

## SCORM VS COMMON CARTRIDGE - CASE STUDY AT UNIVERSITY GOCE DELCEV

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**Abstract:** Education is the driving force in every state and the most of the investments are directed towards improving the educational process and increasing the quality of education. University "Goce Delcev" in Stip also invests quite a lot in the education process and for 8 years the University has been using the Moodle platform for e-learning. Over the years the sharing of courseware and supplementary materials is becoming even more important, as open content and courseware initiatives are expanding worldwide (the University "Goce Delcev" in Stip also has needs to use those tools that enable greater interoperability and reuse of content). In this paper, our research and analysis are directed towards the: crucial part of the process of creating courses and learning objects (will use the courses for informatics from Moodle platform at the University) and solving one of the biggest problems in e-learning systems (possibility of re-use of content), using the specifications for packing – SCORM and Common Cartridge.

**Keywords:** Learning management systems, learning objects, “Goce Delcev” University, SCORM, Common Cartridge, packing tools

### 1. INTRODUCTION

Education is the driving force in every state and the most of the investments are directed towards improving the educational process and increase the quality of education. The main reason for the development of the new technologies in the education process was to facilitate the communication between teachers and students, to save money and time. In the past decade, the major investments were aimed at developing software for the management of complex databases that are combined with digital frames and objects for managing curriculum, working materials and testing students. This technology is known as a Learning management system LMS. As part of the University "Goce Delcev" in Stip there is a special center - Centre for E-Learning systems in which develops the E-learning education (use and maintain the LMS Moodle platform). Platform of Moodle at the University "Goce Delcev" has got 17,405 users, 2114 courses which are grouped into three main categories: undergraduate subcategories 15 (study programs), postgraduate studies with 14 subcategories and doctoral studies. This platform greatly facilitates the communication and work between teacher and students.

In this paper, our research and analysis are directed exactly towards the: crucial part of the process of creating courses and learning objects and solving one of the biggest problems in e-learning systems - possibility of reuse of content. In our case we use the Informatics course from Moodle to make our analyses and package. In order the created course to be implemented in different systems, LMS, we use special specifications that enable packaging of the courses and inclusion of all standards in

a .zip document, which means greater flexibility and interoperability. In this research we will do a detailed analysis of the specifications of SCORM and IMS Common Cartridge that enable packaging of the courses and represent a long-term solution of the problems. Their main feature is interoperability, which enables reuse, less cost and greater flexibility. This functionality will be presented with practical testing of existing course in the Moodle platform by using the tools Mos Solo and eXe.

### 2. LEARNING MANAGEMENT SYSTEMS AND LEARNING OBJECTS

A learning management system (LMS) is a software application or Web-based technology used to plan, implement, and assess a specific learning process. Typically, a learning management system provides an instructor with a way to create and deliver content, monitor student participation, and assess the student performance. A learning management system may also provide students with the ability to use interactive features such as threaded discussions, video conferencing, and discussion forums.

The main benefits from LMS are:

- Manage and track staff training with an LMS: Training administration can be time-consuming and difficult, particularly in medium to large organizations with many staff working in different roles across a variety of physical locations.
- Consolidate all training information into one system: There are significant benefits to having all your training information in a single, consolidated system. At a glance you can review and report on the status of

company-wide training programs, identify staff who have completed certain qualifications, and much more.

- Facilitate e-learning with an online learning platform: Much has been written about the benefits of e-learning, and while an LMS is not essential to implementing online learning it can often make it easier to manage and deploy.
- Reduce training costs with an LMS: While achieving the right training outcomes is critical for talent development and training programs, it goes without saying that cost is always top-of-mind.

A learning object is "a collection of content items, practice items, and assessment items that are combined based on a single learning objective". "The object must be complete unto itself to allow a user to easily apply it." - Art Zygielbaum, University of Nebraska, Lincoln. [13] [7] The Institute (IEEE) defines a learning object as "any entity, digital or non-digital, that may be used for learning, education or training". Most alternative interpretation is given by Stephen Downes: Learning object must be, at least, a digital resource. It must contain pedagogical intent. And finally, that what makes something a Learning Object is not what it is, but rather, how it is used. [13] It can be said that e-learning systems and learning objects represent a revolution in education and learning methodologies.

Moodle is one of the LMS platforms that is popular worldwide and we use this platform in the University „Goce Delcev“- Stip, Republic of Macedonia. Moodle (acronym for Modular Object-Oriented Dynamic Learning Environment) is a free software e-learning platform, also known as Learning Management System, or Virtual Learning Environment. There are quite a few different types of tools on the market ranging from web-based or installed screen recorders to PowerPoint plugins, right up to full-featured content authoring tools (in many cases LMSs include a primitive authoring tool for basic content manipulation. LCMS technology can either be used in tandem with an LMS, or as a standalone application for learning initiatives that require rapid development and distribution of learning content. In the section below we make an analysis of two techniques and we will make a particular example of the objects for e-learning, (in our case the specifications of SCORM and IMS Common Cartridge), using the Mos Solo and eXe tools (in order to make a comparison between them and to determine the basic functionalities).

LMS has the following features:

- *Accessibility*: The ability to locate and access instructional components from one remote location and deliver them to many other locations.
- *Adaptability*: The ability to tailor instruction to individual and organizational needs.
- *Affordability*: The ability to increase efficiency and productivity by reducing the time and costs involved in delivering instruction.
- *Durability*: The ability to withstand technology evolution and changes without costly redesign, reconfiguration or recoding.

- *Interoperability*: The ability to take instructional components developed in one location with one set of tools or platform and use them in another location with a different set of tools or platform.
- *Reusability*: The flexibility to incorporate instructional components in multiple applications and contexts.

### 3. WHAT IS SCORM

SCORM is the acronym of "Shareable Content Object Reference Model" and is a widely-used reference model for e-learning content. SCORM is a set of standards and protocols that make sure that a given training content is classifiable, traceable and reusable in various LMS training environments or platforms. SCORM was created in 2000 in its 1.0 version by ADL (Advanced Distributed Learning), a department of the American Ministry of Defence.

A SCORM training object includes META information which describes its content and its functions in such a way that the platform or environment that hosts it is able to index and catalogue it within a training library or a search system. The SCORM organizational structure is composed of several components: Assets, SCOs, Aggregations, and Organizations. The possibility of testing and sequencing the content is an additional feature and advantage in SCORM. The professor can have a detailed overview of the student's work progress, evaluate his knowledge, engage in discussion forums, and also the student receives feedback about his activity in the course.

SCORM does not provide any guidance on any functional or instructional elements that make up and define the content, like learning objectives, assessments, or knowledge checks, and it does not dictate the formatting or look and feel of screens and the elements on them. Also, it does not dictate any particular organization of content information. All of these design decisions are still completely up to the instructional designer.

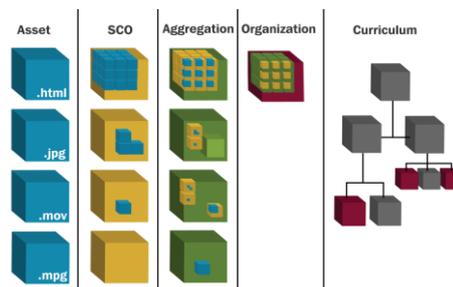


Image 1: SCORM course structure

The SCORM Run-Time Environment (RTE) handles requirements for launching content objects, establishing communication between learning management systems (LMSs) and shareable content objects (SCOs), and managing the tracking information that can be communicated between SCOs and LMSs. SCORM provides technical standards for the structure of e-learning courses. The purpose of these standards is to facilitate interoperable reusability and individualization that SCORM affords. ISDs need to pay attention to how to

structure SCORM learning modules (aka Sharable Content Object or SCO; described in Assets, SCOs, & Aggregations).

Sequencing is similar to the ISD term “branching” in a way that it describes and prescribes the manner in which learners receive content. In SCORM, the “branching” is directed by the sequencing rules your programmer creates, based on your design. Based on these rules, the learning management system (LMS) sequences are all shareable content objects (SCOs).

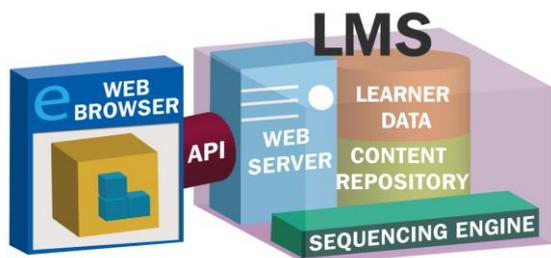


Image 2: Sequencing in SCORM

The easiest and recommended way to create a SCORM content package is by using a template. A template is a conformant SCORM 2004 content package (zip file) consisting of a simple course structure with HTML files that can be modified and extended to create your course. It typically includes a helper JavaScript file, sometimes called the API Wrapper, which makes using the SCORM API (see Understanding the SCORM API) easier for the programmer to use.

Templates are typically provided by the community and may implement instructional design patterns. For the purposes of this document we will use a simple starter template provided by ADL located. The structure of the starter template is simple. It contains a single SCO followed by an aggregation of 2 SCOs. There are tools available to create content packages or you may choose to create them from scratch. Some authoring tools will create the entire content package after you load your SCOs and assets into the tool. The ADL version of the RELOAD is an example of such a tool. RELOAD provides a graphical interface for creating a content package and managing sequencing and other values contained in the manifest file that is described below. Ensure that the tools you select match the knowledge, skill, and ability levels of the team members who will use them. This guide will not go into much detail on tools as there are many variations in functionality.

#### 4. WHAT IS COMMON CARTRIDGE

Today, a publisher has little motivation to put their content into the format of a new, emerging platform. In addition, sharing of courseware and supplementary materials is becoming even more important, not less so, as open content and courseware initiatives are expanding worldwide. Exchange and customization of quality course materials in a way that is efficient for teachers and faculty is a key need to improving education opportunities worldwide. Common Cartridge has the ability to enable

that scenario. Common Cartridge is a set of open standards developed by the IMS member community that enables interoperability between content and systems. Common Cartridge solves two problems. The first is to provide a standard way to represent digital course materials for use in online learning systems so that such content can be developed in one format and used across a wide variety of learning systems (often referred to as course management systems, learning management systems, virtual learning environments, or instructional management systems). The second is to enable new publishing models for online course materials and digital books that are modular, web-distributed, interactive, and customizable (Image 3). Common Cartridge was designed to provide a standard way to package and protect content, as opposed to each publisher or each learning management system creating a proprietary method of protection and enforcement.

#### Common Cartridge Content Hierarchy

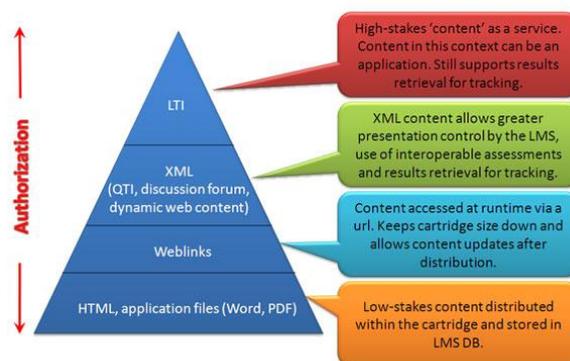
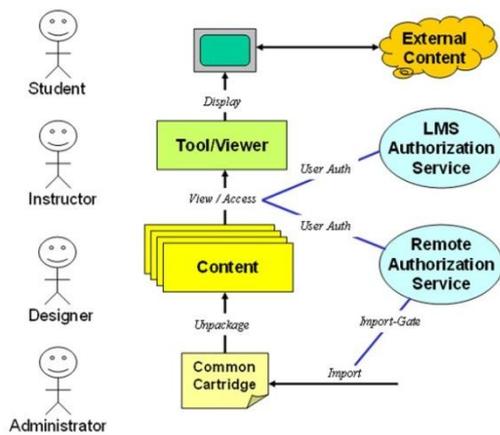


Image 3: Common Cartridge Content Hierarchy

Complementary materials in Common Cartridge are available as .zip files that can be created or downloaded from the publisher's site. Cartridge allows a standard way to represent the digital learning materials. The Learning objects are created in a way that they can be: reused, interoperable, durable, affordable, easy to maintain and adaptive. Common Cartridge was designed explicitly to obtain much higher levels of interoperability than SCORM. This was done by removing the run time component associated with SCORM and by achieving agreement on specific subsets (often referred to as application profiles) of widely used specifications. Because of the previously discussed native understanding of questions and tests, the content of a Common Cartridge is not a "black-box" as in SCORM, and therefore does not need a run time interaction for tracking or sequencing. Common Cartridge, therefore, enables learning platforms to "compete" the sequencing and reporting options they can support, based on the sophistication of the assessments.

The manifest is composed of four sections: metadata, organizations, resources and authorizations. The Metadata section is used to store the cartridge metadata restricted to a loose binding of LOM elements based on the Dublin Core (DC) specification.



**Image 4: Common Cartridge Benefits**

Advantages of common cartridge:

- Greater choice of content: Enables collections of learning resources of various types and sources to be accessed with greater ease to enable the personalization of learning experiences.
- Reduces vendor/platform lock-in: Establishes course cartridge native formats endorsed by educational publishers, and supports a wide variety of established content formats, thus eliminating platform lock-in.
- Greater assessment options: Explicitly supports the Accessible Portable Item Protocol and Question & Test Interoperability standards for exchanging assessment items.
- Increases flexibility, sharing and reuse: Fits within the educational content of enabling instructors to assemble lesson plans of various resources.

## 5. CONTENT PACKAGING TOOLS: MOS SOLO AND EXE - RESULTS

An authoring system is a program which has preprogrammed elements for the development of interactive multimedia software titles. There are various tools that can be used to create a digital content for e-learning. These tools will be analyzed in order to facilitate the work of professors at the University "Goce Delcev" in Stip and enable them to reuse the content.

The Professors in our University, can use the created course in different environments and for different purposes. Unfortunately, most of them are not free software and the user or the company should buy the entire package to be able to use and create digital content. But there are also tools that are open source and also provide users a choice of features, capabilities and different interface. With these tools, the created content becomes more functional, interoperable and reusable. In the previous research, we analyzed more than 40 tools that are most frequently used for creating a digital content.

Special attention is given to the possibility of testing and different options offered by these tools. Planning the assessments is a key part of any design process. This year

the University "Goce Delcev" in Stip started a new project where all university courses will be tested with these tools through Moodle platform. In this paper we will practically test two tools: Mos Solo that is used to create SCORM packages and eXe that is used to create Common Cartridge packages. Their functionality will be shown through the existing course of informatics (course is part of the platform for e – Learning system at University "Goce Delcev" - Stip - the contents will be packed with both tools). Comparison will be made of the two tools - differences in content and interface.

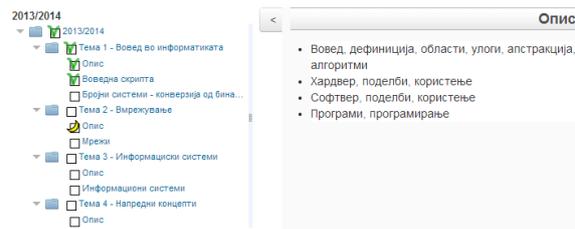
### 5.1 MOS Solo

Mos Solo is a simple yet powerful authoring tool and content editor: it requires none or minimal training but offers the power of a sophisticated multimedia tool. It lets you create highly interactive, graphically appealing, and media-rich eLearning modules, with ease and efficiency: courses, quizzes, evaluations, demos. The content created and edited in MOS Solo can be uploaded with just one click onto a SCORM 2004 compatible LMS / LCMS platform. Designed by trainers for trainers, MOS Solo is ideal for travelling authors who are interested in creating and editing content, even when they are offline.

### 5.2 eXe

eXe is a eLearning XHTML editor, and it is a freely available authoring application that assists teachers in the publishing web content without the need to become proficient in HTML or XML markup. Resources authored in eXe can be exported to the web or LMS. The eXe project developed a freely available Open Source authoring application to assist teachers and academics in the publishing of web content without the need to become proficient in HTML or XML markup. Resources authored in eXe can be exported in IMS Content Package, SCORM 1.2, or IMS Common Cartridge formats or as simple self-contained web pages.

#### eXe Learning 1



**Image 5: eXe in Moodle**

### 5.3 RESULTS

In our case we have the University "Goce Delcev", we use the Moodle platform and the courses for computer science (Computer science is a mandatory subject for all departments, except for the Faculty of Computer Science) to perform the packaging of content. Courses for informatics are divided into 11 different chapters that have different content and articles. The content is built from: 5 discussions, 5 PDF documents, 7 power point presentations, three open-solving exercises, a glossary of

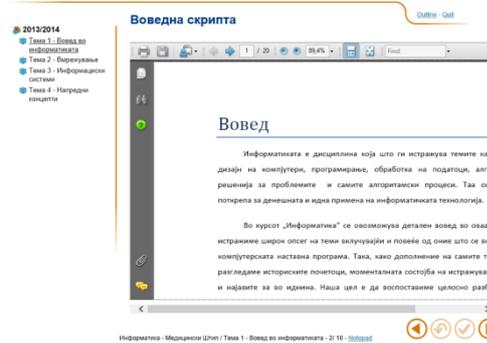
IT terms, a list of blogs, and online testing. Students have special access for login participants, and lessons are divided according to the examination session. On the right panel student can see the latest news and changes in the course. (Image 8) The interface is very simple and easy to use and you can also do navigation on the content.

**Table 1:** Mos Solo vs. eXe in Computer Science course

| Components of content  | Mos Solo R1 040 | eXe learning 1.04   |
|--|-----------------|---------------------|
| Platform   | Windows         | Linux, Windows, Mac |
| Documents (Word, Excel, Power Point, PDF), RSS, Wiki Article | Yes             | No                  |
| Images (jpg, png, gif), Media, Video (flash, mp3)            | Yes             | Yes                 |
| Java Applet  | No              | Yes                 |
| Windows Media, QuickTime, IFrame                             | Yes             | Yes                 |
| Add Activity, Add Page, Quiz                                 | Yes             | Yes                 |
| Search and Replace, Media Browser, Tree Structure            | Yes             | No                  |
| Lesson, Single Question, Multiple Questions, Text Entry      | Yes             | Yes                 |
| Popup, Sequence, Hotspots, Drag and Drop, Slider             | Yes             | No                  |
| Virtual Classroom, message, blog, forum, chat, call          | No              | No                  |

The table is presented: the tools were enclosed in content are marked with YES, and those that are not available are marked with NO. As you can see from the image, the content can be divided in chapters, and the chapters have separate lessons. In the left panel there is ability to perform navigation in content. We have included: all PDF files, word documents and power point presentations. Also the creator can add additional materials such as lessons, charts and other content images.

MOS Solo offers quizzes, testing and sequencing. The creator has a several options: multiple questions, single question, deferent choice, drag and drop, slider. Questions are portrayed randomly, and the students can play a quiz in real time. For any particular issue the students receives notifications if the answer is correct or not, and the program ultimately provides a set of points of the total score of the test.

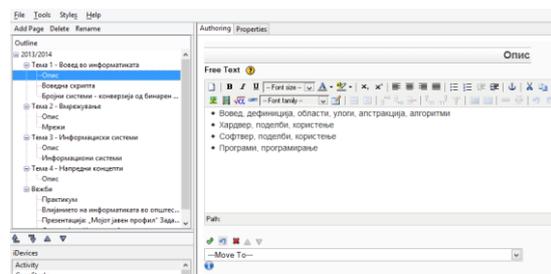


**Image 6:** Mos Solo in Moodle

As weaknesses of this tool we can specify the options that is used in the course of Moodle: possibility of discussions, forums, glossary, list of blogs, but in this version they are not available. Those characteristics and functionalities we can find in the version of Mos Chorus, link: <http://www.mindonsite.com/en/produits/mos-chorus/> and the creator can use this program if he pays package.

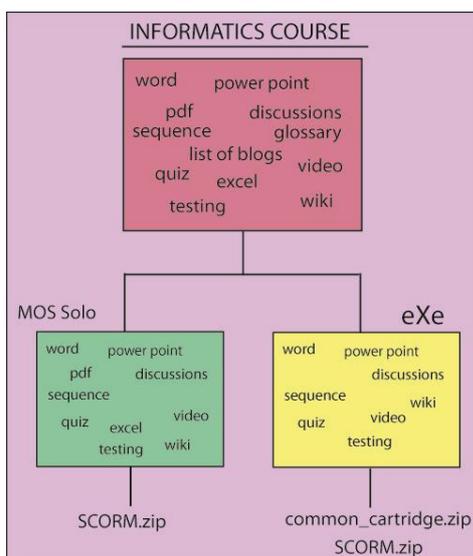
Finally, we say that the Mos Solo has a very easy interface for use and just with a click on the desired lesson or article, the content appears on the screen.

We also tested the eXe of the existing course on informatics, but in contrast to Mos Solo, the eXe has less features and tools. This tool Content is divided in chapters, and the creator can put the appropriate materials. The lectures are divided as Activity and Case Study. This program can't directly import word document or PDF, but existing items can be created as a new item in the content. So all of the content in IT course we created in new articles. This program works on Windows, Mac and Linux operating systems.



**Image 7:** eXe tool

eXe offers quizzes, testing and sequencing. The creator has a choice and options: multiple question, single question, deferent choice, drag and drop, slider. Other features are not enabled- this program is open source and we can create Common Cartridge and SCORM packages.



**Image 8:** Results of packing

## 6. CONCLUSION

As a conclusion of the analysis I would say that SCORM and Common Cartridge have their own advantages and disadvantages. SCORM can best be used in environments where students are communicating only through the computer, and the presence of the teacher is minimal (students often "work" in virtual classrooms, and communication with the teacher is online). SCORM has limited specifications and did not take account of the pedagogical aspects. There are various tools that can be used for packed, and they offer a high level of interoperability and functionality. The focus of Common Cartridge is interactive collaborative learning situations, typically with a teacher, professor, or instructor involved in guiding a cohort. The learning materials can be online, offline, or both - a situation often referred to as hybrid or blended learning. Common Cartridge may be used to facilitate self-paced online learning as well, but Common Cartridge was developed specifically to enable support the online or blended interactive and collaborative courses. Finally, I will say that our tools of Common Cartridge will find much more use (including elements of traditional education) in our University. Cartridge offers greater security and data protection. Common Cartridge was designed explicitly to obtain much higher levels of interoperability than SCORM. Because of the previously discussed native understanding of questions and tests, the content of a Common Cartridge is not a "black-box" as in SCORM. Common Cartridge provides more functionality than SCORM, but does so in a different way, enabling greater simplicity while increasing the functionality and learning scenarios that can be supported. In our educational environment - University "Goce Delcev", Common Cartridge will be much easier to implement and apply the curriculum.

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