



EPICUR
**European Partnership for an Innovative
Campus Unifying Regions**

Guidance for other HEI

Task lead: KIT

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WP4: Pave the way for an Inter-University Campus, using a student (and staff) centred approach

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Introduction

This deliverable is part of the work in **WP4** “Pave the way for an Inter-University Campus, using a student (and staff) centred approach” and especially **Activity 4.2** “Technical platform towards an Inter-University Campus” and **Task 4.2.1** “Procedures for designing courses using or shareable through the VCLP”. This deliverable is the second part of the task and the final deliverable together with the Virtual Campus Learning Platform and the surrounding IT landscape.

In this deliverable we will provide guidance for other higher education institutions (HEI) to either implement a solution like the Virtual Campus Learning Platform we have designed and developed for EPICUR and to connect and integrate the local Learning Management System (Moodle or ILIAS) into the VCLP platform. VCLP is part of the EPICUR Inter-University Campus (EIUC), which will provide a unified access for students and teachers to the courses EPICUR offers. The technical installation of the necessary components of the VCLP part are described and explained in detail in the following chapters.

About EPICUR

The “European Partnership for an Innovative Campus Unifying Regions” (EPICUR) is a European alliance of eight universities throughout the European Union. It is belonging to the first generation of European Alliances to pilot a new way of intensifying collaboration among Higher Education institutions through the creation of a European University.

Started in November 2019 the teams in the universities of the alliance are working together to test and experiment different approaches to make this vision a reality such as through multilingualism and safeguarding and strengthening European linguistic diversity, through student-centred learning and collaborative teaching formats inspired by a Liberal Arts and Science approach, through service-learning and research based internships closely connected to our regional eco-systems, and through imagining and facilitating new forms of mobility (physical, virtual, blended) available within an EPICUR Inter-University Campus (EIUC).



Figure 1: The EPICUR Alliance consists of nine universities in Europe

The nine partners of the EPICUR alliance are:

- AMU Adam-Mickiewicz University of Poznań, Poland
- ALU-FR University of Freiburg, Germany
- AUTH Aristotle University of Thessaloniki, Greece
- BOKU University of Natural Resources and Life Sciences, Vienna, Austria
- KIT Karlsruhe Institute for Technology, Germany
- SDU University of Southern Denmark (since 2021)
- UHA University of Haute-Alsace, France
- UNISTRA University of Strasbourg, France
- UvA University of Amsterdam, The Netherlands

The EPICUR Inter-University Campus

The EPICUR Inter-University Campus is a central online gateway for supporting flexible online, physical and hybrid mobilities for members of the universities of the alliance. Its primary aim is to fully digitalize the mobility admission, selection and monitoring process by offering a secure, scalable and transparent solution based on free and open-source solutions.

The EIUC consist of two main systems to support the EPICUR alliance in teaching: The Virtual Campus Learning Platform (VCLP), accessible at “<https://learn.epicur.education>” and the “Virtual University Registrar System” (VURS).

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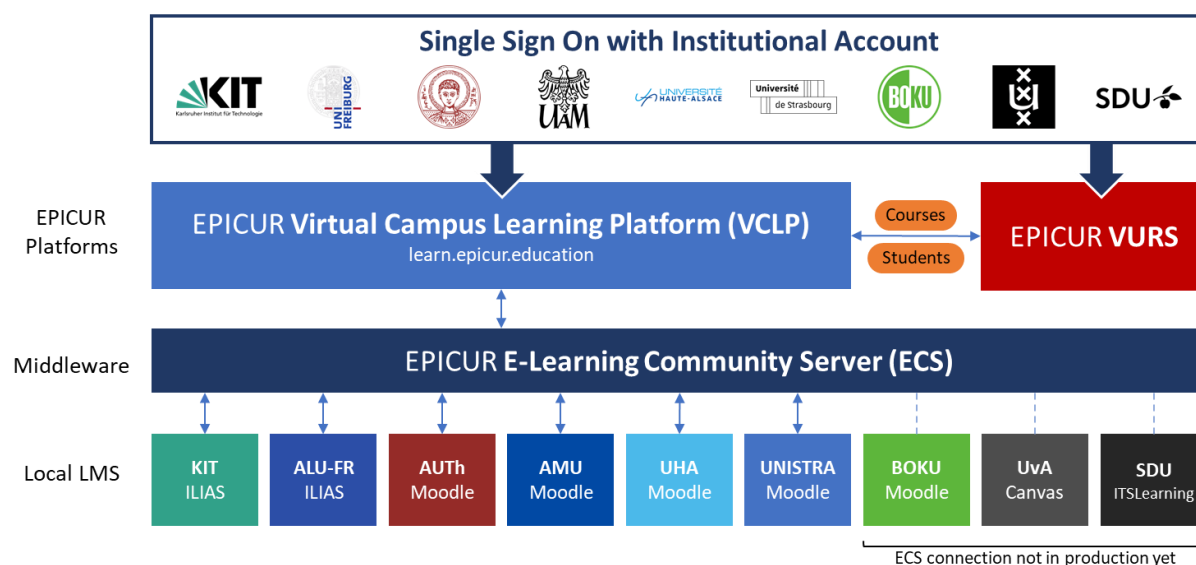


Figure 2: The overall architecture of the EPICUR Inter-University Campus (EIUC)

The VURS is mainly a Campus Management System (CMS) or Student Information System (SIS) is a web-based information system to manage EPICUR courses and students. It provides functions for registering students in courses, collecting grades, generating transcripts of academic achievements and more.

The VCLP is a full Learning Management System, which is based on ILIAS. ILIAS is an open-source and free Learning Management System, which is popular in Germany and Switzerland. Both German universities of the EPICUR alliance are using ILIAS as their main Learning Management System. ILIAS is completely web-based, hence requires only a web browser on the client side to use it. It supports learning content management and tools for collaboration, communication, evaluation and assessments. It is published under the GNU General Public License. The functionality of ILIAS can also be extended with Plug-Ins. There exists a variety of free and commercial Plug-Ins for ILIAS, adding missing functionality for specific cases. As the VCLP is a complete Learning Management System, courses can be directly hosted on the VCLP itself. However, since the VCLP is based on ILIAS, it can also be integrated with other LMS by connecting the LMS to one or more “E-Learning Community Server” (ECS).

The VCLP offers a comprehensive landing page, where the different mobility programs are offered in large tiles in the typical EPICUR colour scheme. There are also large buttons to log in, to apply for EPICUR courses via the VURS and a support and help page. Also, news are shown for upcoming EPICUR events. The page is designed in such a way, that it is also easily readable on mobile devices. With limited space the layout of the page is adjusted accordingly. The main landing page is available for every visitor of the VCLP, a login is not required.

Welcome to EPICUR Inter-University Campus!

EPICUR is developing a wide variety of state-of-the-art teaching and learning formats with an emphasis on collaborative teaching and learning. EPICUR courses deal with multilingualism, tackle real-world problems, include interdisciplinary and intercultural perspectives, and aim to inspire critical thinking and autonomous and transformative learning.

For more information about EPICUR visit our homepage at <https://epicur.education>.

For more information about specific courses, course dates and information on how to register, please click on the appropriate tiles below. Be epicurious!

The landing page features a header with the title 'Welcome to EPICUR Inter-University Campus!'. Below the header, there is a paragraph of introductory text and a link to the homepage. Three large buttons are stacked vertically: 'Log in here!', 'Apply here!', and 'Any questions?'. To the right of these buttons is an image of a student sitting on the floor with a laptop and books. Below the buttons is a grid of seven colored tiles representing different course categories: Languages & Culture (light blue), Liberal Arts & Sciences (dark red), Internships & Service Learning (green), Entrepreneurship Education (dark green), EPICUR Community of Learning & Teaching (red), and PhD Exchange Programme (dark blue). To the right of the grid is a 'Latest News...' section with two announcements: the 2nd annual EPICUR Forum 'Innovation & Inclusion' on November 24-26, 2021, and the 2nd EPICamp 'Sustainability, material use, and climate justice' on December 2-3, 2021.

Figure 3: The Landing Page of the VCLP

By clicking on one of the large, coloured tiles of the mobility program, the course catalogue is displayed. This course information is directly fetched from the VURS system by using a request in the background. This has the advantage that the course information only must be entered once by the EPICUR administrative staff at the local university. Interested students can browse the course catalogue and if logged in find a direct link in order to register for those courses. In addition, the VCLP also provides a help forum for students.

About Languages & Culture:

EPICUR considers language and culture to be vital for the communication within academic communities and for the interaction with societies. A good command of several European languages is a basic precondition to foster educational and research quality and facilitate learning experiences. Offering mobility programmes in the field of European language and culture is one of EPICUR's key priorities to promote multilingualism. In return linguistic and cultural diversity will nurture social cohesion and mutual understanding in Europe as well as improve the employability of students and researchers.

How to Proceed:

1. Choose and select one or more courses from the **Course Catalogue**. Additional admission criteria may apply. Check and confirm that your application complies to the generic **EPICUR Admission Criteria**.
2. Find your courses in the categories below and click the button **Apply now!** to log onto VURS (Virtual University Registrar System).
Submit your application online before the deadline. You will be requested to upload required documentation.
3. Once you've been approved, click the button **Access your course!**



Please check with the exam board of your home institution to determine whether you can transfer the ECTS earned during the (online) course abroad to your programme of study.

Detailed Course Catalogue and Application:

- Modern Greek
- Slavonic
- Nordic/Scandinavian

Figure 4: Languages & Culture mobility program page

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In order to maintain the clarity and a good overview of the available courses, the course catalogue in the VCLP is showing only a subset of all available attributes of a course, which consists of the most important information. If a student is interested in a course in detail, a link to the detailed course catalogue in the VURS is available.

Cultural studies

This course will introduce students to key concepts in cultural studies. We will begin by briefly discussing some key texts and theories in cultural studies mainly by Williams, Hall, Marx, Gramsci and Althusser. We will move on to the establishment of cultural studies as a discipline with reference to the Frankfurt School and the Birmingham School. The rest of the course will chart the areas modern Cultural Studies are covering looking at topics such as (new) media, consumption cultures, post-modernism, gender studies, social networking, subcultures, etc. Learning outcomes: Students will learn to differentiate key concepts of cultural analysis and familiarize themselves with its various research methodologies.

The introduction to cultural analysis will inform the student's understanding of cultural phenomena.

S/he will learn to take a critical approach to the cultural sphere.

Course term: -	Additional information: B2 in English (minimum)	Language of instruction: English	ECTS: 6
Meeting times: This course takes place in the Fall semester 2021/2022 The exact course dates and schedule will be communicated when available	Required documentation: Language certificate B2 in English (minimum)	Focus language: Greek	

Etude des textes techniques et d'actualité.

Greek language course for advanced learners.

Course term:	Additional information:	Language of instruction:	ECTS:
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Figure 5: Example of one EPICUR course as displayed in the VCLP course catalogue

Decentralized course delivery

Offering an EPICUR course directly on the VCLP requires the teachers in many cases to get familiar with a new Learning Management System. This requires additional training and support, which is time-consuming and might often cost money. This is especially true if you are not yet familiar with the ILIAS LMS. In addition, the same offered courses for EPICUR students are also offered as local courses at the university. In these cases, teachers would have to offer the same course on two different learning platforms (VCLP and local Learning Management System). Moreover, since both groups of students are in different LMS, they do not have the ability to communicate with the other student group via the platform (like chat, forums, comments etc.)

To overcome these limitations, the VCLP does use the feature to connect it to other LMS. This is achieved by bridging the VCLP to the other local LMS via a central middleware. It is called "E-Learning Community Server" and is a message-based platform, which receives events as messages from one connected Learning Platform and routes this message to other Learning Platforms. This middleware platform is completely invisible to normal users and works in the background.

In order to connect an ILIAS LMS to an ECS server, no additional software is required, since ECS support is already built in. For Moodle LMS a Plug-In exists, which can be installed into an existing Moodle installation and enables a Moodle also to connect to the ECS server in the same way. For other LMS there is currently no direct support, but since the communication between the ECS server and the LMS is documented, a Plug-In for another Learning Management System can be developed. Another option is to develop an ECS proxy, which is itself connected to the ECS and translated the messages of the ECS server into service calls for the LMS. This requires a server interface of the LMS.

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Any data exchange between the LMS and the ECS server is done in a secured and encrypted way. The authentication of the LMS to the ECS is done by SSL client-certificates, so no third party gets access to the ECS or the connected LMS. Only client certificates issued by the KIT can be used to identify and authenticate an approved LMS. The encryption of the messages is done by standardized Transport Layer Security (TLS).

The ECS is used in the EPICUR context for two important features:

- Course sharing from local LMS to the VCLP
- Course access to the local course from the VCLP

Course sharing

A course on one LMS can be shared (or released) with other connected LMS. While this would technically allow any course on one LMS to appear on all other platforms, this feature is restricted by administrative settings in such a way that it is only possible to share courses from local LMS to the VCLP. In the connected local LMS course settings an additional option is provided. Using this setting course administrators can share (or “export”, “release”) an existing course to the VCLP. This can be set for each course individually.

If a course administrator chooses to share a course to the VCLP, the course will appear on the VCLP in the main category “My EPICUR courses”. This category is linked directly from the landing page if the user is logged in. In addition to the name of the course a short description is also optional available. It also states the university on which the course is hosted.

My EPICUR Courses

Courses





-  Übung zur skandinavischen Geschichte der Neuzeit - WiSe2021/22
Provider: University of Freiburg
-  test epicur stras
Provider: University of Strasbourg (test v3.9)
-  Grundlagen der Halbleiterphysik / Fundamentals of Semiconductors & Optoelectronics (-) WS21/22
Provider: University of Freiburg
-  Multi-junction solar cell technology and concentrator photovoltaic (-) WS21/22
Provider: University of Freiburg
-  Transformative Leadership 2021/2022
Provider: University of Freiburg
-  Νεοέλληνες συγγραφείς ΙΙΙ (1789-1830) - Δ.Σολωμός: ποίηση και ποιητική
Provider: Aristotle University of Thessaloniki
-  2190465 – Grundlagen der Reaktorsicherheit für den Betrieb und Rückbau von Kernkraftwerken
This lecture describes the fundamentals of reactor safety for both the operation and the decommissioning of nuclear power plants
Provider: Karlsruhe Institute of Technology

Figure 6: The “My EPICUR courses” category contains the available courses for a student

However, any shared course will be at first invisible to any user except VCLP administrators. Only students who have been approved for a course will be able to see the course link. This is achieved through the VURS transmitting the approved user accounts to the VCLP via a web service. In doing so the students will have a better overview of their accessible courses and are not confused with a long list of inaccessible courses.

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Course access

By clicking on a course that has been shared from a local LMS to the VCLP in the “My EPICUR courses” category, the logged in user will be directly forwarded to the local LMS and if necessary, a new user account on the local LMS will be created. This account is special in such a way, that it is for EPICUR students only and allows access to the local course. By ECS design it is always prefixed with the organization name set in the ECS, which is “EPICUR_” for the VCLP. For example, if a user has the VCLP account “john.doe@kit.edu”, the username on the local LMS will be “EPICUR_john.doe@kit.edu”.

Technically the authentication between the VCLP and the local LMS is done via the ECS. On clicking a course link on the VCLP, a special random token combined with a computed value (hash) of several user attributes is generated by the VCLP and transmitted to the ECS. Then the user will be forwarded to the course on the local LMS. Thereby also user attributes, like username, first and last name and email address are transmitted in the URL. The local LMS reads also the VCLP token from the ECS, calculates the hash value again and compares it. If both values match, the user is successfully authenticated. This process happens in the background and usually takes less than a second, so it is completely transparent to the user and does not disturb the user experience.

Installation & Configuration Virtual Campus Learning Platform (VCLP)

The main platform for the Virtual Campus Learning Platform is an ILIAS Learning Management System (LMS). ILIAS is a web-based LMS which was originally developed 1997 by the University of Cologne (Universität zu Köln). For users to access ILIAS only a web browser is required. The source code of ILIAS is open-source, published under the GNU General Public License. The system is free to use, a non-profit community is taking care of the change management of ILIAS. ILIAS is being used in many HEI as their primary Learning Management System, especially in the southern regions of Germany and in parts of Switzerland and Austria. ILIAS has a strong, active community of users, supporters, developers and maintainers, which are constantly adding new features to ILIAS and releasing new improved versions of ILIAS. The current version of ILIAS is 7.4. The basic technology required for using ILIAS is a web server like Apache HTTP Server or NGINX with PHP 7 support and a MySQL or MariaDB database server.

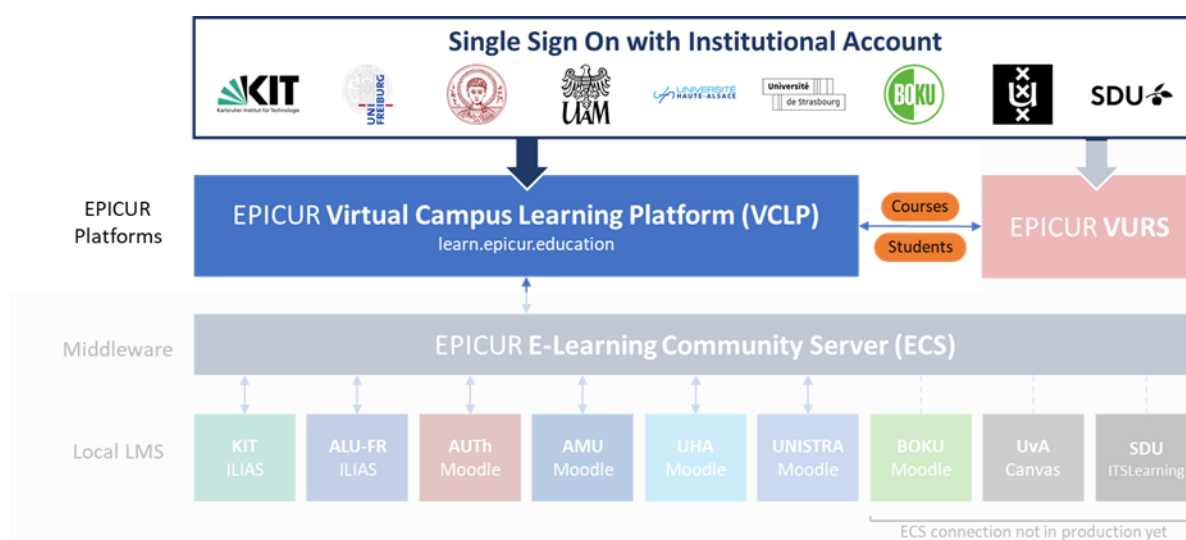


Figure 7: ILIAS as VCLP and Single-Sign-On via Shibboleth

In order to use the VCLP as a teacher or student it is required that you log in into the system as a user. To get a user account on the VCLP, the normal procedure would be to register a user account, choosing a username and a password. While usually easy to set up such an authentication, the approach has some disadvantages. From the user point of view the additional account is another password which must be remembered. As such some users tend to use the same password for all services. This can be a serious security issue since if the password from one system is known to an attacker it is also possible to access all other systems where the same password is used. The best way to avoid these attacks while not requiring the user to choose a different password for each system is to not rely on passwords at all if it can be avoided.

Therefore, for the VCLP we want to reuse the existing local account each member already has at their university. We call this account the "home institution account". Students of staff members usually get a university account as soon as they will be a member (enrolment or start of employment).

We achieved the basic login by using Shibboleth authentication. In such a way it is not necessary to store passwords or other high valuable credentials. In addition, due to the Single-Sign-On aspect of Shibboleth, entering your user credentials is not required if you have already signed in on the Identity Provider for using another university system.

The process to log in into the VCLP is as follows:

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1. The user who wants to login into the VCLP goes to the login page. On the login page the VCLP presents 8 buttons which each EPICUR partner in order to allow the user to select his or her home institution.



Figure 8: Login Screen of the VCLP - Selection of the home institution is required

2. Then the user will be forwarded to the corresponding login page of the institution's Identity Provider. The user enters his well-known university credentials (usually a username and a password) and the credentials are checked locally at the home institution. If the credentials are correct, the Identity Provider will submit encrypted data to the VCLP, containing some basic user attributes. These attributes are a unique username, the so-called eduPersonPrincipalName or EPPN, the first and last name and the email address.

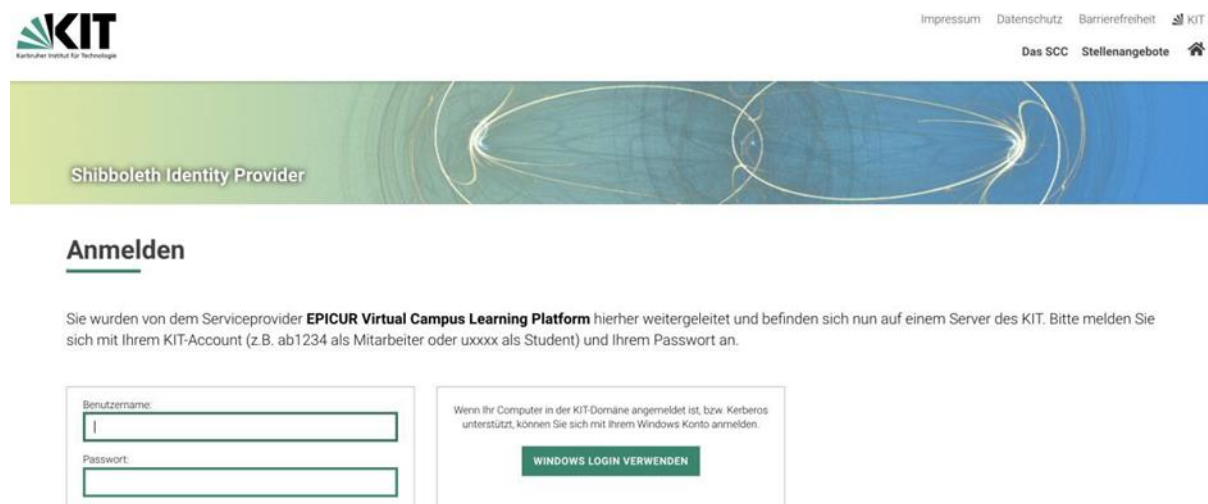


Figure 9: Shibboleth Identity Provider of the Karlsruhe Institute of Technology as an example

3. These attributes are required to create an account on the VCLP. The EPPN will be the main username on the VCLP. The VCLP checks if a user account with the username already exists. If that is the case, the user will be logged in and the VCLP user account will be updated if any of the

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submitted attributes had changed since the last time the user has logged in into VCLP. If the user account does not exist yet, it will be created without any additional user interaction. After logging in for the first time the user can select in the user profile which personal data is visible to other users.

For the communication between the VCLP and the local Identity Providers to work, it is required to establish a trusted relationship between the systems. Since all EPICUR partners are member of the eduGAIN federation, the easiest solution is to publish the VCLP metadata that is required for the Identity Providers in the eduGAIN federation. In doing so, the local administrative staff only must allow the VCLP as an approved Service Provider and select the necessary user attributes the VCLP will receive after a successful user authentication.

The VCLP stores no passwords, but other personal data of EPICUR members, like first name, last name and email address. Therefore, a data privacy policy is required that addresses the handling of personal data in the VCLP. The data privacy policy describes the rights for VCLP uses according to the “General Data Protection Regulation” (GDPR) of the EU and states the technical measures the KIT has taken to protect the personal data from abuse. This data privacy policy is linked in the footer of the VCLP on every page and is publicly available. Since the VCLP is self-hosted by the Karlsruhe Institute of Technology, the KIT is also the responsible party or so-called “Controller of Data Processing”. The KIT hosts the VCLP on its own infrastructure at the “Steinbuch Centre for Computing” (SCC) and does not use any cloud storage outside the KIT facilities.

Installation

The VCLP is installed at KIT on a virtual environment, based on VMware vSphere. For the VCLP we basically need to set up two types of servers: A Web server, which hosts the ILIAS system and a database server, which stores the data. In addition, we also use our central file server at KIT for storing user files (files, which are uploaded by users).

Most requirements of ILIAS can easily be installed by using a packet manager like APT. For example, to install Apache we execute “apt-get install apache2”. Since at KIT we manage several ILIAS platforms, we also using Ansible to automate installation and configuration of our Linux servers.

The ILIAS source code can be installed by cloning the central ILIAS repository at GitHub (<https://github.com/ILIAS-eLearning/ILIAS>). This can be done by using the following commands in the web servers document root directory (docroot):

```
git clone https://github.com/ILIAS-eLearning/ILIAS.git . --single-branch
git checkout release_7
```

After that some PHP dependencies have to be downloaded and static artifacts from the source have to be created by using the “Composer” dependency manager for PHP. The command is

```
composer install --no-dev
```

Finally, the setup program of ILIAS must be executed. First a configuration file with the settings of the particular ILIAS installation has to be created as a JSON file (JavaScript Object Notation). A template JSON file is available named “minimal-config.json”. After the configuration file have been set ILIAS can be configured with the following command:

```
php setup/setup.php install /path/to/my/configuration.json
```

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The setup program will check your installation and maybe prompt with questions. After that the basic ILIAS installation as the VCLP is complete.

Domain

The VCLP is available at <https://learn.epicur.education>. In order to achieve this, the IPv4 and the IPv6 address of the web server (currently 129.13.166.83 and 2a00:1398:5:ec03::810d:a650) has been registered at KIT's Domain Name Server (DNS). The KIT's DNS has control over the subdomain "learn.epicur.education", while the domain "epicur.education" is hosted at the University of Straßbourg (UNISTRA).

```
learn.epicur.education.    NS      dns1.kit.edu.
learn.epicur.education.    NS      dns2.kit.edu.
learn.epicur.education.    NS      ns1.routing.net.
learn.epicur.education.    NS      ns2.routing.net.
learn.epicur.education.    NS      ns3.routing.net.
learn.epicur.education.    A       129.13.166.83
learn.epicur.education.    AAAA    2a00:1398:5:ec03::810d:a650
```

Transport Layer Security

In order to encrypt the communication between the user and the web server we configured access only over the secured HyperText Transfer Protocol (HTTPS). Any access over an unsecured channel will immediately result in a redirect to the secured page. For encryption of the communication a certificate for the domain "learn.epicur.education" is required. We use certificates issued by "Let's Encrypt". Let's Encrypt is a non-profit certificate authority run by Internet Security Research Group (ISRG) that provides X.509 certificates for TLS encryption at no charge. The certificates can be easily obtained by using a tool on the web server called "Certbot" (<https://certbot.eff.org/>). The certificates are only valid for 90 days but are regularly renewed automatically. The renewal process using a protocol named "Automated Certificate Management Environment" (ACME), which allows to prove the domain ownership to Let's Encrypt by a challenge-reponse. After a successful response, a new certificate is issued for 90 days. This process is repeated when the certificates will become invalid in 30 days.

The web server is configured in such a way that only modern security protocols are used, especially only TLS version 1.2 and higher are allowed. The allowed cipher suites for encryption of the data transfer are limited, weak cipher suites are forbidden in the web server configuration. The stronger security will prevent access to the VCLP only for very old web browser (like Internet Explorer version 6 and older) or devices, which are very rarely used today and are a security risk for the user. Additionally, we configured a "HTTP Strict Transport Security" header in the HTTP response. Any browser, who will receive this header is instructed to access the VCLP only via encrypted communication for at least a year. In a quality check of the used encryption configuration with [ssllabs.com](https://www.ssllabs.com) the VCLP currently received an "A+" score.

SSL Report: learn.epicur.education (2a00:1398:5:ec03:0:0:810d:a650)

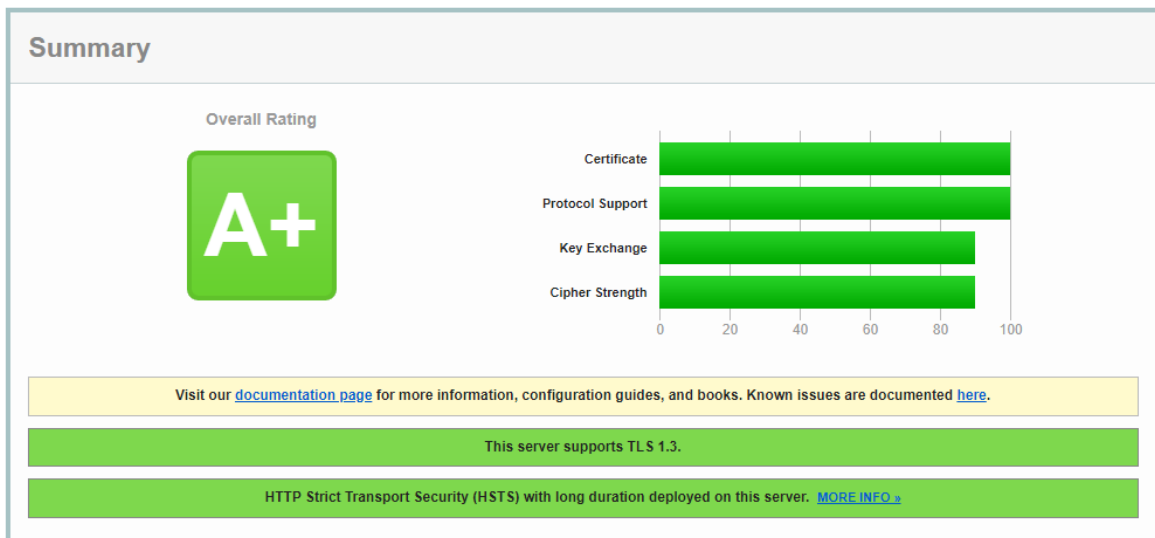


Figure 10: Result of the SSL report on the VCLP platform by SSL Labs

Shibboleth Service Provider

The VCLP is registered as a Service Provider at eduGAIN via the German identity federation DFN-AAI. The entityID of the VCLP is "https://epicur.scc.kit.edu/sp". Please note that this is only the identifier, not an actual web address.

Listing of all entities (1), 1 federation			
1	SP	EPICUR Virtual Campus Learning Platform	Entity details
		Entity ID: https://epicur.scc.kit.edu/sp	
		Registrar: DFN-AAI	
		Org: Karlsruhe Institute of Technology (KIT)	

Figure 11: Service Provider metadata listed at eduGAIN

Since all 9 EPICUR partners must have access to the VCLP, the shibboleth2.xml configuration file of the VCLP includes the metadata of the 9 identity providers each partner provides. For technical reasons two files of identity providers must be included in the configuration:

The DFN-AAI federation provides an XML metadata file with all German identity providers registered at DFN-AAI. This includes the KIT and the University of Freiburg. Since only those two German partners should have access to the VCLP, we are using a whitelist metadata filter to exclude all other identity providers:

```
<MetadataProvider type="XML" validate="true"
  url="https://www.aai.dfn.de/metadata/dfn-aai-idp-metadata.xml"
  backingFilePath="..." reloadInterval="7200">
  <MetadataFilter type="Whitelist">
    <Include>https://idp.scc.kit.edu/idp/shibboleth</Include>
    <Include>https://mylogin.uni-freiburg.de/shibboleth</Include>
  </MetadataFilter>
</MetadataProvider>
```

The DFN-AAI also provides an XML file which lists all registered identity providers at eduGAIN, but not the identity providers from Germany. Since all remaining partners are registered at eduGAIN via their nation-

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wide identity federation, this is the second file of identity provider metadata we have to include in the Shibboleth configuration. In the same way as above, we include only the identity providers of the 7 non-German EPICUR partners.

```
<MetadataProvider type="XML" validate="true"
  url="https://www.aai.dfn.de/fileadmin/metadata/dfn-aai-edugain+idp-
metadata.xml" backingFilePath="..." reloadInterval="7200">
  <MetadataFilter type="Whitelist">
    <Include>https://idp.unistra.fr/idp/shibboleth</Include>
    <Include>https://sso.amu.edu.pl/simplesaml/saml2/idp/metadata.php</Include>
    <Include>https://login.auth.gr/saml2/idp/metadata.php</Include>
    <Include>https://idp.boku.ac.at/idp/shibboleth</Include>
    <Include>https://idp.uha.fr/idp/shibboleth</Include>
    <Include>http://login.uva.nl/adfs/services/trust</Include>
    <Include>https://sso.sdu.dk/wayf</Include>
  </MetadataFilter>
</MetadataProvider>
```

Please note that the URL in the filter are only identities for the identity providers (called entityID), not actual web addresses for browsing.

On a successful login of a user on one of the identity providers, it must provide the following attributes to the VCLP to complete the login process:

eduPersonPrincipalName	User Identifier: The EPPN is unique for a person and contains a local user ID and the identifier of the institution, usually the domain name, divided by “@” symbol (e.g. “li4202@kit.edu”). It does NOT have to be a valid email address.
sn	Sur name: The surname or last name of a person (e.g. “Hoyer”).
givenName	Given name: The given name or first name of a person (e.g. “Philip”).
mail	Mail: The email address of the person (e.g. “hoyer@kit.edu”).
eduPersonScopedAffiliation	Affiliation: Provides information about the person’s affiliation with the organization (e.g. “employee@kit.edu”).

In the ILIAS administration we configure the attribute mapping, so that the attributes are taken over into the VCLP user account. The user can choose which information should be public visible and which should not. Only the user identifier (EPPN) is always visible to other users.

[VCLP-to-VURS connection](#)

ILIAS offers many functionalities to be invoked via an API by other programs. This API is implemented as a SOAP web service, available at the same URL. With the functionality provided, it is possible for example to create new user accounts or to control the visibility of courses for specific users or roles in the VCLP.

In the VCLP we use this functionality to allow EPICUR students only to access those courses, which they have been registered and approved for in VURS. In this way the user interface is much more user friendly, since only a few courses are shown in the “My EPICUR courses” category in the VCLP. It is also more secure, since users cannot access other courses in the local Learning Management System, which they not been approved.

Installation & Configuration E-Learning Community Server (ECS)

The E-Learning Community Server (ECS) is an important component in the EIUC architecture, since it connects the VCLP with the local Learning Management Systems (LMS). It communicates between the connected LMS via a message-oriented system. New courses published by the local LMS are published through the ECS on the VCLP. Also, for users to access the local LMS an authentication token, generated by the VCLP, is published through the ECS and is being consumed by the local LMS in order to authenticate the user coming from the VCLP and give access to the locally hosted course. The ECS itself is hosted at KIT.

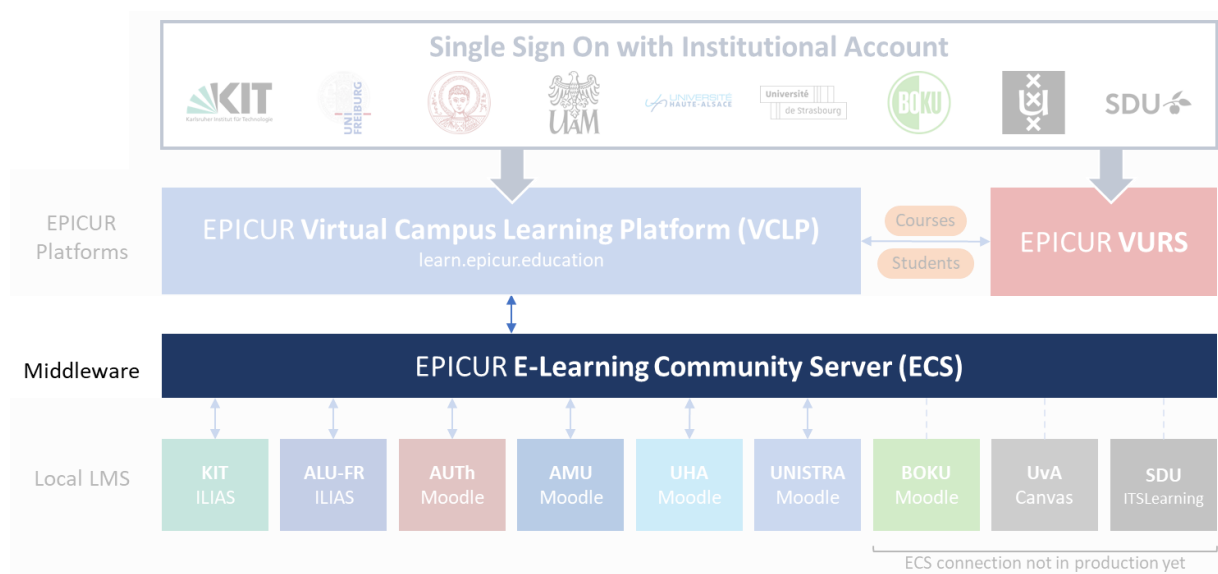


Figure 12: E-Learning Community Server (ECS) as middleware

The ECS was being developed in a project in the federal state of “Baden-Württemberg” in Germany and is being used many years to connect the universities and to share courses for students to allow access from partner universities. This ECS instance is hosted by the University of Stuttgart.

Installation

The ECS can be installed on a Linux machine by using a Debian package. The developer of the ECS offers the package on its website for free:

<https://www.freeit.de/en/welcome/index.html>

ECS requires a PostgreSQL database as storage, which must be also installed. After installation, the ECS must be configured with the following steps:

Create a new database user “ecs4”

```
su - postgres
createuser -d ecs4
exit
```

Create the database:

```
ecs4 run rake db:setup
ecs4 run rake cc:ressources
```

Create the config files and system initial scripts:

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ecs4 scale web=1

It is highly recommended to protect the ECS via a proxy, like Apache web server with the mod_proxy module. In this way, unauthorized access can be denied by the proxy. Also Transport Layer Security should be configured by default. The authentication against ECS is possible in two ways: username/password or certificate-based. In EPICUR we use the much more secure way of certificate-based authentication. This requires that any participant must get a certificate, which can be issued only by the ECS provider, which is KIT in EPICUR.

The ECS provides a basic administrative web interface, which can be accessed by using a browser.

ECS Community and participants

The concept of the ECS enables to allow different participants, which are in general local LMS, to form so-called communities. Each participant can belong to any number of communities. In the participant's administration area, the system administrator can determine which data his university wishes to exchange with which participants in the communities. Each participant only sees the communities to which he or she belongs. This means that there can also be internal university communities of which the external systems are not aware. In EPICUR the ECS has one EPICUR community with the LMS from the partners (KIT, ALU-FR, AUTH, AMU, UHA and UNISTRA) and the VCLP. However, it is possible in the future to form other communities between different partners.

Name: EPICUR

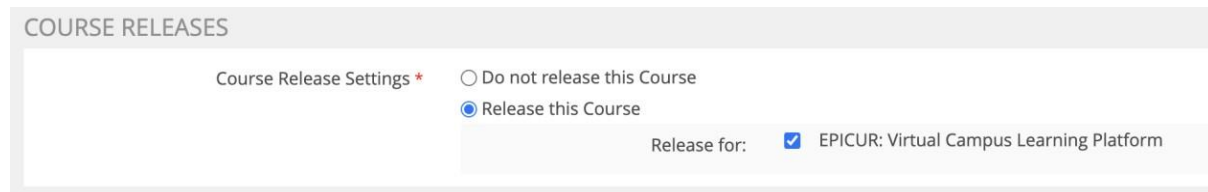
Participants joining the community:	
ID:	Name:
14	Karlsruhe Institute of Technology
16	Virtual Campus Learning Platform
17	Aristotle University of Thessaloniki (stage)
18	Aristotle University of Thessaloniki
20	Adam Mickiewicz University, Poznań
21	University of Freiburg
22	University of Haute-Alsace (test)
24	University of Haute-Alsace
25	University of Freiburg (WB)
26	University of Strasbourg
27	University of Strasbourg (preprod)
28	University of Natural Resources and Life Sciences, Vienna (test)
30	University of Natural Resources and Life Sciences, Vienna
31	University of Strasbourg (test v3.9 new)

Figure 13: The participants in the EPICUR community on the ECS

Course administrators can then share courses with one or more LMS at partners that their system administrator has approved. When a lecturer does this, a course link containing metadata about the course is sent to the ECS. From there, the systems for which the course is released retrieve this information by periodically checking with the ECS to see if there are any new messages for them.

In this architecture, the ECS itself always remains passive: it receives messages from the systems and the systems fetch information from the ECS. The systems for which a course has been released create "course links" from the data, i.e. course objects that function as links.

In EPICUR we restrict this feature by administrative settings in such a way that it is only possible to share courses from local LMS to the VCLP. In the connected local LMS course settings an additional option is provided. Using this setting course administrators can share (or “export”, “release”) an existing course to the VCLP. This can be set for each course individually. ILIAS has this option directly in the main course settings.



COURSE RELEASES

Course Release Settings *

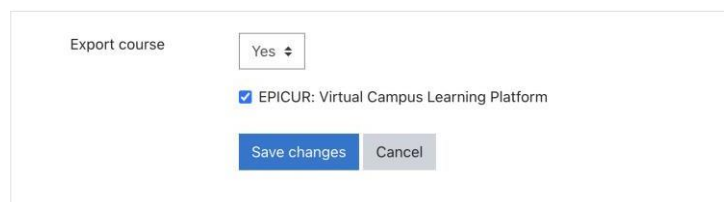
Do not release this Course

Release this Course

Release for: EPICUR: Virtual Campus Learning Platform

Figure 14: Option to share a course with the VCLP in ILIAS

For Moodle LMS the course administrator first must add a “block” named “Export course” to the course, but otherwise the settings are very similar as in ILIAS.



Export course

Yes ▾

EPICUR: Virtual Campus Learning Platform

Save changes Cancel

Figure 15: Option to share a course with the VCLP in Moodle

Authentication process

If a user clicks on a course link, the VCLP sends a hash token, which is formed from his user data, to the ECS and the student arrives at the local LMS via a HTTP redirect. The user's data is attached to the URL. The local LMS creates a hash from this data and compares the result with the token stored on the ECS. If it is identical, it admits the user. The system creates a user account with which the user can log on to the approved course. Otherwise, the user would have manipulated the data in his browser and access to the local LMS is denied.

Name: Virtual Campus Learning Platform
DNS: learn.epicur.education
Email: support@learn.epicur.education
Community Selfrouting: false
Events: true

Identities:	
ID:	Description:

Communities:	
Name:	Description:
EPICUR	

[Edit](#) | [Back](#)

Received Messages (total number: 185):			
Id:	Resource:	Content-Type:	Date:
161	campusconnect/courselinks	application/json	2021-02-09 15:26:19 UTC
163	campusconnect/courselinks	application/json	2021-02-10 10:41:02 UTC
167	campusconnect/courselinks	application/json	2021-02-10 14:19:04 UTC
198	campusconnect/courselinks	application/json	2021-02-11 11:13:04 UTC
207	campusconnect/courselinks	application/json	2021-02-18 09:05:50 UTC
...
7229	campusconnect/courselinks	application/json	2022-04-19 12:17:26 UTC
7233	campusconnect/courselinks	application/json	2022-04-19 15:04:02 UTC
7237	campusconnect/courselinks	application/json	2022-04-20 09:05:14 UTC
7440	campusconnect/courselinks	application/json	2022-05-11 10:34:40 UTC
7586	campusconnect/courselinks	application/json	2022-05-27 14:09:27 UTC

Sent Messages (total number: 3387):			
Id:	Resource:	Content-Type:	Date:
140	sys/auths	application/json	2021-02-05 11:54:21 UTC
141	sys/auths	application/json	2021-02-05 12:13:42 UTC
142	sys/auths	application/json	2021-02-07 09:27:52 UTC
143	sys/auths	application/json	2021-02-08 14:15:08 UTC
144	sys/auths	application/json	2021-02-08 14:21:35 UTC
...
7647	sys/auths	application/json	2022-06-07 06:55:22 UTC
7650	sys/auths	application/json	2022-06-07 12:54:03 UTC
7654	sys/auths	application/json	2022-06-08 07:21:57 UTC
7655	sys/auths	application/json	2022-06-08 11:23:48 UTC
7656	sys/auths	application/json	2022-06-08 13:05:49 UTC

Figure 16: The VCLP participant on the ECS (Identity is hidden) with received and send messages

Installation & Configuration Local LMS

In this chapter the installation and configuration on the local side is described. Currently the supported LMS for connection with ECS are ILIAS and Moodle. While ILIAS support for ECS is already build-in within the product, Moodle requires the installation of a plug-in in order to work with the ECS. Otherwise, the configuration of the ECS connection settings is very similar. Other LMS could be supported in a same way, but development on the necessary connections to the ECS is required using an API of the LMS.

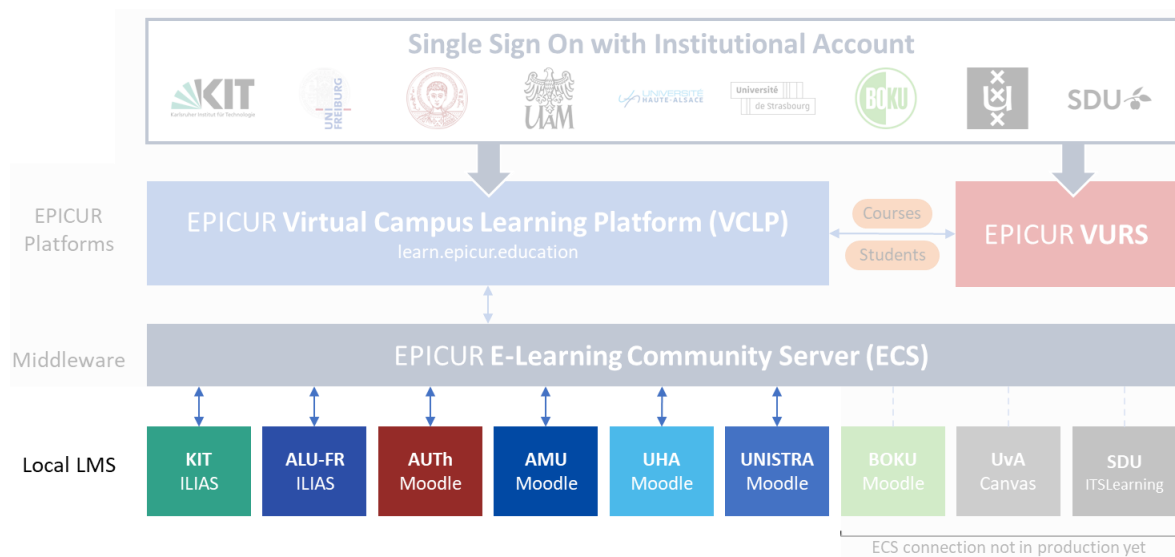


Figure 17: The connection between ECS and the local LMS

Connecting Moodle LMS to ECS

For the EPICUR partners which are using Moodle as the Learning Management System, a Plugin for communication with the E-Learning Community Server is available. This plugin enables the course sharing inside Moodle and also does allow enable users coming from the VCLP to access the courses hosted on Moodle.

The original plugin is called “CampusConnect” and is made by the company “Synergy Learning”. Is is available for free at the following GitHub repository location:

<https://github.com/synergylearning/campusconnect>

Installation of the plugin is simply by downloading the repository and copy it into your Moodle folder. The configuration of the plugin is done in the Moodle web interface as an Administrator. In the “Side administration” go to the tab “CampusConnect” and click “All ECS” (in the “ECS” section). Here you find all configured connections to E-Learning Community Servers (ECS).

CampusConnect

Add New ECS

Available ECS

Active	Name	Actions
No	epicur Server address: https://ecs.scc.kit.edu:443	Edit Delete
No	EPICUR-prod Server address: https://ecs.scc.kit.edu:443 Certificate expiry date: 2 February 2031	Edit Delete
Yes	epicurNeu Server address: https://ecs.scc.kit.edu:443	Edit Delete

Figure 18: All available ECS connections in Moodle

Click on the “Add New ECS” link. In the connection settings you need to provide some configuration data. The configuration settings can be obtained by the institution who manages the ECS. Here we will provide only sample data. It should be noted that it is important to provide a secure connection between the LMS to the ECS server, therefore the Protocol should be always HTTPS (standard port is 443).

Connection settings

ECS enabled

Name !

URL !
You must not include the http:// or https:// part

Protocol !

Port

Figure 19: ECS connection settings

We use a certificate-based authentication method instead authentication by username and password for additional security. For obtaining a certificate the partner who wishes to participate must make a certificate signing request at the partner who is hosting the ECS (for EPICUR this is KIT). A certificate signing request can be easily created with OpenSSL. On most Linux distributions this is already installed, on Windows operating systems OpenSSL can be downloaded and installed from:

<https://wiki.openssl.org/index.php/Binaries>

For creating a certificate signing request the following commands must be executed. First a new private key has to be created:

```
openssl genrsa -des3 -out ecs-example.key 2048
```

You will be asked for a passphrase to protect the key. Keep the passphrase protected, do not forget it!

Create a new certificate signing request (CSR) with the following command:

```
openssl req -new -key ecs-example.key -out ecs-example.csr
```

You will need to enter your passphrase. In addition, OpenSSL will ask you a couple of questions for the certificate. The answers are not important to work correctly, but reasonable values might help in the future if any problems come up. The CSR file now have to be sent to the ECS hosting partner. Here the real certificate is created and a new ECS participant is created and linked with the certificate. From the hosting partner two certificates will then be received: The certificate file (e.g. ecs-example.crt) and the public key of the Certificate Authority (CA, e.g. ecs-example-ca.crt). Both files as well as the the private key (ecs-example.key) need to be uploaded to the Moodle server in an accessible folder. All three file paths and the passphrase for the private key need to be provided in the Connection settings.


Authentication type	<input type="text" value="Certificate/base"/>
Client certificate	<input type="text" value="/path/to/file/ecs-example.crt"/>
Certificate key	<input type="text" value="/path/to/file/ecs-example.key"/>
Key password	<input type="password" value="....."/>
CA certificate	<input type="text" value="/path/to/file/ecs-example-ca.crt"/>


Figure 20: ECS authentication settings

Additional settings are the polling time of the ECS. These can be left to one minute or set to a higher value if necessary. Also, a category ID has to be provided, but in our scenario is not used, since we only will export courses to the VCLP. It is not intended to import courses to the local Moodle platform. Therefore, any category ID can be provided.

In the “User account settings” section a global Role can be selected, which users created by the plugin will get. The “Activation period” is the amount of time, after the account will be deleted if no longer be used.

▼ Local settings

Minimum polling time  Minutes seconds

Category ID 

Please enter the ID of the category where new Course Links will be created

▼ User account settings

Role assignments

Activation period months

Figure 21: Other ECS settings in Moodle

In the ECS participant list you see all participants in the same ECS community called “EPICUR”. While all partners and the VCLP are listed here, we only want to enable the course export from the local Moodle installation to the VCLP be possible. Hence, we only enable in the “Export” column the “Course link” and the “Authentication token” at the VCLP participant, but not on the other participants.

EPICUR

Participants	Further information	Export	Import	Import type
Virtual Campus Learning Platform	Provider: EPICUR Domain name: learn.epicur.education Email: support@learn.epicur.education Abbreviation: EPICUR Participant ID: 2_15	<input checked="" type="checkbox"/> Course link <input type="checkbox"/> Enrolment status <input checked="" type="checkbox"/> Authentication token Edit user data mapping	<input type="checkbox"/> Enabled <input type="checkbox"/> Enrolment status <input checked="" type="checkbox"/> Authentication token <input type="checkbox"/> Use legacy token Edit user data mapping	<input type="text" value="Course link"/>

Figure 22: List of ECS participants in Moodle

For authentication it is important that the CampusConnect authentication plugin is active. You can activate the authentication plugin in the Site administration at “Plugins”, “Authentication” and “Manage authentication”. Here you need to set the “CampusConnect” plugin to active by clicking the eye symbol in the column “Enable”. You need also be careful about the order of the plugins. Basically, in the authentication process the plugin will check if the necessary authentication parameters are set in the URL as parameters for the ECS authentication. If these parameters are missing, the plugin will do nothing and the next authentication plugin in the order will be invoked in the authentication process. Therefore, other authentication plugins (like CAS, LDAP or Shibboleth) can be active in combination with the CampusConnect authentication plugin. Usually, the CampusConnect should be one of the first authentication plugins in the order to be called in the authentication process.

Manage authentication

Available authentication plugins

Name	Users	Enable	Up/Down	Settings	Test settings	Uninstall
Manual accounts	5			Settings		
No login	0					
CampusConnect	4			Settings		
Shibboleth	0			Settings	Test settings	Uninstall

Figure 23: Enabling the CampusConnect authentication plugin

Connecting ILIAS LMS to ECS

The configuration of ILIAS to the ECS is very similar to Moodle. The main difference is that ILIAS requires no installation, since ECS support is already built in into ILIAS. As an administrator you open the Administration pane, go to “Extending ILIAS” and click on “ECS”. On the ECS page “Overview” you find all configured ECS connections. To add a new ECS click “Add New ECS”. The settings here are the same as for Moodle. Please refer to the previous chapter about the configuration of the ECS connection in Moodle.

Connection Settings Save Cancel

Enable ECS Functionality

Name of ECS Configuration

Server URL

Protocol

Port

Authentication Type Certificate-Base

Client Certificate

Certificate Key

Key Password

CA Certificate

Certificate Serial Number

Username/Password

Figure 24: ECS connection settings in ILIAS

The ILIAS ECS participant configuration is also much like the Moodle plugin. In the settings you allow courses to be exported to the VCLP only, but not to the other participants.

EPICUR ()
(1 - 14 of 14) Rows ▾

Participants ▾	Further Information	Export	Import	Import Type	
Virtual Campus Learning Platform	Provider: EPICUR Domainname: learn.epicur.education E-Mail: support@learn.epicur.education Abbreviation: EPICUR Participant-ID: 2_15	Courses	Disabled	ECS Course ▾	Actions ▾

Figure 25: ECS participants in ILIAS

Connecting other LMS to ECS

Two EPICUR partners are using different LMS than Moodle or ILIAS. The University of Amsterdam is using Canvas and the University of Southern Denmark is using ITS Learning. Currently those LMS are not connected to the ECS, since no plugin is available. It is important to note, that ECS support is quite possible to develop, but might require support by the developers.

In the future we will investigate, what ways are possible to enable both LMS to connect to the ECS. This requires open APIs of both LMS and a plugin method to integrate new functionality in the LMS (like an authentication plugin). It might also be possible to develop an ECS connector, which on the one hand connects to ECS and sends and receives the appropriate messages and on the other hand invokes the API of the LMS to provide course links and to authenticate users.

We will also investigate alternative solutions for local LMS login, like using the Single Sign On at VCLP also on the local LMS side. This would then require no authentication plugin on the local LMS side at all.

Conclusion and Outlook

The solution of the VCLP to connect the local LMS provides some advantages, that will overcome limitations in using only a central Learning Management Platform with no connections to other platforms or to provide not a central EPICUR platform at all. In providing the VCLP the EPICUR users have a single gateway to access their EPICUR courses. It is not required for the users to register a user account. They simply reuse their already existing institution account they already have. Access to the courses is easy, by simply clicking the course link they are being redirected to the local LMS and have access to the course (again, no registration for a user account required).

In providing the EPICUR courses on the local LMS, the course administrators do not have to offer their courses on two platforms or more. They can use their local LMS, which they are already familiar with and often have already existing course material on. Offering the course to the VCLP is done with a few steps, where in general no administrative guidance is necessary.

The installation of the ECS connection is not very straight forwarded and provided some challenges during setup and in operation. We also introduced the VCLP in various video conference sessions with EPICUR students and received valuable feedback about improvements we then implemented. While most problems could be solved during the EPICUR work package, there are still some topics, which we want to solve in the next EPICUR phase. These topics include the modernization of the Moodle plugins, especially to be compatible with Moodle 4, but also to provide ECS support for other commercial Learning Management Systems used by EPICUR partners, like Canvas and ITSLearning.

In general, our solution has proved to work very well and as expected and has simplified the course delivery process to EPICUR students and teachers. All EPICUR partners have contributed to this achievement. We want to especially thank all people of the Work Package 4 and the IT departments at all universities for their support and their willingness to contribute to the EIUC solution.