAGLE Learning Platform providing a storage backend for the management of metadata related to OER's, the learners as OER users, and their learning competences and skills.
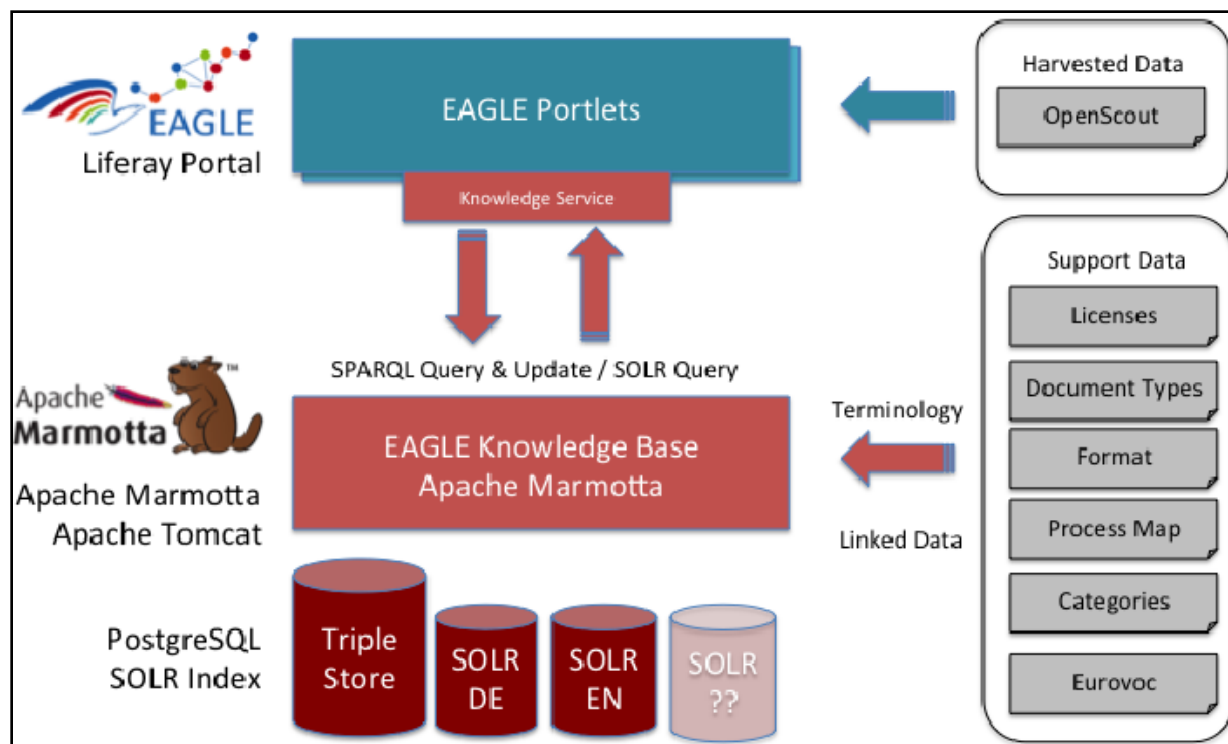
Fig. 1. High-level Architecture of EAGLE Knowledge Backend.

In EAGLE, knowledge management is based on Apache Marmotta, which is an implementation of the LDP standard. In addition, the design and development of the architecture uses the concepts of OSGi (Wikipedia, 2016) and model-driven engineering. For each data provider, a single harvester module is implemented that extends the abstract super harvester. The mechanism of data management illustrated in Figure 2 shows the overall workflow of the harvester controller.
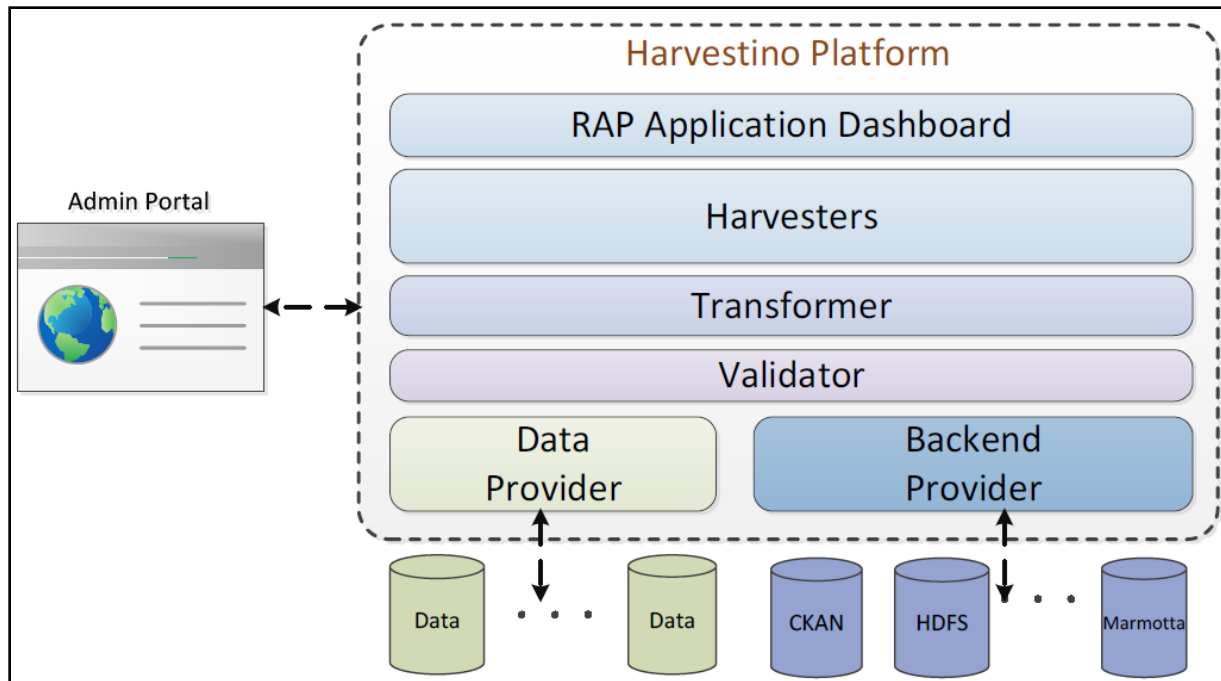
Fig. 2. Overall Stack of Harvestino

As depicted in Figure 2, the harvesting mechanism comprises of five simple steps: i) First, the data is extracted from the data source with the help of data providers; ii) The extracted data is immediately validated for syntactic and semantic errors which, having been obtained from the validation process are logged and reported back to the data provider; iii) Upon successful validation, the input data is transformed to a target meta-model that is the OER model in the case of EAGLE; iv) The transformed datasets are validated once again to check the transformation errors and v) Finally pushed to the backend through the help of a backend provider, for instance Marmotta knowledge service.
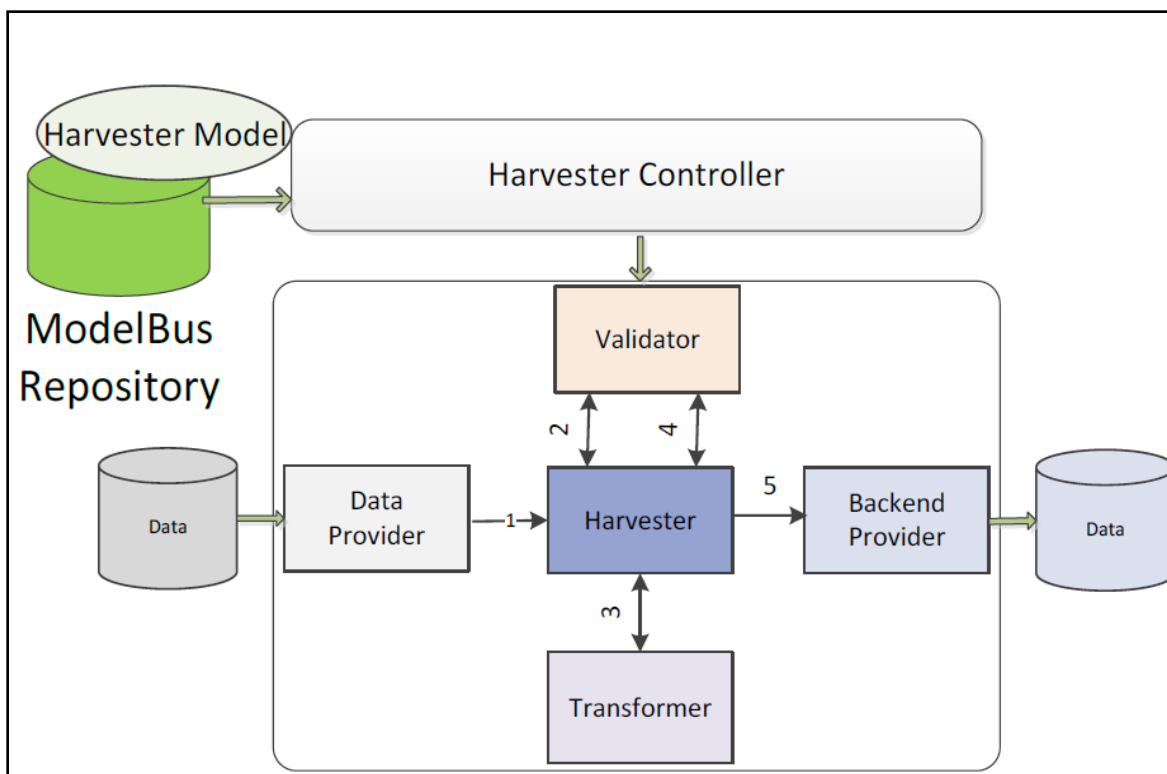
Fig. 3. Modular Workflow of Harvestor Controller.

All the developed modules are based on OSGi extension mechanism and are operated by the Harvester Controller Module (HCM) (depicted in Figure 3). HCM controls the configuration, scheduling as well as the operation of Harvesters. Individual Harvesters are instantiated by the HCM through the Eclipse Extension Point mechanism (Vogella, 2014). This incorporates the *Dependency Inversion Principle* (Vogel, 2012-May and Wikipedia, 2016), through the abstract Harvester class. To attain the cohesive as well as scalable nature, all the modules are designed based on SOLID Design principles (R.C.M.U. BOB, 2009). Harvestino also provides inbuilt Authentication and Authorization to safeguard the security and integrity of the harvesters. As Harvestino uses Model- Driven Engineering concepts, all modules inherently work on models instead of raw data. The HCM controls the operation of modules based on the configurations (individual Harvester Models) stored in the ModelBus repository. ModelBus (Aldazabal, A., Baily, T., Nanclares, F., Sadovykh, A., Hein, C., Esser, M., and Ritter, T., 2008) serves as a

model integration framework that provides the internal storage of harvester related configurations. As Harvestino is built with OSGi, it provides features for hot deployment of modules through the OSGi console. Apart from the OSGi console, Harvestino also realizes a Remote Application Platform (Eclipse.com, 2016) user interface to provide a thin client with a rich widget set to administer the harvesters.

EAGLE Main Features

EAGLE consists of three main components (depicted in Figure 4): i) Search and find, ii) Create and keep track and iii) Engage and share. The Create and keep component enables the users to produce a learning resource: i) Step-1 User Registration and login; ii) Step-2 MyEAGLE Studio; iii) Step-3 Authoring of content. The authoring component is further sub-divided into four components (metadata, resources, categorize and the publishing of the OER. It is considered essential that these various components are entirely accessible.
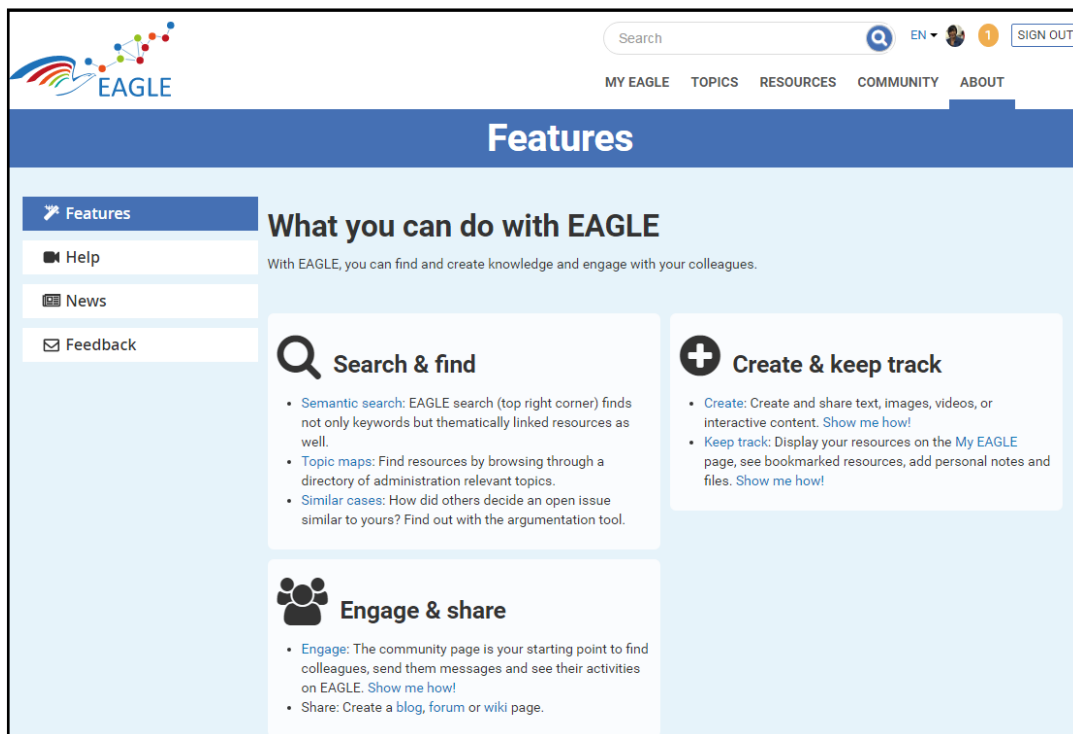

Fig. 4. EAGLE Features.

Therefore, the underlying user interface (UI) frameworks which have been used to build them have all been chosen based on their adherence to WCAG2.0 and ARIA 1.0. As previously mentioned, the EAGLE platform relies on the use of external components to perform various tasks. In order to make tool selections which catered for the needs of diverse users, the criteria developed by the Ageweb project (Ageweb.ch) have been adopted. These criteria do not deviate in any way from the guidelines contained in WCAG2.0; however they expand upon them and focus on usability as well as the more technical aspects of accessibility.

Evaluation

Over the development lifecycle, care has been taken to perform automated as well as manual accessibility checks on the various components and workflows within the platform. Each template has been checked against WCAG2.0 and WAI-ARIA. Evaluation has been undertaken by a Screenreader user to ensure that (in so far as is possible) the platform can be effectively be used with this form of Assistive Technology. Both JAWS and NVDA have been used with the system, in conjunction with Firefox and Internet Explorer. Whilst a thorough analysis has been carried out by an expert Screenreader user in order to ascertain the technical shortcomings in the platform, it has not as yet been possible to carry out an in-depth user-evaluation with other users of this form of assistive technology. The main reason for this is that the development process is only just completed.

The manner in which the expert evaluation was conducted was based around completion of five key tasks. These tasks were: 1) To find information on the platform on a certain topic; 2) Engage in discussions on the forum; 3) To create a blog entry and also to comment on a blog entry of another user of the platform; 4) To interact with various resources on the platform and

rate them, bookmark them, and perform various other related tasks; 5) Establish ties with other colleagues, and create networks for knowledge sharing and peer support.

The results of the expert review were, on the whole, positive. Indeed, most tasks could be completed without difficulty. The one exception to this was that, although resources and other results could be found, interacting with them (i.e., viewing the specific piece of content) required expert knowledge of both NVDA and JAWS. Thus, whilst in theory the portion of the system concerning the task was accessible; its usability was less than satisfactory. As accessibility has been included at all stages of the project, the fix is relatively simple; requiring only that keyboard navigation be added to one key component.

This paper in no way seeks to suggest that the expert evaluation carried out here is a replacement for a comprehensive user evaluation with users of Screenreaders, or indeed other Assistive Technologies. Rather, the members of the project team see this as merely the precursor to carrying out these tests. It is essential that, once the basic accessibility, and more importantly usability of the system is assured, the input of real-world stakeholders is elicited and any issues addressed.

Conclusion

Ensuring that employees have access to online training resources is essential for most organisations today. It is equally important that those with disabilities are not left behind due to inaccessible systems or content. This paper has sought to describe the EAGLE platform; a holistic learning solution which aims to provide a vehicle for learning and knowledge-sharing for employees in local authorities.

In order to ensure the long-term viability of the platform, it is essential that resources are made available to those using it which assists them in making their content accessible. Doing so

ensures that not only the system itself is usable by people with disabilities, but the learning

materials stored on the platform are also usable, and thereby guarantee that those who can benefit

most from digital content can avail of it easily and effectively.

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