

# Authoring for re-use in outcome-oriented learning scenarios

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**Abstract.** Content production processes currently experience a shift in focus. Due to the growing trend of highly individualized learning scenarios they have to face and to combine a multitude of different standards. The European eContent+ network of Excellence ICOPER researches possible strategies and implementations to deal with this new situation. In its course the project develops a comprehensive set of prototypes that use, evaluate and propose extensions to a large number of currently relevant standards such as IEEE RCD, SCORM or OAI-PMH. This paper describes a collaborative, re-use based authoring approach that was realized with one of these prototypes.

**Keywords:** authoring, re-use, interoperability, outcome-oriented learning

## 1 Introduction

Today's technology enhanced learning scenarios focus on learning outcome oriented delivery of learning processes, contents, and services. Rather than pre-defining static curricula individual learning processes are enabled: learner profiles indicate individual gaps, learning outcomes describe the required skills, recommended learning materials help to close these gaps, and assessments indicate successful mastery which is reflected back into learner's profiles. This way, the learner gains a large factor of *ownership of learning* [9].

In such complex learning situations interoperability issues become important: standards to describe learning outcomes, learner profiles, assessment items and learning materials are needed. Technical interoperability between different components of an overall learning delivery toolset is required in order to ensure seamless learning processes. Web-service based approaches help to simplify technical interoperability [12].

The learning outcome orientation also changes the way learning contents are produced and organized. The traditional "one-size-fits-all" approaches deliver the

same content to a large target audience. The production of learning content at high cost is therefore justified. Outcome-oriented content production processes however, deliver highly individualized content and have to cope with a large diversity of interoperability standards due to the multitude of sources they are based on (different learning objects, learning outcomes, learning designs and learner profiles). The need for re-use is therefore essential.

The European ICOPER project [8] analyses and discusses state-of-the art implementations of current standards as a base for the development of a comprehensive set of prototypes that support individual learning, teaching and authoring. In the course of ICOPER, the Open ICOPER Content Space (OICS) was developed, which combines learning object metadata repositories, learning outcome repositories, learning design repositories and learner profile repositories. The OICS offers a service interface, which allows to retrieve from and publish into the OICS [10]. Some of the standards the OICS works with, comprise:

- *IEEE Reusable Competency Definitions (RCD)* defines a data model for describing, referencing and sharing competency definitions. The *ICOPER Learning Outcome Definition (LOD)* is an application profile based on RCD that can be used to create *Personal Achieved Learning Outcome (PALO)* profiles [7].
- *Sharable Content Object Reference Model (SCORM)*, a standard to describe structure and behavior of content and components [1].
- *Learning Object Metadata (LOM)*, an IEEE standard to describe metadata for learning objects in a standardized way [5].
- *Open Archive Initiative's Protocol for Metadata Harvesting (OAI-PMH)*, a protocol specifying the harvesting of metadata for learning objects residing in repositories [6].

In the course of the ICOPER project, a collaborative, re-use based authoring prototype was developed, that is based on the OICS.

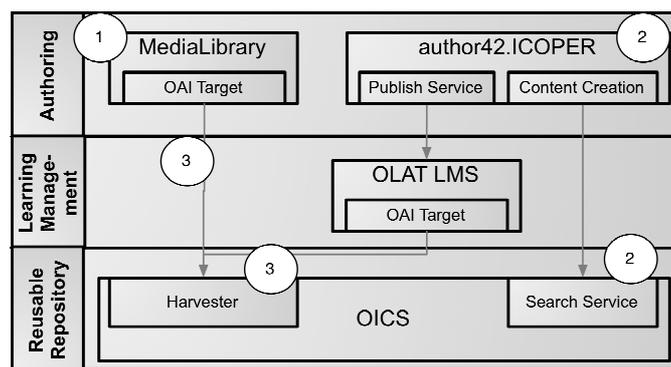


Figure 1. Architecture of the ICOPER authoring for re-use prototype

The prototype focuses on three main processes:

1. **The collaborative collection and organization of media assets.**  
Media assets comprise individual content elements such as texts, pictures, videos, and audios, which form the basis of all content productions.
2. **The collaborative creation of learning units based.**  
Learning units are navigable and interactive learning contents built out of individual media assets.
3. **Preparation for re-use.**  
The previous two processes are supported by a background harvesting process which updates the metadata repository of the OICS in order to make updated contents searchable and retrievable.

## 2 Collaborative collection of multi-media assets

A common problem to all collaborative, re-use based production processes is the retrieval, organization and management of media assets. Especially, when production processes have to cope with heterogeneous target groups (e.g. different languages, support for disabled people) or dynamic topic domains (with many subsequent content versions) media asset management is a complex matter.

Within the ICOPER project we therefore developed the MediaLibrary prototype. This online tool offers the opportunity to share media within a community. As opposed to other publicly available platforms (such as Flickr or YouTube), the MediaLibrary is designed to support media production processes, content-re-use, complex media models (with different versions, variants, languages, media formats) and corresponding metadata. The MediaLibrary is connected to the OICS via an OAI-PMH interface through which media assets within the MediaLibrary can be searched, browsed, and re-used. This way, media asset collections become part of larger learning content and metadata repositories.

## 3 Collaborative creation of learning units

The creation of learning units involves different tasks comprising the development of didactical concepts, storyboards and the actual content production which can be supported by content authoring environments. In our authoring prototype we use a customized version of author42 (named author42.ICOPER) that is a web-based authoring environment with extensible interfaces [2] which enables teams of authors to collaboratively create learning contents.

author42.ICOPER is integrated with the OICS: as a result the whole repository (including contents from the MediaLibrary and other sources) can be searched directly from the content production environment and retrieved results can be seamlessly integrated in the current production process.

To enable this integration, author42.ICOPER was extended with a customized search interface that can be launched from within any content production step. The search interface allows searching the OICS using combinations of different metadata and keyword fields. Search results can be selected and integrated into the current content page just as the users own content would be: page layout, element sizing and positioning functionalities can be used to fit the search results into the content page.

Through a web-service-based publishing interface, the content created can be published from author42.ICOPER into different repositories. In our prototype, we chose the open source learning management system OLAT [4] which we extended with an OAI-PMH target to connect it to the OICS again. This way, the content is available for further re-use.

#### **4 Preparation for Re-use**

Both prototypes, the MediaLibrary and the author42.ICOPER, offer OAI-PMH targets to access their metadata and contents from external repositories. The OICS contains an OAI-PMH compliant harvesting module [11] that is capable of accessing these targets and retrieving the metadata accordingly. That way, the OICS maintains a searchable repository of metadata that refers to the original contents.

The search function of the OICS can be used in two different ways: (a) directly, through the OICS' own search interface, or (b) integrated into other applications using the OICS' web-service interface. The latter being the case in the author42.ICOPER integration of the OICS, which enables search results to be automatically and seamlessly embedded into the content production process.

#### **5 Conclusion and Outlook**

We have presented a prototype to support collaborative, re-use based authoring for modern, outcome-oriented learning approaches. In a first evaluation of the abovementioned prototypes and their interoperability with the Open ICOPER Content Space (OICS), we performed an evaluation workshop at the JTEL SummerSchool 2010 in Ohrid, Macedonia. Ten participants with different backgrounds covering teachers, researchers, and students from computer science, technology enhanced learning and other fields took part in the evaluation.

In a first evaluation step, participants were asked to organize and metatag MediaAssets according to a selected LOD in the MediaLibrary prototype. These assets were re-used in the online authoring system author42.ICOPER to produce a unit of learning. Finally, participants published the results to enable further re-use via the OICS. Despite some technical problems that arose due to the prototypical status of the tools in use, participants could effectively solve their tasks and rated the toolset to be highly relevant.

In the meantime and with the prototype still under way, a new approach to connect repositories and authoring tools undergoes standardization efforts: the Simple Publishing Interface (SPI). This draft standard [3] especially focuses on the

integration of publishing tools (like the authoring tools used in our prototype) and repositories (like the OICS). We are planning to use SPI for the next version of our prototype to support direct collaboration and immediate re-use of results.

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