

# DELIVERABLE



## L E A R N I N G C O M P A S S

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**O2/A2: Development of Online Services**

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*(only for members of the consortium)*



**Erasmus+**



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## 2 CONTENTS

<b>Document Information</b> .....	<b>2</b>
<b>The Consortium</b> .....	<b>3</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>6</b>
<b>1 INTRODUCTION</b> .....	<b>7</b>
1.1 The approach towards the development.....	7
1.2 Audience and license .....	7
1.3 Terms, definitions and abbreviations.....	8
1.3.1 Competence.....	8
1.3.2 Learning Outcome .....	8
1.3.3 Learning Opportunity .....	8
1.3.4 Learning Opportunity Specification.....	8
1.3.5 Learning Opportunity Instance.....	8
1.4 Structure of the report.....	9
<b>2 THE COMPASS REPO</b> .....	<b>10</b>
2.1 Objectives of the COMPASS Repo .....	10
2.2 Implementation .....	10
2.3 Deployment.....	11
2.4 Implemented functionality .....	11
2.4.1 Functional requirements.....	11
2.4.2 Non-functional requirements.....	12
<b>3 IMPLEMENTATION DETAILS</b> .....	<b>14</b>
3.1 DSpace custom installation.....	14
3.1.1 Installation .....	14
3.2 Information Schema.....	17
3.3 DSpace extensions .....	19
3.4 Input Forms.....	24
3.5 Controlled Vocabularies.....	35
<b>4 ONLINE ARTEFACTS</b> .....	<b>36</b>
4.1 COMPASS Repo .....	36
4.1.1 Welcome page.....	36
4.1.2 Search.....	37
4.1.3 Browse .....	40
4.1.4 Login .....	40

4.1.5	Creation of Learning Opportunities.....	41
4.1.6	OAI-PMH target.....	43
<b>5</b>	<b>About COMPASS.....</b>	<b>44</b>

## EXECUTIVE SUMMARY

The main objective of this activity is to transfer the systems architecture design and associated metadata application into a set of software components and services that can allow and facilitate the exploration of alternative lifelong learning opportunity pathways. In order to meet this goal, COMPASS Repo shall be developed that will be readily available to interested organizations in order to develop their learning opportunity structure based on a competence-enhanced Metadata for Learning Opportunities (MLO).

Furthermore, the COMPASS Repo will facilitate the "design patterns" template and will be regularly updated with descriptions and insight from the usage of standards in metadata development in the ICT domain as well as suggestions for transferring to other domains. Both the developed toolkit and the metadata repository will be adopted for the targeted ICT domain.

The following paragraphs describe the identified actors and the essential use cases for the repository of COMPASS Repo. The repository has been developed, tested, staged, and deployed at the web address: <http://195.130.109.197:8080/jspui/>

# 1 INTRODUCTION

The main purpose of the document is to present the technical details of the implementation of the online toolkit for representing lifelong learning opportunities metadata. Also a description of what the prospective COMPASS Repo users want to perform with the software platform. To this purpose, a number of business procedures, functional and non-functional requirements, as well as relevant use cases are analyzed, encompassing the COMPASS Repo basic functionality. In particular the proposed system will consist of:

- a validation service that will allow the validation of metadata instances against predefined application profiles,
- a registry service that allows the creation and management of catalogues/indexes with the providers of metadata records/instances,
- a harvester service that allows the periodical monitoring, fetching, aggregation and updating of metadata records from various distributed providers and
- a repository service that allows the creation of repositories that store the aggregated metadata records that facilitate the discovery, searching and retrieval of metadata records, both through an interactive, online interface at the user browser as well as through web services that other online systems can use to directly integrate resources and metadata.

## 1.1 The approach towards the development

---

The COMPASS Repo is developed in order to describe and present the learning metadata at the domain of higher educational institutes. The specific objectives of the COMPASS Repo are

- The presentation of well-structured Learning Opportunities with explicit integration of learning outcome and competence related information.
- The development of a modular, extendable and interoperable software platform that will model, simulate and benchmark scenarios and operations, and act as a decision making tool.

## 1.2 Audience and license

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The intended audience of this document is basically the software development team of the Compass-Repo software platform. However, the document is prepared in such a way, that the system users may easily read it, in order to understand the basic functionality and capabilities of the platform. Since there are many Projects on the same Scientific Field, the document is classified as public. The reader should follow a serial reading procedure through the chapters in order to fully understand the potential and functionality of the platform.

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## 1.3 Terms, definitions and abbreviations

---

### 1.3.1 Competence

Proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development (source: EQF).

### 1.3.2 Learning Outcome

What a learner is expected to know, understand, or be able to do after successful completion of a process of learning (source: shortened from ECTS Users Guide). NOTE: The full proper term is “intended learning outcome”, and unless it is clear from the context that the reference is to the actual outcome of learning in a person, “learning outcome” should be understood to mean “intended learning outcome” throughout this documentation.

### 1.3.3 Learning Opportunity

A chance to participate in education or training (*source: MLO*).

### 1.3.4 Learning Opportunity Specification

A specification of learning opportunities consists of the compass metadata schema values.

### 1.3.5 Learning Opportunity Instance

An instance of learning opportunities consists of the compass metadata schema values. In our approach the instances will be created using the specifications.

## 1.4 Structure of the report

---

The following sections of this report are structured as following:

- Section 2 provides a short description of the “COMPASS Repo” software service.
- Section 3 provides some details about the implementation of the software service.
- Section 4 provides online artefacts and screenshots of the deployed software service.

## 2 THE COMPASS REPO

### 2.1 Objectives of the COMPASS Repo

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For nearly 30 years that EU has funded the Erasmus programme, over three million European students have been enabled to spend part of their studies at another higher education institution or with an organisation in Europe. The increasing number of students has produced great business potential for information systems, along however with a number of services that will create opportunities to study abroad, to gain valuable work experience by supporting traineeships, etc.

The main aim of COMPASS Repo is to gather learning opportunities offered from Educational Institutes in a central repository in order to offer meaningful services within a higher education context that target (a) the improvement of quality and relevance of offered learning opportunities to current and emerging labor market needs, (b) the enhancement of mobility, making learning opportunities more visible and understandable for students that want to gain additional skills (c) the strengthening of cross-border cooperation of HEIs in the definition of quality flexible learning pathways for their learners, (d) the increase of social responsibility of HEIs through the transparent descriptions of their offerings, (e) the implementation of sustainable infrastructure for all European HEIs and for the EU to leverage in the enhancement of existing or the creation of new related services.

### 2.2 Implementation

---

The COMPASS Repo is based on free and open source software, namely, the DSpace free and open source software. Dspace is a repository application platform used by more than 1000 organizations and institutions worldwide. The main extensions to the DSpace platform and innovations for the development of the COMPASS Repo included:

- Built as an extension of the DSpace latest code base
  - being a branch of <https://github.com/DSpace/DSpace>
  - facilitates integration of new versions and updates of DSpace
- Built using the JSPUI interface
- Initial setup of COMPASS Metadata schema
- Design of forms for description of COMPASS s(input forms)
- Extensions to DSpace to allow relations between objects
  - Allow a new item to be “linked,, to existing items through various relations
- Extensions to DSpace to allow population of items from other items in the same community
- Definition of the COMPASS metadata schema (metadata profile)
- Custom, advanced search using the information of the COMPASS metadata profile

## 2.3 Deployment

---

The system architecture of the COMPASS Repo follows the cloud computing paradigm, relying on sharing of resources to achieve efficiency, coherence and economies of scale. Furthermore, the software architecture makes use of concepts from the Service-Oriented Architecture (SOA) pattern, to decompose the system's operation into semi-autonomous services that can be weaved together to provide the complete functionality of the software platform. The software deployment for the launch and pilot testing of the COMPASS Repo utilized the cloud resources of tei of Athens. The suitable arrangement of VMs, operated by Windows, was designed and implemented for the deployment of the components of the COMPASS Repo.

## 2.4 Implemented functionality

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### 2.4.1 Functional requirements

The current implementation of the COMPASS Repo, meets the following requirements.

ID	Name	Comment
UC.01	Search	Users are able to search the system for learning opportunities given some specific criteria or simply by going through the list of all available items in the repository.
UC.02	Browse	Users are able to browse for learning opportunities, by choosing specific levels and items of categorisation.
UC.03	Persistent Identifiers	Users can use a Persistent Identifier that uniquely relates to a specific learning opportunity of the repository.
UC.04	View learning opportunities	Users may view a web page with the detailed description of a learning opportunity.
UC.05	Provide Feedback	Users shall be able to provide feedback at any stage of their interaction with the system
UC.06	Register	Any user may opt to register with the repository, i.e. create a new account in order to be able to edit and submit new items to the repository.
UC.07	Reset password	Registered users may need to reset their password.
UC.08	Login	Registered users can login to the system with their credentials
UC.09	Logout	A user who has logged in the system can opt to logout in order to terminate the authenticated session.
UC.10	Create a learning opportunity Specification	A registered user can submit the definition of a new learning opportunity to the repository

UC.11	Relate a learning opportunity to other learning opportunity	An editor of a learning opportunity can define relations to other learning opportunities.
UC.12	Create a learning opportunity Instance	In order to submit the definition of a new learning opportunity instance the user has to select form a list the specification that it belongs to.
UC.13	Revise a learning opportunity	An editor of a learning opportunity is able to revise the description of a learning opportunity.
UC.14	Manage updates	Moderators are facilitated in their daily tasks of monitoring updates to the content of the repository
UC.15	Moderate a learning opportunity	Moderators are able to review the description of a learning opportunity and update it if needed.
UC.16	Moderate a relation	Moderators are able to review the relation of a learning opportunity with other learning opportunity.
UC.17	Review feedback	The Moderator's dashboard holds a list of all feedback by end users of the repository.
UC.18	Notify Editor	Moderators are able to notify Editors of learning opportunities
UC.19	OAI-PMH target	The system provides an OAI-PMH target (Open Archives Initiative Protocol for Metadata Harvesting), as a means to harvest the descriptions of all the records in the repository so that services can be built using learning opportunity descriptions from many repositories.

## 2.4.2 Non-functional requirements

The basic non-functional requirements of the COMPASS Repo are presented in the following table:

ID	Name	Comment
UC.01	Usability	The system has been designed with usability in mind – computer literacy of users can vary a lot, given the fact that the covered topics are of global interest.
UC.02	Efficiency	The system does not exceed specific resource consumption for given load
UC.03	Performance	Search results appear timely and overall system's response time is rated as "fast".
UC.04	Availability	The system has an 24x7 availability with minimum down-time and scheduled maintenance.
UC.05	Certification	The system does not include or make references to inappropriate content.

UC.06	Open Source	System design and coding promotes open source.
UC.07	Extensibility	Design allows for development of extensions, plugins and connectors.
UC.08	Compatibility	The system adopts standards and employs protocols for communicating with related external systems, tools and services.
UC.09	Scalability	The system scales well, being able to maintain or even increase its level of performance with the addition of cloud resources (virtual machines) and/or the upgrade of existing infrastructure (CPU cores, RAM memory, bandwidth, etc.)

## 3 IMPLEMENTATION DETAILS

### 3.1 DSpace custom installation

DSpace has been configured and programmatically adapted in order to meet the requirements of the COMPASS Repo. The following is an extract of the key points related to the installation of DSpace.

Based on the instructions of “Installing Dspace” at

<https://wiki.duraspace.org/display/DSDOC5x/Installing+DSpace>.

We set up the following prerequisite software:

- Oracle Java JDK 7
- Apache Maven 3.0.5+
- Apache Ant 1.8
- PostgreSQL 9.0
- Apache Tomcat 9. In Tomcat we apply the following modifications

#### Server.xml

```
!-- Define a non-SSL HTTP/1.1 Connector on port 8080 -->
<Connector port="8080"
    maxThreads="150"
    minSpareThreads="25"
    maxSpareThreads="75"
    enableLookups="false"
    redirectPort="8443"
    acceptCount="100"
    connectionTimeout="20000"
    disableUploadTimeout="true"
    URIEncoding="UTF-8"/>
```

#### 3.1.1 Installation

The installation consists of the following steps:

- **Database Setup .**

Create a Dspace database, owned by the Dspace PostgreSQL user

- **Initial Configuration**

- `dspace.install.dir` - must be set to the [dspace](installation) directory (On Windows be sure to use forward slashes for the directory path! For example: "C:/dspace" is a valid path for Windows.)

- dspace.hostname - fully-qualified domain name of web server.
- dspace.baseUrl - complete URL of this server's DSpace home page but without any context eg. /xmlui, /oai, etc.
- dspace.name - "Proper" name of your server, e.g. "My Digital Library".
- solr.server - complete URL of the Solr server. DSpace makes use of Solr for indexing purposes.
- default.language
- db.driver
- db.url
- db.username - the database username used in the previous step.
- db.password - the database password used in the previous step.
- mail.server - fully-qualified domain name of your outgoing mail server.
- mail.from.address - the "From:" address to put on email sent by DSpace.
- mail.feedback.recipient - mailbox for feedback mail.
- mail.admin - mailbox for DSpace site administrator.
- mail.alert.recipient - mailbox for server errors/alerts (not essential but very useful!)
- mail.registration.notify- mailbox for emails when new users register (optional)

- **Build the Installation Package (mvn package)**

```

C:\Windows\System32\cmd.exe
INFO] Reactor Summary:
INFO]
INFO] DSpace Parent Project ..... SUCCESS [ 1.966 s]
INFO] DSpace Services Framework :: API and Implementation ..... SUCCESS [ 7.366 s]
INFO] DSpace Kernel :: API and Implementation ..... SUCCESS [ 35.403 s]
INFO] DSpace Addon Modules ..... SUCCESS [ 0.077 s]
INFO] DSpace Kernel :: Additions and Local Customizations ..... SUCCESS [ 0.436 s]
INFO] DSpace XML-UI (Manakin) ..... SUCCESS [ 31.578 s]
INFO] DSpace XML-UI (Manakin) :: Local Customizations ... SUCCESS [ 16.528 s]
INFO] DSpace JSP-UI ..... SUCCESS [ 13.732 s]
INFO] DSpace JSP-UI :: Local Customizations ..... SUCCESS [ 13.965 s]
INFO] DSpace RDF ..... SUCCESS [ 15.336 s]
INFO] DSpace RDF :: Local Customizations ..... SUCCESS [ 7.999 s]
INFO] DSpace REST :: API and Implementation ..... SUCCESS [ 9.990 s]
INFO] DSpace REST :: Local Customizations ..... SUCCESS [ 7.300 s]
INFO] DSpace SWORD ..... SUCCESS [ 6.705 s]
INFO] DSpace SWORD :: Local Customizations ..... SUCCESS [ 7.333 s]
INFO] DSpace SWORD v2 ..... SUCCESS [ 4.848 s]
INFO] DSpace SWORD v2 :: Local Customizations ..... SUCCESS [ 9.699 s]
INFO] Apache Solr Webapp ..... SUCCESS [ 18.546 s]
INFO] DSpace SOLR :: Local Customizations ..... SUCCESS [ 6.810 s]
INFO] DSpace OAI-PMH ..... SUCCESS [ 7.800 s]
INFO] DSpace OAI-PMH :: Local Customizations ..... SUCCESS [ 5.850 s]
INFO] DSpace Assembly and Configuration ..... SUCCESS [01:01 min]
INFO] DSpace XML-UI Mirage2 Theme ..... SUCCESS [ 2.496 s]
INFO]
INFO] BUILD SUCCESS
INFO]
INFO] Total time: 04:54 min
INFO] Finished at: 2017-02-15T16:53:54+02:00
INFO] Final Memory: 57M/367M
INFO]
dspace-5.5>

```

- **Install DSpace (ant fresh\_install)**

```

C:\windows\system32\cmd.exe
init_geolite:
[echo]
[echo] =====
[echo] The DSpace code has been installed.
[echo]
[echo] To complete installation, you should do the following:
[echo]
[echo] * Setup your Web servlet container (e.g. Tomcat) to look for your
[echo] DSpace web applications in: /dspace/webapps/
[echo]
[echo] OR, copy any web applications from /dspace/webapps/ to
[echo] the appropriate place for your servlet container.
[echo] (e.g. '$CATALINA_HOME/webapps' for Tomcat)
[echo]
[echo] * Start up your servlet container (e.g. Tomcat). DSpace now will
[echo] initialize the database on the first startup.
[echo]
[echo] * Make an initial administrator account (an e-person) in DSpace:
[echo]
[echo] /dspace/bin/dspace create-administrator
[echo]
[echo] You should then be able to access your DSpace's 'home page':
[echo]
[echo] http://195.130.109.197:8080/jspui
[echo]
[echo] =====
[echo]
[echo]
BUILD SUCCESSFUL
Total time: 1 minute 8 seconds
C:\dSPACE-5.5\dSPACE\target\dSPACE-installer>

```

- **Deploy Web Applications**

In order to deploy the web applications we define the context roots of the web applications in the directory [tomcat]/conf/Catalina/localhost

```

<?xml version='1.0'?>
<Context
  docBase="[dSPACE]/webapps/solr"
  reloadable="true"
  cachingAllowed="false"/>

```

- **Administrator Account**

We create an administrator account from the command line: [dSPACE]/bin/dspace create-administrator

## 3.2 Information Schema

term	label	LOS	LOI	source	COMPASS Definition
<b>dc.contributor</b>	Contributor	x	x	<a href="#">dc/elements/1.1</a>	An entity responsible for making contributions to the learning opportunity or its description. Note: the system automatically records the metadata editors for the described learning opportunity.
dc.coverage	Coverage	x	x	<a href="#">dc/elements/1.1</a>	The spatial or temporal topic of the learning opportunity, the spatial applicability of the learning opportunity, or the jurisdiction under which the learning opportunity is relevant.
<b>dc.creator</b>	Creator	x	x	<a href="#">dc/elements/1.1</a>	An entity primarily responsible for creating the learning opportunity.
<b>dc.date</b>	Date	x	x	<a href="#">dc/elements/1.1</a>	A point or period of time associated with an event in the lifecycle of the learning opportunity or its description.
<b>dc.description</b>	Description	x	x	<a href="#">dc/elements/1.1</a>	An account of the learning opportunity.
dc.format	Format	x	x	<a href="#">dc/elements/1.1</a>	The file format, physical medium, or dimensions of the learning opportunity.
<b>dc.identifier</b>	Identifier	x	x	<a href="#">dc/elements/1.1</a>	An alternative unambiguous reference to the learning opportunity within a given context. Note: the primary identifier is automatically assigned by the system.
<b>dc.language</b>	Language	x	x	<a href="#">dc/elements/1.1</a>	A language of the learning opportunity.
<b>dc.publisher</b>	Publisher	x	x	<a href="#">dc/elements/1.1</a>	An entity responsible for making the description of the learning opportunity available.
<i>dc.relation</i>	Relation	x	x	<a href="#">dc/elements/1.1</a>	A related learning opportunity.
<b>dc.rights</b>	Rights	x	x	<a href="#">dc/elements/1.1</a>	Information about rights held in and over the description of the learning opportunity.
dc.source	Source	x	x	<a href="#">dc/elements/1.1</a>	A related learning opportunity from which the described learning opportunity is derived.
<b>dc.subject</b>	Subject	x	x	<a href="#">dc/elements/1.1</a>	The topic of the learning opportunity.
<b>dc.title</b>	Title	x	x	<a href="#">dc/elements/1.1</a>	A name given to the learning opportunity.
dc.type	Type	x	x	<a href="#">dc/elements/1.1</a>	The nature or genre of the learning opportunity.
mlo.assessment	Assesment	x		<a href="#">mlo</a> , <a href="#">compass</a>	A description of the broad approach to assessment strategy used in the learning opportunity.

mlo.cost	Cost		x	<a href="#">mlo, compass</a>	A cost associated with obtaining access to the learning opportunity instance.
mlo.credit	Credit	x		<a href="#">mlo, compass</a>	An account of the credits that can be obtained from completion of a learning opportunity
mlo.duration	Duration		x	<a href="#">mlo, compass</a>	A duration of the learning opportunity instance.
mlo.engagement	Engagement		x	<a href="#">mlo, compass</a>	The logistical means by which individuals engage in a learning opportunity instance, encompassing temporal, modal and spatial patterns of engagement and attendance.
mlo.hasPart	Has part	x	x	<a href="#">mlo, compass</a>	A relation to a learning opportunity that is logically included in the described learning opportunity.
mlo.level	Level	x		<a href="#">mlo, compass</a>	An account of the education level of the learning opportunity.
mlo.languageOfInstruction	Language of instruction		x	<a href="#">mlo, compass</a>	A language in which the learning opportunity instance is available to be taught.
mlo.location	Location		x	<a href="#">mlo, compass</a>	The spatial location for the delivery of the learning opportunity instance.
mlo.objective	Objective	x	x	<a href="#">mlo, compass</a>	An aim or learning objective for the learning opportunity.
mlo.offeredAt	Offered At		x	<a href="#">mlo, compass</a>	A description of a learning opportunity provider that offers the learning opportunity instance.
mlo.places	Places		x	<a href="#">mlo, compass</a>	Number of places available for participants in the learning opportunity instance.
mlo.prerequisite	Prerequisite	x	x	<a href="#">mlo, compass</a>	A prerequisite or entry requirement for accessing the learning opportunity.
mlo.qualification	Qualification	x		<a href="#">mlo, compass</a>	A qualification that can be obtained from completion of a learning opportunity.
mlo.specifies	Specifies	x		<a href="#">mlo, compass</a>	A relation to a learning opportunity instance that is an instance specified by the described learning opportunity specification.
mlo.start	Start		x	<a href="#">mlo, compass</a>	A point or period of time associated with the start of the learning opportunity instance.
mlo.url	URL	x	x	<a href="#">mlo, compass</a>	A hyperlink to a web resource that provides an alternate representation of the learning opportunity.

### 3.3 DSpace extensions

The following paragraphs describe briefly the main extensions to the DSpace source code for the implementation of the functionality of the COPMASS Repo.

#### 3.3.1 CompassBasicPopulator

This class will be used in order to define the collections that will be used in order to populate data from learning specification to learning instance.

```
//-----methods-----
public CompassBasicPopulator() {
    //initialization...
    strategyExtractor=Dispatcher - new StrategyExtractorDispatcher();
    collectionHandlesToApplyAssociation - new TreeMap<>();

    //declare handling for form submission...
    Map<Integer, ExtractionRule> settingsForTeiAthItDepPostGradLos - new HashMap<>();
    settingsForTeiAthItDepPostGradLos.put(3, ExtractionRule.ITEMS_FROM_SAME_COLLECTION);
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.ITALIAN_GRAD_LOS,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLos));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.TUD_GRAD_LOS,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLos));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.NOIIS_GRAD_LOS,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLos));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.TUT_GRAD_LOS,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLos));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.TEI_GRAD_LOS,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLos));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.UM_GRAD_LOS,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLos));

    //declare handling for form submission...
    Map<Integer, ExtractionRule> settingsForTeiAthItDepPostGradLoi - new HashMap<>();
    settingsForTeiAthItDepPostGradLoi.put(1, ExtractionRule.LOSPECIFICATIONS_FOR_SELECTED_LO_INSTANCE);
    settingsForTeiAthItDepPostGradLoi.put(5, ExtractionRule.ITEMS_FROM_SAME_COLLECTION);
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.ITALIAN_GRAD_LOI,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLoi));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.TUD_GRAD_LOI,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLoi));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.NOIIS_GRAD_LOI,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLoi));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.TUT_GRAD_LOI,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLoi));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.TEI_GRAD_LOI,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLoi));
    collectionHandlesToApplyAssociation.put(FormSubmissionSettings.UM_GRAD_LOI,
        AssociationOptions.getInstance(true, settingsForTeiAthItDepPostGradLoi));
}
```

#### 3.3.2 FetchLoSpecificationsForLoInstanceExtractor

This class will be used in order to define the values of the fields that will be extracted. The fields form LO specification to LO instance

```

17
@Override
public List<Tuple2> getAllItemsFromCollection(Collection collection) throws SQLException {

    final String collectionNameToCompare = collection.getName();

    final List<Tuple2> items = new ArrayList<>();

    LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> HERE!");

    for (Community c : Arrays.asList(collection.getCommunities())) { //for every community...

        LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> first: " + c.getName());

        for (Collection col : Arrays.asList(c.getCollections())) { //for every collection of the selected community....

            String collectionNameToBeCompared = col.getName();
            if (!collectionNameToBeCompared.contains(LEARNING OPPORTUNITY SPECIFICATION SUFFIX)) {
                continue;
            }

            collectionNameToBeCompared = collectionNameToBeCompared.replaceAll(LEARNING OPPORTUNITY SPECIFICATION SUFFIX, "");

            LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> second: " + col.getName());
            LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> second to comp: " + collection.getName());

            if (collectionNameToBeCompared.equals(collectionNameToCompare)) {
                LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> strike a match!");

                List<Item> tempListItems = new ArrayList<>();

                ItemIterator ii = col.getAllItems(); //grab the items from this collection...
                while (ii.hasNext()) {
                    Item i = ii.next();

                    LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> third(1): " + i.getName());
                    LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> third(2): " + i);

                    tempListItems.add(i);
                } //while.

                items.add(new Tuple2(col, tempListItems)); //and save them...

            } else {
                LOG.error("CompassHelper#getLOSpecificationsForLOInstance --> not strike a match!");
            }
        }
    }
}

```

### 3.3.3 FormSubmissionSettings

In this class we define the ids of the collections that will use our new submission process. For example the collection with id 123456789/27 and 123456789/28 will follow our new process instead of the default.

```
package org.dspace.compass.association.settings;

/**
 *
 */
public class FormSubmissionSettings {

    public static String ITALIAN_GRAD_LOS - "123456789/27";
    public static String ITALIAN_GRAD_LOI - "123456789/28";

    public static String TUD_GRAD_LOS - "123456789/15";
    public static String TUD_GRAD_LOI - "123456789/14";

    public static String NOFS_GRAD_LOS - "123456789/31";
    public static String NOFS_GRAD_LOI - "123456789/32";

    public static String TUT_GRAD_LOS - "123456789/34";
    public static String TUT_GRAD_LOI - "123456789/35";

    public static String TEI_GRAD_LOS - "123456789/4";
    public static String TEI_GRAD_LOI - "123456789/3";

    public static String UM_GRAD_LOS - "123456789/37";
    public static String UM_GRAD_LOI - "123456789/38";

}
```

### 3.3.4 Tuple2

This class will be used in order to manipulate the items and the collections of the repo.

```
package org.dspace.compass.association.util;

import java.util.List;
import org.dspace.content.Collection;
import org.dspace.content.Item;

/**
 * Used by COMPASS ASSOCIATION ENGINE.
 *
 */
public final class Tuple2 {

    private Collection collection;
    private List<Item> items;

    public Tuple2(Collection c, List<Item> i) {
        this.collection = c;
        this.items = i;
    }

    public Collection getCollection() {
        return collection;
    }

    public void setCollection(Collection collection) {
        this.collection = collection;
    }

    public List<Item> getItems() {
        return items;
    }

    public void setItems(List<Item> items) {
        this.items = items;
    }

}
```

### 3.3.5 LearningOpportunity

In this class we describe the fields of the Specification and Instance that will be used in order to retrieve and populate the values.

```
public class LearningOpportunity {  
  
    public static final String EN_US - "en_US";  
  
    public static final String COMPASS_SCHEMA_NAME - "compass";  
    public static final String DC_SCHEMA_NAME - "dc";  
  
    public static final String LEARNING_OPPORTUNITY_SPECIFICATION_ELEMENT_NAME - "learningOpportunitySpecification";  
    public static final String LEARNING_OPPORTUNITY_ELEMENT_NAME - "learningOpportunity";  
  
    //-----QUALIFIERS DECLARATION (SPECIFICATION - LOS)-----  
    //dc-related...  
    public static final String CONTRIBUTOR - "contributor";  
    //COVERAGE  
    public static final String CREATOR - "creator";  
    public static final String DATE - "date";  
    public static final String DESCRIPTION - "description";  
    public static final String FORMAT - "format";  
    public static final String IDENTIFIER - "identifier";  
    public static final String LANGUAGE - "language";  
    public static final String PUBLISHER - "publisher";  
    public static final String RELATION - "relation";  
    public static final String RIGHTS - "rights";  
    public static final String SOURCE - "source";  
    public static final String SUBJECT - "subject";  
    public static final String TITLE - "title";  
    public static final String TYPE - "type";  
    //learningOpportunitySpecification related...  
    public static final String ASSESSMENT - "assessment";  
    public static final String CREDIT - "credit";  
    public static final String HAS_PART - "hasPart";  
    public static final String LEVEL - "level";  
    public static final String OBJECTIVE - "objective";  
    public static final String PREREQUISITE - "prerequisite";  
    public static final String QUALIFICATION - "qualification";  
    public static final String URL - "url";  
}
```

### 3.3.6 LOInstanceFormDb

In this class we describe two processes

- We retrieve the values of the metadata fields of a specification,
- We populate the values at the associated fields of the instance.

```

public class LOInstanceFormDb {

    //add the labels of the fields you wish to populate...
    private static final Map<String, LOInstanceFormAction> FIELDS_TO_POPULATE = new HashMap<>();

    static {

        FIELDS_TO_POPULATE.put("Contributor", new LOInstanceFormAction() {
            @Override
            public Metadatum[] extractCorrectInfoFromLOSpec(Item itemToFetchData) {
                return itemToFetchData.getMetadatum(
                    LearningOpportunity.DC_SCHEMA_NAME,
                    LearningOpportunity.CONTRIBUTOR,
                    null,
                    LearningOpportunity.EN_US);
            }
        });

        FIELDS_TO_POPULATE.put("Creator", new LOInstanceFormAction() {
            @Override
            public Metadatum[] extractCorrectInfoFromLOSpec(Item itemToFetchData) {
                return itemToFetchData.getMetadatum(
                    LearningOpportunity.DC_SCHEMA_NAME,
                    LearningOpportunity.CREATOR,
                    null,
                    LearningOpportunity.EN_US);
            }
        });

        FIELDS_TO_POPULATE.put("Date", new LOInstanceFormAction() {
            @Override
            public Metadatum[] extractCorrectInfoFromLOSpec(Item itemToFetchData) {
                return itemToFetchData.getMetadatum(
                    LearningOpportunity.DC_SCHEMA_NAME,
                    LearningOpportunity.DATE,
                    null,
                    LearningOpportunity.EN_US);
            }
        });

        FIELDS_TO_POPULATE.put("Description", new LOInstanceFormAction() {
            @Override
            public Metadatum[] extractCorrectInfoFromLOSpec(Item itemToFetchData) {
                return itemToFetchData.getMetadatum(
                    LearningOpportunity.DC_SCHEMA_NAME,
                    LearningOpportunity.DESCRPTION,
                    null,
                    LearningOpportunity.EN_US);
            }
        });
    }
}

```

## 3.4 Input Forms

The COMPASS Repo input forms provide the configuration that guide DSpace's mechanism for the browser-based forms targeted to registered members of the repository, in order to create and update definitions of learning opportunities. We have developed two forms. The "compass\_form\_lo\_instance" that will be used for the creation of LO instances and the "compass\_form\_lo\_specification" that will be used for the creation of LO specifications.

```
<?xml version="1.0"?>
<!DOCTYPE input-forms SYSTEM "input-forms.dtd">

<input-forms>

  <form-map>

    <!-- LO SPECIFICATION INPUT FORM -->

    <name-map collection-handle="123456789/4" form-name="compass_form_lo_specification"/>
    <name-map collection-handle="123456789/15" form-name="compass_form_lo_specification"/>
    <name-map collection-handle="123456789/27" form-name="compass_form_lo_specification"/>
    <name-map collection-handle="123456789/31" form-name="compass_form_lo_specification"/>
    <name-map collection-handle="123456789/34" form-name="compass_form_lo_specification"/>
    <name-map collection-handle="123456789/37" form-name="compass_form_lo_specification"/>
    <name-map collection-handle="123456789/66" form-name="traditional"/>

    <!-- LO INSTANCE INPUT FORM -->

    <name-map collection-handle="123456789/3" form-name="compass_form_lo_instance"/>
    <name-map collection-handle="123456789/14" form-name="compass_form_lo_instance"/>
    <name-map collection-handle="123456789/28" form-name="compass_form_lo_instance"/>
    <name-map collection-handle="123456789/32" form-name="compass_form_lo_instance"/>
    <name-map collection-handle="123456789/35" form-name="compass_form_lo_instance"/>
    <name-map collection-handle="123456789/38" form-name="compass_form_lo_instance"/>
  </form-map>

  <form-definitions>

    <!-- START OF COMPASS FORM LEARNING OPPORTUNITY INSTANCE -->
    <form name="compass_form_lo_instance">
      <page number="1">
        <!-- LEARNING OPPORTUNITY SPECIFICATION HAS PART [ASSOCIATION] -->
        <field>
          <dc-schema>compass</dc-schema>
          <dc-element>learningOpportunity</dc-element>
          <dc-qualifier>specifies</dc-qualifier>
          <repeatable>>false</repeatable>
          <label>Learning Opportunity Instance Specifies</label>
          <input-type value-pairs-
name="learningOpportunity_associationDummy">dropdown</input-type>
          <hint>Select specifies for learning opportunity instance that is an instance
specified by the described learning opportunity specification.</hint>
          <required></required>
        </field>
      </page>

      <page number="2">
        <field>
          <dc-schema>dc</dc-schema>
          <dc-element>title</dc-element>
          <repeatable>>false</repeatable>
          <label>Title</label>
          <input-type>onebox</input-type>
          <hint>A name given to the learning opportunity.</hint>
          <required></required>
        </field>
        <field>
          <dc-schema>dc</dc-schema>
          <dc-element>identifier</dc-element>

```

```

    <repeatable>false</repeatable>
    <label>Identifier</label>
    <input-type>onebox</input-type>
    <hint>An alternative unambiguous reference to the learning opportunity within
a given context. Note: the primary identifier is automatically assigned by the system.</hint>
    <required></required>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>type</dc-element>
    <repeatable>true</repeatable>
    <label>Type</label>
    <input-type>onebox</input-type>
    <hint>The nature or genre of the learning opportunity.</hint>
    <required></required>
    <vocabulary closed="false">LOIT</vocabulary>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>description</dc-element>
    <repeatable>true</repeatable>
    <label>Description</label>
    <input-type>textarea</input-type>
    <hint>An account of the learning opportunity.</hint>
    <required></required>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>rights</dc-element>
    <repeatable>true</repeatable>
    <label>Rights</label>
    <input-type>textarea</input-type>
    <hint>Information about rights held in and over the description of the
learning opportunity.</hint>
    <required></required>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>subject</dc-element>
    <repeatable>true</repeatable>
    <label>Subject</label>
    <input-type>onebox</input-type>
    <hint>The topic of the learning opportunity.</hint>
    <required></required>
    <vocabulary closed="false">test</vocabulary>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>date</dc-element>
    <repeatable>false</repeatable>
    <label>Date</label>
    <input-type>date</input-type>
    <hint>A point or period of time associated with an event in the lifecycle of
the learning opportunity or its description.</hint>
    <required></required>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>language</dc-element>
    <dc-qualifier>iso</dc-qualifier>
    <repeatable>false</repeatable>
    <label>Language</label>
    <input-type value-pairs-name="common_iso_languages">dropdown</input-type>
    <hint>A language of the learning opportunity.</hint>
    <required></required>
  </field>

  <field>
    <dc-schema>dc</dc-schema>
    <dc-element>creator</dc-element>
    <repeatable>false</repeatable>
    <label>Creator</label>

```

```

        <input-type>name</input-type>
        <hint>An entity primarily responsible for making the resource.</hint>
        <required></required>
    </field>

    <field>
        <dc-schema>dc</dc-schema>
        <dc-element>publisher</dc-element>
        <dc-qualifier></dc-qualifier>
        <repeatable>false</repeatable>
        <label>Publisher</label>
        <input-type>onebox</input-type>
        <hint>An entity responsible for making the description of the learning
opportunity available.</hint>
        <required></required>
    </field>
    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunity</dc-element>
        <dc-qualifier>url</dc-qualifier>
        <repeatable>true</repeatable>
        <label>URL</label>
        <input-type>onebox</input-type>
        <hint>A hyperlink to a web resource that provides an alternate representation
of the learning opportunity.</hint>
        <required></required>
    </field>
</page>

<page number="3"> <!-- common mlo attributes with los-->

    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunity</dc-element>
        <dc-qualifier>prerequisite</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Prerequisite Learning Outcomes</label>
        <input-type>onebox</input-type>
        <hint>A prerequisite or entry requirement for accessing the learning
opportunity.</hint>
        <required></required>
        <vocabulary closed="false">loiq</vocabulary>
    </field>
    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunity</dc-element>
        <dc-qualifier>competence</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Prerequisite Competences</label>
        <input-type>onebox</input-type>
        <hint>An aim or learning objective for the Learning Opportunity
Instance.</hint>
        <required></required>
        <vocabulary closed="false">loiq</vocabulary>
    </field>
    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunity</dc-element>
        <dc-qualifier>objective</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Outcomes</label>
        <input-type>onebox</input-type>
        <hint>An aim or learning objective for the learning opportunity.</hint>
        <required></required>
        <vocabulary closed="false">loiq</vocabulary>
    </field>

    <field>
        <dc-schema>dc</dc-schema>
        <dc-element>relation</dc-element>
        <repeatable>true</repeatable>
        <label>Equivalent</label>
        <input-type>onebox</input-type>
        <hint>A related learning opportunity.</hint>
        <required></required>

```

```

        </field>

</page>

<page number="4">
<field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunity</dc-element>
    <dc-qualifier>cost</dc-qualifier>
    <repeatable>>false</repeatable>
    <label>Cost</label>
    <input-type>onebox</input-type>
    <hint>A cost associated with obtaining access to the learning opportunity
instance.</hint>
    <required></required>
</field>
<field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunity</dc-element>
    <dc-qualifier>duration</dc-qualifier>
    <repeatable>>true</repeatable>
    <label>Duration</label>
    <input-type>date</input-type>
    <hint>A duration of the learning opportunity instance.</hint>
    <required></required>
</field>
<field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunity</dc-element>
    <dc-qualifier>engagement</dc-qualifier>
    <repeatable>>true</repeatable>
    <label>Attendance_Mode</label>
    <input-type value-pairs-
name="learningOpportunity_attendance_mode">dropdown</input-type>
    <hint>The logistical means by which individuals engage in a learning
opportunity instance, encompassing temporal, modal and spatial patterns of engagement and
attendance.</hint>
    <required></required>
</field>
<field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunity</dc-element>
    <dc-qualifier>languageOfInstruction</dc-qualifier>
    <repeatable>>true</repeatable>
    <label>Language of instruction</label>
    <input-type value-pairs-name="common_iso_languages">dropdown</input-type>
    <hint>A language in which the Learning Opportunity Instance is available to be
taught.</hint>
    <required></required>
</field>

    <field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunity</dc-element>
    <dc-qualifier>location</dc-qualifier>
    <repeatable>>false</repeatable>
    <label>Location</label>
    <input-type>onebox</input-type>
    <hint>The spatial location for the delivery of the learning opportunity
instance.</hint>
    <required></required>
</field>

    <field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunity</dc-element>
    <dc-qualifier>offered</dc-qualifier>
    <repeatable>>false</repeatable>
    <label>Offered_At</label>
    <input-type>onebox</input-type>
    <hint>A description of a learning opportunity provider that offers the
learning opportunity instance.</hint>
    <required></required>
</field>

```

```

    <field>
      <dc-schema>compass</dc-schema>
      <dc-element>learningOpportunity</dc-element>
      <dc-qualifier>places</dc-qualifier>
      <repeatable>true</repeatable>
      <label>Places</label>
      <input-type>onebox</input-type>
      <hint>Number of places available for participants in the learning opportunity
instance.</hint>
      <required></required>
    </field>

    <field>
      <dc-schema>compass</dc-schema>
      <dc-element>learningOpportunity</dc-element>
      <dc-qualifier>start</dc-qualifier>
      <repeatable>false</repeatable>
      <label>Start</label>
      <input-type>date</input-type>
      <hint>A point or period of time associated with the start of the learning
opportunity instance.</hint>
      <required></required>
    </field>

  </page>

  <page number="5">
    <!-- LEARNING OPPORTUNITY SPECIFICATION HAS PART [ASSOCIATION] -->
    <field>
      <dc-schema>compass</dc-schema>
      <dc-element>learningOpportunity</dc-element>
      <dc-qualifier>hasPart</dc-qualifier>
      <repeatable>true</repeatable>
      <label>Has Part</label>
      <input-type value-pairs-
name="learningOpportunity_associationDummy">dropdown</input-type>
      <hint>A relation to a learning opportunity that is logically included in the
described learning opportunity.</hint>
      <required></required>
    </field>
  </page>

</form>

<!-- START OF COMPASS FORM LEARNING OPPORTUNITY SPECIFICATION -->
<form name="compass form lo specification">
  <page number="1">
    <field>
      <dc-schema>dc</dc-schema>
      <dc-element>title</dc-element>
      <repeatable>false</repeatable>
      <label>Title</label>
      <input-type>onebox</input-type>
      <hint>A name given to the learning opportunity.</hint>
      <required>You must enter a main title for this item.</required>
    </field>
    <field>
      <dc-schema>dc</dc-schema>
      <dc-element>identifier</dc-element>
      <repeatable>true</repeatable>
      <label>identifier</label>
      <input-type>onebox</input-type>
      <hint>An alternative unambiguous reference to the learning opportunity within
a given context. Note: the primary identifier is automatically assigned by the system.</hint>
      <required>you must enter an identifier for this item.</required>
    </field>

    <field>
      <dc-schema>dc</dc-schema>
      <dc-element>type</dc-element>
      <repeatable>false</repeatable>

```

```

<label>Type</label>
<input-type>onebox</input-type>
<hint>The nature or genre of the learning opportunity.</hint>
<required></required>
<vocabulary closed="false">LOIT</vocabulary>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>description</dc-element>
<repeatable>true</repeatable>
<label>Description</label>
<input-type>textarea</input-type>
<hint>An account of the learning opportunity.</hint>
<required></required>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>rights</dc-element>
<repeatable>true</repeatable>
<label>Rights</label>
<input-type>onebox</input-type>
<hint>Information about rights held in and over the description of the
learning opportunity.</hint>
<required></required>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>subject</dc-element>
<repeatable>true</repeatable>
<label>Subject</label>
<input-type>onebox</input-type>
<hint>The topic of the learning opportunity.</hint>
<required></required>
<vocabulary closed="false">test</vocabulary>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>date</dc-element>
<repeatable>false</repeatable>
<label>Date</label>
<input-type>date</input-type>
<hint>A point or period of time associated with an event in the lifecycle of
the learning opportunity or its description.</hint>
<required></required>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>language</dc-element>
<dc-qualifier>iso</dc-qualifier>
<repeatable>false</repeatable>
<label>Language</label>
<input-type value-pairs-name="common_iso_languages">dropdown</input-type>
<hint>A language of the learning opportunity..</hint>
<required></required>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>creator</dc-element>
<repeatable>false</repeatable>
<label>Creator</label>
<input-type>name</input-type>
<hint>An entity primarily responsible for making the resource.</hint>
<required></required>
</field>

<field>
<dc-schema>dc</dc-schema>
<dc-element>publisher</dc-element>
<dc-qualifier></dc-qualifier>

```

```

        <repeatable>false</repeatable>
        <label>Publisher</label>
        <input-type>onebox</input-type>
        <hint>An entity responsible for making the description of the learning
opportunity available.</hint>
        <required></required>
    </field>
</page>

<page number="1">
    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>url</dc-qualifier>
        <repeatable>true</repeatable>
        <label>URL</label>
        <input-type>onebox</input-type>
        <hint>A link to a web resource that provides an alternate representation of
the resource.</hint>
        <required></required>
    </field>

    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>credit</dc-qualifier>
        <repeatable>false</repeatable>
        <label>Credit</label>
        <input-type>onebox</input-type>
        <hint>An account of the credits that can be obtained from completion of a
learning opportunity</hint>
        <required></required>
    </field>

    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>qualification</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Qualification</label>
        <input-type>onebox</input-type>
        <hint>A qualification that can be obtained from completion of a learning
opportunity.</hint>
        <required></required>
    </field>

    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>prerequisite</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Prerequisite Learning Outcomes</label>
        <input-type>onebox</input-type>
        <hint>A prerequisite or entry requirement for accessing the learning
opportunity.</hint>
        <required></required>
        <vocabulary closed="false">loiq</vocabulary>
    </field>

    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>competence</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Prerequisite Competences</label>
        <input-type>onebox</input-type>
        <hint>An aim or learning objective for the Learning Opportunity
Instance.</hint>
        <required></required>
        <vocabulary closed="false">loiq</vocabulary>
    </field>
    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>objective</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Outcomes</label>
        <input-type>onebox</input-type><!-- -->

```

```

Instance.</hint>
    <required></required>
    <vocabulary closed="false">loiq</vocabulary>
</field>

<field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunitySpecification</dc-element>
    <dc-qualifier>level</dc-qualifier>
    <repeatable>false</repeatable>
    <label>Level</label>
    <input-type>onebox</input-type>
    <hint>An account of the education level of the learning opportunity.</hint>
    <required></required>
    <vocabulary closed="false">level</vocabulary>
</field>

<field>
    <dc-schema>compass</dc-schema>
    <dc-element>learningOpportunitySpecification</dc-element>
    <dc-qualifier>assessment</dc-qualifier>
    <repeatable>true</repeatable>
    <label>Assessment</label>
    <input-type>onebox</input-type>
    <hint>A description of the broad approach to assessment strategy used in the
learning opportunity.</hint>
    <required></required>
</field>

</page>

<page number="1">
    <!-- LEARNING OPPORTUNITY SPECIFICATION HAS PART [ASSOCIATION] -->
    <field>
        <dc-schema>dc</dc-schema>
        <dc-element>relation</dc-element>
        <repeatable>true</repeatable>
        <label>Equivalent</label>
        <input-type>onebox</input-type>
        <hint>A related learning opportunity.</hint>
        <required></required>
    </field>
    <field>
        <dc-schema>compass</dc-schema>
        <dc-element>learningOpportunitySpecification</dc-element>
        <dc-qualifier>hasPart</dc-qualifier>
        <repeatable>true</repeatable>
        <label>Has Part</label>
        <input-type value-pairs-
name="learningOpportunity_associationDummy">dropdown</input-type>
        <hint>A relation to a learning opportunity that is logically included in the
described learning opportunity.</hint>
        <required></required>
    </field>
    <!-- specifies(?)... -->
</page>
</form>
<!-- END OF FORM -->

</form-definitions>

<!-- form-value-pairs populate dropdown and qualdrop-value lists. -->
<!-- The form-value-pairs element holds child elements named 'value-pairs' -->
<!-- A 'value-pairs' element has a value-pairs-name and a dc-term -->
<!-- attribute. The dc-term attribute specifies which to which Dublin Core -->
<!-- Term this set of value-pairs applies. -->
<!-- Current dc-terms are: identifier-pairs, type-pairs, and -->
<!-- language_iso-pairs. The name attribute matches a name -->
<!-- in the form-map, above. -->
<!-- A value-pair contains one 'pair' for each value displayed in the list -->
<!-- Each pair contains a 'displayed-value' element and a 'stored-value' -->
<!-- element. A UI list displays the displayed-values, but the program -->
<!-- stores the associated stored-values in the database. -->

```

```

<form-value-pairs>
<!-- VALUE PAIRS FOR learningOpportunity_type metadata schema for: compass -->
<value-pairs value-pairs-name="learningOpportunity_type">
  <pair>
    <displayed-value>Course</displayed-value>
    <stored-value>course</stored-value>
  </pair>

  <pair>
    <displayed-value>Seminar</displayed-value>
    <stored-value>seminar</stored-value>
  </pair>

  <pair>
    <displayed-value>Internship</displayed-value>
    <stored-value>internship</stored-value>
  </pair>

  <pair>
    <displayed-value>Program of Study</displayed-value>
    <stored-value>program_of_study</stored-value>
  </pair>
  <pair>
    <displayed-value>Postgraduate Program</displayed-value>
    <stored-value>postgraduate_program</stored-value>
  </pair>
</value-pairs>

<!-- VALUE PAIRS FOR learningOpportunity.qualificationEducationLevel metadata schema for:
compass -->
<value-pairs value-pairs-name="learningOpportunity_qualificationEducationLevel">
  <pair>
    <displayed-value>Bachelor Degree</displayed-value>
    <stored-value>bachelor</stored-value>
  </pair>

  <pair>
    <displayed-value>Master Degree</displayed-value>
    <stored-value>master</stored-value>
  </pair>

  <pair>
    <displayed-value>PhD Degree</displayed-value>
    <stored-value>phd</stored-value>
  </pair>

  <pair>
    <displayed-value>Postdoc</displayed-value>
    <stored-value>postdoc</stored-value>
  </pair>
</value-pairs>

<!-- VALUE PAIRS FOR learningOpportunity.creditScheme metadata schema for: compass -->
<value-pairs value-pairs-name="learningOpportunity_attendance_mode">
  <pair>
    <displayed-value>Face to face</displayed-value>
    <stored-value>facetoface</stored-value>
  </pair>

  <pair>
    <displayed-value>E-learning</displayed-value>
    <stored-value>elearning</stored-value>
  </pair>

  <pair>
    <displayed-value>Full time</displayed-value>
    <stored-value>fulltime</stored-value>
  </pair>

  <pair>
    <displayed-value>Part time</displayed-value>
    <stored-value>parttime</stored-value>
  </pair>

```

```

</value-pairs>

<pair>
  <displayed-value>Animation</displayed-value>
  <stored-value>Animation</stored-value>
</pair>
<pair>
  <displayed-value>Article</displayed-value>
  <stored-value>Article</stored-value>
</pair>
<pair>
  <displayed-value>Book</displayed-value>
  <stored-value>Book</stored-value>
</pair>
<pair>
  <displayed-value>Book chapter</displayed-value>
  <stored-value>Book chapter</stored-value>
</pair>
<pair>
  <displayed-value>Dataset</displayed-value>
  <stored-value>Dataset</stored-value>
</pair>
<pair>
  <displayed-value>Learning Object</displayed-value>
  <stored-value>Learning Object</stored-value>
</pair>
<pair>
  <displayed-value>Image</displayed-value>
  <stored-value>Image</stored-value>
</pair>
<pair>
  <displayed-value>Image, 3-D</displayed-value>
  <stored-value>Image, 3-D</stored-value>
</pair>
<pair>
  <displayed-value>Map</displayed-value>
  <stored-value>Map</stored-value>
</pair>
<pair>
  <displayed-value>Musical Score</displayed-value>
  <stored-value>Musical Score</stored-value>
</pair>
<pair>
  <displayed-value>Plan or blueprint</displayed-value>
  <stored-value>Plan or blueprint</stored-value>
</pair>
<pair>
  <displayed-value>Preprint</displayed-value>
  <stored-value>Preprint</stored-value>
</pair>
<pair>
  <displayed-value>Presentation</displayed-value>
  <stored-value>Presentation</stored-value>
</pair>
<pair>
  <displayed-value>Recording, acoustical</displayed-value>
  <stored-value>Recording, acoustical</stored-value>
</pair>
<pair>
  <displayed-value>Recording, musical</displayed-value>
  <stored-value>Recording, musical</stored-value>
</pair>
<pair>
  <displayed-value>Recording, oral</displayed-value>
  <stored-value>Recording, oral</stored-value>
</pair>
<pair>
  <displayed-value>Software</displayed-value>
  <stored-value>Software</stored-value>
</pair>
<pair>
  <displayed-value>Technical Report</displayed-value>
  <stored-value>Technical Report</stored-value>
</pair>
<pair>
  <displayed-value>Thesis</displayed-value>
  <stored-value>Thesis</stored-value>

```

```

</pair>
<pair>
  <displayed-value>Video</displayed-value>
  <stored-value>Video</stored-value>
</pair>
<pair>
  <displayed-value>Working Paper</displayed-value>
  <stored-value>Working Paper</stored-value>
</pair>
<pair>
  <displayed-value>Other</displayed-value>
  <stored-value>Other</stored-value>
</pair>
</value-pairs>

<!-- default language order: (from dspace 1.2.1)
      "en_US", "en", "es", "de", "fr", "it", "ja", "zh", "other", ""
-->
<value-pairs value-pairs-name="common_iso_languages" dc-term="language_iso">
  <pair>
    <displayed-value>N/A</displayed-value>
    <stored-value></stored-value>
  </pair>
  <pair>
    <displayed-value>English (United States)</displayed-value>
    <stored-value>en_US</stored-value>
  </pair>
  <pair>
    <displayed-value>English</displayed-value>
    <stored-value>en</stored-value>
  </pair>
  <pair>
    <displayed-value>Spanish</displayed-value>
    <stored-value>es</stored-value>
  </pair>
  <pair>
    <displayed-value>German</displayed-value>
    <stored-value>de</stored-value>
  </pair>
  <pair>
    <displayed-value>Greek</displayed-value>
    <stored-value>gr</stored-value>
  </pair>
  <pair>
    <displayed-value>French</displayed-value>
    <stored-value>fr</stored-value>
  </pair>
  <pair>
    <displayed-value>Italian</displayed-value>
    <stored-value>it</stored-value>
  </pair>
  <pair>
    <displayed-value>Japanese</displayed-value>
    <stored-value>ja</stored-value>
  </pair>
  <pair>
    <displayed-value>Chinese</displayed-value>
    <stored-value>zh</stored-value>
  </pair>
  <pair>
    <displayed-value>Turkish</displayed-value>
    <stored-value>tr</stored-value>
  </pair>
  <pair>
    <displayed-value>(Other)</displayed-value>
    <stored-value>other</stored-value>
  </pair>
</value-pairs>

</form-value-pairs>
</input-forms>

```

## 3.5 Controlled Vocabularies

---

The Compass Repo makes use of controlled vocabularies in order to guide the definitions of Learning Opportunities. For the purpose of the submission process we have created 4 controlled vocabularies.

- Educational Level vocabulary
- Qualification vocabulary based on the ACM IT Competency Model
- Subject Vocabulary based on the ACM Computing Classification System
- The vocabulary for the type of the Learning Opportunities.

## 4 ONLINE ARTEFACTS

All software development related to the implementation of the COMPASS Repo has been put under version control, based on the git utility, and tracked at the repository management system “BitBucket”.

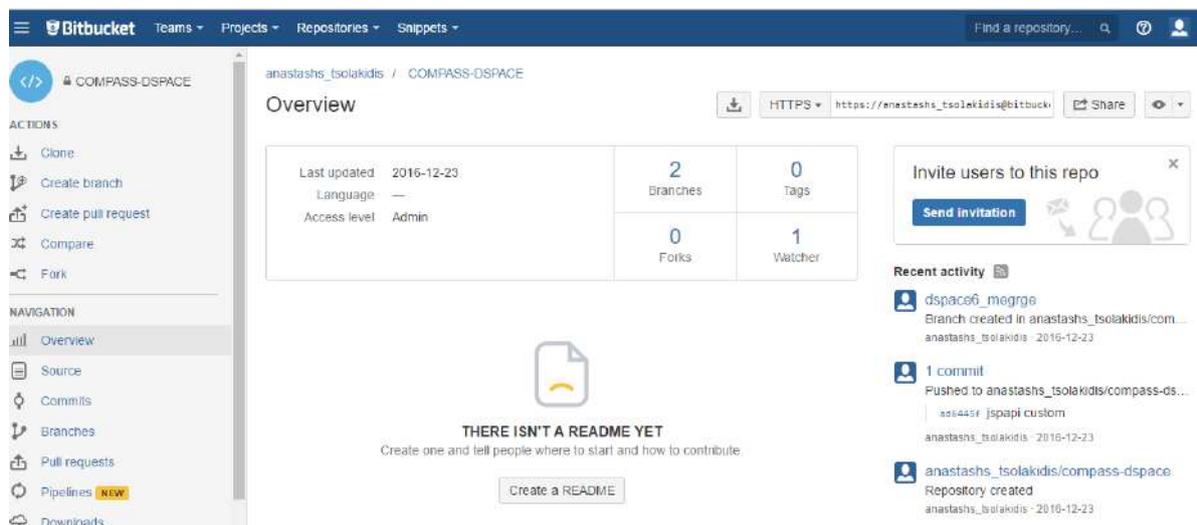


Figure 1: Bitbucket repository of the COMPASS Repo

Furthermore, the repository offers issues tracker and wiki. The URL for the code repository is: [https://bitbucket.org/anastashs\\_tsolakidis/compass-dspace](https://bitbucket.org/anastashs_tsolakidis/compass-dspace).

### 4.1 COMPASS Repo

The COMPASS Repo is available at the URL: <http://195.130.109.197:8080/jspui/>

The following paragraphs provide some indicative screenshots from the operation of the software.

#### 4.1.1 Welcome page

In the Welcome page there exist

- A search form, where the users can search for everything that exists on the repository
- A discovery panel where the users can discovery items based on i) the outcomes, ii) the subjects and iii) the competences.
- A central panel where the users can view the learning opportunity providers.

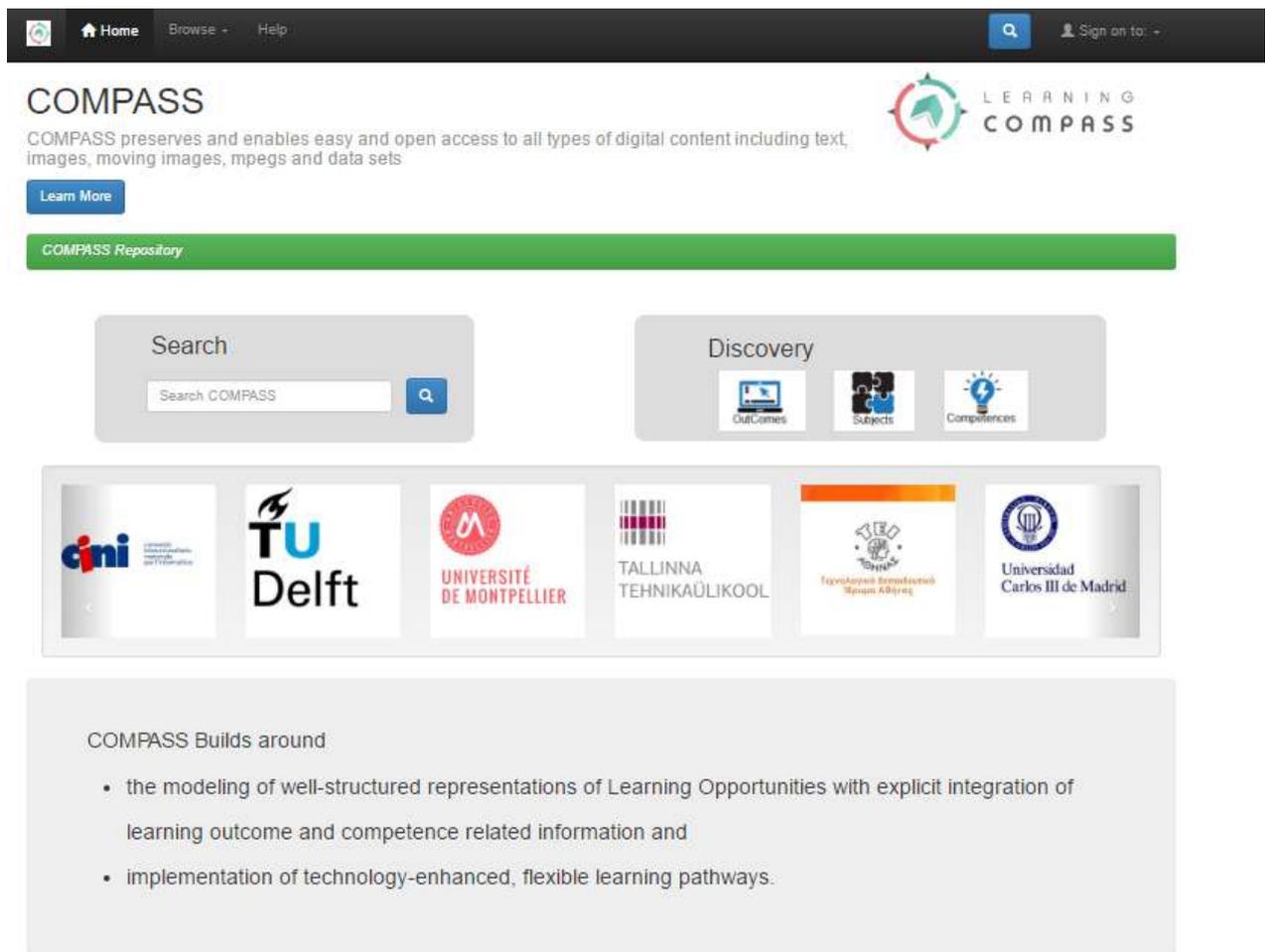


Figure 2: Home Page of COMPASS Repo

#### 4.1.2 Search

One of the main functionalities of the COMPASS Repo is the ability to search through the content and the definitions of all the items of COMPASS Repo. The search results are displayed with a set of so-called “facets”, i.e. filters that can be used to filter the results to any interesting subset.

Home Browse Help Sign on to

### Search

Date	Title	Author(s)
2017-03-05	Computer architecture	Alro Farulla, Giuseppe
2013-09-01	Computer Architecture	Kehagias, Dimitris
-	Computer Architecture	-
-	Computer Architecture	-
2017-09-01	Computer Architecture #1	TSOLAKIDIS, ANASTASIOS
2017-03-05	Database management systems	Alro Farulla, Giuseppe
2017-03-05	Computer network technologies and services	Alro Farulla, Giuseppe
2017-03-05	Synthesis and optimization of digital systems	Alro Farulla, Giuseppe
2017-10-01	Distributed programming II	Alro Farulla, Giuseppe
2017-10-01	Computer system security	Alro Farulla, Giuseppe

### Discover

**Subject**

- General and reference 1
- Hardware 1
- Introductory course to Assistive 1
- The course offers an overview of ... 1

**Prerequisite**

- Linux Operating System 1
- No one 1

**Engagement**

- face-to-face 3
- fulltime 1
- parttime 1

**Objective**

- Linux System Administration 1
- Frame the specific problem of dist... 1

**Competence**

- Linux System Administration 1
- Linux System Administration:Expl... 1
- Linux System Administration:Impl... 1
- No one 1

**Figure 3: Searching for a specific term (“architecture”)**

In addition the user can search based on the subject areas, competences or outcomes by selecting the corresponding link on the homepage. For example on figures 4, 5 the user search based on the subject areas of “Hardware” and “General and References”.

COMPASS Repository

Search By Subject

Discover

Subject

Hardware::Printed circuit boards 1

Search

Date	Title	Author(s)
2017-03-06	Specification and simulation of digital systems	Airò Farulla, Giuseppe
2017-03-06	Synthesis and optimization of digital systems	Airò Farulla, Giuseppe
		TSOLAKIDIS, ANASTASIOS

Figure 4: Searching for subject area “Hardware”.

Search By Subject

Discover

Prerequisite

Linux Operating System 2

Engagement

face2face 1

fulltime 1

Objective

Linux System Administration 2

Competence

Linux System Administration 2

Linux System Administration:Exp... 2

Linux System Administration:Imp... 1

Search

Date	Title	Author(s)
2017-09-01	Computer Architecture #1	TSOLAKIDIS, ANASTASIOS
2017-03-06	Database management systems	Airò Farulla, Giuseppe
2013-09-01	Computer Architecture	Kachagias, Dimitris
2017-03-06	Computer network technologies and services	Airò Farulla, Giuseppe

Figure 5: Searching for subject area “General and References”.

### 4.1.3 Browse

Along with searching for specific items, the COMPASS Repo supports browsing through the repository, to enable users find specific units of LO instance or specification. Browsing by collections enables navigation through the hierarchy of collections and sub-collections and explore the LOs in each collection.

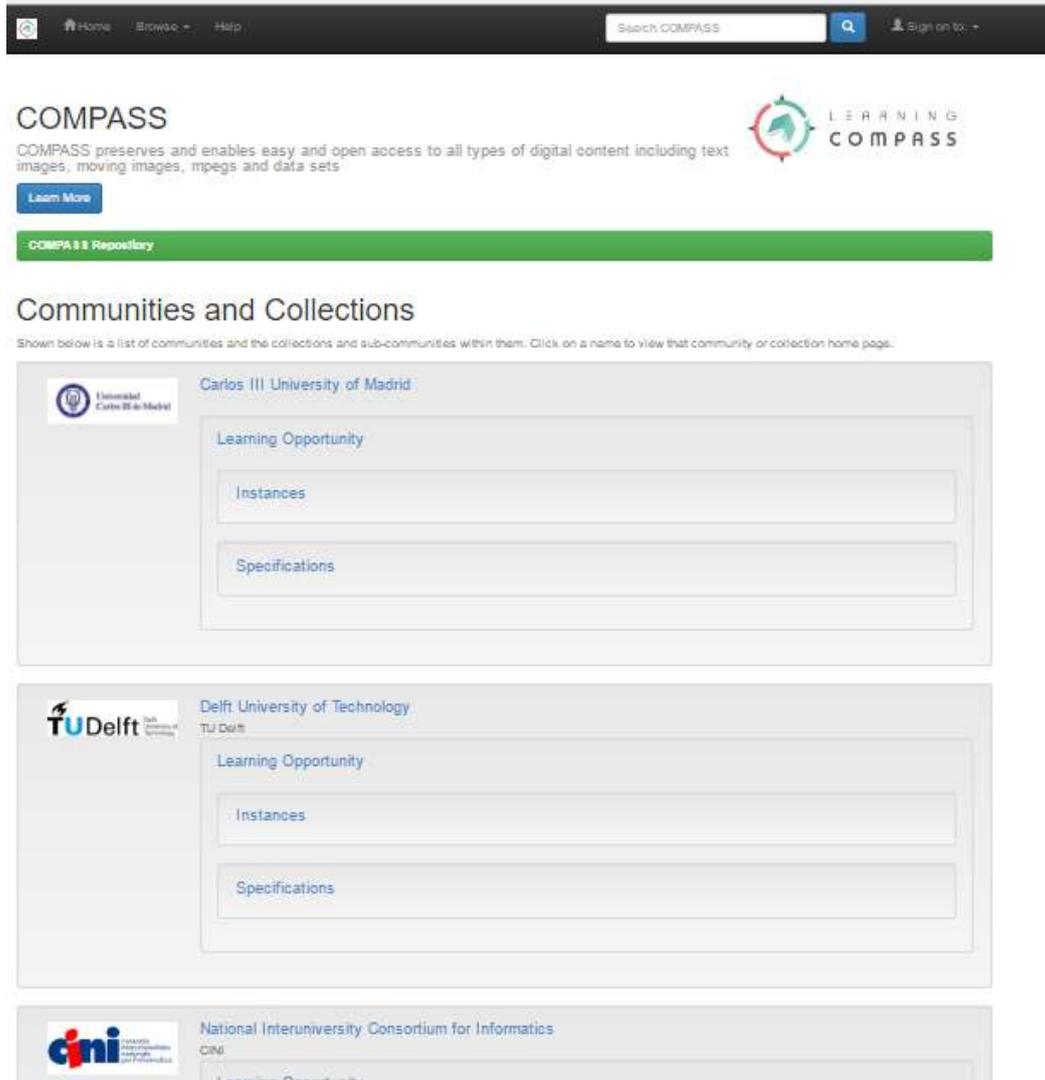


Figure 6: Browse on repository's communities.

### 4.1.4 Login

Registered members of the COMPASS Repo can use their username and password to sign-in to the system. After successful authentication, members can review their profile, view an activity log with updates since their last visit, and manage the submissions of definition of learning Opportunities.

**Figure 7: Member sign-in**

#### 4.1.5 Creation of Learning Opportunities

Authorized members can create definitions of Learning Opportunities (LO) using the input forms that have been configured in COMPASS Repo, according to the COMPASS metadata schema. The forms facilitate description of Learning Opportunities against controlled vocabularies and taxonomies. In order to create an instance of a LO the users have to submit a specification. In figure 9, we can see that the user can associate the LO with another LO with the “has part” association.

**Figure 8. LO specification submission forms.**

**Figure 9. LO specification submission form.**

The submission of an instance is described in figure 10 , where the user initially selects the specification that will be used in order to create the instance.

**Figure 10. LO instance submission form (selection of specification).**

After the selection of a specification, the user begins the submission of an instance where the most of the fields are already completed from values of the specification.

Please fill further information about this submission below.  
 A name given to the learning opportunity.  
**Title**

An alternative unambiguous reference to the learning opportunity within a given context. Note: the primary identifier is automatically assigned by the system.  
**Identifier**

The nature or genre of the learning opportunity. (Help on Subject Categories...)  
**Type**

An account of the learning opportunity.  
**Description**

**Figure 11. LO instance submission form (with populated data).**

#### 4.1.6 OAI-PMH target

The COMPASS Repo provides a harvesting tool which can be used by other systems to retrieve the content of the Communities. That functionality allows the existence of a central COMPASS Repo which periodically can monitor, fetch and update the metadata records from various distributed providers. The COMPASS Repo uses the OAI-PMH protocol for the harvest target and the COMPASS metadata schema, based on Dublin Core (DC), for the definition of LOs.

The base URL for the OAI-PMH target is: <http://195.130.109.197:8080/oai/request>

DSpace OAI-PMH Data Provider Identify Sets Records Identifiers Metadata Formats

Response Date: 2017-02-19 14:10:34

### Repository Information

Repository Name	COMPASS Repository
E-Mail Contact	compass_repo@telath.gr
Repository identifier	http://195.130.109.197
Sample Identifier	oai: http://195.130.109.197:123456789/1234
Protocol Version	2.0
Earliest Registered Date	2017-01-26 08:53:56
Date Granularity	YYYY-MM-DD hh:mm:ss
Deletion Mode	transient

**Figure 12. COMPASS Repo OAI-PMH Data Provider**

## 5 ABOUT COMPASS

*COMPASS consists in the integration and extension of European standardization achievements in the field of learning opportunity and learning outcomes/competence information for the creation of models, open technology infrastructure and meaningful services within a higher education context that target (a) the improvement of quality and relevance of offered learning opportunities to current and emerging labor market needs, (b) the enhancement of mobility, making learning opportunities more visible and understandable for students that want to gain additional skills (c) the strengthening of cross-border cooperation of HEIs in the definition of quality flexible learning pathways for their learners, (d) the increase of social responsibility of HEIs through the transparent descriptions of their offerings, (e) the implementation of sustainable infrastructure for all European HEIs and for the EU to leverage in the enhancement of existing or the creation of new related services.*



**Erasmus+**

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