



DELIVERABLE SUBMISSION SHEET

To: Wolfgang Dode *(Project Officer)*
 EUROPEAN COMMISSION
 Directorate-General for Research & Innovation
 RTD/B/6
 B-1049 Brussels Belgium

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 Project manager: Alexa Joyce (acting project manager in the absence of Rinske van den Berg)
 Project coordinator: Marc Durando

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is now complete. It is available for your inspection.
 Relevant descriptive documents are attached.

The deliverable is:

- a document
- a Website (URL:)
- software (.....)
- an event
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ECB - WP 4

D4.1 - ECB PORTAL

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AUTHOR, COMPANY	Bart Vanhulle, European Schoolnet
REVIEWER, COMPANY	Jean-Noel Colin, Erigo, Belgium Jim Ayre, Multimedia Ventures Europe Ltd., United Kingdom Denis Gillet, École polytechnique Fédérale de Lausanne, Switzerland
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¹ 1 PU = Public

PP = Restricted to other programme participants (including the EC services);

RE = Restricted to a group specified by the Consortium (including the EC services);

CO = Confidential, only for members of the Consortium (including the EC services).

INN - Internal only, only the members of the consortium (excluding the EC services)

Executive summary

inGenious is the platform of the European Coordinating Body in Maths, Science and Technology Education.

The ECB / inGenious portal (<http://ingenious-science.eu>) will act as the main public communication hub for the entire project. The Teacher and Partner community are restricted communities that only registered users / partners can access according to their rights and roles.

The portal and its tools will be delivered in several steps:

- The partner community was launched in April 2011 just after the start of the project to facilitate the exchange of documents and information amongst all partners.
- The first version of the public Website was launched during September (M7) in 3 languages: English, German and French
- The public Website will be updated in January 2012 (M12) to fix bugs, support 5 more languages (Italian, Spanish, Swedish, Portuguese and Dutch), apply adjustments and integrate more tools and features
- A second major release of the Portal and Teacher Community will be made around M24, adding more tools and possibly more languages

This document describes the technical aspects of the platform, its tools and their implementations.

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<http://www.ingenious-science.eu>

Coordinated by European Schoolnet

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TABLE OF CONTENTS

Introduction	8
Reminder of the context	8
Structure of the document	8
Risk Analysis	9
PORTAL INFRASTRUCTURE & DEVELOPMENT	10
1.1 Liferay Web platform	10
1.1.1 Partner Community	11
1.1.2 Public Community	12
1.2 Infrastructure	13
1.2.1 Liferay	13
1.2.2 MySQL Database	13
1.2.3 Memory requirements	13
1.2.4 Disk space requirements	13
1.2.5 Caching mechanism	14
1.2.6 Other services	14
1.2.7 Maintenance & Upgrading	14
1.2.8 Hosting & Support	14
1.3 Development methodologies & practices	15
1.3.1 Requirements gathering and Analysis	15
1.3.2 Software development methodology	15
1.3.3 Codebase and staging environments	16
1.3.4 Development of the portal and tools	18
2 European Schoolnet Services	18

2.1	OpenID	18
2.2	Learning Resource Exchange Service	19
2.3	Social Data Manager Service.....	19
2.4	Mailing Lists	21
2.5	Operational Data Store (ODS)	22
2.6	Library of portlets	22
2.7	Translation Manager	23
3	EXTERNAL SERVICES & CONTENT	24
3.1	External Services	24
3.1.1	Yahoo Pipes.....	24
3.1.2	Flickr, YouTube,	25
3.2	External content sources	25
3.2.1	RSS news feeds.....	25
3.2.2	Partner resource contributions	25
	Conclusion	26
	Appendix I: List of abbreviations	27
	Appendix II: Learning resource exchange.....	28

TABLE OF FIGURES

Figure 1: ECB Portal infrastructure diagram	10
Figure 2: Development staging diagram	15
Figure 3: LRE integration for the ECB Portal	18
Figure 4: Translation workflow diagram	21
Figure 5: Yahoo pipes diagram for the ECB Portal	22
Figure 6: LRE overview.....	25

INTRODUCTION

Reminder of the context

The deliverable on the ECB portal is a report detailing the technical aspects of the portal implementation and the technologies used. It is important to remember that the development and deployment of the portal and its tools are a work in progress. This means that future developments and integrations might be slightly different from what will be described here or how it was done in the past.

The website supporting the ECB project is divided into 3 different parts:

- the public website, where all teachers, students and the general public can find the repository of best European practice, European STEM news and events;
- the partner community which is a private space where partners can communicate and find meetings minutes, financial reports, deliverables, description of work, etc;
- the teacher community which is designed for inGenious teachers to communicate between themselves, as well as with teacher coordinators, and partners if they need more information on a practice tested in their class, or if they would like to create a partnership. This community contains a private page where inGenious teachers and teacher coordinators can communicate without partners nor other teachers to see this page.

For more information on those three parts, please refer to the Deliverable 5.1: ECB Website.

Structure of the document

The first chapter presents the Web platform technology called Liferay, the hardware infrastructure and development methodologies. The second chapter presents the services and tools developed by EUN used in the ECB portal. The third chapter describes the usage of external technologies and the integration of external resources / content.

Risk Analysis

Risk	Consequence	Pre-emptive efforts	Proposed reactions
Data protection related to Partners information in resources	Private data shared on the website via resources uploaded by Partners.	Moderation of the resource entries	Resource can be removed immediately on request of the mentioned partner
Photos and videos shared by Partners, containing private data	Can be sued if the person on the video didn't give his consent	Providing partners with forms to be signed by participants before the video is shot or the picture taken	Photos and videos can be removed immediately from the platform on request of people appearing on them.
Copyright infringement	Resource belongs to another company	The partner is always associated with the practices he shared	A partner can decide to remove a practice from the repository if he considers his practice is not used in a proper way.
Stability of the server	Can crash if the server load becomes too high	Anticipating the moments when server load could peak	The purchase of more hardware like memory and tuning the software applications
External features such as RSS and forum entries, etc	Some RSS or forum entries can include irrelevant or immoral ideas (e.g racist comments)	The web editor is checking regularly the forum entries and RSS feeds published in the website and such entries can be deleted	<p>A user acting several times in an irresponsible way would have his name on a black list and could not participate to the forum/blog anymore.</p> <p>An RSS feeds which contains irrelevant news can be removed from the RSS harvester (Yahoo Pipes).</p>

PORTAL INFRASTRUCTURE & DEVELOPMENT

1.1 Liferay Web platform

ECB is built on top of an Enterprise, Open Source Web platform named Liferay². Liferay was the natural choice for the Web platform due to the experience and toolset that EUN has developed using Liferay over several years.

Liferay offers predefined tools for content and document management; Web publishing; user management; and has many community features such as forums and blogs. Liferay also acts as a so-called 'portlet' container which supports the creation and rendering of new components and modules (named portlets) according to the Portlet Specification defined in the Java Specification Requests JSR168³ and JSR286⁴.

Liferay integrates perfectly with third party tools and technologies (like REST, SOAP, Webservices, ...) which makes it a very versatile development platform for the creation and integration of innovative and functional tools, on the one hand by making use of its standard portlets and custom created portlets and on the other hand by linking it to 3rd party technologies and tools. Thanks to its built-in Content Management tools it also provides good support for multilingual content and pages.

The goal for the ECB portal and communities is to be able to mix Liferay standard portlets and custom built portlets seamlessly in order to achieve the preset goals and deliverables of the project. To achieve that goal, the Web portal platform and different services must run on a compatible hardware infrastructure which can support any load created by the Website.

² <http://www.liferay.com>

³ <http://www.jcp.org/en/jsr/detail?id=168>

⁴ <http://www.jcp.org/en/jsr/detail?id=286>

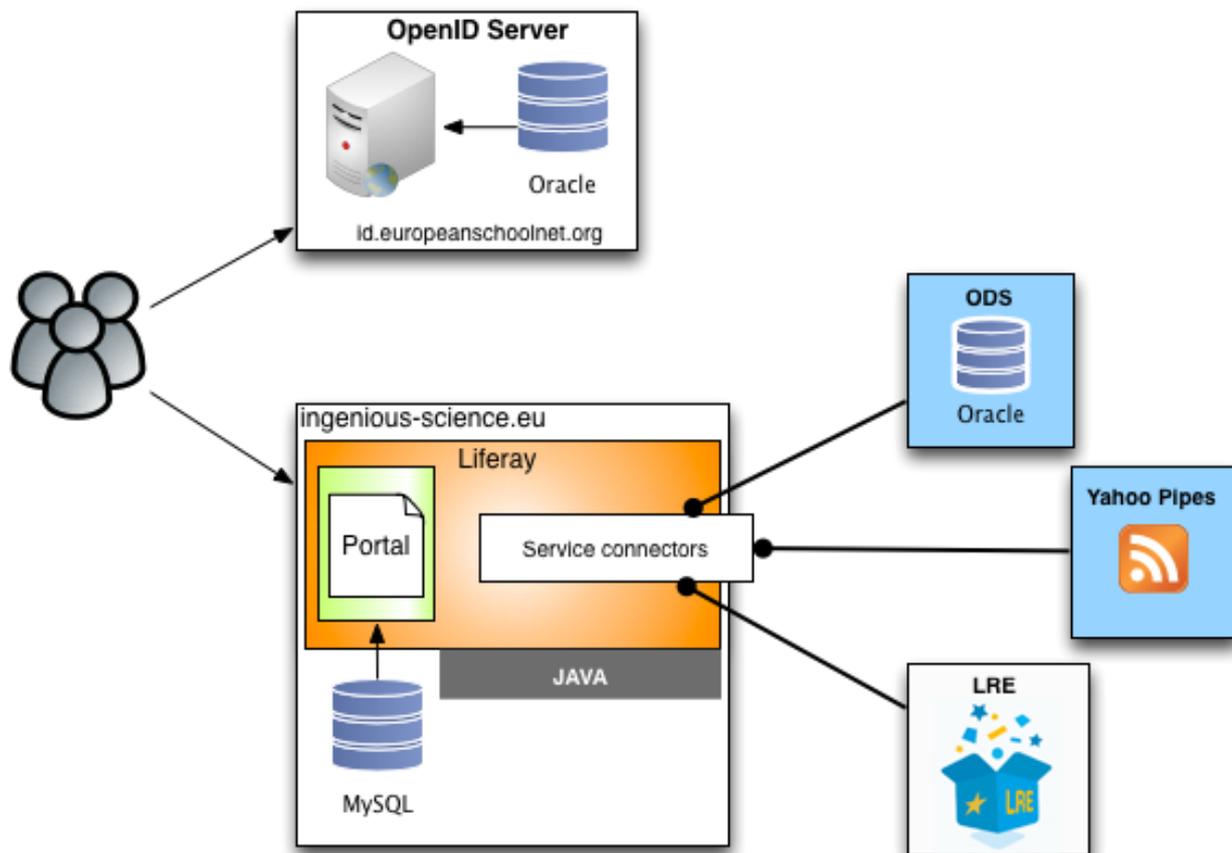


Figure 1: ECB Portal infrastructure diagram

1.1.1 Partner Community

The ECB Partner community⁵ was the first Liferay community launched for ECB during April 2011. Its purpose is to provide all partners a private workspace for sharing documents and information. This community currently offers the following features and tools for the partners:

- Simple, functional design with a well-defined page structure for easy navigation
- OpenID registration for authentication
- The Liferay Content Management System (CMS) to create, structure and manage pages and their text documents/content

⁵ <http://ecb.eun.org/group/partners/home>

- Recent Activities Portlet (ex: latest uploaded documents, latest forum posts, ...)
- Map featuring the countries of the different ECB partners
- A directory listing all partners with a link to the details of their contact persons
- Document Library Portlet to structure and upload files (ex: PDF, Word document, ...)
- Forum/Messaging board Portlet for discussion amongst partners

1.1.2 Public Community

The Public community⁶ was the second Liferay community launched during October 2011. It acts as the main publication/communication hub for the project. It also provides targeted information about science. It currently offers the following features and tools for users:

- ECB branded, functional design
- Pages created, structured and managed through the Liferay CMS
- News section using RSS feeds⁷
- Events / Calendar portlets⁸
- Resource Repository portlets⁹
- Educational Materials Repository portlets¹⁰

More tools and features will be added to the Public portal during 2012 when also the Teacher Community will be launched with its own set of tools.

⁶ <http://www.ingenious-science.eu/>

⁷ <http://www.ingenious-science.eu/web/guest/news>

⁸ <http://www.ingenious-science.eu/web/guest/events>

⁹ <http://www.ingenious-science.eu/web/guest/resources>

1.2 Infrastructure

1.2.1 Liferay

The Liferay Web platform is usually deployed on top of a Java Web server. The ECB Liferay platform has been deployed on the Apache Tomcat Liferay bundle. While Liferay can also be deployed on other Java Application servers like Jboss, it was decided to use the default Tomcat bundle because of its optimization for use with Liferay.

The Liferay version used for ECB is Liferay 5.2.3. This was the latest major stable version of Liferay at the time when the ECB Portal development started.

The Liferay bundle is hosted by a Java Virtual Machine, Java(TM) SE Runtime Environment (build 1.6.0_27-b07) 64bit. This Virtual Machine is installed on a Debian GNU/Linux 5.0 x86_64 server. This is the same server (technology) used for some other services that are used within ECB as described later in this deliverable.

1.2.2 MySQL Database

An instance of the database technology named MySQL¹¹ needed to be installed as well in order to provide the storage for all the services offered by the Liferay server. The MySQL version used for ECB is 5.0.51. and is installed along with Liferay, on the same Linux server, to reduce network latency and simplify access to it. This is a common practice with Liferay based portals. This MySQL Database server can also be used for custom developments if needed to store data.

1.2.3 Memory requirements

The minimum requirements for a Liferay portal is 1GB for a smooth operation at a normal load/activity rate. For ECB this is set to 4GB with an option to dynamically scale it when there is an increase of activity. The memory allocation is expected to be scaled up in the future when a continuous increase of activity is expected.

1.2.4 Disk space requirements

There is also a minimum amount of 1000MB of free disk space required to guarantee a proper operation of the Liferay platform and MySQL server. More disk space will be required when the portal grows in terms of activity and content (user uploads, user content contributions, etc.)

¹⁰ <http://www.ingenious-science.eu/web/guest/lre>

¹¹ <http://www.mysql.com/>

1.2.5 Caching mechanism

In order to offer the best kind of performance (and thus user experience) Liferay makes heavy use of content / data caching mechanisms. For that it combines Database caching with in-memory caching by using a number of built-in Java functionalities and technologies like Hibernate. This ensures that the load on bottleneck services like the database is kept to a minimum, thus reducing the risk of load spikes slowing down the platform and lowering the user experience quality.

1.2.6 Other services

ECB also implements portlets that make use of services that run outside of the Liferay bundle:

- REST Services are typically deployed on a dedicated Apache Tomcat¹² 6.0.29 server which communicates with a dedicated MySQL 5.0.51 server.
- Other services (like the ODS for person registrations) require an Oracle Enterprise Database¹³, currently using version 11.1.0.6, in combination with a Java Middleware layer usually deployed on Jboss¹⁴ 4.2.2

Several services (like the EUN Learning Resource Exchange) require an additional amount of memory and disk space that needs to be taken into account in order to ensure that the portal functions properly.

1.2.7 Maintenance & Upgrading

It should be noted that all hardware end software services are regularly subject to maintenance and upgrade. These are needed to improve and stabilize the infrastructure the portal and its services. This means that any version numbers mentioned above will not necessarily be the same for the entire duration of the project and are likely to change during the course of the ECB project.

1.2.8 Hosting & Support

All production services are hosted in a data centre with a permanent support team who can act immediately during moments of downtime and failure or malfunction. Both the portal and services can easily be moved to another server and restarted thanks to the Virtualization approach. Every

¹² <http://tomcat.apache.org/>

¹³ <http://www.oracle.com/index.html>

¹⁴ <http://www.jboss.org/>

night incremental backups of the servers, data and services are taken so they can easily be restored with a minimum loss when a failure occurs and the service(s) can't be recovered.

1.3 Development methodologies & practices

In order to optimize and guarantee the development of the ECB portal and its tools a number of standard practices / methodologies is applied. This ranges from collecting the requirements and specifications to the actual implementation, testing and eventual deployment to the production server(s).

1.3.1 Requirements gathering and Analysis

Based on the workplan requirements need to be gathered before any development can be done. These are usually collected in 2 forms:

- Wireframes: (simple, mockup versions of Webpages and their tools)
- Written user stories: these detail the different actions and workflows in a standard, simple and understandable way

Both the wireframes and User Stories are then forwarded to the developer(s) who analyze and extract the technical Use Cases and Workflows from them in the form of Workflow diagrams, UML, ...

These are then presented back to those (typically ECB partners and work package leaders) who defined the requirements and needs for review by email or during planned meetings (Steering Committee meetings, workgroup meetings, skype meetings, ...) after which adjustments can be made if needed. When the UCs and Workflows are finalized the actual development can start.

1.3.2 Software development methodology

At EUN it's a common practice to apply the Agile development methodology¹⁵ in its most basic form for short/small developments or by applying the SCRUM methodology¹⁶ for longer developments (typically 2 weeks or longer).

Agile development is best suited for short "burst" developments that can be done with a minimal amount of planning and rely on regular testing and feedback from the ones requesting the

¹⁵ http://en.wikipedia.org/wiki/Agile_software_development

¹⁶ http://en.wikipedia.org/wiki/Scrum_%28development%29

development during the development cycle. This allows for quick adaptation and change before the development cycle is over and usually results in a faster and more fine-tuned delivery than with traditional development methodologies.

The SCRUM methodology applies Agile development to help plan and execute longer developments by splitting them into smaller time blocks (typically 2 weeks) called sprints. During each sprint a number of tasks need to be executed. During the execution of a sprint this list of tasks usually doesn't change and can't be influenced. At the end of every sprint a review is organised involving the developer(s) and the client to go through what was done during the last sprint and define what needs to be done (change or further development) in the next sprint.

For ECB both forms of Agile development are applied depending on the nature of the development. For a small development like a RSS portlet simple Agile would be applied while SCRUM would be used for the implementation of the matching tool.

1.3.3 Codebase and staging environments

All the portal, theme and Java code for portlets and external tools/modules are stored and maintained in Subversion¹⁷, an open source version control system. The ECB portal and tools are compiled and deployed from Subversion by using Apache ANT¹⁸ and shell scripts.

To ensure a quality delivery 3 staging environments have been setup:

- Development: used by developers for code and integration testing
- Test: used for testing the ECB Portal, communities, tools and content integration. This is typically done by the project partners
- Production: the live deployment of the portal, accessible by all users

When new developments have been completed they are moved to the Development environment first for testing by the Developers. The moving of the code can also be done automatically through the use of an automatic build and deployment tool like Hudson¹⁹.

¹⁷ <http://subversion.tigris.org/>

¹⁸ <http://ant.apache.org/>

¹⁹ <http://wiki.hudson-ci.org/display/HUDSON/Meet+Hudson>

When no major issues are found the code is moved to the Test environment where more testers evaluate the changes and the portal functioning. Only when the testers confirm the changes work properly is the portal and its contents moved to the Production environment.

While it's not necessary to have all 3 environments it is a recommended practice to ensure a quality delivery for extended projects like ECB.

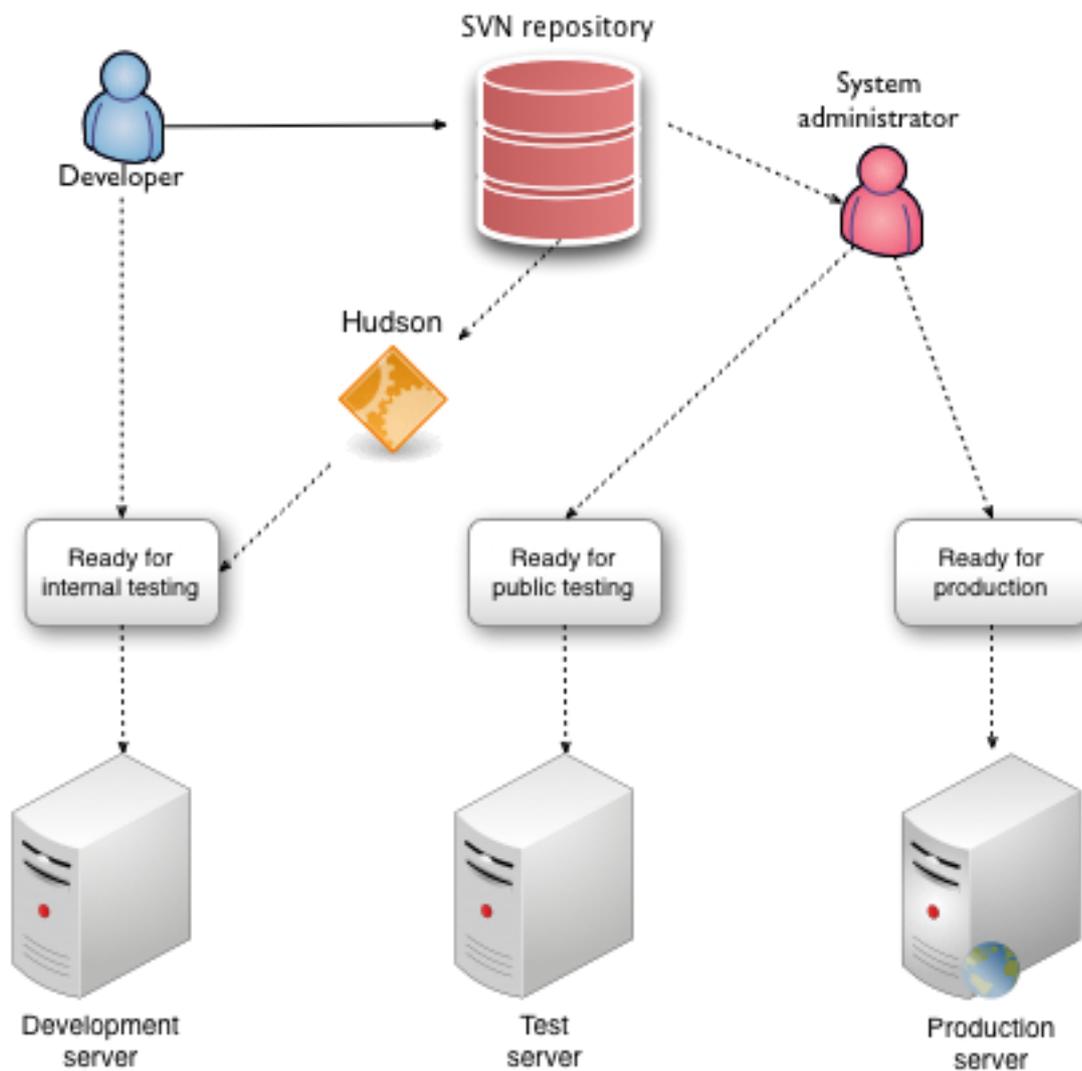


Figure 2: Development staging diagram

1.3.4 Development of the portal and tools

As the developments are mainly done using Java, developers typically use the widely known IDEs like Eclipse²⁰ in combination with several plugins.

A developer will first develop in their local environment which is a replication of the ECB portal and its services. They will then test the new developments or changes in their local development and can call upon the input of a colleague to validate or review the changes.

Once the development is considered stable, conforms to the requirements and compiles without errors it is committed to the SVN code repository after which it can be deployed on any of the staging environments for further testing or production usage. This is usually done by “tagging” a build as stable and using the tag to check out the portal and its tools and deploy it.

When a build is ready for production it will be tagged as final and given to the System Administrator who checks out the tagged code, compiles it and applies it to the production environment after taking backups of the previous version of the portal code and content. In case a critical failure occurs the portal is rolled back to its last stable version/backup to ensure a continuous functioning of the portal.

2 EUROPEAN SCHOOLNET SERVICES

2.1 OpenID

To manage identities in ECB, European Schoolnet (EUN) uses its own implementation of the OpenID²¹ protocol which is supported by the Liferay Web platform.

OpenID is a decentralized authentication protocol allowing users to use any OpenID provider (ex: Google) to register a user account for ECB. It is expected that most users will create an EUN OpenID account as it is tightly integrated into the overall architecture and tools used for ECB.

It should be noted that OpenID is not a Single Sign On (SSO) service, it is only an identity Manager. A SSO system could be put on top of it but that is currently not the case for ECB since it is not a requirement as such. Liferay implements a form of SSO between its communities which reduces the need for a separate SSO system.

²⁰ <http://www.eclipse.org/>

²¹ <http://openid.net/developers/>

The EUN OpenID service is deployed as a Webapp on an Apache Tomcat 6.0.29 server which also provides a connection to the Oracle Enterprise Database that is used to store and maintain the user accounts data.

2.2 Learning Resource Exchange Service

The LRE Service uses so called Search index files to perform a search in the ECB resources database/tools. These index files are also used to retrieve the data for any found results.

These files are produced by the central LRE Service; they are then stored on the local file system and made available to the ECB portal so they can be loaded into the memory when the portal starts up. The location of these files needs to be configured on the system by specifying them in the JVM start-up settings or XML configuration files in Liferay.

The size of these files is proportional to the number of resources made available in ECB. The search index files usually require around 50MB of disk space. The memory consumed by the caching of these files after the portal has been restarted is minimal and is easily covered by the 4GB of memory currently set for the portal.

Any resource searches and retrieval will be done against the resources stored in the memory to optimize the performance to the maximum.

The local index files can be periodically or manually refreshed in order to keep the resource repository up to date.

Resources in ECB will typically be created (or imported from partners) on the portal first and then synchronized to the LRE Service after which they'll be searchable through the LRE Service. In addition the LRE Service can already offer a number of relevant resources for ECB.

2.3 Social Data Manager Service

Registered users in ECB will be able to perform social actions on the LRE resources they find through the search through the Social Data Manager (SDM) service. These actions would be:

- Rating of resources
- Commenting of resources
- Bookmarking of resources (adding to favourites) by tagging

The SDM exposes CRUD (Create, Read, Update, Delete) services to capture these social actions, and aggregates data for producing all social details for a given resource.

Capturing the actions or requesting the social details is done by performing 1 or more REST²² calls to the LRE SDM Service. The connection to this service is configured in the JVM start-up settings of the server or in the Liferay XML configuration files.

The underlying implementation of the SDM service is based on RESTlets running on a Tomcat 6.0.29 server that communicates to a standalone MySQL database server, which is not the same as the Liferay MySQL server.

The SDM service is hosted on the same infrastructure as the ECB portal and tools to reduce the network latency to a minimum.

It should be noted that the LRE SDM service will most likely serve as a model for implementing the rating and other social services for the practice examples database and tools. This does not necessarily mean it will be the LRE SDM as such but perhaps a copy or simplified version for the ECB tools.

²² http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm

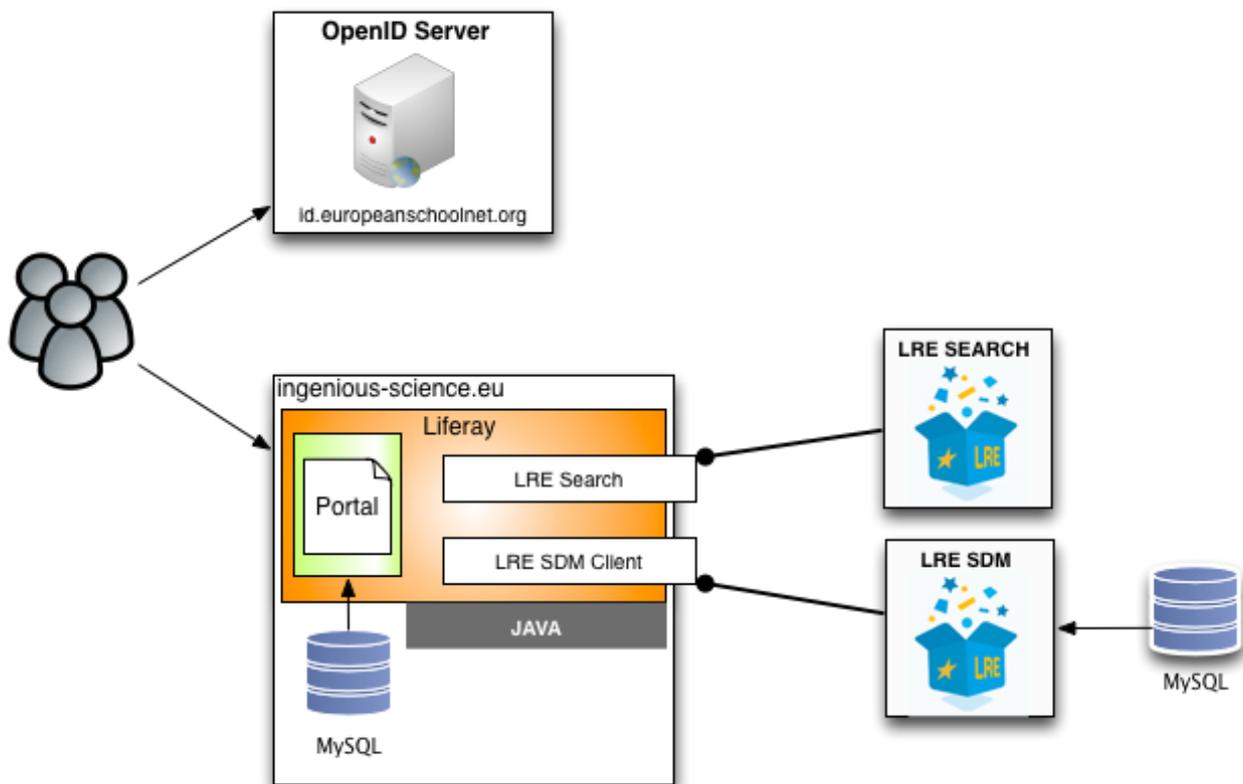


Figure 3: LRE integration for the ECB Portal

2.4 Mailing Lists

ECB offers the possibility for users to subscribe to one of the ECB mailing lists in order to receive the newsletter and other relevant communication.

The mailing list software used is called Mailman²³. It's a free, lightweight software which is easy to manage. The subscriber email addresses are stored in flat files on the filesystem which make them easy to copy, maintain and backup.

ECB implements a simple mechanism / portlet to subscribe to these mailinglists in an easy and quick way. This portlet let's a person choose a language and submit their email address. Once submitted the data is stored in a file per language on the server which is processed every 15 minutes by a shell script. The purpose of this script is to check if a recorded email address for a language is a member of the mailinglist. If they're not a member yet they're added to the

²³ <http://www.list.org/site.html>

mailinglist. Once this process is complete the file on the server is emptied and ready for new subscriptions and will be processed again after 15 minutes.

2.5 Operational Data Store (ODS)

EUN researched and defined a common data model for the storage of Person and Organisation data, based on its experience within past and present projects. This data model is the core foundation of the EUN ODS service, used by EUN projects to store user and school/organisation profiles, which also provides the flexibility to store specific information for the project with each profile. The EUN ODS uses the EUN OpenID Service to identify users who register and have their data stored in the ODS by their OpenID.

The EUN ODS backend has been built on top of Oracle Enterprise Database, version 11.1.0.6, together with a Java based Middleware layer deployed on Jboss 4.2.2 so the Service can be accessed from the Liferay portlets.

The EUN ODS frontend is implemented by a set of Liferay portlets which expose all the different steps needed to register an extended user profile and to edit it afterwards while being logged in to the portal.

The ECB portal will use the ODS (Operational Data Store) Service for the registration of the extended user accounts when it rolls out the portal update that will support the Teacher community and pilot school registrations. Existing OpenID accounts for ECB will be able to complete their registration and profile data upon the first login after the ODS Tools have been put into place.

2.6 Library of portlets

The ECB portal has access to a library of portlets that EUN has developed in the past for its portals. These portlets offer various interesting functionalities like:

- Events repository & Calendar views
- News gallery
- Navigation (menu, breadcrumb)
- Flexible Content Galleries

Some of these portlets can (and will) be used in the ECB portal and communities, by applying custom styling and enhanced features, to help construct the Website and its content.

2.7 Translation Manager

The ECB portal makes use of the Translation Manager tools developed by European Schoolnet to translate content and publish them on the ECB portal.

An editor typically creates a new piece of content for ECB and transfers it to the Translation Manager platform and requests it to be translated in 1 or more languages. The Translation Coordinator then forwards the translation request to the responsible translators who translate the content in a reasonable amount of time (typically between 2-5 days).

Once the content has been translated the Translation Coordinator is informed that the content is ready to be imported back to the ECB platform. Once the translations have been imported to the ECB platform the content and its translations are published on the Portal.

The translation manager runs in a Liferay environment in a similar setup as the ECB portal and implements custom portlets to provide the different needed functionalities. In order to ensure that this process works smoothly the Translation Manager implements advanced workflow mechanisms and user management tools to assign and track all the steps of the translation process.

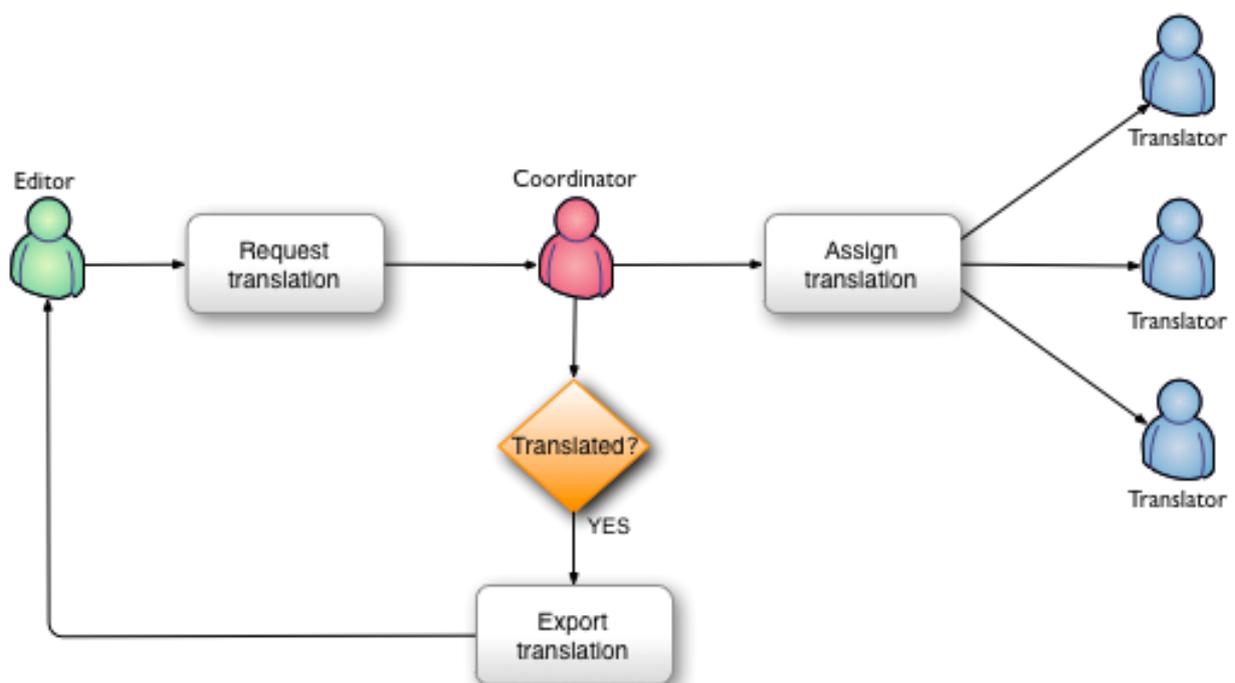


Figure 4: Translation workflow diagram

3 EXTERNAL SERVICES & CONTENT

3.1 External Services

One of the goals of ECB is to act as a hub to gather and expose information from its partners and other relevant sources on the ECB portal. To facilitate such mechanisms a number of solutions are, or will be put in place, which allow the harvesting of external data and displaying them inside the ECB portal

3.1.1 Yahoo Pipes

Yahoo Pipes²⁴ is currently a free service offered by Yahoo which offers an innovative way of linking and processing RSS feeds to combine them in 1 or more piped feed that can be exported/cached into a service you can load onto your portal.

ECB uses Yahoo Pipes to collect the various RSS feeds provided by the partners and transforms it into 1 feed that is then loaded into the ECB portal through a RSS portlet in Liferay. The feed is regularly refreshed by Yahoo pipes depending on the rate of update for the RSS feeds from the partners.

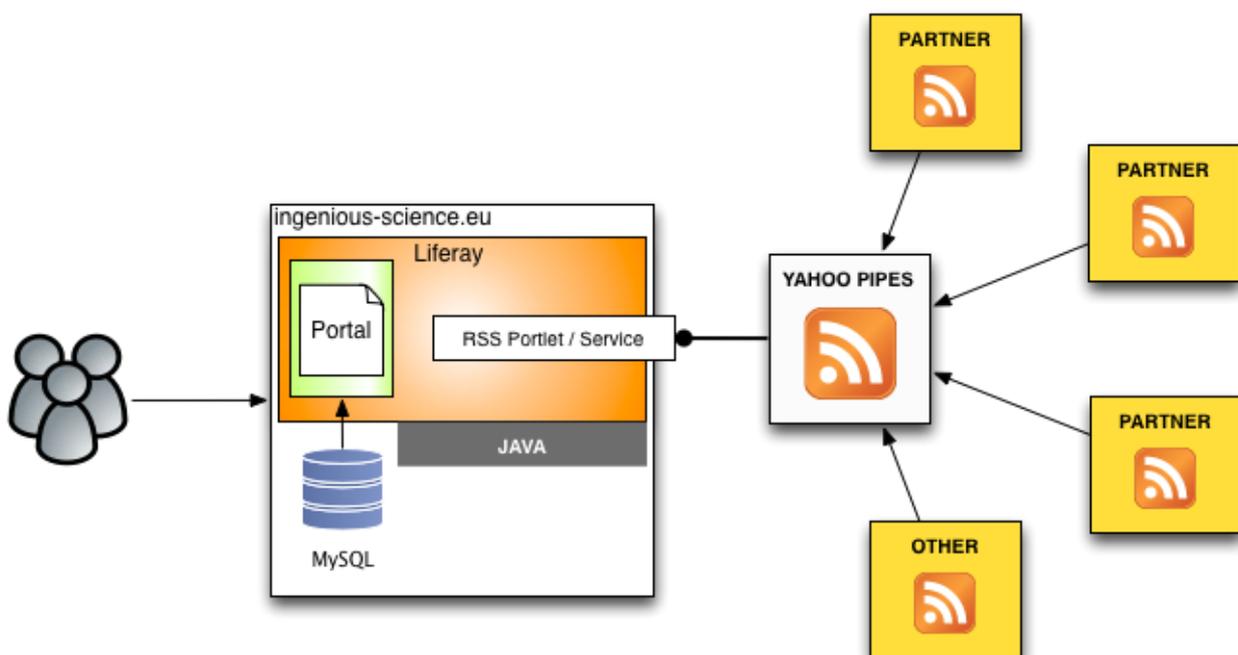


Figure 5: Yahoo Pipes diagram for the ECB portal

3.1.2 Flickr, YouTube, ...

From a content perspective services like Flickr and YouTube are often used on a portal as well. This is no different for ECB. These services can be exposed in a number of ways through Liferay. They can be specialized portlets that only render the specific type of content or they can be included by the Content Management System from Liferay. Depending on the need and application both approaches can be valid for ECB.

3.2 External content sources

3.2.1 RSS news feeds

An important source of content for the ECB portal will be the RSS feeds of the partners. This allows the harvesting of news and other content in an automatic way through the use of Yahoo Pipes (see 3.1.1), producing a single feed that can be loaded and displayed on the ECB portal.

In addition it might also be decided that other sources are relevant for harvesting RSS formatted content. If this is the case they can be either added to the existing Yahoo Pipes feed crawler or new ones can be setup if needed to provide ways to distinguish between sources.

3.2.2 Partner resource contributions

One objective of ECB is to collect relevant resources from its partners and make them available through the portal. There are different solutions for this:

- LRE: the LRE Service can allow ECB partners to become content providers. If the partner implements the LRE profile their resources can be harvested and made available through the LRE Search service.
- Local Resource repositories: local resource galleries can be setup on the ECB portal where partners can upload their resources. These resources can then be searched by a local search tool for the gallery and eventually be made available through the LRE
- Custom solutions: if there is a need a custom solution can be discussed and implemented which exposes resources from a partner through an external source on the ECB portal.

²⁴ <http://pipes.yahoo.com/pipes/>

CONCLUSION

The inGenious portal and community is the result of months of work in close cooperation with its partners to provide a stable, modern online environment with user-friendly tools and lots of content to attract both teachers and students and make them take part in the project and to help continuously improve the platform and its tools.

Teachers and Partners can communicate through the various spaces and fora and the best European practice from Industries will be accessible for teachers to use in the classroom.

European Schoolnet will make sure that the Public website will always be a good place to promote the inGenious workshops, academies, competitions, online chats, communities of practice, summer schools, and all other activities taking place in the project.

APPENDIX I: LIST OF ABBREVIATIONS

ACRONYM	MEANING
WP	Work Package
ECB	European Coordinating Body in Maths, Science and Technology education
ODS	Operational Data Store
RSS	Really Simple Syndication
LRE	Learning Resource Exchange
SDM	Social Data Manager

APPENDIX II: LEARNING RESOURCE EXCHANGE

The Resource Learning Exchange²⁵ (LRE) from European Schoolnet is a service that enables schools and teachers to find educational content and resources from many different sources and countries. It was developed for the Ministries of Education and their networks of learning content repositories to allow them to easily exchange high quality learning resources so that they can be used by teachers in different countries.

The LRE is the result of years of evolution through the support of the ministries of Education and European Commission funded projects (FP6/FP7) such as ASPECT, CELEBRATE, CALIBRATE and MELT. It is being further developed through projects like eQNet and with the support from the LRE content partners who regularly update and add learning resources.

The core principle behind the LRE is a network of content providers who make quality learning resources available through their network that can be “harvested” by the LRE federation. Each provider has to apply the LRE Metadata application profile and format their learning resources according to this machine-readable format (based on standards like the Learning Object Metadata (LOM) standard issued by the Learning Technology Standards Committee (LTSC) of IEEE). These resources are then stored in repositories exposed to the LRE that federates it.

The technical success factor of the LRE boils down to being performant and reliable enough so it can provide its end-users with access to learning resources adapted to their needs whenever they need them.

²⁵ <http://lreforschools.eun.org/>

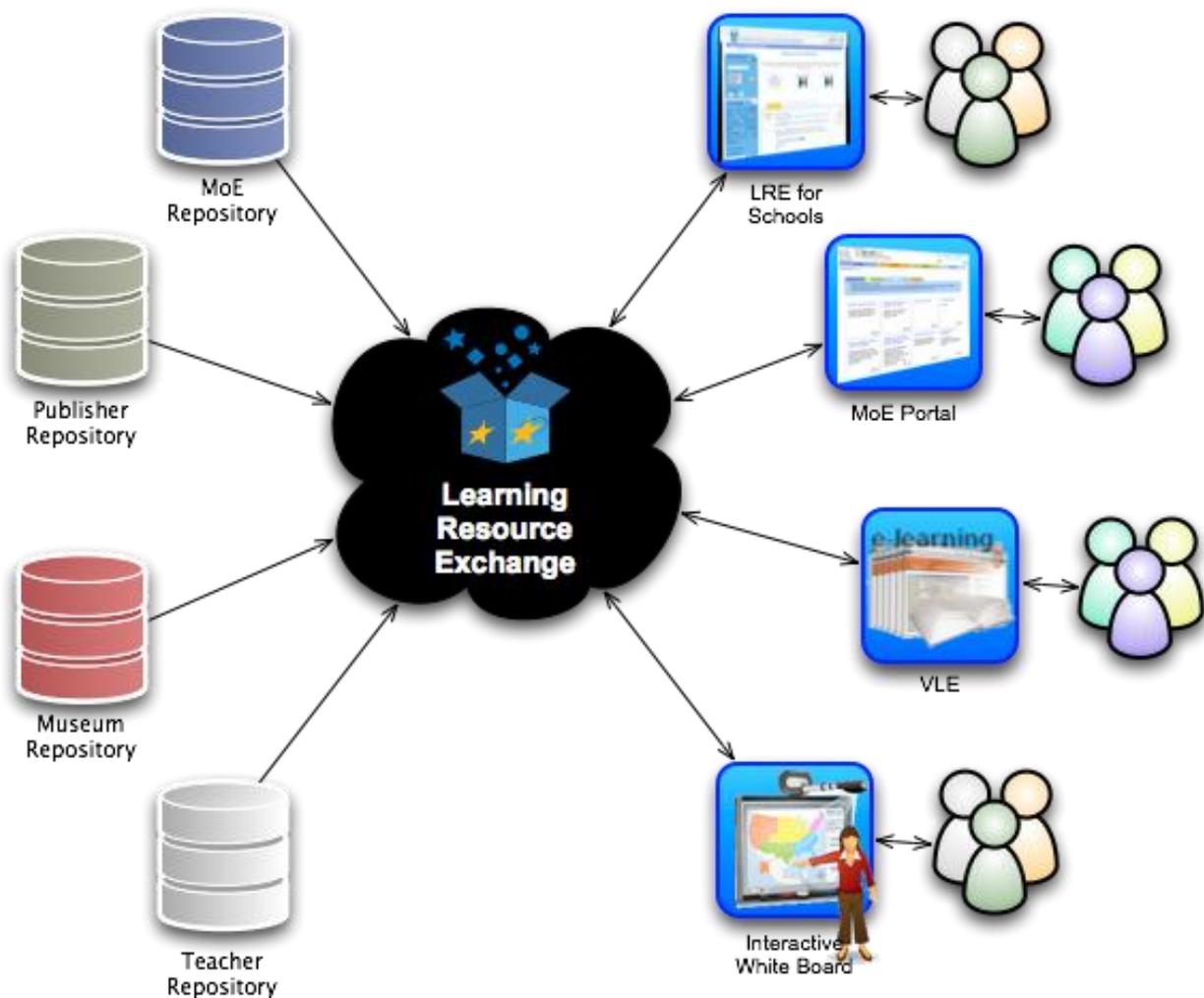


Figure 6: LRE overview

Once federated, resources can be browsed, with or without the use of filters, and viewed or downloaded. Registered users can also perform social actions on these resources through the Social Data Manager Service.

While the LRE has its own dedicated portal a set of Liferay portlets have been developed by European Schoolnet in order to allow other projects and their portals to provide the LRE services from their portals. These portlets support the same behaviour and features from the regular LRE portal (like the search and social tagging tools) and provide customization options like skinning the look and feel and filter the available resources by preset criteria (ex: by subject) in order to return the most relevant learning resources within the context of the project and portal.