DEVELOPING AN ACADEMIC INSTITUTIONAL REPOSITORY. THE CASE OF THE OPEN UNIVERSITY OF CYPRUS

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Abstract

The amount of digital content produced nowadays, is enormous. Academic institutions produce and make available a plethora of digital objects like research articles, theses, dissertations, reports, audiovisual collections and many others. In addition, academic libraries digitize materials to create collections of historical, political and scientific significance and are responsible for keeping, preserving, archiving and publishing the content produced by their students and academic personnel. Aiming in that direction, the Open University of Cyprus, an institution responsible for delivering distance learning at the Republic of Cyprus, designed and deployed "Kypseli" Institutional Repository.

In this work, the authors depict the methodology and tools used for building an academic institutional repository using open source tools at the Open University of Cyprus. Moreover, the procedures used for publishing content and the integration of the repository to the rest of the university's infrastructure are analysed, along with the challenges faced during the implementation and deployment phase. In addition, a number of metrics are presented, accompanied by statistics of usage.

Keywords: academic repository, distance education, e-learning, digitization.

1   INTRODUCTION

In recent years, there has been an increase in the number of academic institutional repositories deployed by universities all around the world. These repositories hold both the scholar work of the institution and the cultural heritage of the area that hosts the institution [1]. In the Republic of Cyprus, there are three public universities; the University of Cyprus, the Open University of Cyprus (OUC) and the Cyprus University of Technology. Each of the three Universities currently has an institutional repository. In this paper we focus on "Kypseli" (http://kypseli.ouc.ac.cy), the OUC's institutional repository.

The university responsible for the distance education in Cyprus is the Open University of Cyprus. It was founded in 2002 and its first students were admitted in 2006. The OUC uses the open and distance education methodology to deliver courses to students all over the world. To support the distance education methodology used, a number of technological innovations were introduced, like the eClass eLearning Platform [2] and the Library services.

The eClass eLearning platform is an integrated system that combines synchronous and asynchronous learning tools for delivering educational content to the university students, supports virtual classrooms where both students and educators can join and attend a lesson and collaborate. Students use this platform to deliver their coursework, theses and dissertations. This workflow also includes a state of the art plagiarism detection and prevention system [3] that helps educators in grading and monitoring the quality of the delivered coursework. Educators can also use this platform to create educational content and incorporate it to the available courses.

The OUC Library, is not the typical academic library found in a conventional university. The OUC Library is responsible for the normal day to day jobs like cataloguing, acquisitions, circulation, interlibrary loans etc. and for facilitating the construction and selection of educational content for the eLearning courses delivered to students. More specifically, librarians are responsible for helping educators to select appropriate educational material for distance education courses using numerous

bibliographic electronic sources. The selected material is checked for complying with methodology and accessibility standards.

The OUC Library is also responsible for supporting the OUC digitization center that is equipped with a number of digitizers and a robotic book scanner. The center staff also has access to advanced digitization software to produce high quality images of scanned books and other material. The digitized material is submitted to the repository for indexing and archiving.

Recently, the OUC has completed a joint project with the University of Cyprus for deploying a state of the art Library Information System. Among the many innovative services of this system, we highlight the union catalogue and the power search functionality for searching in various sources, like electronic databases and journals, institutional repositories and the online public access catalogue (OPAC) of each participating university.

In this work, we depict the methodology and tools used for building the OUC's academic institutional repository. This paper is organized as follows: In the first section, the history of the OUC's institutional repository is presented along with the rest of the library and eLearning services. Next, in the second section, a description of the process followed to design and implement the repository is presented, followed by a presentation of the content hosted in the repository in the third section. In the fourth section we present usage statistics from the repository and we conclude by presenting our future plans for the repository.

2   DESIGN AND IMPLEMENTATION OF KYPSELI INSTITUTIONAL REPOSITORY

In 2011 the Library of the OUC and the eLearning and Digital Content Management Team of the University received a number of requests for archiving theses, dissertations and disseminating outcomes of research projects at the university. Also, there was an increasing need for digitization of material and a "place" for delivering it to the public.

Following the standard practice in deploying new services at the university [4], we assembled a project team with librarians and IT experts to investigate possible solutions that could meet these requirements. First, the project team prepared a detailed specification document including the requirements gathered from stakeholders and the goals of this project. More specifically, the following goals and user expectations were detected:

1) Ability to host and archive scholarly and research data produced at the OUC
2) Ability to deliver content to faculty and public
3) Ability to preserve and promote cultural heritage
4) Ability to add and reuse content in teaching

The fact that the OUC is a distance learning University and the majority of our users are not physically located at or near the university campus, requires that all previously identified goals should apply to all geographic locations.

2.1   Software Selection

To meet the expectations and goals, the project team decided to proceed with the design and development of a digital repository. This repository must meet a number of technical requirements like:

1) Internet accessibility
2) Expandability and scalability
3) Ability to integrate with other systems deployed at the OUC
4) Interoperability

At that time the project team decided to proceed with a solution that will be deployed in-house and will be based on open source software that uses well established technologies and has a large community to support it.

Based on best practices from other Institutions and after following the directions of the Digital Repository Infrastructure Vision for European Research (DRIVER) which is now merged with the OPENAIRE initiative [5], we decided to proceed with the deployment of the DSpace (http://www.dspace.org) open source repository.

DSpace is an open source software developed by the Massachusetts Institute of Technology Library and Hewlett-Packard company that enables open sharing of content, preserves content and enables easy and open access to all types of digital content including text, images, moving images, videos and data sets. DSpace has a number of functionalities that match our needs and goals like categorization of items in collections and communities, preservation of data and metadata. DSpace has a large user community and more than 1000 institutions use it. Additionally, it offers a customizable web user interface and there is a plethora of resources for administering and using it.

2.2 Design and Implementation

During the design phase, we were concerned with proper sizing of the repository, the selection of a proper data submission process, the integration of the repository with other systems and the theme design.

For proper sizing of the repository, we considered the material that would be hosted. The OUC had numerous Programs of Study that produced various types of materials (documents, videos, etc.). Also, the OUC was in the process of launching new Programs of Study and the Library services were involved at that time in two digitization projects, so it was very difficult to guess the amount of space needed. To size properly, we counted the size of theses and dissertations and the size of the two digital collections available at that time. We allocated that space with an additional 30% to cover for future needs.

Content submission is one of the main design considerations. DSpace has a built in submission process that allows different workflows to be applied. In our case, users submit content to the repository and they enter basic metadata like content title, keywords, description, license and the upload the file. When content submission completes, a subject librarian is notified to check content and the provided metadata. Content is published when it is approved by the subject librarian.

Repository's theme design was based on the standard DSpace theme with some styling additions to match the OUC logo and brand stylesheet. This theme is built with accessibility in mind and is viewable by all devices with a modern browser.

2.3 Repository Infrastructure and Integrations

"Kypseli" Institutional repository is hosted on a virtual infrastructure that allows adding and removing resources according to the organization's needs. Currently, we use a virtual machine based on a Linux operating system. Content is kept on a storage area network (SAN) that allows constant and reliable access to it. This infrastructure allows resizing of the repository space with minimum downtime of the system.
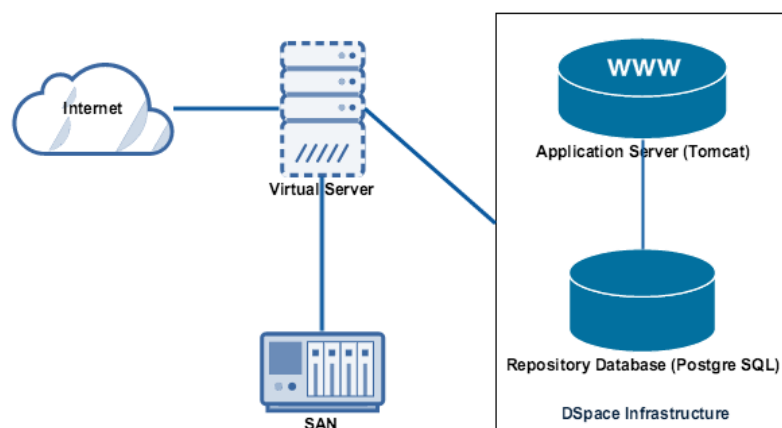

Figure 1 – "Kypseli" Institutional Repository architecture

In terms of high level architecture, the repository is tightly integrated to the eClass eLearning platform, the Library Information System (LIS) and the Identity Management System (IDM).

Integration between the eClass eLearning platform and "Kypseli", allows educators to search for digital content in the repository and add it to the selected course. Students can click on the item and retrieve

it directly from the repository. This is very useful for educators during the course creation process for adding bibliography, examples of other students' theses and dissertations and multimedia content.

The University's Identity Management System is also integrated to the Institutional Repository. Currently, this integration includes a DSpace plugin that communicates with the IDM infrastructure for managing (create, delete, update) users according to the university's user policies and handling the Single Sign On (SSO) functionality between the different connected systems. This integration minimizes the administration needed for users, since each user (student, educator, administrative staff) is automatically added to the repository and appropriate access levels are given.

This plugin also adds users to custom DSpace groups for handling item access. For instance, the library staff is automatically added to each collection's admin group for monitoring the item submission process. Also, users visiting the repository can use the SSO service to avoid many logins on the university's systems.

"Kypseli" Institutional repository is also integrated with the Library Information System of both the OUC and the University of Cyprus. When a user searches for an item (book, thesis, journal, etc.) in the search interface of the LIS, results from the repository are presented as well. This integration is important since it minimizes the number of search entries a user has to enter for finding the desire item.

2.4 User Support

For a project to be successful, it needs to have support and its users must have access to help resources. More importantly, its users must be able to use it seamlessly. Aiming in that direction, the project team organized a number of workshops to promote the usage of the repository and a number of webcasts were created to support the basic operations such as submission of items, browsing and searching. Also, a team of IT and librarians were trained to provide support to the repository users. This support team provides continuous support through email, telephone and the library website.

2.5 Metadata

One of the major advantages of using a repository is the ability to categorize items using metadata, allowing easy indexing and searching for content. DSpace uses by default the Dublin Core (DC) metadata schema [6]. We use the basic metadata fields for all items in our repository, and we enhanced the schema for specific collections that needed some additional metadata fields for better describing the items, like the theses collection, were we used the *dc.contributor.advisor (fullname of the student's advisor)* and *dc.description.abstract (the abstract* of the thesis).

2.6 Content Licensing

For every digital material submitted in "Kypseli", users must choose an appropriate license for delivering it. Anyone can retrieve content from "Kypseli", but for each item submitted, the author's rights must be respected.

When a new item is submitted to the repository, users must select the type of license they want to use. The repository provides a number of license types such as copyrighted, public access license and creative commons licenses. Especially for creative commons, "Kypseli" retrieves the licenses directly from the available website (https://creativecommons.org) and the user can choose the desired license. Users are also obliged to accept the OUC's license for submission and delivery of content.

2.7 Open Access

As an Open Access repository, "Kypseli" was built by complying with the Budapest Declaration (2002) [7] which clearly mentions that all created material needs to be given back to the whole knowledge community free.

"Kypseli" Institutional Repository allows its content to be indexed by many open access institutional repositories [8], acting as a data provider using the OAI-PMH protocol [9] of metadata harvesting. Repository's content is contributed to the following service providers: OpenDoar, OAIster, Openarchives.gr and OPENAIRE.

Recently, "Kypseli" contributed to all harvesting communities more than 700 digital items (photos) that were created and uploaded to its digital collections, as part of a project for cultural heritage prevention and promotion of Cyprus monuments, hosted at each municipality and village of the country.

3 CONTENT HOSTED IN KYPSELI

The OUC's institutional repository, currently hosts and manages a large part of the intellectual and research production of the university. It also has the primary role of delivering and archiving all digital collections created by the OUC library.

Content hosted in the repository is categorized as primary research material, peer-reviewed research material, electronic and digital publications/collections. This content is hosted under the DSpace hierarchy model that uses communities as the highest level of content hierarchy. Communities include collections that can be part of a single community or multiple communities. Both communities and collections contain descriptive metadata that characterize them and their child objects (collections or items) [10].

Users can locate items by browsing through the collections by publication date, author, title and keywords and can search for words in text or the metadata of each item.

3.1 Structure and Available Collections

Content in "Kypseli" is distributed in three major communities:

1) "The Academic Repository of the Open University of Cyprus" includes 1521 published theses and dissertations submitted by undergraduate, graduated and PhD students of the University's Programs of Study.
2) "Electronic Publications" includes content created by the faculty and the administrative staff of the OUC. This community also includes digital material related to the various activities and events of the university.
3) "Digital Collections" includes all digitized collections, which are the outcomes of digitization projects.

The first community includes three sub-communities for each type of thesis or dissertation such as undergraduate dissertations, graduate theses and PhD theses. In every sub-community there is a collection for each Program of Study.

The second community includes four collections:

1) "Introduction to the History of Cyprus" [11]. This e-book is the product of collaboration between the OUC and the Ministry of Foreign Affairs. The University and the Ministry came together in an effort to design and to implement an introductory course on the History of Cyprus, addressed primarily to Greek Cypriot expatriates. To that end, a group of leading experts on the field of ancient, medieval and modern history of Cyprus wrote specially-commissioned chapters, organized according to the principles and methodologies of Open and Distance Adult Learning, by means of which the course would be delivered.
2) "*Πλατφόρμα*". This newsletter is a semi-annual journal, published by the faculty of Humanities and Social Sciences and includes articles related to scholar and research activities of the Programs of Study under this faculty.
3) "University publications". This community includes annual and periodical publications of the OUC, like the Annual report of each University unit, the University strategic plan for each year and other publications in digital format.
4) "The Greek Edition of the Columbia Journalism Review". This community includes all editions of the journal which is published four times per year.

The third community includes two collections of digitized material and one collection of photographs that are the outcome of a research project:

1) "Κύπρος Χρυσάνθης" archive. This collection includes all digitized letters and poems of a Cypriot intellectual person that contributed the most to the islands intellectual production.
2) "Bulletin of Cyprus Statistical Services (Population and Health topics)". This collection includes a number of annual reports created during 1950-1955 and published by the Cyprus Statistical Authority.

3) "Cyprus: land of memories, places of art". This collection includes the raw research outcomes of the program entitled "Cyprus: land of memories, places of art" [12], which started in 2011 and finished in 2013. The program was funded by the Open University of Cyprus.

Moreover, the library is involved in a number of other digitization projects that will soon be published in this community.

3.2 Thesis Submission Workflow

Students at the OUC submit their thesis or dissertation online, using the eClass eLearning Platform. The whole process is performed online and students are required to prepare their thesis document, and upload it to eClass eLearning Platform. After uploading, the document is automatically checked for plagiarism and the results are forwarded to the student's advisor. This process can be repeated several times, until the thesis document reaches a version that both the student and the advisor are satisfied with the result.

The next step is to forward the thesis document to the examination committee. Members of this committee can send comments and the student must proceed with updating the document. After the student completes its thesis defense, the final version of the document is submitted to the repository.

Thesis is uploaded to the repository and Library staff (subject area librarian) gets an automated notification to check the document, add missing metadata and approve the submission. We chose this workflow to ensure that each thesis will have all the appropriate metadata before publishing and avoid possible mistakes done by untrained contributors. Students are also required to submit their thesis also in physical form for the University archive which is hosted at the Library's premises.

4   METRICS AND STATISTICS

For measuring the usage and user engagement for "Kypseli" Institutional Repository, we have used a number of tools like google analytics and DSpace built-in statistics component to monitor usage and keep track of user actions.

Starting in 2011 when the repository was first created, until May of 2016 "Kypseli" Institutional Repository hosts 2209 items. These items were accessed more than 1,112,288 times. In Table 1 we present detailed statistics of the number of items hosted and accessed, user logins and searches performed by users.

Table 1 - Overview of hosted items and user access

Metrics	Values
Items	2,209
Files views	803,734
Item views	1,112,288
Collection views	160,430
Community views	138,181
User logins	15,913
Searches performed	82,728

The majority of people visiting the repository, come from Greece and Cyprus. In Figure 2, the distribution of visitors is depicted.
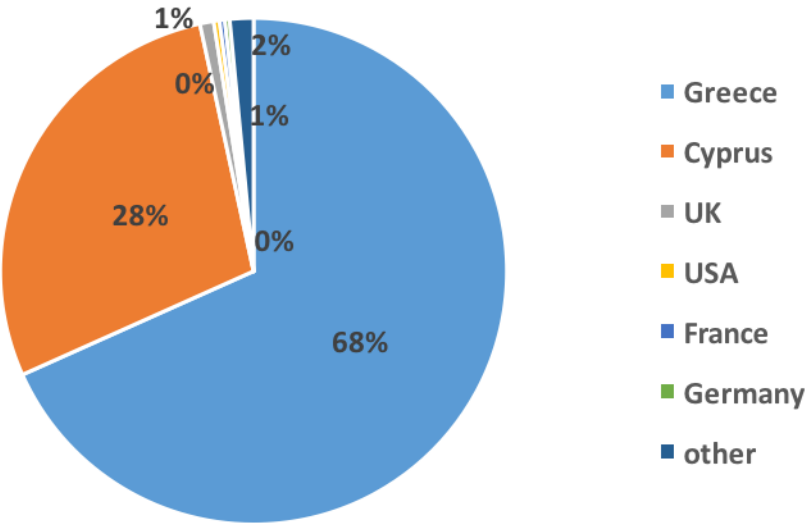

Figure 2 - Visits per country

From a technological aspect, most of the repository's visitors use a desktop device to browse and access items. During the last three years, we have detected an increase in the number of users who prefer to access the repository using a mobile device. In Figure 3 the percentage of users' device type preference is depicted and in Figure 4, the browsers used by visitors of the repository are shown.
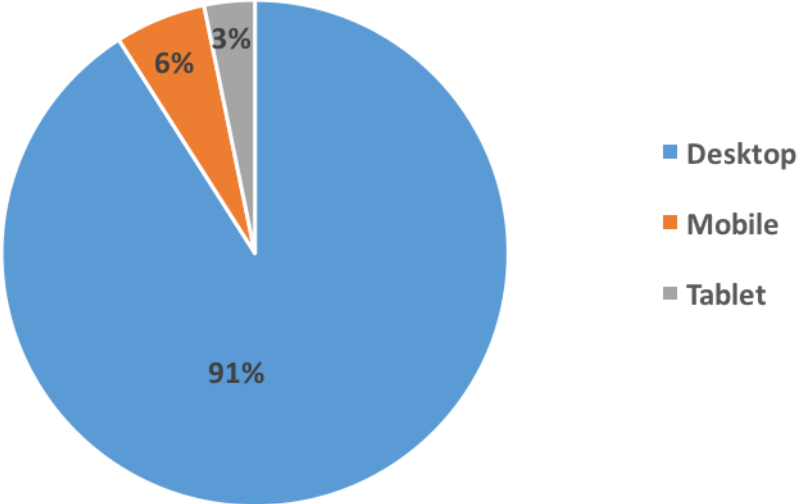

Figure 3 - Visits per type of device

Browsers used by visitors

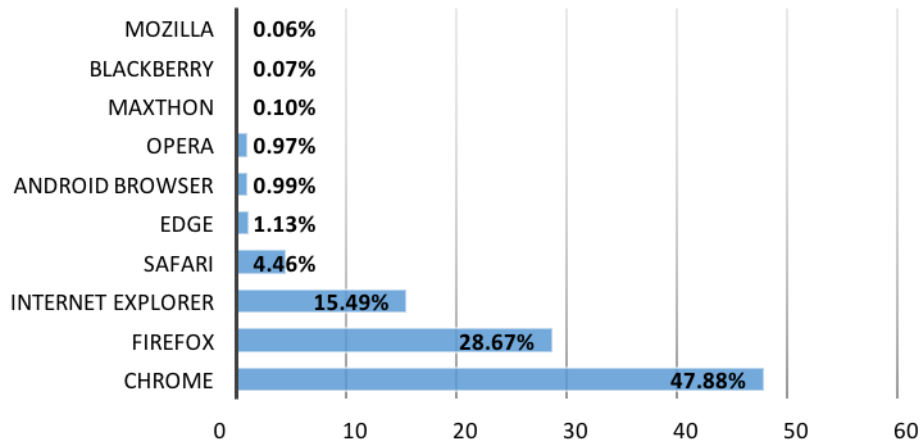| Browser	Percentage
MOZILLA	0.06%
BLACKBERRY	0.07%
MAXTHON	0.10%
OPERA	0.97%
ANDROID BROWSER	0.99%
EDGE	1.13%
SAFARI	4.46%
INTERNET EXPLORER	15.49%
FIREFOX	28.67%
CHROME	47.88%

Figure 4 - Browsers used by visitors

By analyzing visitor sources, we detected that 96% of social network visitors come from Facebook, 3% from LinkedIn and 1% from other sources. In terms of searching, the majority of visitors use Google Scholar and Openarchives.gr to browse the repository.

Further analysis of the above results, shows the tendency of users to use mobile devices to access the repository. This change from desktop computers to mobile devices, requires that the repository is accessible by any type of device to maximize user experience. This is also backed up by the fact that users use various browsers to access the repository. In Figure 4, readers can see browsers used to access the repository. This variety in access devices and browser preference increases the need for interoperability and accessibility of the repository.

5   FUTURE WORK & COCLUSION

In this paper, we presented the methodology we used for designing and deploying the "Kypseli" Institutional Repository at the Open University of Cyprus. This repository hosts numerous collections that are made available to students, faculty and the public. Repository's content is also used for educational purposes during the Academic Year inside the university's eLearning Platform, where students get direct access to it.

Our efforts are now focused on updating this repository and enhance the user experience. There are numerous additions that we plan to deploy in the new repository, like multilingual interface, a mobile device theme that will adjust on user's device screen and a better content previewer.

Currently, there is an ongoing discussion for launching a project for the creation of the National Open Access Repository that will be hosting all research documents and deliverables from National and European funded projects at the Republic of Cyprus. Additionally, this repository will harvest all academic and digital repositories of the republic and will present the content under its umbrella. The OUC repository will be part of this effort and expertise gained by the project team will be used for the design and development of this project.

Finally, we aim in hosting more digital collections for promoting the history and culture of the Republic of Cyprus.

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