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# PROCEEDINGS

## SIXTH INTERNATIONAL SCIENTIFIC CONFERENCE

# COMPUTER SCIENCE' 2011

## INTERNATIONAL WORKSHOP

## Supercomputer Architectures and Applications

**Technical University of Sofia**

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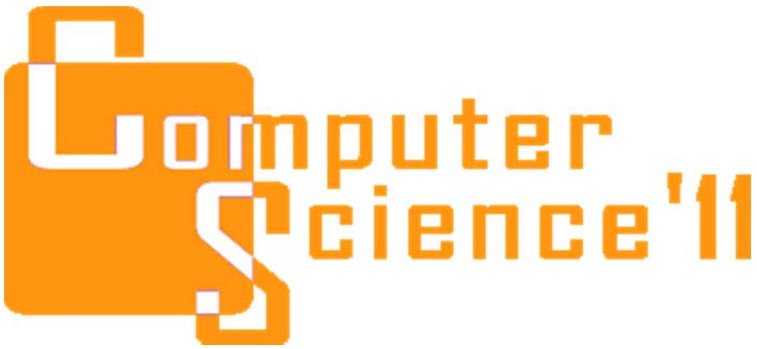
## Sixth International Scientific Conference




## WORKSHOP ON

## Supercomputer Architectures and Applications

**Ohrid, Macedonia**

**01 - 03 September 2011**

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# CONTENTS

# Localized Learning Objects Discovery and Exchange

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***Abstract:*** *A myriad of digital resources that can be used in educational purposes and which can be Learning Objects has emerged on the Internet. Imperative of the scientific research community is to make these Learning Objects available to all who have an interest in education: companies, universities, schools, professors, teachers, students, pupils, lifelong learners, etc. The objective to be achieved is that Learning Objects are easily found and that they can be reused an unlimited number of times. The process of localization of the learning objects means applicability of different languages (multilingualism) and different cultural contexts (multiculturalism). The paper proposes LME - Localized Metadata Enrichment – a process for improvement of discovery and exchange of the localized Learning Objects from a localized repository.*

***Keywords:*** *Learning Objects, Learning Objects Repository, Learning Objects Discovery*

## 1. INTRODUCTION

There are already a huge number of digital resources on the Internet that can be used for learning. The organization of these digital resources in the form of Learning Objects and they are stored in Learning Objects Repositories. With this continuous growth of the number of Learning Objects that exist online and in repositories a problem appears: how to find exactly those learning objects we need at the particular moment. To improve the availability of Learning Objects a standardization of metadata that describe Learning Objects is introduced, specifications for interoperability of repositories are adopted and they are organized as global federations of independent repositories. This works flawlessly in the case when Learning Objects and Learning Objects Repository are in English language, but when it comes to Learning Objects and Learning Objects Repository that are adapted to different languages and different cultural contexts global availability is significantly hampered.

Since most of the learning objects are non-textual (animations, images, video, audio) the discovering of learning objects in repositories can be an impossible task without metadata. As expected, the number of learning objects in repositories will grow expotentially, and the lack of metadata will be a fundamental and critical limiting factor for the ability to find, discover, manage and use the objects.

In this paper we propose a process of LME - localized metadata enrichment that would improve the availability of Localized Learning Objects stored in Localized Learning Objects Repository. With the application of this localized metadata enrichment globalized Learning Objects Discovery and Exchange are improved. The paper is organized in four parts. The second section briefly defines Learning Objects and explains the need for metadata, identifies the standards and specifications that are important for creating a Localized Learning Objects Repository, The concept of these repositories is

given in the third part. The process of localized metadata enrichment is described in the fourth section. The conclusion is given at the end.

## 2. LEARNING OBJECTS, METADATA AND STANDARDIZATION

### *2.1. Learning Objects and Metadata*

There is no single definition of the Learning Objects. We accept David Wiley's definition: A Learning Object is any digital resource that can be reused to support learning. He emphasizes that a learning object should be digital and reusable. The size and content of the learning object is associated with reusability, i.e. depends on reusability. Others agree that learning objects are modules or units that should be delivered through or by means of computers, which are independent and that provide a whole learning content in a planned learning. Learning Objects should be independent, i.e. it should be possible to use them independently from other objects and contents, that they should possess at least a minimum amount of information from which something can be learned and that their use is conditioned by computers.

Generally, regardless of different definitions, learning objects are digital resources, modular in nature and used in the learning process. Their size can vary, they can be applied in different areas and have different levels of granularity. Learning objects can be connected with other learning objects in order to create a greater teaching unit (Figure 1). In relation to learning objects research and development are directed towards their reusability and therefore it is obvious that they should be digital resources.

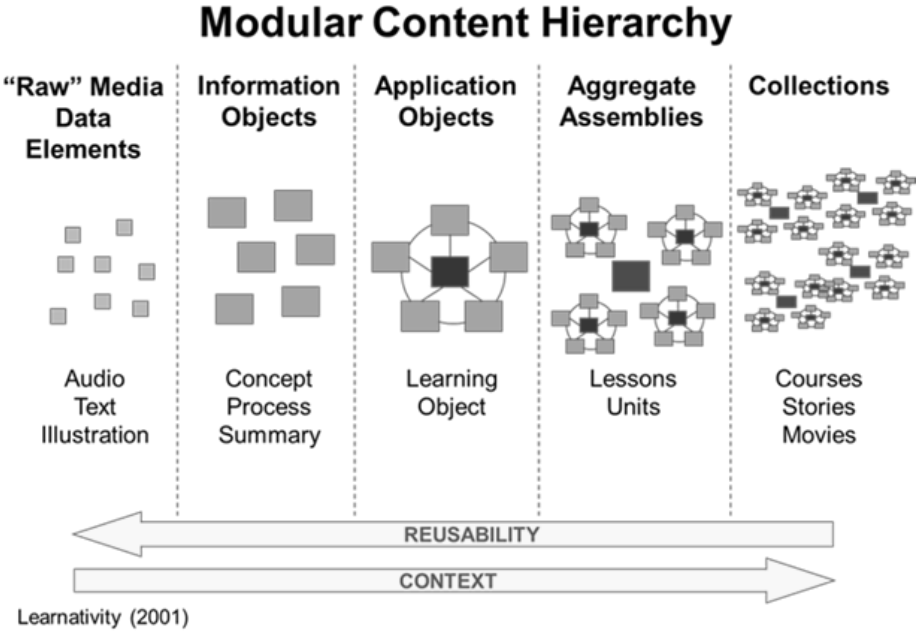


Fig.1: Modular Content Hierarchy

When it comes to learning objects as digital resources it means that they can be, but are not limited only to: texts, simulations, animations, websites, tutorials, tests, multimedia, video clips, sounds, images, illustrations, diagrams, graphs, maps or exams. All digital resources are a huge collection of data, bits and bytes of information. Digital resources are stored in repositories, and are described by metadata.

Metadata is information about an object, either physical or digital. For learning objects metadata represent data about an object. Technically it is the XML scheme used to describe learning objects. The purpose of metadata for learning objects is to support discovery learning objects, and thus facilitate their reusability. The objectives of the metadata are to enable users to seek and use learning objects.

### *2.2. Standards used for Learning Objects discovery and exchange*

To enable global retrieval and exchange of learning objects accredited standards for interoperability of digital content for learning are required. With the use of accredited standards the risk in the implementation of large investments in technologies for learning are also reduced. A number of institutions and bodies work on the accreditation of these standards; here we would like to mention some of the most influential: IEEE LTSC, CEN and IMS GLC. The standards of interoperability are generally divided into: 1. standards and specifications for discovery contents and standards; 2. specifications for contents using. The standards and specifications for discovery contents we would like to emphasize as important are: OAI-PMH, IEEE LOM, IMS DRI and IMS LODE. The last specification, IMS LODE, is still a draft version. IEEE LOM facilitates sharing and exchange of learning objects by creating conditions for the development of catalogues and lists.

- OAI-PMH - Open Archives Initiative Protocol for Metadata Harvesting.
- IEEE LTSC LOM - Learning Technology Standards Commitee, Learning Objects Metadata Standard.
- IMS LODE - Learning Object Discovery and Exchange specification
- IMS DRI - Digital Repositories Interoperability specification

## 3. FEDERALIZED LOCALIZED LEARNING OBJECT REPOSITORY

The process of localization of the learning objects and repositories means adaptation of the repositories and the learning objects stored in them to be used in different languages (multilingualism) and different cultural contexts (multiculturalism).

Localized learning object repositories (LLOR) can function as a standalone repository and perform all the functions to be performed by a repository. A DBMS server has the central role in the architecture of the LLOR repository, where the metadata and the locations of files that are added to the metadata are stored (see Figure 2). Files that are picked up in the repository are stored on file servers, and communication with users is through the web server. For those files that are located on another network location in the metadata a link is written and these are the so called external learning objects. End users access the repository through any LMS or LCMS or directly, as already indicated, through a web interface repository. In such a case functionalities for localized search can be built in, which will meet the main goals of discovery and exchange of learning objects. But in that way a repository will remain isolated and learning objects will not be available to users who are not members of this repository.

The solution for such repositories is that they are associated in a federation of repositories (see Figure 3). In such a federation of repositories there is a server Harvester tasked to collect, i.e. to harvest metadata from the associated localized repositories by protocol OAI-PMH.

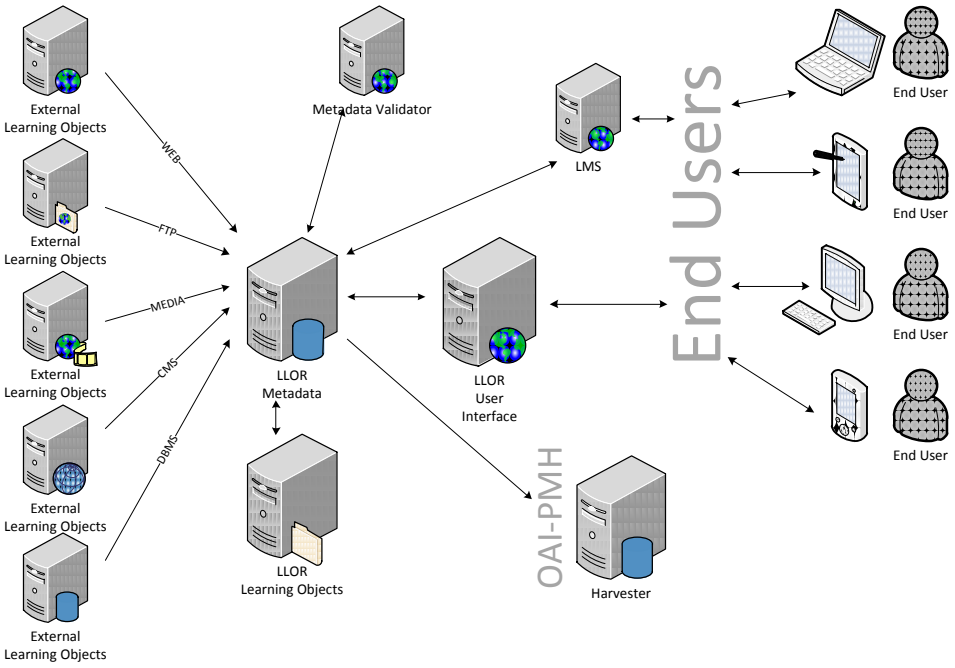


Fig.2: Localized Learning Objects Repository

These metadata are then validated on the server for validation and are ultimately saved in the global repository. The global repository is available to end users through a system for management of contents and learning. Associated local repositories can also function independently.

Since the federation may be accompanied by repositories with different linguistic and cultural backgrounds, the incorporation of functionalities for localized search will not be a solution. In this case a federalized repository learning objects discovery should be enabled with enrichment of metadata with localized data. So, during the harvesting of metadata the data necessary to detect learning objects will be gathered.

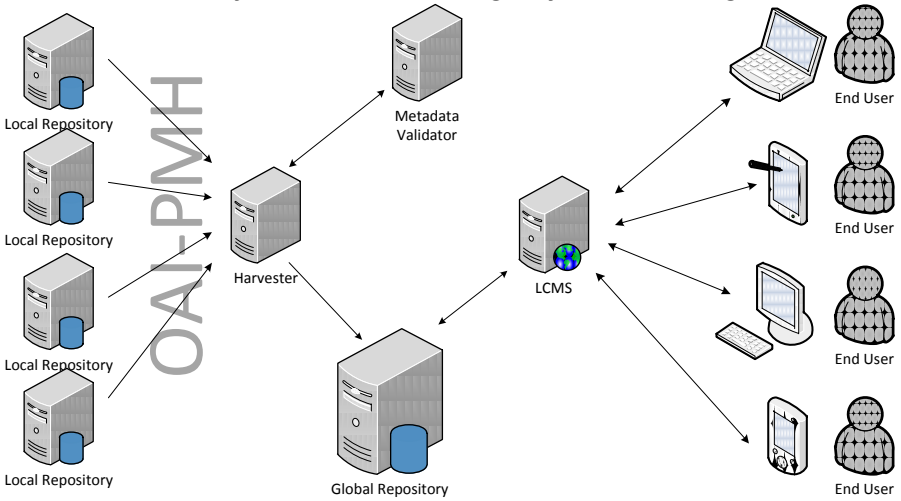


Figure 3: Federalization of repositories

## 4. METADATA ENRICHMENT PROCESS

Enrichment of metadata is a process which, based on user-entered metadata, using certain algorithms, automatically generates additional metadata that further describe the learning object and thus facilitate its discovery in the repository.

The process of enrichment of metadata (LME – Localized Metadata Enrichment) consists of three components: Localized Metadata Transliteration (LMT), Localized Metadata Word Stemming, (LMWS), Keywords and Metadata Vocabulary Bank (KwM-VB) (Fig.4).

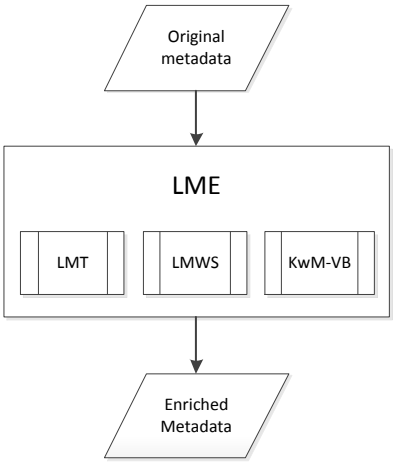


Fig. 4: Localized Metadata Enrichment

LMT - Localized Metadata Transliteration - Transliteration is the process of converting a text from one alphabet to another in a systematic manner according to specific, predetermined rules. In terms of information technology, transliteration is mapping from one system of writing into another. This is done word by word, or ideally letter by letter. The objective of transliteration is that the reader can reconstruct the original spelling of unknown transliterated words, based on the information given.

LMWS – Localized Metadata Word Stemming - Setting the search queries in a search engine, in any human language, depends much on the grammatical rules of that language. This fact in most cases makes these rules for searches in English unsuitable.

KwM-VB – Keywords and Metadata Vocabulary Bank. This is actually about a multilingual dictionary – a thesaurus that initially gives about 2255 words and expressions. Words and expressions that are used as standard metadata and keywords are taken from here. The dictionary and the concept of the dictionary are taken from the project LRE (Learning Resource Exchange for Schools), a member of EUN (European Schoolnet). LRET (Learning Resource Exchange Thesaurus), formerly known as ETB (European Thesaurus Browser) s published as a result and it is now managed through the project ASPECT of VBE (Vocabulary Bank for Education). Words and expressions in this vocabulary-thesaurus have been translated to Macedonian language.

## CONCLUSION

The number of digital resources that can be used is increasing daily. The installation of such resources on the Internet is not enough to enable their discovery and exchange. Organization and storage of these digital resources in the form of Learning Objects is made in repositories. Learning Objects are described with their metadata. Metadata are key elements through which the discovery and exchange of Learning Objects is made. If there is sufficient metadata for each Learning Object, their search will be much easier and more successful. In this paper we propose a methodology for localized metadata enrichment through which easier search, discovery and exchange are achieved, while simultaneously interoperability is also achieved globally - without the need for additional intervention or implementation of special rules on global federalized repositories.

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