



Co-funded by the
Erasmus+ Programme
of the European Union



Technical Documentation: RLMS WebLab- Deusto <General> v 2.2

Date
2019

**Platform Integration of
Laboratories based on the
Architecture of visiR – PILAR**

**PROJECT
Number:2016-1-
ES01-KA203-
025327 Erasmus+
- Strategic
Partnerships for
Higher Education**

Authors:

*Pablo Orduña, Labsland & DeustoTech
Unai Hernández, Javier García-Zubía, UDEUSTO
Félix García Manuel Castro, UNED*





Co-funded by the
Erasmus+ Programme
of the European Union

2016-1-ES01-KA203-025327
Erasmus+ - Strategic Partnerships for Higher Education





Table of contents

1. Summary.....	9
2. Screenshots.....	9
Server tester	13
3. Federation.....	15
3.1. See it in action.....	15
3.2. Features	16
3.2.1. Transitivity.....	16
3.2.2. Federated load balance	17
3.3. Examples	17
4. Technical description	19
4.1. Architecture	19
4.2. Technologies	20
4.3. Communications	20



Co-funded by the
Erasmus+ Programme
of the European Union

2016-1-ES01-KA203-025327
Erasmus+ - Strategic Partnerships for Higher Education



List of Acronyms

LDAP	Lightweight Directory Access Protocol
PILAR	Platform Integration of Laboratories based on the Architecture of visIR
RLMS	Remote Laboratory Management System
SCORM	Shareable Content Object Reference Model



List of Figures

Figure 1: WebLab-Deusto Login page.	9
Figure 2: fpga remote laboratory interface in WebLab-Deusto.....	10
Figure 3: WebLab-Deusto experiments panel.....	10
Figure 4: WebLab-Deusto usage analysis.....	11
Figure 5: WebLab-Deusto usage patterns.....	12
Figure 6: WebLab-Deusto server tester.	13
Figure 7: federation of remote laboratories.....	15
Figure 8: Transitive federation.	16
Figure 9: Distributed load balance federation.....	17
Figure 10: Distributed architecture of WebLab-Deusto.....	19



1. Summary

WebLab-Deusto is an Open Source (BSD 2-clause license) remote laboratory management system developed in the University of Deusto. A remote laboratory is a software and hardware solution that enables students to access equipment which is physically located in a university, secondary school or research centre. There are many types of remote laboratories (for physics, chemistry, electronics...). What WebLab-Deusto does is:

1. provide a set of APIs to develop new remote laboratories.
2. maintain remote laboratories developed on top of WebLab-Deusto: manage users, permissions, user tracking, scheduling, etc.
3. share remote laboratories developed on top of WebLab-Deusto: let other universities or secondary schools use your laboratories.
4. use remote laboratories provided by other universities (such as the University of Deusto).

If you want to see examples of running laboratories, try the demo version at:

<https://weblab.deusto.es/weblab/>

2. Screenshots

<https://weblab.deusto.es/weblab/login>

weblabdeusto

Deusto
Universidad de Deusto
Deustuko Unibertsitatea
University of Deusto

Log in

Username
Username

Password
Password

Log in »

Some experiments allow guest access

Log in as guest

WebLab-Deusto

WebLab-Deusto is a Remote Laboratory. Students access experiments physically located in the university, having the same experience as if in traditional hands-on-lab sessions. There is more information regarding the project in the WebLab-Deusto Research Group site.

Support

For any technical issue you may find, please contact us at weblab@deusto.es

Demo

If you do not have a user account, you can try our demo experiments with the username **demo** and the password **demo**.

Open Source

WebLab-Deusto is Open Source Software, and it is available in <https://github.com/weblabdeusto/weblabdeusto/>

Figure 1: WebLab-Deusto Login page.

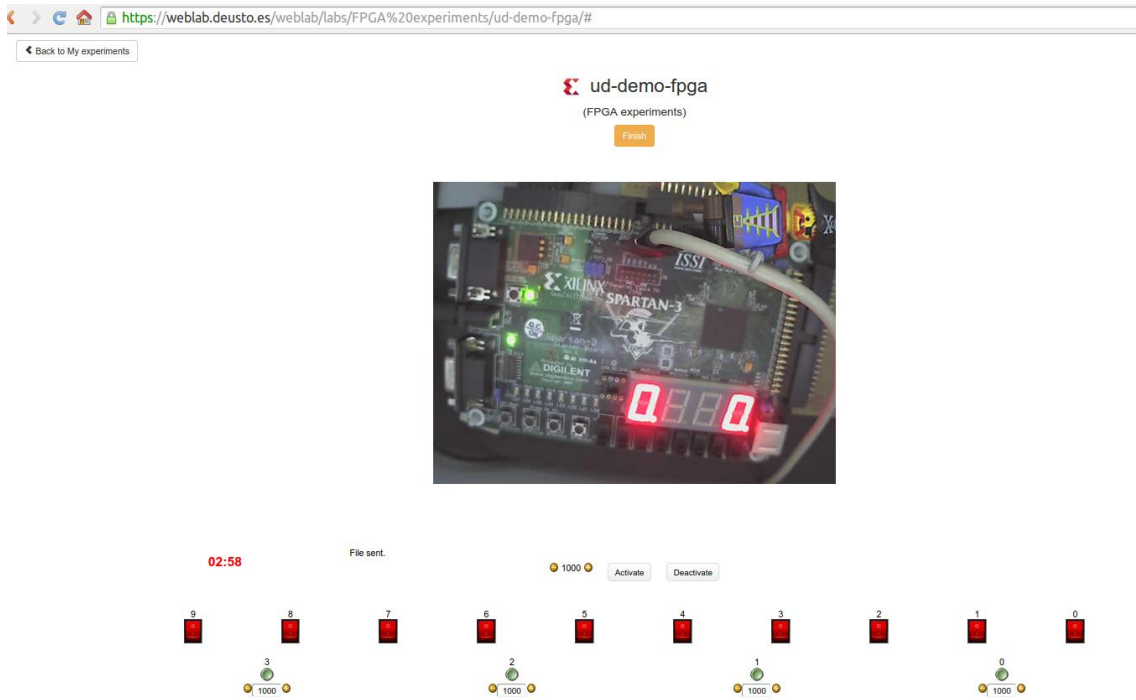


Figure 2: fpga remote laboratory interface in WebLab-Deusto.

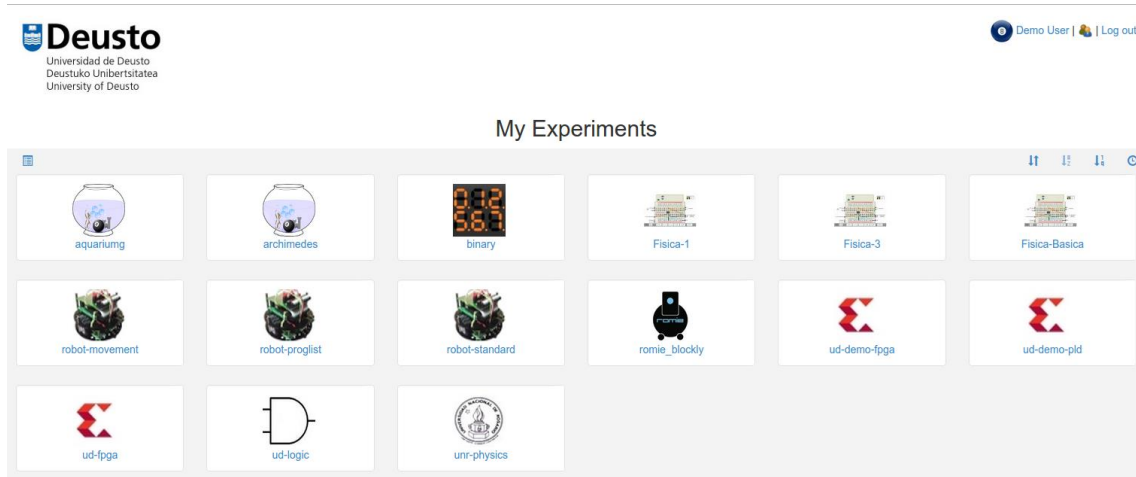


Figure 3: WebLab-Deusto experiments panel.

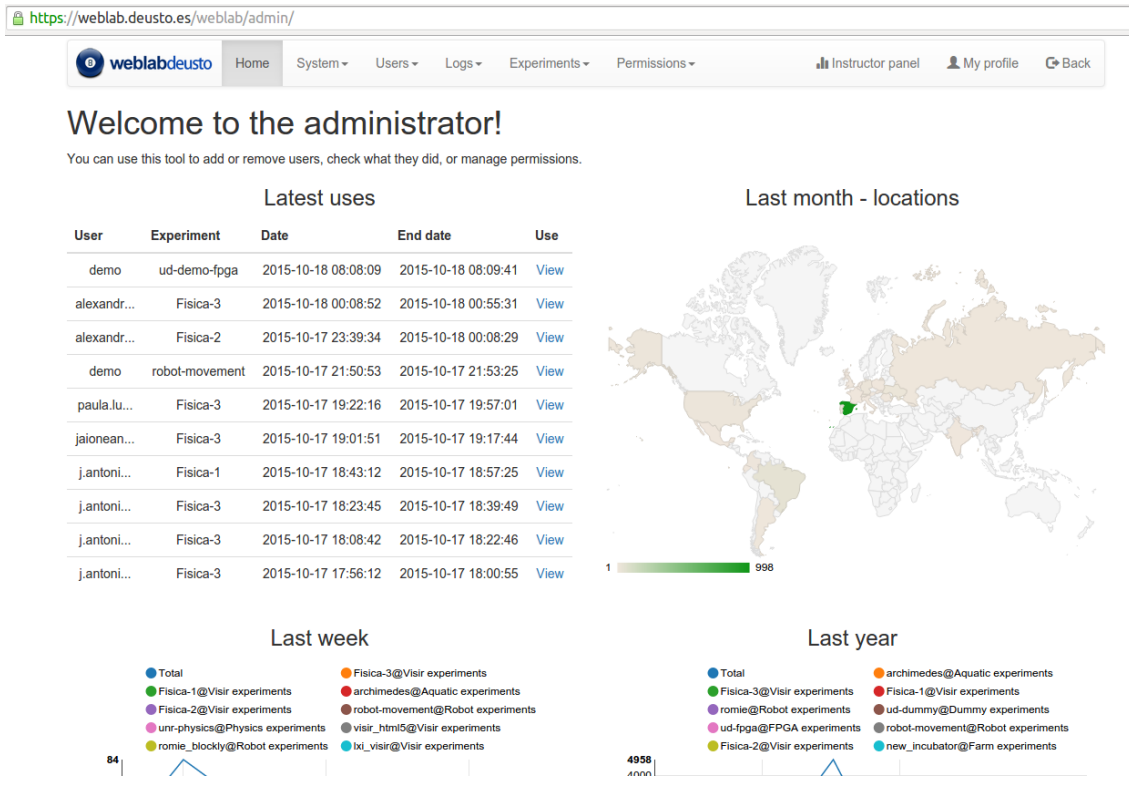


Figure 1: Administrator panel in WebLab-Deusto.

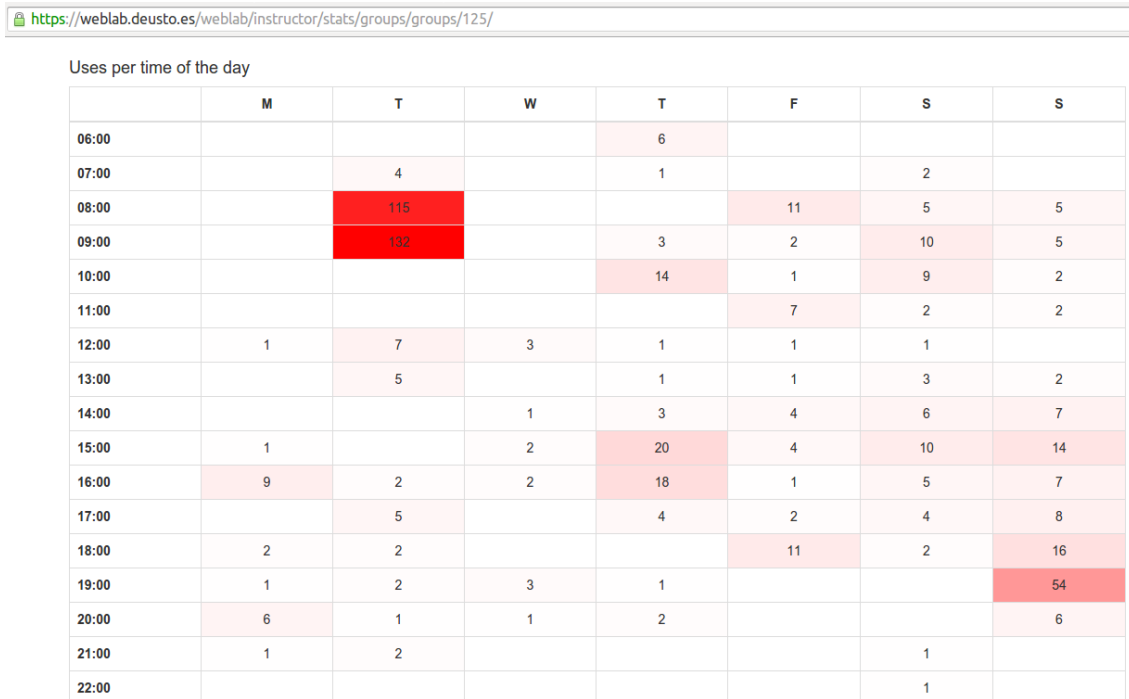


Figure 4: WebLab-Deusto usage analysis.



<https://weblab.deusto.es/weblab/instructor/stats/groups/groups/125/>

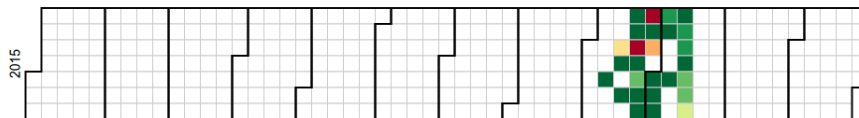
• ud-pld@PLD experiments

Uses

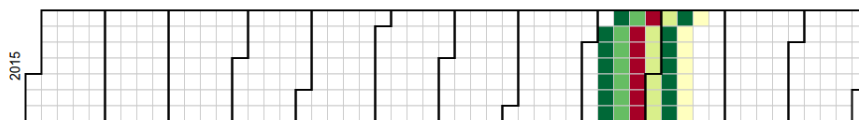
Property	Value
Users:	58
Total uses	618 uses (10.66 uses per user)
Total time	887249.84 seconds - over 10 days; 15297.41 seconds per user

Usage patterns

Uses per day



Uses per week



Average time per day

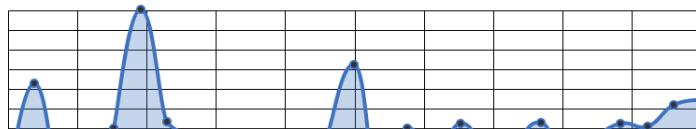


Figure 5: WebLab-Deusto usage patterns.

3. Federation

WebLab-Deusto natively supports federating remote laboratories. This means that if two universities install WebLab-Deusto, any of the systems will be able to consume laboratories provided by the other university.

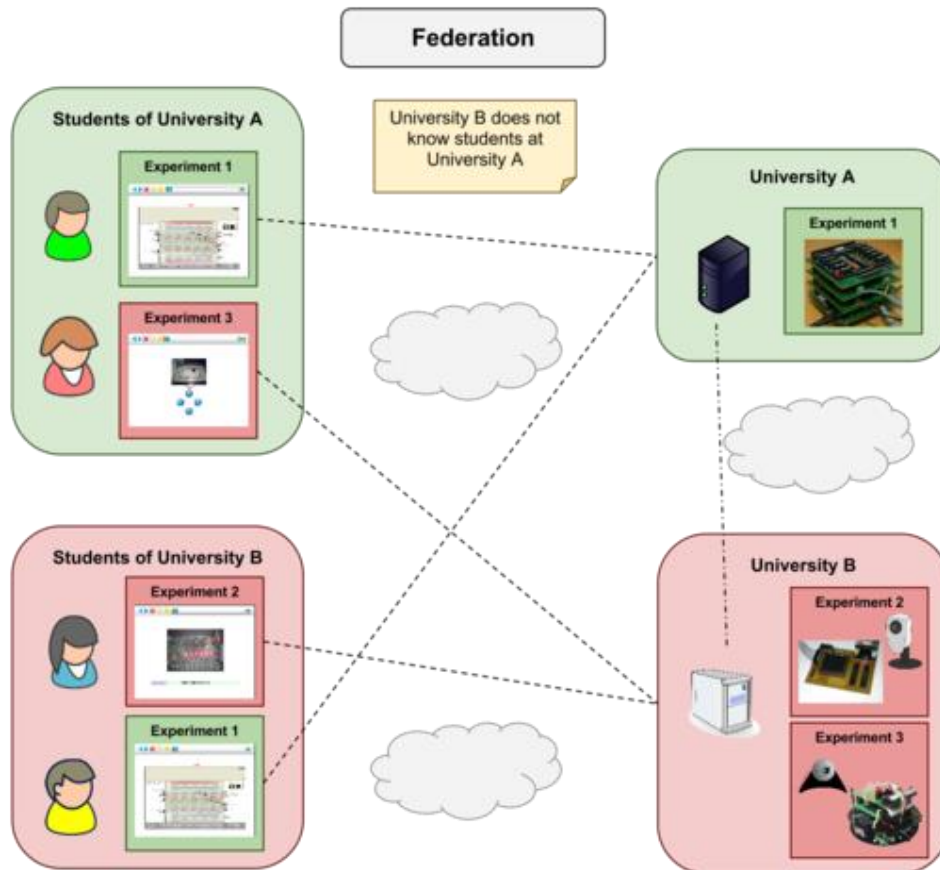


Figure 7: federation of remote laboratories.

3.1. See it in action

When you run the WebLab-Deusto demo, there is a particular laboratory called *submarine*. If you run it, you'll see that whenever it is reserved, the web page redirects you to other domain (from www.weblab.deusto.es to fishtank.weblab.deusto.es). Internally, there are two independent WebLab-Deusto deployments there: one is the main system at Deusto, the other is a constrained system running in an ARM device (called IGEPv2). The first one (in this case, the **consumer**) is telling the second one (**provider**), "Hi, I'm 'deusto', and I want to use this laboratory that I'm granted for 250 seconds for a local user here called 'demo'". Later, the consumer will be requesting the provider for the user tracking, so the administrators of WebLab-Deusto will be able to track the 'demo' user.

Other way to test it is by [deploying WebLab-Deusto](#) (the basic default installation is a straightforward process). By default, the installation is a consumer of a federated system which is the main server of WebLab-Deusto. By adding different users and granting them permissions



to the robots lab, and after accessing the lab with this user you'll be able to see in the administrator panel that it has been used.

Finally, you can also see the federation video.

3.2. Features

Two main features are provided by WebLab-Deusto:

3.2.1. Transitivity

If you're a provider of a laboratory, your consumers may technically re-share this laboratory. Basically, this enables subcontracting laboratories. See the transitive federation video.

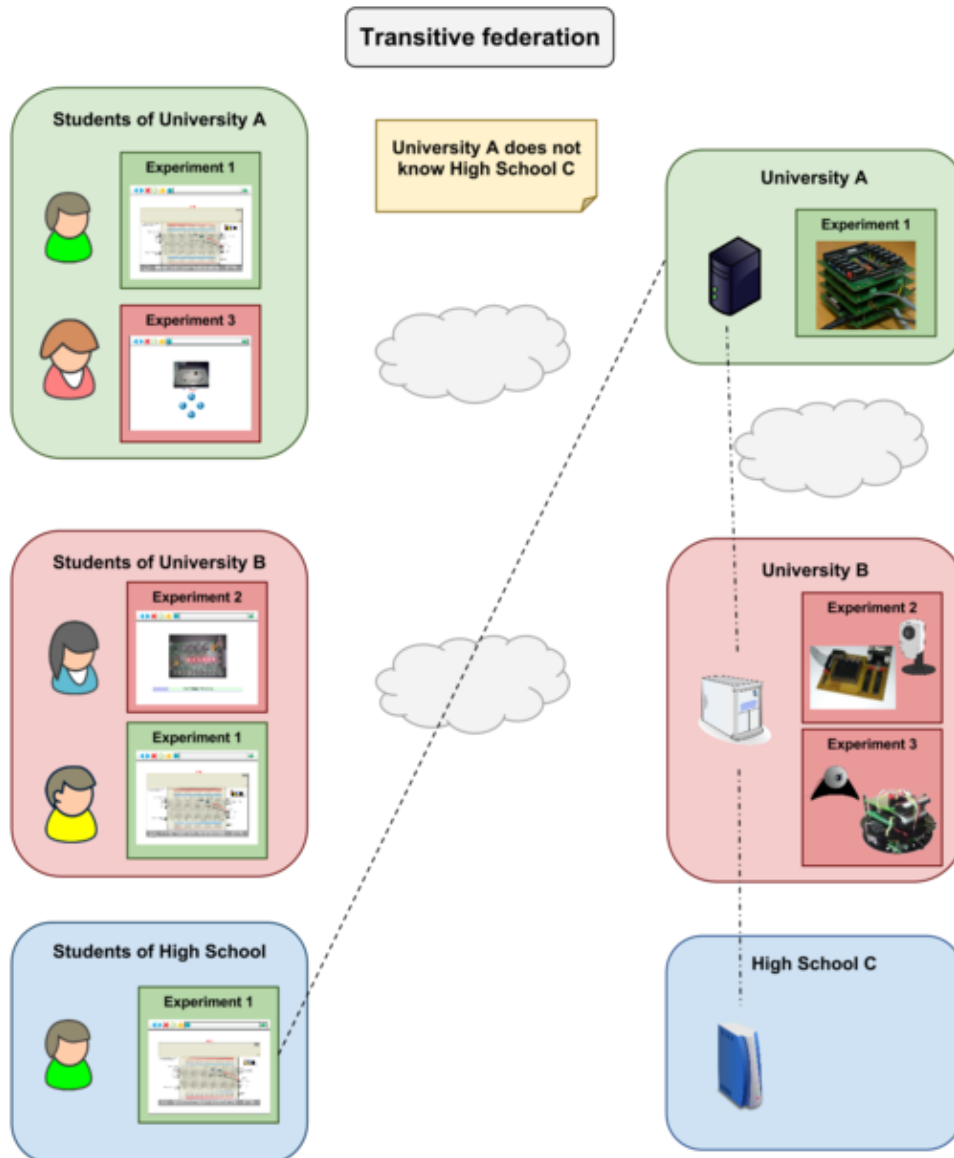


Figure 8: Transitive federation.



3.2.2. Federated load balance

If there are multiple providers of a copy of a laboratory, you can balance the load of users among them automatically.

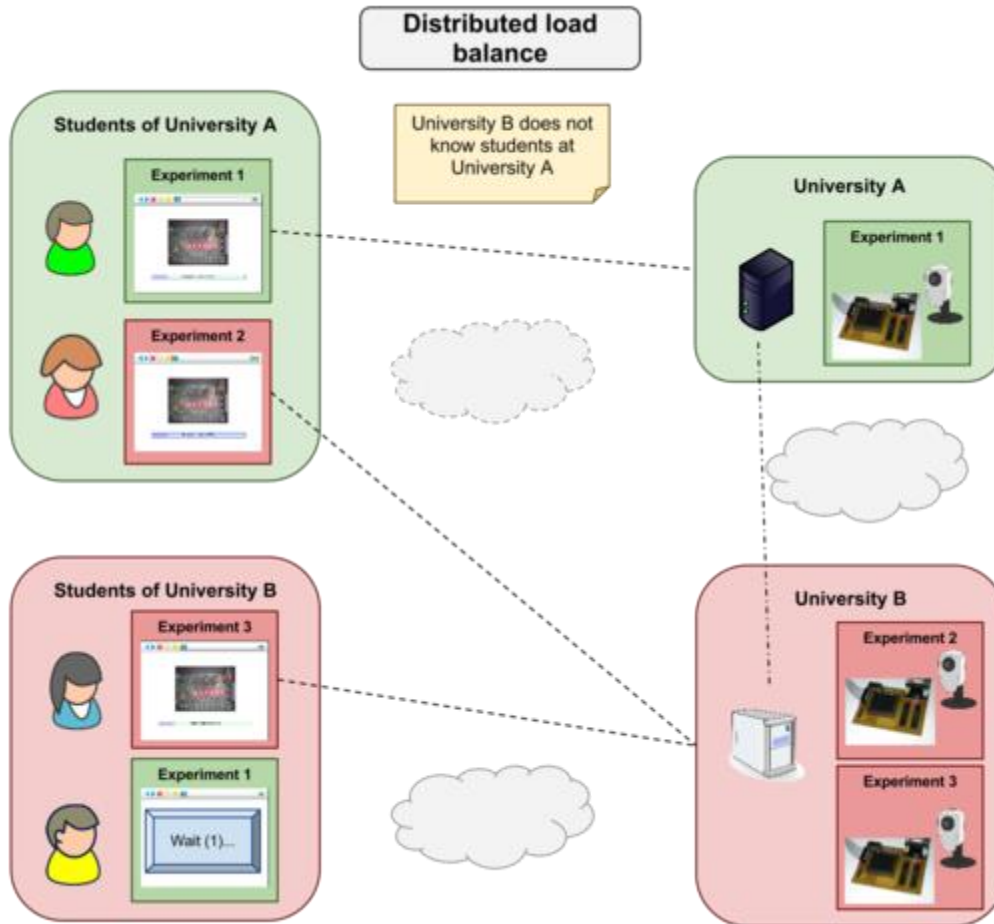


Figure 9: Distributed load balance federation.

3.3. Examples

Other WebLab-Deusto deployments (in addition to the one in University of Deusto):

- LabsLand: <https://weblab.labsland.com>
- UNED: <https://weblab.ieec.uned.es/>
- HBRS: <https://fpga-vision-lab.h-brs.de/weblab/>
- Slovenská technická univerzita: <http://weblab.chtf.stuba.sk/>
- UPNA: <https://weblab.unavarra.es/>
- TU-Dortmund: <https://weblab.zhb.tu-dortmund.de>
- FH Aachen: <https://weblab.fh-aachen.de>
- UGA: <https://remotelab.engr.uga.edu>



- ISEP: <https://openlabs.isep.ipp.pt/weblab/>
- UNED (Costa Rica): <https://labremoto.uned.ac.cr/weblab/>
- UNAD: <https://lab-remoto-etr.unad.edu.co/weblab/>
- UNIFESP: <https://weblab.unifesp.br/weblab/>
- UPNA: <https://weblab.unavarra.es/weblab/>
- UFH: <https://weblab.ufh.ac.za/weblab/>
- Université Abdelhamid Ibn Badis Mostaganem: <https://weblabdeusto.leog.univ-mosta.dz/weblab/>

4. Technical description

This section describes the internals of a single WebLab-Deusto deployment. However, the architecture is enriched supporting federation. Go to the [federation](#) section for further information.

4.1. Architecture

Locally, WebLab-Deusto is based on the distributed architecture shown in following diagram:

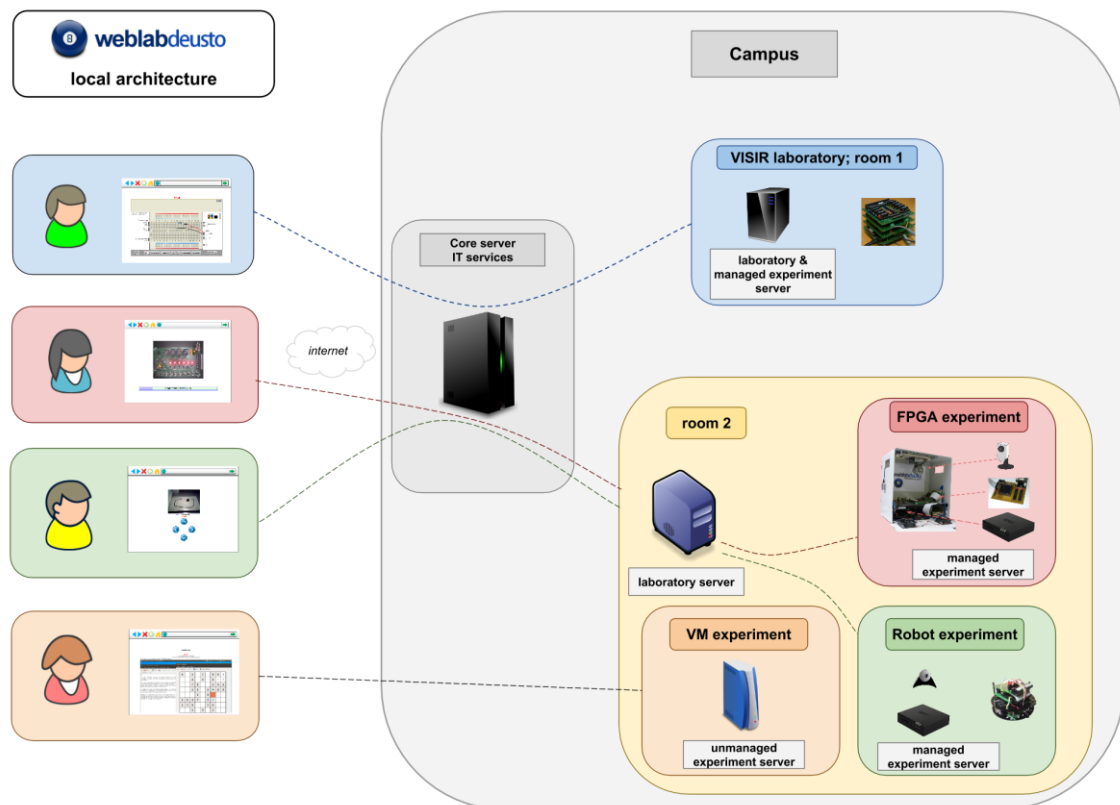


Figure 10: Distributed architecture of WebLab-Deusto.

In this architecture, clients connect to the core servers, using commonly HTTP with JSON. These servers manage the authentication, authorization, user tracking, federation (sharing) and scheduling. From there, the system forwards requests to the laboratory servers, which forward them to the final experiments. One exception are the unmanaged laboratories (such as Remote Panels, Virtual Machines or so), where students directly connect to the final host directly (and therefore user tracking is lost).

As detailed later, the communications however enable that all these servers are spread in different machines in a network, or they can all be running on the same machine or even in the same process. For instance, the login server and the core server are usually always in the same process, while the laboratory server may be in other computer and the experiment server could be in the same process as the laboratory server. It just depends on the deployment desired and the required latency.



4.2. Technologies

WebLab-Deusto is developed in Python and using Open Source technologies (MySQL or SQLite, Redis, etc.), but we provide multiple APIs for developing laboratories in different languages. The user interface is developed in HTML, but it supports labs in other legacy technologies.

The server uses an ORM called SQLAlchemy. In theory, WebLab-Deusto should be independent of the database provider, but it has only been tested with MySQL and SQLite. For scheduling, WebLab-Deusto supports two types of back-ends: SQL database (again, MySQL and SQLite) and Redis, which is much faster.

4.3. Communications

WebLab-Deusto communications have been built on top of a pluggable system of protocols. When a component tries to connect to other server, it provides the WebLab-Deusto address of this server, and the communications broker will check what possible protocols can be used and it will automatically choose the fastest one (e.g., if both components are in the same process, it calls it directly instead of using any kind of serialization or communication).