Educonector: Open access to Mexican Academic and Scientific Production

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Abstract
This paper presents a description of the metadata harvester software development, called educonector.info. This system provides access to reliable and quality educational resources, shared by Mexican Universities through their repositories, to anyone with Internet Access. We present the conceptual and contextual framework, followed by the technical specifications, the conclusion and future work.
This paper is based on the experience gained from working with the technical committee of the project sponsored by CUDI-CONACYT titled: Metasearch of Educational repositories to Promote the Use of Learning Objects and Open Educational Resources: Best Practices.

Keywords
Mexico, metadata harvester, digital repository, open educational resources, metadata, search engine

Introduction
The search for information on the Web is an everyday activity, find free, reliable and quality information is a challenge. Many of our search results are widely varying quality and it is difficult to find reliable educational content online.
According to estimates by Van de Sompel (2011), the Web is growing at an amazing rate; every minute over 70 new domains are being registered and more than 500,000 documents are being added to websites. In Mexico actually there are more than 4.1 million people that usually access to internet. (AMIPCI, 2013).
The rapid Web expansion and the increasing Internet access brings great opportunities and challenges for Universities, among them, the opportunity to develop a culture of sharing and reusing scientific, academic and cultural information to benefit all people with internet access. And the challenge to disseminate those digital content to be reached by Web users.

Adame et al (2013) explain, that recently in Mexico, the Open Acess Movement which promotes to use information technology to help equalize the distribution of knowledge; has triggered the development of OER, and the implementation of repository systems in the universities.
This paper research aims to show the development of a metaconector that allows to harvest various repositories that can be used by infomediaries, in order to facilitate the task of finding, evaluate and share high quality content all Internet users who know it.
This is based on the experience gained from working with the technical committee of a project sponsored by CUDI -CONACYT, titled: “Metasearch of Educational repositories to Promote the Use of Learning Objects and Open Educational Resources: Best Practices.”

Conceptual Framework
In 2002 the term Open Educational Resource (OER) was coined by the United Nations Educational, Scientific and Cultural Organization (UNESCO), to refer to educational resources generated to provide digital access through information and communication technologies (ICT), for use them, with non-commercial purposes, following the guidelines of Open Access (Budapest Open Access Initiative, 2001).

The term OER is largely synonymous with the term OpenCourseWare (OCW), although the OCW is defined as a free and open digital publication of high quality university-level educational materials.

The William and Flora Hewlett Foundation defines OER as “resources for teaching, learning and research resources that reside in the public domain or have been released under a licensing scheme that protects intellectual property and allows its use as free and the generation of derivative works for others.” (Atkins et al 2007: 4)

OER are identified as, course materials, modules, books, videos, tests, software, and other tools, materials or techniques used to support access to knowledge.

The OER have a transformative power, that lies in the ease with which such digitalized resources can be shared via the Internet. One key differentiator between OER and any other educational resource is licence. An OER incorporates a licence that facilitate the use, reuse and potentially adaptation, without first requesting permission from the copyright holder. (Butcher et al 2011:5)

One vital aspect of the OER economy is the role of metadata. Metadata is often simply defined as “data about data”. The OER need metadata or tags that allow them accessibility, reusability and interoperability. (Burgos, 2010).

Metadata describes what the resource is, such as the subject keywords, how to use it, and how the resource is to be managed. We can say that the metadata are tags to identify learning objects and educational resources with the possibility of being verified by a third party (W3C, 2010), ensuring accessibility to the descriptions of the objects and digital resources. Among the most common metadata standards for these purposes have IEEE LOM (LOM, 2010), Dublin Core Metadata Initiative (DCMI, 2010) and SCORM (SCORM, 2010).

The term interoperability refers to the ability to have two or more systems to exchange information and then reuse that information (Castro and López, 2012)

While explaining why and how OER are labeled, now we will know the system that contains them. Lynch (2003), defines a repository as a computer system where multiple databases or files are located for distribution over the Internet. It is a data provider that integrates a set of services that incorporate, collect, preserve, consulting and support management and dissemination of digital resources properly classified, to the community members, through a Web interface.

Search engines are programs that track documents according to specified keywords and return a result list with a brief description of the Websites or documents found related to search criteria. Currently there are many engines using different software programs search, some are Web crawlers, also called bots or spiders that are designed to index Web pages and find words contained in those pages.

Metaconector, a synonym of metasearch is a search engine, metadata aggregator, infomediary type, and infomediary is the term that results from the combination of the words: information and intermediary. (Adame, Burgos and Lloréns, 2013). A metaconector is a Website that gathers and organizes large amounts of metadata and acts as an intermediary between those who need and those who provide information, as primary sources of information and repository providers. The metasearch can be configured to perform federated search or

The harvest of metadata is a semi-automated process, which is led by a person with knowledge in library and information systems. It is a search on demand, in real time, it uses a central container that temporarily store records from related repositories; among their characteristics it requires less search processing time, therefore less response time. (educonector, 2013).

We can say that the OAI-PMH is a low barrier mechanism for repository interoperability (OAI, 2012).

**Contextual Framework**

One of the main lines of work in the Open Education Movement, focuses on the production, spread, use and reuse of open educational resources. Currently, global agencies such as UNESCO and Education For All (EFA), among others, promote projects aimed at the creation, use and processing of REA, and the development of repositories and systems that support and sustain its purpose, convinced that knowledge is a driver of economic development and growth in developing countries (UNESCO -EFA, 2005).

Haddad and Draxler (2002), highlight that the digital content repositories also known as contentware, represents a crucial and challenging issue for organizations and educational institutions.

Therefore, there is the initiative to develop an interagency basis developing a metaconector that allows access to the metadata of different digital educational repositories, that provides interoperability through the OAI-PMH (Lagoze and Van de Sompel, 2008).

As a basis for this project, there are the following metaconnectors:

- OA- Hermes. Mexican Metasearch engine (Castro and Garcia, 2007)
- Diffusion in Red Alert is one of the largest portals Bibliographic free access, whose primary purpose is to give greater visibility to Hispanic literature. (Dialnet, 2011).
- Network of Scientific Journals from Latin and the Caribbean, Spain and Portugal (Redalyc, 2011).
- Institutional Repositories for Scientific documentation. Project with members of 8 countries, Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Venezuela (Network, 2011).
- Digital Repository Infrastructure Vision for European Research, harvested regularly from more than 249 repositories, from 33 countries (DRIVER, 2011).
- Find the pearls. It is a catalog of millions of records representing open access resources, fueled by open access collections worldwide using OAI -PMH (OAIster, 2011).
- Bielefeld Academic Search Engine. Allows searches of open academic resources. Operated by the Library of the University of Bielefeld offers OAI –PMH URL validation (BASE, 2011).
- ARIADNE Foundation European Partnership is open to the world to share and reuse knowledge. The core of the ARIADNE infrastructure is a distributed learning object repositories network (ARIADNE, 2011).
The Global Learning Objects Brokered Exchange - GLOBE was established from the following founding members: the ARIADNE Foundation in Europe, education.au in Australia, LORNET in Canada, the U.S. and MERLOT in NIME in Japan. (GLOBE, 2011).

The OpenCourseWare via RSS feeds (Metaconector, 2011).

Metasearcher via RSS feeds (Universia, 2011).

JOCW. (2011). Japan OpenCourseWare Consortium.

Intute, comprising the Universities of Nottingham, Birmingham, Bristol, Heriot- Watt, Manchester Metropolitan and Oxford Merlot that exhibits REA refereed to academic consortium of different suppliers. (Intute, 2011).

Metaconector.educonector.info Technical Specification

The educonector.info is a metasearch engine that through the communication tool of Internet-based network, OAIConect (OAI, 2012) allows the linking of different Mexican digital repositories of open educational resources through harvest intermediate metadata. The metadata are interpreted considering the Dublin Core standard, and stored on a local server that serves as a repository of metadata while creating an index them to facilitate the implementation of search mechanisms on a Web interface. See in Figure 1, a) Repositories of OER interoperables by OAI-PMH b) Harvester, search engine c) Generating step of infomediary catalog d) Search interface.

Figure 1. diagram of the steps for the development educonector.info

Technical basis
The metaconector educonector.info was setting up with general public licence (GPU) software, like the platform OAI.Connect and the learning management content (LMC) Drupal, system used to setting up dynamic websites. This software allows to publish, manage and organize big data content in a website (educonector, 2013).

Harvesting metadata process
Most repositories related to educonector, are organized in collections, so the spider program of the educonector, searches the OER metadata in the selected collections. Previously each repository is analyzed for a selective harvesting of it collections. With this step a repository
profile is created for document the reliable information that allows to define harvesting metadata rules.

Few questions, used to design and to document the profile of each collection were:
What is the subject, discipline or knowledge area that the collection is specialized? What is the volume of records collection? What is the periodicity of harvest?

The OAI Protocol for Metadata Harvesting, provides a framework for interoperability of applications based on metadata harvesting. According to Lagoze and Van de Sompel, (2008) there are two types of actors within OAI-PMH:

A) Data providers are repositories that expose structured metadata via OAI-PMH.

B) Service providers then make OAI-PMH service requests to harvest that metadata.

OAI-PMH is a set of six verbs that are used for metadata harvesters (service providers) to collect metadata; each verb has a unique purpose and meaning that make it easier to analyze the data. See table 1.

Table 1. Types of petition in the OAI-PMH.

<table>
<thead>
<tr>
<th>OAI Request</th>
<th>OAI Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify</td>
<td>Provides basic information repository as the repository name, base URL, protocol version, the first registration date, granularity, support deleted records, e-mail address of the repository.</td>
</tr>
<tr>
<td>ListSets</td>
<td>Provides a list of collections that have been established in the repository.</td>
</tr>
<tr>
<td>ListMetadataFormats</td>
<td>Provides a list of metadata format that are supported by the repository.</td>
</tr>
<tr>
<td>GetRecord</td>
<td>Provides a unique identifier to unambiguously identifies an item within a repository.</td>
</tr>
<tr>
<td>ListRecords</td>
<td>Facilitates the metadata for each record that meets the specified criteria.</td>
</tr>
<tr>
<td>ListIdentifiers</td>
<td>Provides basic information for each record in the repository that meets the specified criteria.</td>
</tr>
</tbody>
</table>

Roles involved to setting up the educonector
Moderator, person who coordinates the members of the team, Technician, responsible for the repository that will be related. Librarian or person with related studies in information science and library, and a programmer, responsible for developing the software application.

Process for harvesting digital repositories
1. Analysis of digital repositories, data providers.
2. Define rules to import metadata per collection.
3. The search results are presented on the Website educonector.info
4. Monitoring, expect enter from another repository and update frequency of harvest
Top Features of educonector.info

- The technology used in its development, allows prompt response options related through the infomediary catalog, which includes the list of OER.
- Optimizes technological infrastructure where the application and digital content resides, because do not stores the OER content, only points to them.
- Through a simple web interface provide links to open educational qualified contents from Mexican Universities.

Results
As a result of this project research, 9 mexican universities had registered their Open Repositories like data providers in the OAI registry. The visits to the repositories, related to the educonector, have incremented in average 15%. The metaconector educonector.info provides an optimal response time, thanks to the normalization and harvesting of metadata DC-OAI. Among other cooperation initiatives and the Open Educational Resource Movement, educonector info promotes the creation of new open repositories, with the opportunity to has Mexican presence in the world, through the ODOAR. Actually there are 11 repositories from 9 universities linked to the educonector. They are listed below, and you can visit each repository across the educonector (2013). See figure 2.

- Escuela de Graduados del Tecnológico de Monterrey (ITESM) or DAR: Develop, Learn and Reuse.
- Instituto Tecnológico de Chihuahua (ITCH) or Expovision or Portal SINED - Multimedia Podcast: National System of Distance Education.
- Universidad de Guadalajara (Ude G), CREA: Resource Center for Teaching and Learning.
- e-Gnosis: Digital Magazine Science and Technology.
- Institutional Repository of the Universidad Veracruzana.
- Universidad Autonoma of Nuevo León (UANL), UANL Institutional Repository.
- Universidad de las Americas, Puebla (UDLAP), CIRIA: Interactive Resource Center Information and Learning.
- Universidad Autonoma de Mexico (UNAM) Institutional Repository CUAED.
- Universidad Autonoma del Estado de Hidalgo (UAEH), Digital Library Repository.
- Instituto Tecnológico de Estudios Superiores de Occidente (ITESO - Guadalajara) Repository EduDoc - Education Documentation Centre.
- Universidad Autonoma del Estado de Hidalgo (UAEH) Digital Library.

Figure 2. Google Map, with the actual distribution of Mexican repositories related to educonector.info. Source: own authorship
Conclusions and future work

Based on the result of the develop of educonector.info, the aim of raising awareness of the open education movement, was achieved. First, among the twelve researchers of the participating universities. Later the students and teachers of their universities.

When we worked with the technical committee, we learned about the OAI-PMH protocol, the Dublin Core metadata standard, the structure of the repositories and search engines in addition to Creative Commons licensing.

The experience to work from different States of the Mexican Republic was one of the most significant challenges, it demonstrates that is possible if all the researchers are commited with the project. The use of Internet 2 was very useful for the remote meetings.

From the 9 universities related to educonector, 8 have a Dspace software, and use Dublin Core metadata.

Dublin Core facilitates the repositories harvesting, but is not the only metadata standard that we can use. The Simple Dublin Core standard, does not provide many of the attributes needed to tag mobile or multimedia OER, like photos or podcast; therefore, a possible future research work, will be about the inclusion of LOM metadata to repositories.

It is important to write a guidance for setting up repositories over GNU software, that allow the technicians save time and money in the development process.

If we compare the number of open repositories in USA and Europe, we can see that in Latin America we have a considerable lag, in areas such as e-Science, e-Journals and Open Access. Therefore it is necessary to disseminate, promote, research and innovate in this areas. Over all, it is necessary to develop the culture of producing reliable educational resources, to share under Creative Commons licensing.

We suggests considering the uniform development of institutional repositories. And motivate other Mexican and Latin American universities to participate in the open access movement, as well as think of a core metadata adhoc to Spanish-speaking academic characteristics.

We need think about how to manage the increasing data and archive size of the new OER. At the moment, we have a double-search problem in educonector, and we are considering federate searches.

In Mexico, we have a big potential to innovate the use of ICT and to produce OER that improve learning opportunities.
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