

“Bridging the gap: from Individual Behaviour to the Socio-Technical Man (IBSEN)”

D1.3 EXPERIMENTAL INFRASTRUCTURE

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PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Approvals

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1.- Experimental Infraestructure

1.1.- Physical server

A new server has been acquired in order to conduct the experiments. This server is currently located in Zaragoza and has the following specifications:

- Superserver SUPERMICRO 1U SYS-6X8DWIQ-R76
- 2 INTEL HASWELL 12C E5-2680V3 2.5G 30M 9.6GT/s QPI
- 8 16GB DDR4-2133 2Rx4 LP ECC REG
- 1 3.5" SATA 4TB HUS724040ALA640 6Gbs 7.2K 64MB
- 2 2.5" SATA3 SSDSC2BB480G6 INTEL DC S3510 480GB MLC
- 2 3.5" CONVERT TO 2.5" HOT-SWAP

The computer is running on a state-of-the-art server at the BIFI Data Centre. This data center provides the optimal conditions regarding network connection availability and speed (10Gbps), cooling systems, controlled access/surveillance, uninterruptible power supply system and a generator set in case of power failure.

In order to prevent attacks against its availability and data leak risks, both Universities have the usual security protocols to protect the infrastructure against Distributed Denial of Service (DDos) attacks, Besides that, the server runs a Linux distribution, firewall protected, and with the latest software updates installed regularly. Furthermore, the experimental data in this server is fully anonymized. The app is programmed in one of the most modern frameworks for web development in the market (Django), which provides a security layer against the most common application-based attacks, such as SQL-injection or cross-site scripting.

Regular load and stress tests have been made to measure the performance. Several modifications have been introduced into the software to improve the speed, reliability and overall performance. The Ibsen team has used Apache Jmeter for load testing and measuring a variety of services.

The following table is an example in which 1000 concurrent users connect to the server in 10 secs (100 users/sec) and requests two actions. The first one is to access to the home page (not demanding task) and the second one is a request to join a session to start and experiment which is a very demanding task (database access and calculations). There are no errors and the webapp serves the worst request in 1.5 seconds.

Action	Samples	Avg	Min	Max	St. Dev	Error %	Performance	Kb/sec
Home page	1000	153	4	723	130.45	0%	100	19.48
Join_session	1000	351	8	1567	423.23	0%	100	7.21
Total	2000	256	4	1567	356.32	0%	200	26.69

Fig 1. Load test results for 1000 concurrent users in 10 seconds

1.2.- Basic software structure

The software developed in the framework of IBSEN is hosted by Unizar in its own repository infrastructure. It uses Git as a distributed version control system.

<http://hurriquest.ibercivilis.es/rhodecode/ibsen/>

The repository has two parts. The first one is the core of the application and is used by all the apps designed for the experiments. The developers of an experiment would not be able to alter this core when they design their codes. The Unizar team, in collaboration with the other members of the IBSEN project, is in charge of developing this core library to add the required functionalities and modules in order to be able to design all sort of experiments.

The second one contains a series of experiments already designed and shared by community members. These experiments are ready to be launched out of the box.

The server is logically separated for each laboratory associated. Each lab has access to the physical server via ssh to its own folder. Furthermore, each group has its own webserver and database. Currently, we have 3 associated laboratories:

amsterdam.ibsen-h2020.eu

madrid.ibsen-h2020.eu

valencia.ibsen-h2020.eu

nectunlab.ibsen-h2020.eu

Each one of these pages corresponds to an independent oTree instance server with their own experiments and status.

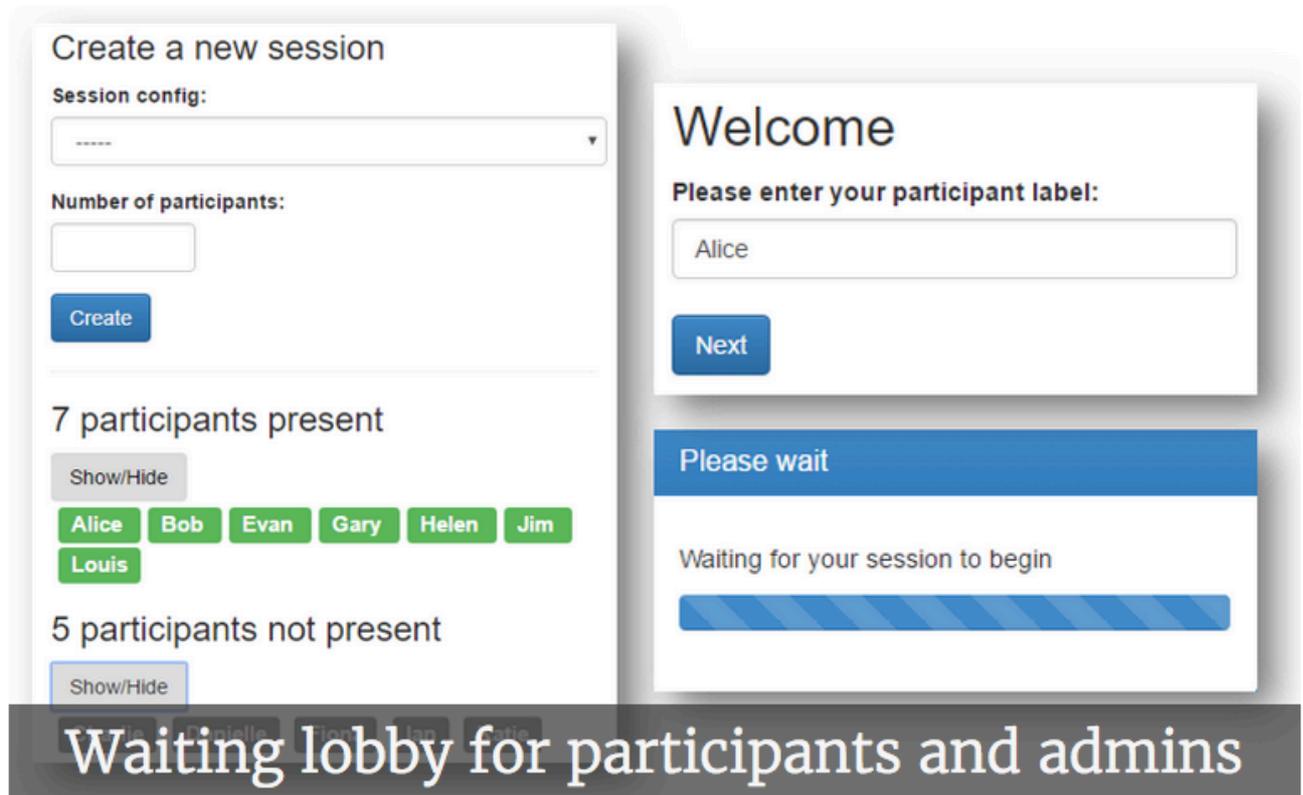
1.3- Otree software

At the beginning of the project, the consortium analyzed different platforms that were available already at different levels of development. The idea was to work starting with one of them and further develop the platform and software to fulfill IBSEN's objectives. We required a few conditions, but the most important ones were: it should be open access software, it should allow for customization and it should be scalable to allow for experiments with thousands of individuals. The team finally chose to use oTree (<http://www.otree.org/>) as starting point for the software. Otree is an experimental economics framework built on top of Django (a Python webapp framework). It is highly structured and modularized, also designed with the toolbox approach in mind. It has a good documentation and about 20 already programmed experimental treatments, ready to test and with their source code available. See Fig. 1 below for a screenshot of the oTree web page and Fig. 2 for a sketch depicting the basic structure of an oTree experiment.

oTree

A modern open platform
for social science experiments

[Home](#) [Demo](#) [Download](#) [Docs](#) [FAQ](#) [GitHub](#) [Paper](#)



The screenshot displays two main panels from the oTree website. The left panel, titled "Create a new session", includes a "Session config:" dropdown menu, a "Number of participants:" input field, and a "Create" button. Below this, it shows "7 participants present" with a "Show/Hide" button and a list of names: Alice, Bob, Evan, Gary, Helen, Jim, and Louis. Underneath, it lists "5 participants not present" with another "Show/Hide" button. The right panel, titled "Welcome", asks the user to "Please enter your participant label:" with an input field containing "Alice" and a "Next" button. Below the input field is a blue bar with the text "Please wait" and a progress indicator. The text "Waiting for your session to begin" is displayed below the bar. A dark grey banner at the bottom of the screenshot contains the text "Waiting lobby for participants and admins".



This is a joint project by the [Daniel Chen](#) group and [Martin Schonger](#). You can read about the platform in our paper [oTree: An Open-Source Platform for Laboratory, Online, and Field Experiments](#)

Fig 2. oTree website

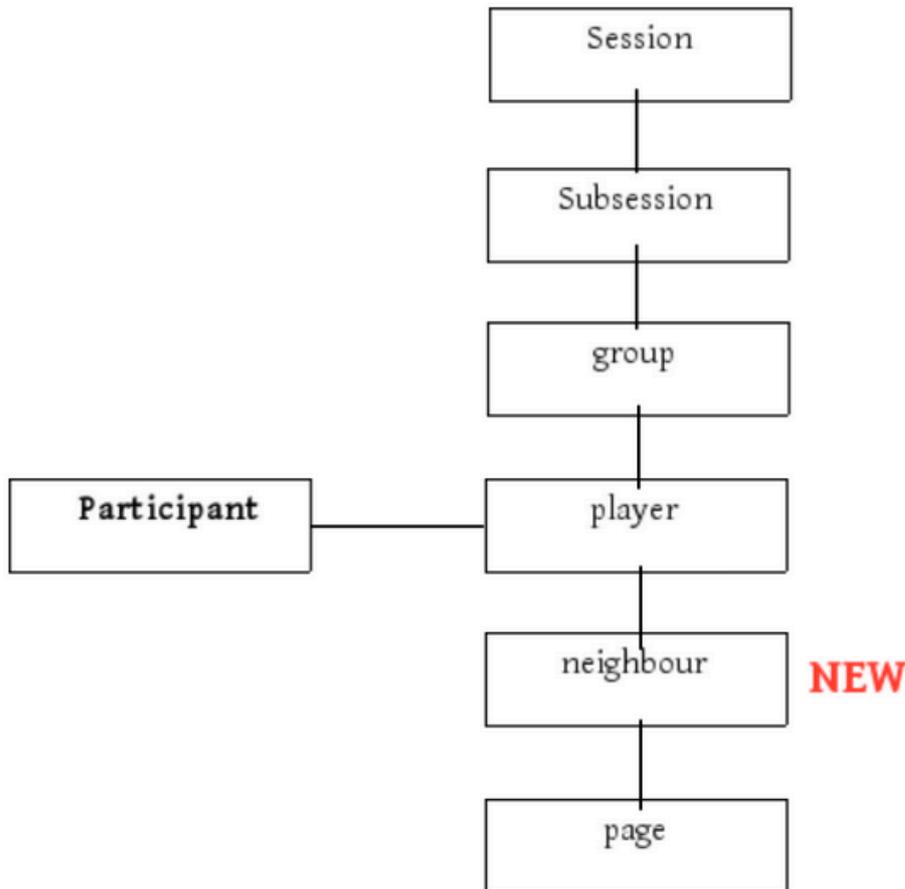


Fig 3. Sketch of the oTree basic experiment structure

Otree fulfilled what IBSEN required: it is an open source software, which aligns perfectly with the IBSEN goal to make all our material freely available at the end of the project. In addition, it is as flexible as to permit connections with other sources of subjects, such as, e.g., Amazon Mechanical Turk. Finally, it's main advantage is that its modular structure is very suitable for an ever increasing bank of possible experiments: the core structure of the software is independent of the experiments, and new modules can be added in the future without altering it to address further needs.

One of the major problems of the initial oTree software was the impossibility of developing experiments involving networks. A new module integrated into the core structure has been designed in order to be able to conduct these types of experiments

The network module follows the otree philosophy and allows to the developer of the experiments:

- Setting an initial network configuration. A set of methods have been designed to generate different types of networks (lattice, ring, homogeneous (Erdős-Rényi), heterogeneous (Barabási-Albert), etc.)
- Rearranging the network after each round. The initial networks can be modified completely passing a matrix with the new links between players.
- Designing new experiments in which the players are able to propose new connections, break the existing ones and reject or accept the received proposals. This would allow for experiments where the network is dynamic and not static.

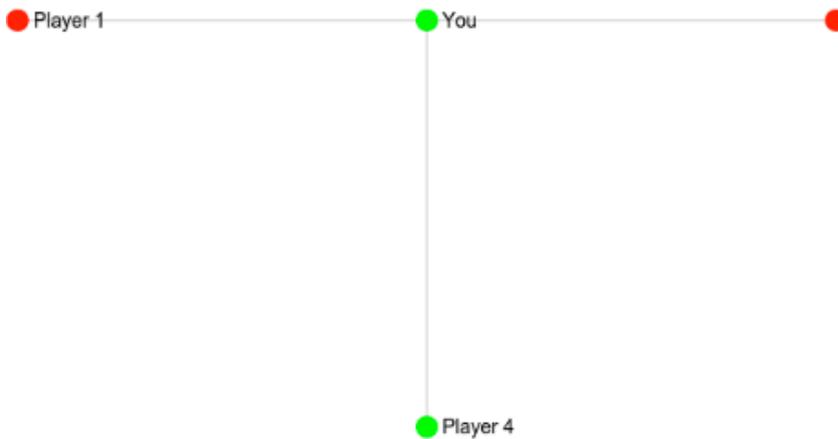
A simple experiment has been implemented to demonstrate the new capabilities of the system. In this simple experiment, the participants are initially distributed in a single group. The network for this

group is a ring with two neighbors for each player. The participants play a simple prisoner's dilemma and the benefits are dependent on the decisions of their neighbors. After each round, the participant can propose new connections and remove links, modifying the network of connections for the following rounds. This experiment has been added to the IBSEN repository so that the developers can examine the new functionalities. A screenshot of the experiment is shown below:

Results

You chose to cooperate and your neighbors:

- Player 2 chose to defect
- Player 3 chose to defect
- Player 4 chose to cooperate



As a result, you earned	0 puntos
In addition, you get a participation fee of	50 puntos
In total, you receive	50 puntos

Siguiente

Instrucciones

In this study, you will be randomly and anonymously paired with another participant. Each of you simultaneously and privately chooses whether you want to cooperate or defect. Your payoffs will be determined by the choices of both as below:

Fig 4. Simple Experiment with networks

Apart from this new module, the team has collaborated with Chris Wickens, the main oTree developer, to improve the software. Some of the tasks carried out are the following:

- The core of the application has been switched to a more efficient “server push” architecture based on websockets instead of polling.
- Multiple tests have been made to evaluate the performance improvement and stability of the new architecture.
- Debugging of the current platform with special emphasis on race condition issues.

The first experiment session carried out entirely with oTree in a physical lab was completed on June 15. It was a small group (24 participants) playing physically in a lab but the platform ran smoothly and handled everything satisfactorily. The experiment was one of the sessions of the “Hierarchy” study, duly approved by the UC3M ethics committee.

1.4.- Interconnection between Recruitment system and Experimental software

Crucially, the recruitment system and the experimental software are designed as independent systems in order to protect the volunteers’ personal data and to keep a centralized, well protected database. Such an structure is also useful to make the data obtained in the experiments anonymous for giving access to them to the whole research community. However, both platforms should interact between them. This is mainly due to the following reasons:

- Subjects enroll in experimental sessions through the recruitment application, but they actually participate with software developed in the experimental platform (oTree). Participants should not access oTree directly (at least the first time), therefore they should get their participation link by the recruitment application
- While an experiment is being conducted, it might be necessary to send notifications to participants, and oTree does not store any contact data at any point (again, to protect data).
- Finally, when electronic payments have to be implemented, that should be done from the recruitment application, but the amount to be paid is in the oTree database.

In order to connect both platforms, the IBSEN technical team decided to implement a JSON RESTful API. This is the optimal solution, because oTree is based on Django, which already provides the adequate infrastructure. This is also the case for the recruitment system, which is being developed using a PHP-based MVC framework which also provides the appropriate tools.

The interconnections of both systems in a typical experiment will follow this timeline:

1. An experimental session is created in the recruitment system, allowing subjects to enroll. An experimental session is started in oTree, and participation links are generated.
2. (1st interconnection) The recruitment system makes a request to oTree to obtain as many participation links as subjects needed per session (and enrolled).
3. (2nd interconnection, optional) If oTree needs to send a notification, it requests the email of the participant from the recruitment system.
4. (3rd interconnection, optional) When the experiment ends, the recruitment system requests from oTree the number of points that the subjects obtained in the experiment to implement monetary payments. Once it is done, points data is destroyed in the recruitment system.

Since this interconnection is critical to the whole IBSEN platform, it is being carefully developed and tested. The 1st interconnection is already implemented and tested in a mock experiment, while the IBSEN technical team is working on the other two.

2.- Status assessment

As described above, there is an appropriate server available to all teams from UNIZAR, and there is a beta version of the software, which through the network module, should allow to run all the experiments planned in WP2. While we will of course keep improving the software, by fixing any possible problems appearing in the existing platform and by adding new modules to it, we conclude that we have accomplished our goal in agreement with Milestone MS2. The next six months will see intensive usage of the software so it can be fully tested and delivered in final form, and our experimental infrastructure will be fully operative and presented to other experimental groups in our Month 18 meeting in Cambridge (March 2017).