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HEIBus  
Smart HEI-Business collaboration for skills and competitiveness

## **HEIBus Project**

# **WORK PACKAGE 2: Best practices of HEI- company cooperation**

## **Deliverable 2.3**

# **Internet based platforms for communication**

June 2017



<b>WP2</b>	<b>D2.3. Internet based platforms for communication</b>
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<b>Short Description</b>	Within this document 15 internet based platforms for serving HEI-company cooperation are searched and analyzed. The purpose is to find the best practices for platforms or forums which are used for communication between HEIs and companies. The best practices are analyzed and later in WP4, the project partners are either building a new platform or joining in best available platform, according to the analysis of WP2. The platform helps the continuation of the HEIBus activities after the project
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## 1. Introduction

The goal of this document is to search and analyze 15 internet-based platforms for serving HEI-company cooperation. This will serve as basis for WP4 where the project partners are either building a new platform or joining in best available platform. The platform will help the continuation of the HEIBus activities after the project.

In the next subsection the needs and prerequisites with regard to communication are analyzed. Then, most widely used platforms in HEIs and companies are enumerated, indicating which of these platforms could be utilized in both areas. Fifteen of these platforms are chosen for an in-depth analysis. Finally, conclusions are presented.

## 2. Communication Requirements

A **Communication Platform** describes the way organizations share information. Two clearly distinct types of organizations are considered in this document: HEIs and companies. In both cases, the content and form of the platform can vary depending upon the needs and prerequisites of the organization in question. Fig. 1 shows the flow of communication within these organizations and stakeholders.

The principal channel of communication in the academic sector, HEIs, is with the students. Learning Management Systems (LMS) are widely used to support student learning and faculty teaching [1]. Various types of LMS vendors, such as proprietary and open source, have been introduced into HEIs and will be detailed in Subsection 3.1. To provide a supportive learning environment, LMSs have evolved over the years including the new advances made in Information and Communication Technology (ICT) [2]. Previously, LMSs were mainly used as centralized source of material for lecturers and students to access at anytime and anywhere. Then, tracking and reporting tools to enhance student learning and performance were included. Nowadays, LMSs have increased their communication capabilities including the use of a variety of technologies for videoconferencing, chats, etc., and for implementing secure communications.



### Communication platforms in :

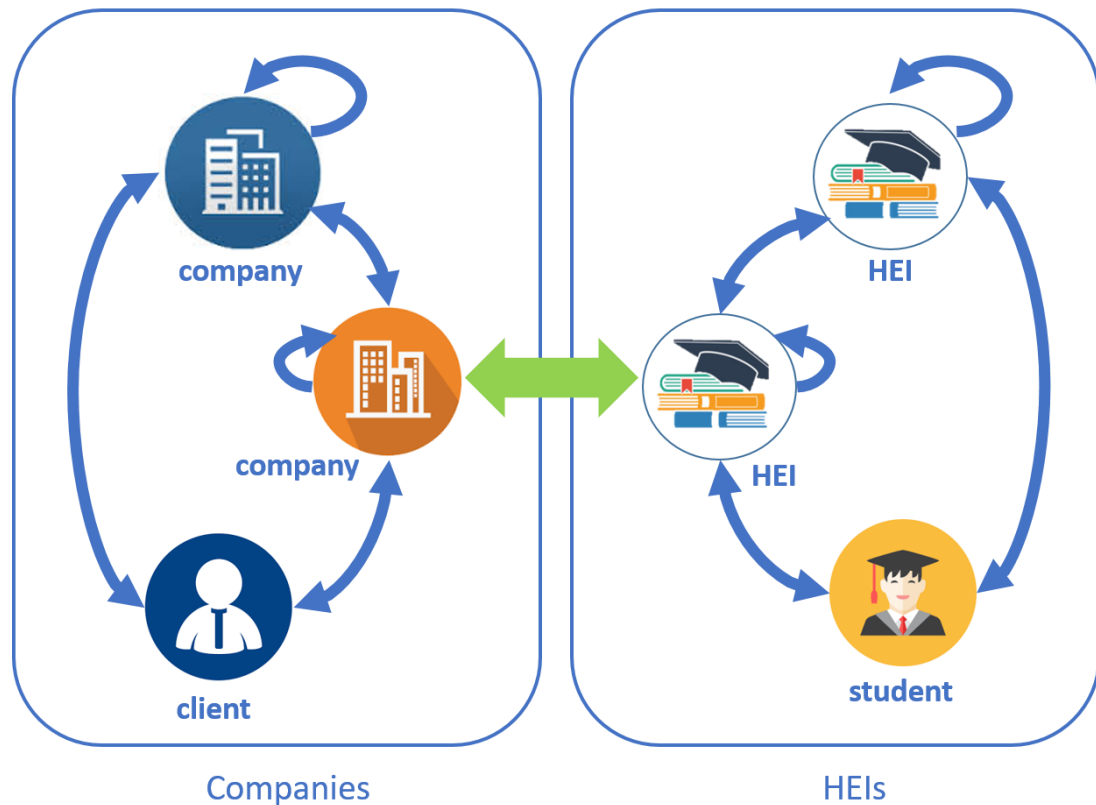


Fig. 1. Communication Platforms in Organizations

Other mode of communication is when it happens within the HEI, that is, internal communication. Mailing, standard telephone calls, talking via an IP telephony<sup>1</sup> service (e.g. Skype [3]), chats and texting are the most common channels among HEI staff. When it is necessary to share written information and work together in a collaborative and supportive way, cloud storages services such as OneDrive [4], Dropbox [5], Google Drive [6], among others, are utilized. These means of communication can also be extrapolated to HEIs-HEIs communication.

In the business sector, internal and external channels of communication are also defined. Internal communication comprises applications (Apps) for communication among team members and Enterprise

<sup>1</sup> IP telephony (Internet Protocol telephony) is a general term for the technologies that use the Internet Protocol's packet-switched connections to exchange voice, fax, and other forms of information.



Resource Planning (ERP<sup>2</sup>) systems. Both functionalities could be also encountered as a unified platform for data, real-time information flow and for managing effective internal communication. External communication channels are platforms which enable customers and suppliers to develop cross-enterprise solutions.

One of the most important issues in the business sector is security. Normally, companies handle sensitive information or even confidential about new projects, suppliers, customers and prospects. It is for this reason that professional platforms and Apps are used instead of open source.

Although this document focuses in this type of communication platforms, a review of the most commonly used in HEIs and Companies is also done. Considering the present and potential communications needs in the HEIBus project, a set of basic features has been defined. The platforms, subject of study should fulfill the majority of these requirements.

- **Written communication:** e-mail, forum (asynchronous) instant messaging (synchronous)
- **Live communication:** send and receive video/voice message (Asynchronous), IP telephony, Video conferencing (Synchronous).
- **Document sharing.** Document and content management with collaborating, reviewing and revising tools.
- **Projects management software.** Task responsible management and scheduling.

In Sections 3 and 4, open source and proprietary platforms, that fulfill the identified requirements, will be analyzed. The identified platforms could be used by HEIs, companies or by both and they also could provide support to one or more requirements. Platforms integrating a set of communication services are known in the business sector as Unified Communications (UCs). As this concept is widely spread across the business sector, a set of UC platforms will be also analyzed.

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<sup>2</sup> Enterprise resource planning (**ERP**) is business process management software that allows an organization to use a **system** of integrated applications to manage the business and automate many back office functions related to technology, services and human resources.



### 3. Platforms concerning a specific type of organization

Given that the aforementioned organizations serve different major goals and objectives, their necessities for communication may also vary. One of the HEIs main activities is to provide support and service to students. In this regard, software applications for the administration, documentation, tracking, reporting and delivery of educational courses or training programs are utilized. These applications are known as Learning Management Systems (LMS) and could be also used in companies for training purposes.

The design and management of more efficient production processes and systems is the main goal for companies. Software applications for ERP and project management are increasingly used in manufacturing sector and in services sector as well. In addition, when the HEIs are involved in knowledge transfer and research activities, project management software applications facilitate working in a cooperative way.

Hereafter comprise an analysis of the most widely used software platforms for training activities, resource planning and project management.

#### 3.1. HEIs. Learning Management Systems

Learning Management Systems are also known as Course Management System (CMS), Learning Content Management System (LCMS), Virtual Learning Environment (VLE), Virtual Learning System (VLS), learning portal, or e-learning platform [7].

A classification of LMS can be established based on the working space where they are used:

- **Corporate LMS:** Corporate training is fundamentally centered on knowledge transfer and may also ask learning to help generate new knowledge that assists an organization to develop and evolve, for example, a system used for managing learners, learning programs, learner histories, and certifications.
- **Academic LMS:** Learning in academia primarily focuses on knowledge transfer and not on skills training. It also focuses on teaching and learning with a global scope, while corporate eLearning is more focused on business needs. For example, a system used for managing virtual class content, interactions, and classmates. HEIs use this type of LMS platforms.
- **Integrated LMS/LCMS:** a system that integrates learning management features with other functionality for developing, managing, and delivering learning content.



Nowadays, they are essential tools in Higher education. For example, in Spain the use of LMSs is 95% (students) and 91% (faculty) [8]. LMSs could be considered secure platforms as users must be identified by login before their use. Normally, the login is an account of the HEI. Hence, this type of communication platform is valid for communications among lecturers and students.

These platforms provide the following services [9], [10]:

- Personalized Virtual Space, with the possibility of online storage of private content and achievements (reports, badges...).
- User management, including membership of groups and permissions on resources.
- Learning resources in different formats (proprietary, pdf, docx...) such as modules of theory.
- **Communication tools such as forums, chats, videoconference rooms, etc.** This service is much related with section 2 listed communication requirements.
- Content creation tools with the possibility of allowing collaborative work. These contents can be web pages, wikis, learning modules, blogs, portfolios, documents in different formats, etc.
- Tools for collecting user opinions such as surveys and/or voting.
- Users' evaluation tools, such as, online tests, tasks and exercises, as well as, their management and communication of marks and comments to students about the performed work.
- Tracking system of the users' learning progress based on numbers of accesses, work time, competences, objectives and surpassing of events.

Taking into account previously listed services, it is obvious that LMSs provide support to meet section 2 identified communication requirements.

**Written Communication.** LMSs offer the following possibilities for written communication.

- *E-mail.* It is included in all platforms.
- *Forum.* Forum allows asynchronous communications among users via enriched text, interchange of files as attaches in messages. Additionally, an alert service is also offered.
- *Chat.* The majority of the LMSs offer this communication service, based on instant messages interchange (synchronous). This could be either native or third-party (plugin) service.
- *Others.* Several LMSs offer resources which can generate communications in an automatic way. Examples:
  - *News.* This block shows latest updates on the LMS's repository.
  - *Calendar.* Some repositories such as coursers allow adding a calendar in which appear events and key dates.





- *RSS. It is another automatic communication service. It offers the possibility to obtain information from webs (webfeed) and present it in the LMS. It also allows transforming a LMS related information in RSS format to be used in a web.*

**Live communication.** LMSs do not offer the live communication service as a native resource. This does not imply the non-support of this requirement. The majority of LMSs add live communication support adding extensions and plugins that allow integrating third-party software into LMSs. This is the natural via to add the video-conferencing and VoIP services. BigBlueButton [11] and OpenMeeting [12] are examples of open-source videoconferencing tools, but meanwhile Adobe Connect [13] and Cisco WebEx [14] are proprietary and commercial videoconferencing tools. It is important to remark that every LMS implements its own possibilities for creating extensions and plugins according to supported communication standards.

**Document sharing.** All LMSs offer the possibility to create groups of users and to share a cooperative work space in which create documents and any type of files. Normally, there is a maximum size for archives and for the space of every user. Additionally, some LMSs offer document collaborative edition, wikis, blogs, and portfolios possibilities.

**Projects management software.** This requirement is very useful for companies but not so much for HEIs. As far as authors know, only the Technical Project module allows IEEE process based project management in educational environment [15].

### 3.2. Company. Resource Planning & Project Management

The requirements defined in Section 2 are dealt with in very different ways depending of the size and culture of the company. The recent trend towards cloud computing and the subsequent bloom of applications offers a myriad of different ways of satisfying these requirements, with some traditional business software incorporating communication features of these new applications in an intent to maintain their relevance.

Three types of software products, typically found in companies, have a potential of partially fulfilling the communication requirements in the context of HEI-Business collaboration projects: Enterprise Resource Planning software, unified communication systems and project management software.

**ERPs** are typically big programs that include several modules to fulfill different requirements common to most business organizations. Their original purpose was to centralize all the information regarding production and accounting so that educated business decisions could be made. From that point, these suites have evolved to include more features, such as document repository, human

resources, sales, marketing and project management, even internal communications tools for the employees of the firm. These suites may provide specific access to external partners of the company, such as customers or suppliers, so that information exchange between the parties can be carried out without the external partners having access to the whole set of information available in the ERP.

There are plenty of different ERP solutions available in the market, both proprietary and open source. SAP [16] and Microsoft Dynamics [17] are the two major commercial general purpose alternatives, with Odoo [18] and ERPNext being the two leading open source alternatives. There are also simpler ERP suites targeted at specific industries for small and medium business, usually commercial and developed or commercialized by regional companies. Some examples are AM Hotel [19] or Winman [20].

In turn, **UCs** are suites that integrate different communication services, such as instant messaging, voice and video conferencing or desktop sharing so that a unified interface is presented to the employees. One of the key features of this software is the integration of VoIP services, so that traditional telephonic communications are also dealt with using the platform. Examples of this type of software include proprietary solutions like Elastix [21] or Cisco Spark [22] and open source alternatives like Ezuze [23].

Finally, **project management software** is the third typically available software of interest. Two major types of project management software can be distinguished: traditional project management software and team collaboration software. Traditional project management software focuses on defining the tasks that make up a project, the corresponding responsible for each of those and their time scheduling. This software does not typically provide a shared repository for documents, nor does it allow communication between the team members. The paradigmatic example of this software is Microsoft Project [24].

On the other hand, team collaboration software typically emphasizes the communication and collaboration among the members of the team, providing a centralized space to contain all the information related to the project. Some of these implement specific project management methodologies and other software products simply provide services, being fairly agnostic about how they are to be used.

Examples of this type of software are Basecamp [25], aimed at simplifying the project management tasks and communications both internal and with the clients; Trello [26], a platform



designed for keeping track of and remembering tasks and viewing previous team action and Redbooth [27], which is an app specially designed for project management activities and forming teams. Some of these applications also provide instant communication facilities, to-do lists and automatic report generation.

## 4. Platforms concerning both types of organizations

All the organizations have a clear need to ensure an effective communication among their staff members, known as internal communication, and with other organizations. To this end, a wide range of possibilities is also available. These communication platforms may include several ways of communication or can be highly specialized and limited to just one way.

Most common platforms in HEIs and Companies for live, written communication and document sharing are identified detailing their main requirements.

### 4.1. Live communication software

Project teams and groups need tools such as collaborative spaces with private, group messaging, chat and video conference capabilities. This is especially important when the staff is spread across geographical locations and the project needs updates on its progress. A great range of possibilities is available for this mode of communication. Amongst the most outstanding platforms for live communication are: Slack [29], HipChat [30], Fuze [31], Yammer [32], Skype and Skype Business [3], Google hangouts [33] and Adobe Connect [34]. Most of them offer: group and private chats, file sharing, video calling and file transfer.

**Slack** is defined as one of the favorite tools for real-time team communication. Conversations are organized on different topics referred to as *channels*. One-on-one communication or private channels, with only a few co-workers, can be created. Voice, video calling and screen and document sharing are also supported.

Another tool for real-time chat is **HipChat**. This tool not only offers group and private chats, file sharing and video calling, but also unlimited file transfer (free for 5GB storage). Because of its low price



(approximately 2 euros per months for unlimited storage) it is very attractive for small businesses and startups.

**Fuze**, defined as a Unified Communication System, provides HD video calls, video conferencing and also organizes and conducts a meeting. It has Fuze Analytics tool, which helps with analyzing enterprise processes and any kind of data.

**Yammer** describes itself as an excellent communication tool which includes single Inbox (for latest news), document collaboration, conversation space, file sharing, context-based search, etc. This tool was acquired by Microsoft in 2012 and can be easily integrated with MS products.

**Skype** is one of the greatest tool that organizations still use for live communication. Similar to prior platforms it also provides features like group chats, file sharing, free audio and video calls, free group video calling, and screen sharing. **Skype business**, which was released in 2015, provides similar services, with the addition of integration with Office apps, online meetings, scheduling meeting in Outlook.

**Google Hangouts** offers text, voice or video chats, either one-on-one or in a group. This platform replaces the previous chat capabilities built into Google+, Gmail and Google Talk so it is defined as a unified communication service.

## 4.2. Written communication software

Written communication is any transmission of messages over communication networks that brings together members of a particular organization for an open discussion on any topic. Traditionally, email has been one of the most important written communication source for organizations. Now, with all the different communication tools available, the number of emails sent is gradually decreasing. Some of these tools are:

- Live chats. They are used for quick responses allowing instant communication and collaboration among co-workers. Most of the former software platforms, for live communication, include this functionality.
- Project sites. It is a powerful communication tool when a group or a team has to collaborate on a project. This tool has traditionally been used to communicate,



collaborate and share resources in companies and now is also used in HEIs. This tool was described in Section 3.2.

- Message boards. They are mainly used for seeking advice about a certain work task or other work-related questions. This tool can manage internal communications between employees or can be locked down so that only management is able to post messages to staff.
- Discussions forum. It can help to enhance effective communication in organizations by providing a platform for team collaboration, conversations and discussions. In an email format, it is difficult to get that “conversation” feel but, with this tool, employees can contribute in one or several discussion topics.

Most of the platforms, described in the former Subsection, include some of these written communication tools.

### 4.3. Document sharing software

Applications with this functionality (also known as Document Management, DM, software) can be used to share files (with a drag and drop function) and to write down documents in a collaborative way (with capture notes and comments function). As in the preceding platforms, there is a wide range of DM software. Amongst the most notable DM software, with free version available, are the following: Dropbox Business [35], Evernote Business [36], Google Drive for Work [37], Microsoft OneDrive for Business [38] and Editors' Choice Zoho Docs Standard [39].

Most of them include similar functionalities but differ on cloud storage capacity, number of users and available features. Normally, it is required to pay a separate subscription to increase the capacity, number of users or to include features such as edit documents on line, email, project management and version history<sup>3</sup>. Another interesting feature is to include the option to share files and interact with external users and Google Drive for Work, OneDrive for Business, and Zoho Docs Standard include it.

Some DM systems include password-protect particular files, which adds an extra level of security and limits who can view them, even if they have the URL. Mobile apps for Android, iOS, and Windows tablets and phones are also offered. This enables mobile access regardless of the device.

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<sup>3</sup> Version history allows to track who has edited a file and to revert to an earlier versión.



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## 5. Assessment of Internet based platforms for communication

This section deals with the assessment of 15 Internet based platforms for communication. Platforms are divided into three categories: (1) concerning HEIs, (2) concerning companies and (3) concerning both types of organizations. The assessment is made according to the requirements defined in Section 2.

### 5.1. Platforms concerning HEIs

There are different distributions of the LMS market according to the considered world region [40]. Fig. 2 lists the regions on the basis of annual income due to products and e-learning services. Note that North America clearly stands out with 50% of the income. Asia and Oceania rank in the second with the 23 percentage of the capital income. In the third position is Western Europe with the 17%, which is far followed by Latin America and Eastern Europe.

Taking into account the annual income and the population of the regional focus, this work is going to be centered on North America (US and Canada) and Europe. Asia and Oceania, despite having 23% on the annual income, are not going to be studied because they are non-uniform regions [40]. Additionally Asian population is most used to manage video sharing than LMS platforms [41].

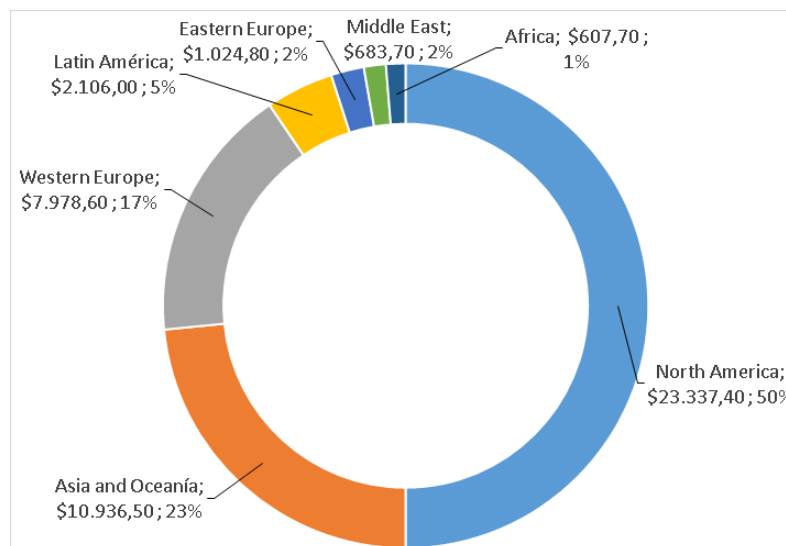


Fig. 2. Annual income by products and e-learning services in the world regions



The LMS market share across North America is presented in [42]. The LMS as a primary system of 3676 HEIs institutions have been checked. The graph illustrated in Fig. 3 summarizes which are the most spread platforms.

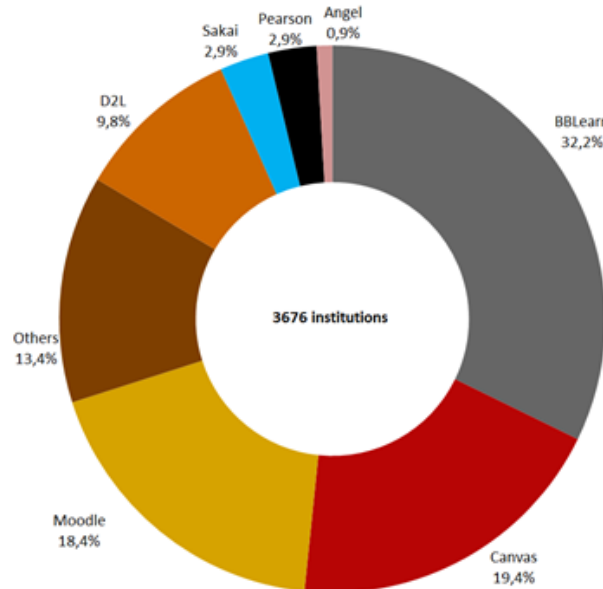


Fig. 3. : Percentage of American HEI Institutions using each LMS as Primary System

**BlackBoard** [43] is the platform per excellence most used as a primary LMS in American HEIs ( with 32.2 %). **Canvas** [44], a relative new LMS, ranks in the second with 19.4%. Few years ago **Moodle** [45] was in this position but this LMS has decreased to the third rank position with 18.4 % of use. Other platforms to be also considered are **D2L (Desire to Learn)** [46] and **Sakai** [47] with 9.8 % and 2.9 %, respectively.

With respect to the most thickly spread LMSs in Europe, [50] performs a complete analysis. This report checks the primary systems of 1604 Institutions. Fig. 4 illustrates which are the most used LMS platforms. In Europe, **Moodle** is per excellence the most used primary LMS, in fact, the 65 % of the 1604 institutions use it. **BlackBoard Learn** is in the second position, the 12 % of HEIs use it. This is followed far by **Ilias** [48] that is used by 4 %. Other important LMSs are **Sakai** and **Itslearning** [49] used by 3% and 2% of the consulted institutions, respectively.



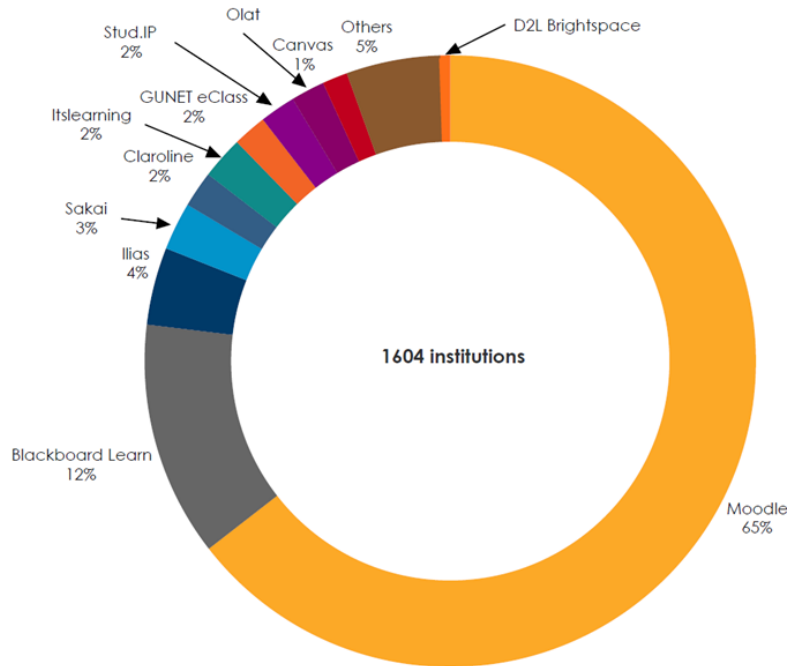


Fig. 4. Percentage of European HEI Institutions using each LMS as Primary System [47]

Hence, taking into account [42] and [50] Fig. 5 illustrates the selected platforms to analyze if they fulfil the communication requirements.



Fig. 5. Selected LMS platforms

### Moodle



URL: <https://moodle.org/?lang=en>; <https://moodle.net/>



Moodle has been the LMS market leader since the last decade. Currently, despite being the first in the rank of number on installations in the world, it is living a deceleration in the new users. In fact, in 2012 the 80% of the new users selected Moodle, meanwhile in 2016 this percentage decreased till 53.

This is an open-source LMS with a very large and active community. It supports Written Communication requirements and document sharing natively. Additionally, thanks to its large number



of plug-ins (1356) [51], which facilitate the integration possibility with other systems, supports live communication requirements. In fact, plugins developed by third-party such as BigBlueButton [11], Blackboard Collaborate [52], Live-School [53], OpenMeetings [12], Vitero [54], WebEx [14], WebRTC Experiments [55] allow the videoconferences support. Finally, according to Projects management software, the “Technical Project” plugin [15] can be used to provide a complete Project driven tool for real project use.

It also supports LTI (Learning Tools Interoperability) [56] and xAPI (Experience API) [57], two standards that allow integrating external tools in the LMS.

## Blackboard learn



URL: <http://www.blackboard.com/learning-management-system/blackboard-learn.aspx>

This is the leader in North American LMS market and it ranks in the second position in Europe. Blackboard is the most used proprietary LMS in the world. It offers three solutions with flexible delivery options, including Software-as-a-Service (SaaS), self-hosted, and Blackboard hosted:

- *Learning core*: Learning delivery
- *Learning Essentials*: Learning and collaboration (it includes video conference software).
- *Learning2 NET+*: Learning, collaboration and Analytics & Services

It supports *Written Communication* requirements and *document sharing* natively. Blackboard Collaborate module provides support to live communication requirements. Note that *Learning core* does not allow videoconferencing.

Blackboard learn does not offer *Projects management software*.

Finally, the integration of external tools in this LMS platform can be performed only via LTI.



Blackboard



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## Canvas



URL: <https://www.canvaslms.com/>



canvas

Canvas platform is the one LMS with the greatest future. Currently, the 77 percentage of North American new users select Canvas as LMS platform. In Europe this percentage is 33.

An open source and cloud-computing platform. It supports *Written Communication* requirements natively. It also supports all *Document sharing* requirements except Wiki and Blog. This LMS platform offers web conferencing with Big Blue Button.

Canvas does not offer *Projects management software*.

Finally, the integration with external tools in this LMS platform can be performed via LTI and its ecosystem [58].

## D2L Brightspace



URL: <https://www.d2l.com>



D2L also known as Desire2Learn ranks in fourth position in North American LMS market. It is a proprietary LMS.

It supports *Written Communication* requirements natively. It also supports all *Document sharing* requirements except Wiki and Blog. This LMS platform offers *web conferencing* by Virtual classroom, an external tool developed by YouseeU [59].

D2L does not offer *Projects management software*.

Finally, the integration with external tools in this LMS platform can be performed via LTI.

## Sakai



URL: <https://sakaiproject.org/>



Sakai offers LMS's typical functionalities [60] It is an open source LMS which can be used in Host yourself or cloud-hosted way. There is an open community that provides support. So, it is easy to extend Sakai using community-developed tools or by integrating learning tools of choice using common industry standards [61].



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It supports *Written Communication* requirements natively. It also supports all *Document sharing* requirements except Portfolio and Blog. This LMS platform offers live communication requirements support by third-party developed software modules: BigBlueButton [11] , Adobe Connect [13], Open Meetings [12], Kaltura [62].

Sakai does not offer *Projects management software*.

Finally, the integration with external tools in this LMS platform can be performed via LTI and xAPI standards.

Ilias



URL: <https://www.ilias.de/>



Ilias is other open source LMS which is very used in Europe. It offers LMS's typical functionalities and adds additional functionalities through plugins.

It supports *Written Communication* and *document sharing* requirements natively. This LMS platform offers live communication requirements support by third-party developed software modules: BigBlueButton [11], Adobe Connect [13], Open Meetings [12]. Vitero [54]and SABA [63] plugins offers virtual classroom support.

Ilias does not offer *Projects management software*.

Finally, the integration with external tools in this LMS platform can be performed via LTI Standard. Currently the support by xAPI standard is under development.

ItsLearning



URL: <https://itslearning.com/global/>



ItsLearning is an open-source LMS very used in Nordic Countries.

It supports *Written Communication* requirements natively. It also supports all *Document sharing* requirements except Wiki, portfolio and Blog. This LMS platform offers live communication



requirements support by third-party developed software modules: Adobe Connect [13], Zoom [64] and Kaltura [62]. Note that in this case, these modules are integrated as external tools (API of LTI).

ItsLearning does not offer *Projects management software*.

Finally, the integration with external tools in this LMS platform can be performed via LTI Standard.

Table 1 summarizes how the studied LMSs platforms fulfil the identified communication requirements. Taking into account this information the much suitable LMS is **Moodle**.

Table 1. List of LMSs Platforms and Communication Requirements

<b>Written Communication properties</b>							
E-mail	✓	✓	✓	✓	✓	✓	✓
Forum	✓	✓	✓	✓	✓	✓	✓
Chat	✓	✓	✓	✓	✓	✓	✓
Other	✓	✓	✓	✓	✓	✓	✓
<b>Live Communication</b>							
Video	✓	✓	✓	✓	✓	✓	✓
Voice	✓	✓	✓	✓	✓	✓	✓
Video Conf.	✓	✓	✓	✓	✓	✓	✓
<b>Document Sharing</b>							
V. space	✓	✓	✓	✓	✓	✓	✓
Group	✓	✓	✓	✓	✓	✓	✓
Wiki	✓	✓	✗	✗	✓	✓	✗
Doc	✓	✓	✓	✓	✓	✓	✓
Portfolio	✓	✓	✓	✓	✗	✓	✗
Blog	✓	✓	✗	✗	✗	✓	✗
<b>Project support</b>							
	Limited using plugin	✗	✗	✗	✗	✗	✗
<b>External Tools Integration</b>							
LTI	✓	✓	✓	✓	✓	✓	✓
Plugins	✓	✗	✗	✗	✓	✓	✗
xAPI	✓	✗	✓	✗	✓	✗ Developing	✗
Other	WebServices		Open API	API	WebServices	WebServices	WebServices API



## 5.2. Platforms concerning Companies

The selection of platforms for further analysis has been based on the representativeness and number of users of the product for the different categories considered in Section 3.2.

### Basecamp

URL: <https://basecamp.com/>



Basecamp is a software specifically designed for project management and team collaboration. It centralizes all the information regarding the project in a single place, providing an easy overview of the state of the project, pending tasks, communication history, and document repository.

The main features of the software are:

- *Instant messaging tool*: provides a way to send instant messages and documents to team members.
- *Message board*: this is a discussion board that replaces email threads.
- *To-do lists*: allows to define and assign tasks to team members, set due dates and add notes on the tasks.
- *Schedule*: a calendar for setting meetings and important milestones of the project.
- *Docs & files*: centralized repository for sharing files and documents. It does not allow online editing of the documents.
- *Automatic Check-ins*: automatic questions to keep track of the status of the project.

This software is a suite specifically designed for team collaboration, so it covers all the requirements of the project but the video conferencing. It is provided as a paid (100 euros / month) cloud service, so users just need to create an account and use a web browser.

### Odoo

URL: <https://www.odoo.com/>



Odoo is an open source ERP that incorporates many different modules for different necessities of businesses, such as CRM (Customer Relation Management), accounting, human resources management and inventory control. The relevant modules for the project are the project management, written communications and document repository modules, which allow to cover all the requirements except for live communications.



The project management tool implements a Kanban board where tasks can be assigned to people and their status can be tracked. This tool is highly intertwined with the written communication app, which allows to send instant messages, as well as asynchronous messages. The software also sends automatic messages when tasks change their state to relevant stakeholders. In turn, the document repository module allows to upload documents related to the project so that they are centralized and available to each member of the team. This module, however, is not as user friendly as the other two.

This software fulfills most of the communication requirements, however, it is a full ERP software, which implies that includes many other features not required for the project and provides a more complex interface to the user. If the software is already available, it could be used for the project. There are, however, alternative software suites that provide the features of interest, such as Basecamp or Trello, that do not convey the overhead of the additional complexity of a full ERP system.

## Elastix

URL: <https://www.elastix.org/>



Elastix is a software-based PBX (Private Branch Exchange) based on Debian and 3CX that incorporates clients for desktops and smartphones and allows web conferencing via WebRTC, providing a basic Unified Communications solution. The software integrates chat, fax and voice to mail and allows its integration with CRM (Customer Relation Management Software).

From the HEI-Company point of view, this software provides solutions just for the live communication requirements, being an alternative solution to Google Hangouts, Skype and Adobe Connect Pro. However, one of the main strengths of tool is the integration of VoIP into the software suite, a feature that is unlikely to be useful.

## Cisco Spark

URL: <https://www.ciscospark.com>



Cisco Spark is a Unified Communication suite that provides solutions for written and live communications, as well as document sharing. Its main features include:

- **Meetings:** provides a means for live communication, with the capability of sharing the screen and using virtual blackboards to sketch ideas and discuss.



- **Messaging:** provides a location for storing messages and files associated to projects. This feature is similar to the ones provided by general purpose project management and collaboration software, such as BaseCamp and Trello.

From the HEI-Company point of view, this software provides solutions for several of the requirements, being an alternative solution to Google Hangouts, Skype and Adobe Connect Pro and to file storage and written communication tools. Upsides of this suite are the screen sharing and blackboard feature, which are useful tools for the virtual conferences. However, one of the main strengths of tool is the integration of VoIP into the software suite, a feature that is unlikely to be useful for the project.

From the platform summary, shown in Table 2, **Basecamp**, or other alternative software with similar characteristics, such as Trello, are a strong candidate for HEIBus. The only really weak-point is that this platform does not fulfill with the live communication requirement. To address this gap, live communication software, such as those ones analyzed in Subsection 4.1, could be included.

Table 2. List of Companies/Platforms and Communication Requirements

<b>Written Communication properties</b>				
E-mail	✓	✓	✓	✓
Forum	✓	✓	✗	✓
Chat	✓	✓	✓	✓
Other	✓	✓	✓	✓
<b>Live Communication</b>				
Video	✗	✗	✓	✓
Voice	✗	✗	✓	✓
Video Conf.	✗	✗	✓	✓
<b>Document sharing</b>				
V. space	✓	✓	✓	✓
Group	✓	✓	✓	✓
Wiki	✓	✓	✗	✗
Doc	✓	✓	✗	✓
Portfolio	✓	✓	✗	✗
Blog	✓	✓	✗	✗
<b>Project support</b>				
	✓	✓	✗	✗
<b>External Tools Integration</b>				





<b>LTI</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Plugins</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>xAPI</b>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>Other</b>				

### 5.3. Platforms concerning both types of organizations

The platforms presented in Section 4 are of particular interest because are used and known by both organizations. As a general rule, several types of software are used together, as all the desired requirements are not included in one single platform. There is a multitude of options for live communication, written or document sharing. For this reason, the four platforms chosen for this analysis have to include as much requirements as possible.

#### Fuze

URL: <https://www.fuze.com/>



It is considered as an unified platform as it includes voice, video and messaging services. Fuze can integrate with Microsoft Outlook, Lync, Google Calendar, Box and some other apps. It also offers implementation services to ensure that the solution incorporates the needed requirements. Among the offered products are the following:

- HD Audio and Video conferencing.
- Analytic platform that capture and help evaluate usage trends, workforce performance, customer engagement, and enterprise processes.
- Integration with some of the most popular business applications: Outlook, Gmail, skype for business, google calendar, etc.

#### Google Suite

URL: <https://gsuite.google.com/>



G Suite is a brand of cloud computing, collaboration tools and products developed by Google. It comprises Gmail, Hangouts, Calendar, and Google+ for communication and Drive among other applications. Including these applications document sharing and live and written communication



requirements are available. It also provides a secure and trusted infrastructure offering software tools for: Data Loss Prevention<sup>4</sup>, identity-aware proxy<sup>5</sup>, security key enforcement<sup>6</sup>.

## Skype / Skype Business

URL: <https://www.skype.com/en/business/>



Both are unified communications tools which provide video conference, messaging, meetings and screen sharing. Although they share a common name there are significant variations in their features and functions. Skype can be used only for small organizations or startups as it does not have all the functionality of an enterprise phone system. Skype for Business has meeting options and controls not included in Skype. As an example, it allows to record meetings and gives special meeting controls for presenters and a meeting lobby for attendees. In addition, Skype for Business gives enterprise-grade security allowing to manage employee accounts.

## Adobe Connect

URL: <http://www.adobe.com/products/adobeconnect.html>



It is a web conferencing software service which offers online meetings, webinars and virtual classrooms. The main features for these services are:

- Mobile access for IOS and Android
- Participants enter free with no downloads.
- Quickly create additional online meeting rooms with templates
- Securely store files, documents, layouts and notes
- Record, edit and republish meetings.
- Highly secure communication.
- Can be integrated in enterprise UC systems.
- Can be integrated in a learning management system.

Table 3 shows the communication requirements for the assessed platforms. Google Suite, as it includes a wide range of applications, can meet our needs for communication. Because of security issues

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<sup>4</sup> DLP is an application that classify and redact sensitive data

<sup>5</sup> Application to control access to the cloud applications

<sup>6</sup> 2-step verification with a security key uses cryptography to provide two-way verification

and its possibility of integration into UC and LMS, Adobe Connect can be an interesting alternative for video conferences. Indeed this system is being used in HEIBus and in some of the project partners for video conferencing. In this case, two

Table 3. List of Platforms and Communication Requirements

				
<b>Written Communication properties</b>				
E-mail	✓	✓	✗	✗
Forum	✓	✗	✗	✗
Chat	✓	✓	✓	✓
Other	✓	✓	✓	✓
<b>Live Communication</b>				
Video	✓	✓	✓	✓
Voice	✓	✓	✓	✓
Video Conf.	✓	✓	✓	✓
<b>Document sharing</b>				
V. space	✗	✓	✗	✗
Group	✗	✓	✓	✓
Wiki	✗	✗	✗	✗
Doc	✓	✓	✓	✓
Portfolio	✗	✗	✗	✗
Blog	✗	✓	✗	✗
<b>Project support</b>				
	✓	✓	✗	✗
<b>External Tools Integration</b>				
LTI	✗	✗	✗	✓
Plugins	✓	✗	✗	✓
xAPI	✓	✗	✗	✓
Other		APIs		WebServices



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## 6. Conclusions

Today, there is a wide range of possibilities for communications within and among organizations. A plethora of solutions is available for live and written communications, document management, learning management systems, resources planning and project management. Some of these applications are proprietary or open source with the option to increase or improving their functionalities by paying licenses.

Communication platforms context and form can vary depending upon the needs and prerequisites of the organizations. As commented above, LMSs are used for learning activities which are one of the primary purposes of HEIs and training companies. Since LMS can include additional functionalities, which increase their communication capabilities, the most widespread in the world have been described and analyzed.

As result of this review, Moodle has been identified as an interesting alternative for HEIBus communications as it includes all the desired requirements. However, this cannot be an attractive option for HEIs with a different LMS or for companies who use their proprietary communication platform.

With regard to companies, software for resources planning and project management have been assesses. Here, the conclusion is that BaseCamp is a strong candidate for HEIBus. The only really weak-point is that this platform does not fulfill with the live communication requirement. So this platform can be used in conjunction with Adobe Connect, the current videoconferencing platform of HEIBus.

As the new trend is to use one single platform with all the required services, applications well known to both the academic and company sectors have been studied. In this case, two alternatives have been encountered. Google Suite, which includes a wide range of services, fulfils the communication necessities for HEIBus. The other option is Adobe Connect as one of the best alternatives for virtual conferencing because of its security issues and its possibilities of integration, not only in LMSs, but also in UCs.



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