



UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH



**Development of a new social network for science**

**A Degree Thesis**

**Submitted to the Faculty of the  
Escola Tècnica d'Enginyeria de Telecomunicació de  
Barcelona**

**Universitat Politècnica de Catalunya**

**by**

**Miquel Llaneras Gayà**

**In partial fulfilment  
of the requirements for the degree in  
Telecommunications Technologies and Services  
ENGINEERING**

**Advisors: Anna Umbert Juliana, Gregor Rozinaj**

**Barcelona, June 2014**

## **Abstract**

The Development of a new social network for science project, is the work produced by the student Miquel Llaneras, from the Polytechnic University of Catalonia in coordination with the Slovak University of Technology in Bratislava. It has been supervised by professors Anna Umbert from Barcelona and Gregor Rozinaj from Bratislava.

The initial idea was to develop a new general social network for scientists, where the scientific community could interact and grow together by sharing their projects. Finally, the project made a turn into the creation of a more specific social network that would offer a platform where the annual Redzur International Workshop could take place.

The result is a new website platform written in PHP, MySQL, JS, HTML and CSS, with the usage of open-source software such as Drupal and RocketChat. The platform offers a place where participants of Redzur can share their projects and interact with each other.

## **Resum**

El projecte Development of a new social network for science és el treball realitzat per l'alumne Miquel Llaneras, de la Universitat Politècnica de Catalunya, en coordinació amb la Slovak University of Technology in Bratislava. El projecte ha estat supervisat pels professors Anna Umbert de Barcelona i Gregor Rozinaj de Bratislava.

La idea inicial consistia en la creació d'una nova xarxa social per a la comunitat científica en general, on els usuaris podrien interactuar i millorar junts compartint els seus projectes. Finalment, l'objectiu va girar cap al desenvolupament d'una xarxa social més específica, que voldria oferir una plataforma on realitzar el Redzur Interational Workshop.

El resultat és una nova plataforma web escrita amb PHP, MySQL, JS, HTML i CSS amb la utilització de software de codi lliure com Drupal i RocketChat. La plataforma ofereix als participants de Redzur un espai on compartir els seus projectes i interactuar entre ells.

## **Resumen**

El proyecto Development of a new social network for science es el trabajo realizado por el alumno Miquel Llaneras, de la Universidad Politècnica de Catalunya, en coordinaci3n con la Slovak University of Technology in Bratislava. El proyecto ha sido supervisado por los profesores Anna Umbert de Barcelona y Gregor Rozinaj de Bratislava.

La idea inicial consistía en la creaci3n de una nueva red social para la comunidad científica en general, donde los usuarios podrían interactuar y mejorar juntos compartiendo los proyectos. Finalmente, el objetivo gir3 a el desarrollo de una red social m3s específica, con la intenci3n de ofrecer una plataforma donde realizar el Redzur International Workshop.

El resultado es una nueva plataforma web escrita en PHP, MySQL, JS, HTML y CSS con la utilizaci3n de software de c3digo libre como Drupal y RocketChat. La plataforma ofrece a los participantes de Redzur un espacio d3nde compartir sus proyectos e interactuar mutuamente.



Dedication: This project is dedicated to the science community, which helps the whole world improve and make humanity a better race. Special mention for all the open-source software developers, which helped a lot in the process of this project.

## **Acknowledgements**

As the author of the project, I would like to express my gratitude to some people who helped in the development of this project.

First of all, special mention to prof. Ing. Gregor Rozinaj PhD., the supervisor in Bratislava of the thesis and who provided a lot of guidance and advise during the whole process.

Continuing in the STUBA university, Juraj Londak, Maroš Michalík and Ivan Minárik helped with the configuration of the server as well as the testing process, thanks to them for making it possible.

Finally, I am very thankful to the professor Anna Umbert, who helped me being the supervisor of the project in my home university in Barcelona, UPC.

## Revision history and approval record

Revision	Date	Purpose
0	09/06/2020	Document creation
1	29/06/2020	Document revision

### DOCUMENT DISTRIBUTION LIST

Name	e-mail
Miquel Llaneras Gayà	<a href="mailto:llaneras9@gmail.com">llaneras9@gmail.com</a>
Anna Umbert Juliana	<a href="mailto:annau@tsc.upc.edu">annau@tsc.upc.edu</a>
Gregor Rozinaj	<a href="mailto:gregor.rozinaj@stuba.sk">gregor.rozinaj@stuba.sk</a>

Written by:		Reviewed and approved by:	
Date	09/06/2020	Date	29/06/2020
Name	Miquel Llaneras	Name	Anna Umbert
Position	Project Author	Position	Project Supervisor

## **Table of contents**

Abstract .....	1
Resum .....	2
Resumen .....	3
Acknowledgements .....	5
Revision history and approval record .....	6
Table of contents .....	7
List of Figures .....	9
List of Tables: .....	11
1. Introduction.....	12
1.1. Statement of purpose .....	12
1.2. Requirements and specifications .....	12
1.3. Methods and procedures .....	12
1.4. Initial Work Plan .....	13
1.4.1. Work Packages .....	13
1.4.2. Time Plan (Gantt diagram) .....	15
1.5. Incidences .....	16
1.6. Updated Work Plan .....	16
1.6.1. Work Packages .....	16
1.6.2. Time Plan (Gantt diagram) .....	19
2. State of the art of the technology used or applied in this thesis:.....	21
2.1. OpenVPN .....	21
2.2. PuTTY .....	21
2.3. WinSCP.....	21
2.4. Ubuntu.....	21
2.4.1. Linux .....	22
2.5. Drupal.....	22
2.6. Bootstrap.....	22
2.7. RocketChat.....	22
2.8. Sublime Text .....	22
2.9. Languages .....	23
2.9.1. PHP .....	23
2.9.2. MySQL .....	23
2.9.3. JavaScript .....	23



2.9.4.	HTML .....	23
2.9.5.	CSS.....	24
3.	Methodology / project development: .....	25
3.1.	Configuration .....	25
3.1.1.	Student computer .....	25
3.1.2.	Virtual Machine.....	25
3.2.	Development .....	29
3.2.1.	First Demo.....	29
3.2.1.1.	Back-end.....	29
3.2.1.2.	Front-end .....	30
3.2.1.3.	Testing .....	31
3.2.2.	Upgraded demo.....	32
3.2.2.1.	Theming .....	32
3.2.2.2.	Chat and comments .....	33
3.2.2.3.	User interface.....	35
3.2.2.4.	Testing .....	36
3.2.3.	Final product.....	37
3.2.3.1.	Errors correction.....	37
3.2.3.2.	Last tests.....	38
3.2.3.3.	Adaptation for 14 <sup>th</sup> Redzur edition .....	38
4.	Results .....	40
4.1.	Final product.....	40
4.2.	Adapted version .....	50
5.	Budget.....	52
6.	Conclusions and future development:.....	53
	Bibliography:.....	54
	Appendices:.....	55
	Glossary .....	58

## **List of Figures**

Figure 1. Initial Work Plan breakdown structure.....	13
Figure 2. Gantt of WP1 of Initial Work Plan.....	15
Figure 3. Gantt of WP2 of Initial Work Plan.....	15
Figure 4. Gantt of WP3 of Initial Work Plan.....	15
Figure 5. Full Gantt of Initial Work Plan.....	16
Figure 6. Gantt of WP1 of Updated Work Plan.....	19
Figure 7. Gantt of WP2 of Updated Work Plan.....	19
Figure 8. Gantt of WP3 of Updated Work Plan.....	19
Figure 9. Gantt of WP4 of Updated Work Plan.....	19
Figure 10. Gantt of WP5 of Updated Work Plan.....	20
Figure 11. Full Gantt of Updated Work Plan.....	20
Figure 12. Drupal requirements.....	28
Figure 13. Drupal site configuration.....	28
Figure 14. Drupal home page.....	29
Figure 15. Website home page.....	40
Figure 16. New projects block.....	40
Figure 17. Log in page.....	41
Figure 18. Create new account page.....	41
Figure 19. My account page.....	42
Figure 20. Add project view.....	42
Figure 21. My projects page.....	43
Figure 22. Own projects view.....	43
Figure 23. Authors page.....	44
Figure 24. Author view.....	44
Figure 25. Projects page.....	45
Figure 26. Project view.....	45
Figure 27. Project comments view.....	46
Figure 28. Add comment to project view.....	46
Figure 29. Messages page.....	47
Figure 30. Thread view.....	47
Figure 31. Create new thread view.....	48

Figure 32. RocketChat log in and create new account.....	48
Figure 33. Chat in RocketChat.....	49
Figure 34. Jitsi video call example.....	49
Figure 35. Adapted home page.....	50
Figure 36. Adapted projects page.....	50
Figure 37. Adapted project view.....	51
Figure 38. Adapted RocketChat.....	51

## **List of Tables:**

Table 1. Work Packages of Initial Work Plan.....	14
Table 2. Milestones of Initial Work Plan.....	15
Table 3. Work Packages of Updated Work Plan.....	17
Table 4. Milestones of Updated Work Plan.....	18
Table 5. Cost of project.....	52

## 1. Introduction

This thesis has been developed by Miquel Llaneras, a student from the Polytechnic University of Catalonia, UPC, during an Erasmus stay in the Slovak University of Technology in Bratislava, STUBA. It has been carried out at the Faculty of Electrical Engineering and Information Technology, FEI, and supervised by prof. Ing. Gregor Rozinaj, PhD.

In the home university, the student courses the degree in Telecommunications Technologies and Services Engineering at the faculty Escola Tècnica d'Enginyeria de Telecomunicació de Barcelona, ETSETB, located in the city of Barcelona. The supervisor in the home university has been professor Anna Umbert Juliana, PhD in Telecommunications.

### 1.1. Statement of purpose

The objective of this project is the development of a website platform, based in the creation of a new social network for scientists. The main goal is to contribute to the science community by delivering a tool that could make easier and faster communications, in order to help scientists evolve and improve through the sharing of knowledge.

The project starts with the idea of using all the improvements made in the last decades in the ambit of telecommunications to create a network where the scientific community can share their knowledge faster, and in consequence of that fact, improve faster all together.

### 1.2. Requirements and specifications

To achieve this goal, the tool intended to create requires to have at least the following features:

- An authentication process to create users.
- A personalized profile for every user.
- Personal projects repositories to store and display the projects.
- Forums where users can share their projects and interact through comments.
- Chat functionalities so users can talk with each other, including groups.

More features could be added to improve the usage of the platform as well as the user experience, for example privacy options, videoconferencing, or more personalization options.

In terms of the specifications, the only restriction is to not add expenses to the development of the platform, so all the external software used should be open-source.

This is due to two factors, first of all the lack of budget and second and most importantly, to respect the idea of the project. This project defends that through the sharing of knowledge the whole community evolves, so this project should give example of this idea by proving that shared knowledge in the form of open-source software can help create a better platform.

### 1.3. Methods and procedures

The procedure to the development of this project includes the usage of different methods, explained as follows.

The goal is to build a website maximizing the best possible result in relation to the effort dedicated to it. Since it is only one person working on the project for a few months some methodology and software applications were used to make the building easier.

The development has been done inside a server of the FEI faculty, working on top of Ubuntu 16.04 as operating system (OS). Referencing to the building of the website the Content Management System (CMS) Drupal[1] has been used to facilitate the process. Finally, to implement better chat functionalities the software Rocket Chat was implemented.

In order to access the server from the outside, the program OpenVPN[2] has been used, as well as PuTTY[3] and WinSCP[4]. Sublime Text[5] 3 has been used as text editor for coding. As mentioned before, all of the software used was free so no expenses were added to the budget despite some of this programs might offer payable premium services.

#### 1.4. Initial Work Plan

Before starting the project an Initial Work Plan was created to provide structure and organization to the project.

##### 1.4.1. Work Packages

The following figure Fig. 1 shows the breakdown structure of the plan, including the work packages and tasks.

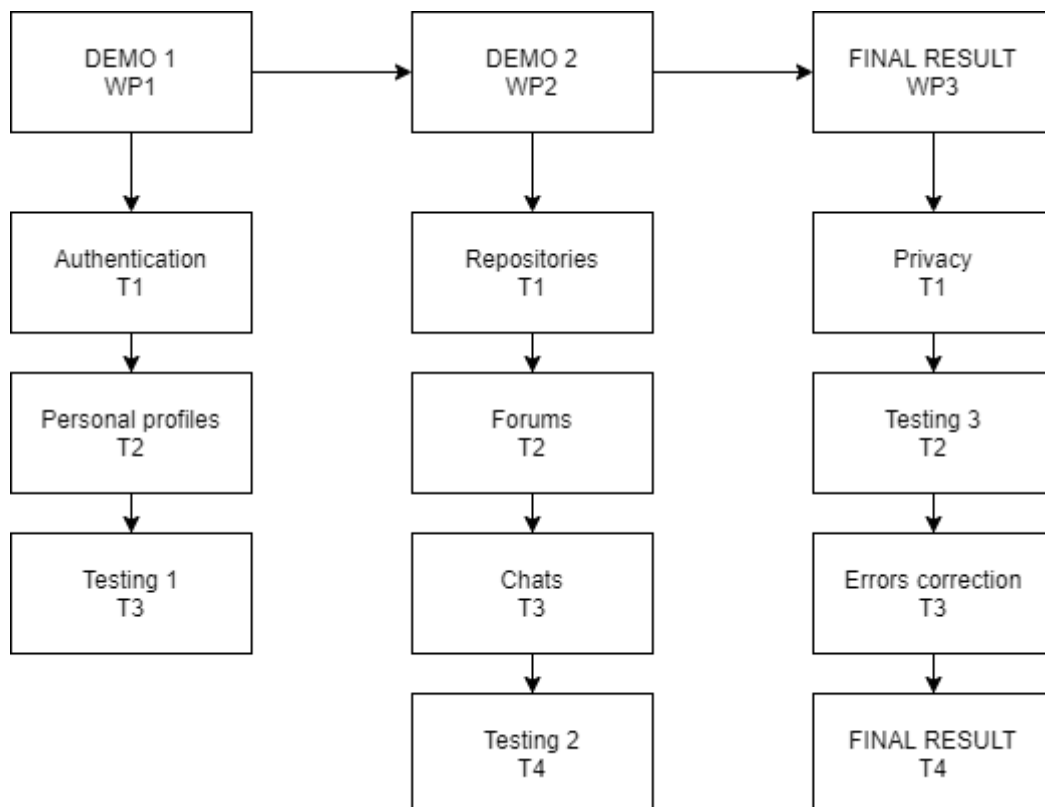


Figure 1. Initial Work Plan breakdown structure.

The Work Packages with the corresponding tasks are described in Tb. 1:

Project: Demo 1	WP ref: WP1	
Major constituent: Software	Sheet 1 of 3	
Short description:  First working demo with the fewest possible functionalities	Planned start date: 10/03/2020 Planned end date: 13/04/2020	
	Start event: 10/03/2020 End event: 13/04/2020	
Internal task T1: Authentication process development Internal task T2: Personal profiles development Internal task T3: Tests	Deliverables:  Demo 1 result	Dates:  13/04/2020
Project: Demo 2	WP ref: WP2	
Major constituent: Software	Sheet 2 of 3	
Short description:  Second demo with more functionalities	Planned start date: 13/04/2020 Planned end date: 11/05/2020	
	Start event: 13/04/2020 End event: 11/05/2020	
Internal task T1: Personal projects repositories development Internal task T2: Forums development Internal task T3: Chats development Internal Task T4: Tests	Deliverables:  Demo 2 result	Dates:  11/05/2020
Project: Final Result	WP ref: WP3	
Major constituent: Software	Sheet 3 of 3	
Short description:  Last demo with all functionalities, final tests and result	Planned start date: Planned end date: 22/06/2020	
	Start event: End event: 22/06/2020	
Internal task T1: Privacy options development Internal task T2: Tests Internal task T3: Correction of errors Internal task T4: Final tests and result	Deliverables:  FINAL RESULT	Dates:  22/06/2020

Table 1. Work Packages of Initial Work Plan.

The marked milestones for the plan can be seen in Tb. 2:

WP#	Task#	Short title	Milestone / deliverable	Date (week)
1	T1	Authentication	None	30/03/2020
1	T2	Personal profiles	None	06/04/2020
1	T3	Testing 1	Demo 1 result	13/04/2020
2	T1	Repositories	None	20/04/2020
2	T2	Forums	None	27/04/2020
2	T3	Chats	None	04/05/2020
2	T4	Testing 2	Demo 2 result	11/05/2020
3	T1	Privacy	None	18/05/2020
3	T2	Testing 3	None	25/05/2020
3	T3	Errors correction	None	01/06/2020
3	T4	FINAL RESULT	Result	22/06/2020

Table 2. Milestones of Initial Work Plan.

### 1.4.2. Time Plan (Gantt diagram)

The Gantt diagram representing the time structure of the Work Plan is displayed in the following figures, Fig. 2, Fig. 3, Fig. 4 and Fig. 5.

- Work Package 1:

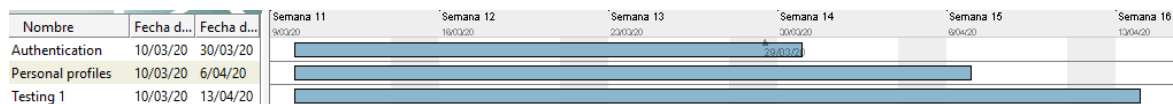


Figure 2. Gantt of WP1 of Initial Work Plan.

- Work Package 2:

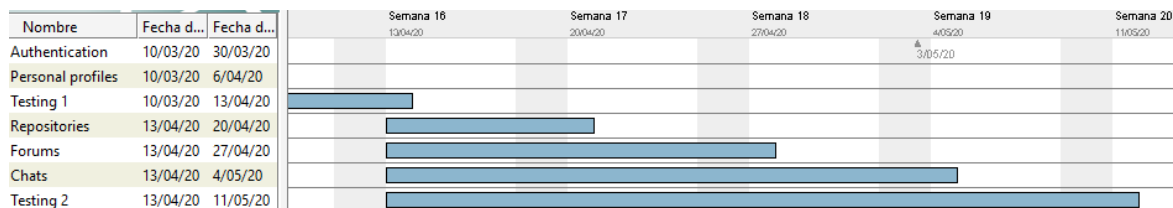


Figure 3. Gantt of WP2 of Initial Work Plan.

- Work Package 3:

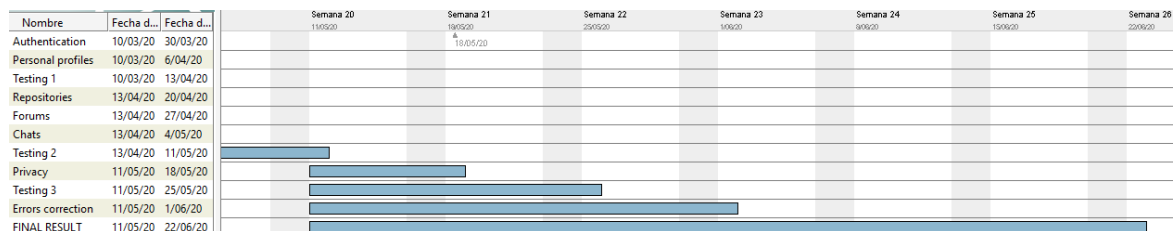


Figure 4. Gantt of WP3 of Initial Work Plan.



- Total:

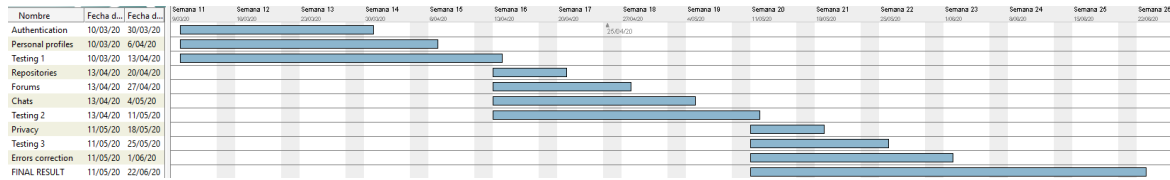


Figure 5. Full Gantt of Initial Work Plan.

## 1.5. Incidences

At the first meetings between student and supervisor Gregor Rozinaj, it is agreed to continue the work of an ongoing project with the same purpose as the one in question. The project was started at the FEI faculty in STUBA university by previous students and it pretended to create a website platform to share the projects of the university. The idea was to continue this project and improve it by adding social network functionalities as well as expansion of outside the STUBA university.

After spending the first weeks configuring a virtual machine to work on and trying to copy the existing website inside it, some incidents appeared. The process to access the files of the previous project was more complicated than expected, and the worldwide pandemic due to the COVID-19 virus made it even harder. The biggest problem was the impossibility to contact the previous students working in the project, without their help there was no access to the files in order to copy the project in the new server.

Due to the mentioned incidences, new options for the project were analysed between prof. Gregor and student Miquel. During this analysis of alternatives, it was started an attempt of building the original website using the Django framework, but it was discarded due to a better suggestion proposed later. Since finally it didn't take any part on the project, this attempt will not be discussed here, but the code can be find in the file attached to this thesis.

The conclusion to this study was to create a more specific social network, in order to use it for the Redzur International Workshop. Redzur is an annual conference organized by the Slovak University of Technology in Bratislava and the Association of Telecommunications Users in Slovakia, with the participation of prof. Gregor Rozinaj as General Chair.

The new idea of the project is to create a website based platform with all the necessary features in order to use it for the Redzur Workshop. In order to solve the delays suffered from the incidences and be able to deliver the final package with the expected result at the expected dates, the Work Plan is updated.

## 1.6. Updated Work Plan

### 1.6.1. Work Packages

The Updated Work Plan included new Work Packages as well as some modifications in the ones already existing. The result of the new work can be seen in the following table, Tb. 3:

Project: Upgrade attempt	WP ref: (WP1)	
Major constituent: Software	Sheet 1 of 5	
Short description:	Planned start date: 10/03/2020 Planned end date: 31/03/2020	
Failed attempt of upgrading an already existing website	Start event: 10/03/2020 End event: 31/03/2020	
Internal task T1: Configuration of a new Virtual Machine(VM) Internal task T2: Attempt to copy the website on the new VM	Deliverables:	Dates:  31/03/2020

Project: Study of solutions	WP ref: (WP1)	
Major constituent: Software	Sheet 1 of 5	
Short description:	Planned start date: 01/04/2020 Planned end date: 06/04/2020	
Study of possible solutions	Start event: 01/04/2020 End event: 06/04/2020	
Internal task T1: Build a new website using the Django framework Internal task T2: Build a new website with the CMS Drupal	Deliverables:  Django demo	Dates:  06/04/2020

Project: Demo 1	WP ref: WP2	
Major constituent: Software	Sheet 3 of 5	
Short description:	Planned start date: 10/03/2020 Planned end date: 13/04/2020	
First working demo with the fewest possible functionalities	Start event: 07/04/2020 End event: 30/04/2020	
Internal task T1: Authentication process development Internal task T2: Personal profiles development Internal task T3: Personal projects repositories development Internal task T4: Tests	Deliverables:  Demo 1 result	Dates:  30/04/2020

Project: Demo 2	WP ref: WP3	
Major constituent: Software	Sheet 4 of 5	
Short description:	Planned start date: 01/05/2020 Planned end date: 14/05/2020	
Second demo with more functionalities	Start event: 01/05/2020 End event: 14/05/2020	

Internal task T1: Forums development Internal task T2: Chats development Internal Task T3: Tests	Deliverables:  Demo 2 result	Dates:  14/05/2020
Project: Final Result	WP ref: WP4	
Major constituent: Software	Sheet 5 of 5	
Short description:  Last demo with all functionalities, final tests and result	Planned start date: 15/05/2020 Planned end date: 22/06/2020	
	Start event: 15/05/2020 End event: 22/06/2020	
Internal task T1: OPTIONAL: development of videoconference tool Internal task T2: Tests Internal task T3: Correction of errors Internal task T4: Final tests and result	Deliverables:  FINAL RESULT	Dates:  22/06/2020

Table 3. Work Packages of Updated Work Plan.

The marked milestones of the updated plan can be seen in Tb. 4.

WP#	Task#	Short title	Milestone / deliverable	Date (week)
1	T1	VM configuration	None	20/03/2020
1	T2	Failed copy	None	31/03/2020
2	T1	Django attempt	Django demo	06/04/2020
2	T2	Drupal solution	None	06/04/2020
3	T1	Authentication	None	24/04/2020
3	T2	Personal profiles	None	24/04/2020
3	T3	Repositories	None	24/04/2020
3	T4	Testing 1	Demo 1 result	30/04/2020
4	T2	Forums	None	11/05/2020
4	T3	Chats	None	11/05/2020
4	T4	Testing 2	Demo 2 result	14/05/2020
5	T1	Videoconference (Optional)	None	25/05/2020
5	T2	Testing 3	None	01/06/2020
5	T3	Errors correction	None	08/06/2020
5	T4	FINAL RESULT	Result	22/06/2020

Table 4. Milestones of Updated Work Plan.

### 1.6.2. Time Plan (Gantt diagram)

The Time Plan in a Gantt diagram format can be seen in the respective figures with the necessary updates applied, Fig. 6, Fig. 7, Fig. 8, Fig. 9, Fig. 10 and Fig. 11.

- Work Package 1:

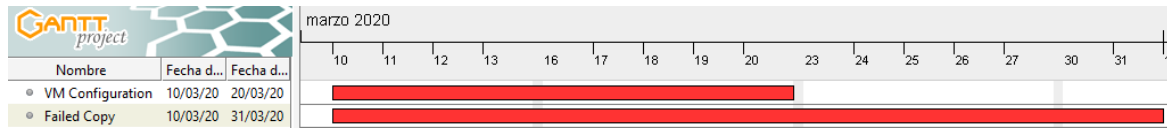


Figure 6. Gantt of WP1 of Updated Work Plan.

- Work Package 2:

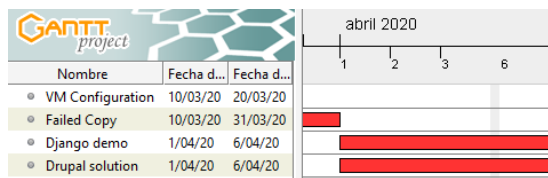


Figure 7. Gantt of WP2 of Updated Work Plan.

- Work Package 3:

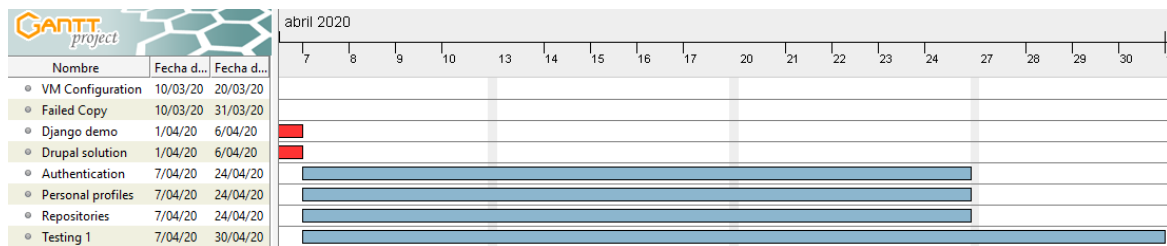


Figure 8. Gantt of WP3 of Updated Work Plan.

- Work Package 4:

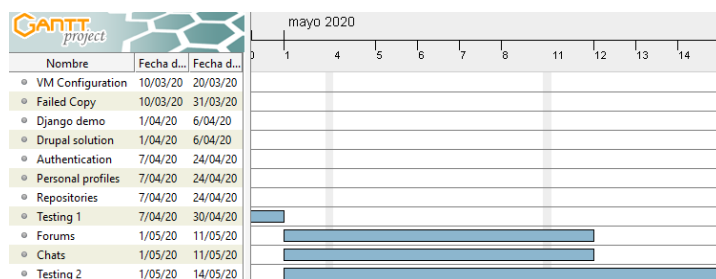


Figure 9. Gantt of WP4 of Updated Work Plan.

- Work Package 5:

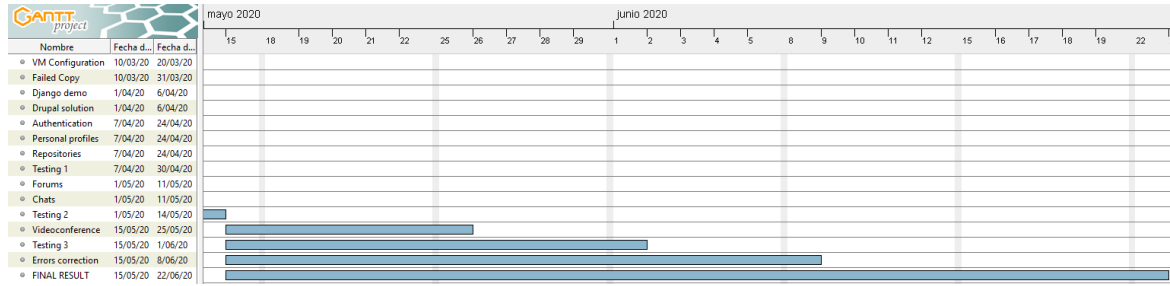


Figure 10. Gantt of WP5 of Updated Work Plan.

- Total:

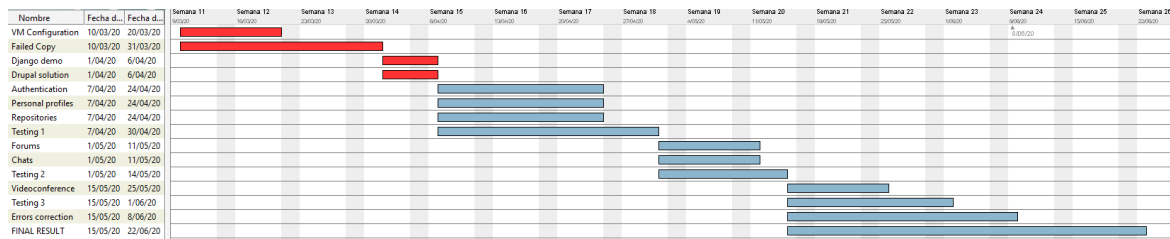


Figure 11. Full Gantt of Updated Work Plan.

## **2. State of the art of the technology used or applied in this thesis:**

The development of this project included the usage of different software applications and programs. In this section all of them will be explained in order to clarify the state of the art of the technology applied in this thesis.

In order to connect the computer used for the development to the server where the website runs the programs OpenVPN, PuTTY and WinSCP were used. The server runs the operating system Ubuntu[6], based on Linux[7] distribution, and for the development of the platform the CMS Drupal took a good part. Moreover, the theme used for the project was from the framework Bootstrap[8] and the chat was based in the RocketChat[9] software. Finally, the languages in which the website is written are PHP, MySQL, HTML, JS and CSS. The editor used for coding was Sublime Text.

### **2.1. OpenVPN**

OpenVPN is an open-source commercial software that implements virtual private network (VPN) techniques to create secure point-to-point connections. It was written by James Yonan and is published under the GNU General Public License (GPL).

OpenVPN allows peers to authenticate each other using pre-shared secret keys, certificates or username/password. It uses a custom security protocol that utilizes SSL/TLS for key exchange. It is capable of traversing network address translators (NATs) and firewalls.

### **2.2. PuTTY**

PuTTY is an open-source application that creates a terminal emulator, serial console and a network for file transfer. It is primarily maintained by its author, Simon Tatham.

PuTTY supports many variations on the secure remote terminal, and provides user control over the SSH encryption key and protocol version. It allows several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection and can also connect to a serial port.

### **2.3. WinSCP**

Windows Secure Copy, or WinSCP, is an open-source software that provides SFTP, FTP, WebDAV, Amazon S3 and SCP client connections for Microsoft Windows. Originally it was hosted by the University of Economics in Prague, where its author worked at the time. Since July 16, 2003, it is licensed under the GNU GPL and hosted on SourceForge.net.

The main function is secure file transfer between a local and a remote computer. Moreover, it offers a file manager and file synchronization functionality. The program is based on the implementation of the SSH protocol from PuTTY and FTP protocol from FileZilla.

### **2.4. Ubuntu**

Ubuntu is an open-source Linux distribution based on Debian and officially released in three editions: Desktop, Server and Core. Is developed by Canonical and a community of other developers under a meritocratic governance model. A new version is released every 6 months, and has long-term support (LTS) releases every two years. Canonical provides

security updates and support for every release, and generates revenue to the sale of premium services related to Ubuntu.

#### **2.4.1. Linux**

A Linux distribution is an operating system made from a software collection that is based upon the Linux kernel and, often, a package management system. A typical Linux distribution comprises a Linux kernel, GNU tools and libraries, additional software, documentation, a window system, a window manager, and a desktop environment.

The developer of the Linux kernel and first Linux distribution was Linus Torvalds. Today more than 500 Linux distributions exist, and they are used in more than 50% of all the web servers.

#### **2.5. Drupal**

Drupal is an open-source web content management framework distributed under the GNU General Public License. It is written in PHP and provides a back-end framework for more than 2% of all websites worldwide.

The Drupal community comprises more than 1.39 million members, including 117,000 users actively contributing, resulting in more than 44,000 free modules that extend and customize Drupal functionality, over 2,800 free themes that change the look and feel of Drupal, and at least 1,300 free distributions that allow users to quickly and easily set up a complex, use-specific Drupal in fewer steps.

The standard release of Drupal, known as Drupal core, contains basic features common to content-management systems. These include user account registration and maintenance, menu management, RSS feeds, taxonomy, page layout customization, and system administration. The Drupal core installation can serve as a simple website, a single- or multi-user blog, an Internet forum, or a community website providing for user-generated content.

#### **2.6. Bootstrap**

Bootstrap is a free and open-source CSS framework directed at responsive, mobile-first front-end web development. It contains CSS and optionally JavaScript-based design templates for typography, forms, buttons, navigation, and other interface components.

#### **2.7. RocketChat**

Rocket.Chat is an open-source Web Chat Server developed in JavaScript and using the Meteor full stack framework. It provides a great solution for communities and companies wanting to privately host their own chat service or for developers looking forward to build and evolve their own chat platforms.

#### **2.8. Sublime Text**

Sublime Text is a shareware cross-platform source code editor with a Python application programming interface (API). It natively supports many programming languages and mark-up languages, and functions can be added by users with plugins, typically community-built and maintained under free-software licenses.

## 2.9. Languages

### 2.9.1. PHP

PHP is a popular general-purpose scripting language that is especially suited to web development. It was originally created by Danish-Canadian programmer Rasmus Lerdorf in 1994.

PHP stands for Hypertext Preprocessor, the PHP code is usually processed on a web server by an interpreter as a module, daemon or Common Gateway Interface (CGI). On a web server, the result of the interpreted and executed PHP code, which may be any type of data such as generated HTML or binary image data, would form the whole or part of a HTTP response.

### 2.9.2. MySQL

MySQL is an open-source relational database management system (RDBMS) under the terms of the GNU GPL.

A relational database organizes data into one or more data tables in which data types may be related to each other. SQL is a language programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

Despite MySQL has stand-alone clients that allow users to interact directly with a MySQL database using SQL, it is usually used with other programs to implement applications that need relational database capability.

### 2.9.3. JavaScript

JavaScript, often abbreviated as JS, is a programming language that conforms to the ECMAScript specification. JavaScript is high-level, often just-in-time compiled, and multi-paradigm. It has curly-bracket syntax, dynamic typing, prototype-based object-orientation, and first-class functions.

Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web. JavaScript enables interactive web pages and is an essential part of web applications. The vast majority of websites use it for client-side page behavior, and all major web browsers have a dedicated JavaScript engine to execute it.

### 2.9.4. HTML

Hypertext Mark-up Language (HTML) is the standard mark-up language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.

Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page.



HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items.

### **2.9.5. CSS**

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a mark-up language like HTML. CSS is a cornerstone technology of the World Wide Web and maintained by the World Wide Web Consortium (W3C) alongside HTML.

CSS is designed to enable the separation of presentation and content, including layout, colours, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file, and reduce complexity and repetition in the structural content.

### **3. Methodology / project development:**

The development of the whole project can be divided in different parts, explained as follows and created in the respective order.

A first process containing all the configuration needed, with the installation of all programs and applications and proper set up. Afterwards, the actual development process started, where the building of the website took place. The development can be split in 3 different parts, the first demo, the upgraded demo and the final product.

#### **3.1. Configuration**

##### **3.1.1. Student computer**

The configuration process started in order to have access to the FEI faculty server from the computer of the student, which uses Windows 10 as OS.

To achieve this, the program OpenVPN was installed from the following link:

- <https://openvpn.net/downloads/openvpn-connect-v3-windows.msi>

OpenVPN offers a free and full-featured VPN Client that is developed in-house, allowing us the connection to the desired server. To do so, an account to the UMIKT department, with permission to access the server, was granted to the student by system administrator Maros Michalik. Furthermore, the configuration file *umikt.opvn* was provided and installed inside the folder */OpenVPN/config*, being now possible to bypass the firewall to access the server.

With the purpose of interacting with the sever and the VM, two more applications were installed in the author computer. The first one allows to access the terminal from the Ubuntu system of the VM. The application is called PuTTY, and is an open-source software for the Windows platform that works as a SSH and telnet client. It can be downloaded from the following link:

- <https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

WinSCP is a free and open-source SFTP, FTP, WebDAV, Amazon S3 and SCP client for Windows. Its main function is secure file transfer between a local and a remote computer and offers basic file manager and file synchronization functionality. This program allows the author to easily edit the files inside the server, making the coding faster and more comfortable. The download is in the following link:

- <https://winscp.net/download/WinSCP-5.17.6-Setup.exe>

##### **3.1.2. Virtual Machine**

Once all the configuration needed in the author device is finished, it was time to start the configuration of the Linux system where the website would be developed.

To start, the device connects to the VPN using the account of UMIKT and opens the application PuTTY. To connect to the VM in the application PuTTY the IP address *147.175.103.115* and the port *2232* are set. Then the system opens a terminal and a user account is asked. An account was provided from system administrator Juraj Londák and the student was finally connected to the VM.

Later in the project, another account with all the root Linux privileges was created. The need of this account appeared while trying to edit some files through WinSCP, it turned out the root privileges were necessary to access the files. Since there is no option in the application to use the command *sudo* every time to edit the files, the best solution was to create an account that did not need to use it.

To achieve this, using the existing account and PuTTY a root account was created and the file */etc/ssh/sshd\_config* was modified in order to grant access to the root account when connected through SSH.

The first step to configure the VM is to install the LAMP web service stack. LAMP is the acronym for Linux, Apache, MySQL and PHP. The combination of this software services together provide the tools necessary to create a fully-functional web server.

First of all, the webserver Apache2 was installed using the command:

- *sudo apt install apache2.*

In the next step it was installed MariaDB, a database server based in the MySQL relational database management system. To make a secure installation the following commands were used:

- *sudo apt-get install mariadb-server mariadb-client*
- *sudo mysql\_secure\_installation*
- *sudo systemctl restart mysql.service*

To continue with the process, a third party repository to download PHP was installed as follows:

- *sudo apt-get install software-properties-common*
- *sudo add-apt-repository ppa:ondrej/php*

And with the following command, PHP 7.1 and the necessary modules were installed:

- *sudo apt install php7.1 libapache2-mod-php7.1 libapache2-mod-php7.1 php7.1-common php7.1-mbstring php7.1-xmlrpc php7.1-soap php7.1-gd php7.1-xml php7.1-intl php7.1-mysql php7.1-cli php7.1-mcrypt php7.1-ldap php7.1-zip php7.1-curl*

To finish the PHP installation, the *php.ini* file from the folder */etc/php/7.1/apache2/* was modified with the following parameters:

- *file\_uploads = On*
- *allow\_url\_fopen = On*
- *memory\_limit = 256M*
- *upload\_max\_filesize = 128M*
- *max\_execution\_time = 360*
- *date.timezone = Europe/Bratislava*

With LAMP installed the creation of a database was the intuitive next step. As a way to, the next commands were followed:

- *sudo mysql -u root -p -> open mysql as root user*
- *CREATE DATABASE drupal; -> create the database called drupal*
- *CREATE USER 'miquel'@'localhost' IDENTIFIED BY 'password'; -> The user miquel is created in the server with a password set on password.*

- *GRANT ALL ON drupal.\* TO 'miquel'@'localhost' IDENTIFIED BY 'password' WITH GRANT OPTION;* -> all permissions are granted to the user *miquel* for database *drupal*.
- *FLUSH PRIVILEGES;* -> Reload the grant table to save operations.
- *EXIT;* -> exit MySQL

Finally, is time to download Drupal. To do so, the next commands are executed to download the latest version of that time, Drupal 8.8.4:

- *cd /tmp && cd /tmp && wget <https://ftp.drupal.org/files/projects/drupal-8.8.4.tar.gz>*  
-> download the file from Drupal website.
- *tar -zxvf drupal\*.gz* -> extract the file
- *sudo mv drupal-8.4.2 /var/www/html/drupal* -> move to the correct folder
- *sudo chown -R www-data:www-data /var/www/html/drupal/* -> modify permissions
- *sudo chmod -R 755 /var/www/html/drupal/* -> modify permissions

To continue, the file *drupal.conf* is created inside the folder */etc/apache2/sites-available/* in order to configure the Apache2 configuration file for Drupal. In the file the following configuration is added:

```
<VirtualHost *:80>
    ServerAdmin londak.juraj@gmail.com
    DocumentRoot /var/www/html/drupal
    ServerName 147.175.103.115:9082
    ServerAlias www.mmclab.eu

    ErrorLog ${APACHE_LOG_DIR}/error.log
    CustomLog ${APACHE_LOG_DIR}/access.log combined

    <Directory /var/www/html/drupal/>
        Options FollowSymlinks
        AllowOverride All
        Require all granted
    </Directory>

    <Directory /var/www/html/drupal>
        RewriteEngine on
        RewriteBase /
        RewriteCond %{REQUEST_FILENAME} !-f
        RewriteCond %{REQUEST_FILENAME} !-d
        RewriteRule ^(.*)$ index.php?q=$1 [L,QSA]
    </Directory>
```

</VirtualHost>

At last, the configuration is finished so now the site is enabled using the commands below:

- `sudo a2ensite drupal.conf`
- `sudo a2enmod rewrite`
- `sudo a2enmod env`
- `sudo a2enmod dir`
- `sudo a2enmod mime`

To finish, restart the Apache2 server so all changes are applied:

- `sudo systemctl restart apache2.service`

The last step of the configuration, is to open our website in a browser and configure the Drupal initial parameters. To do so, in google chrome the link <http://147.175.103.115:9082> is opened.

At this point Drupal asks for the language, profile, verify the requirements, database, and some configuration. In the figures Fig. 12 and Fig. 13 the requirements and configuration can be seen.



Figure 12. Drupal requirements.

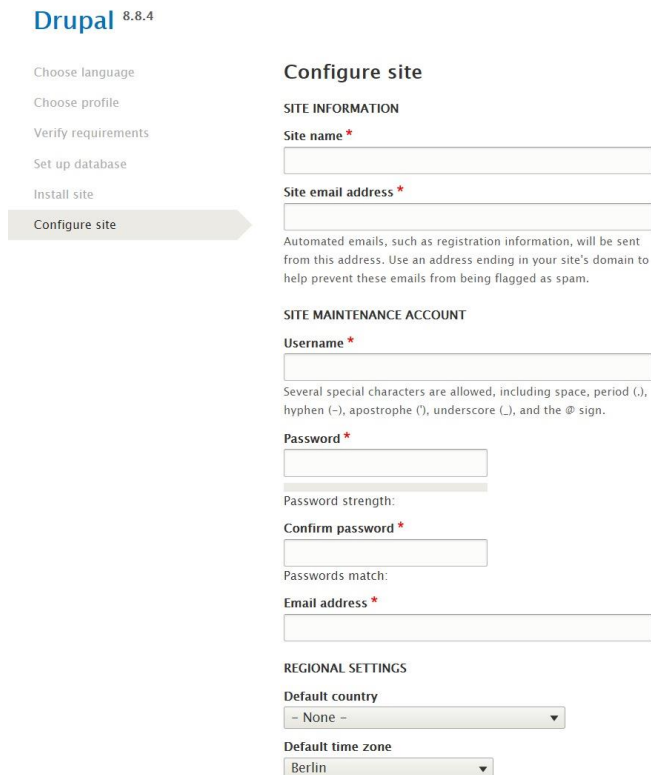


Figure 13. Drupal site configuration.

When all the fields were correctly filled, the site is set to start the development and the home page created by Drupal is displayed as in Fig. 14.

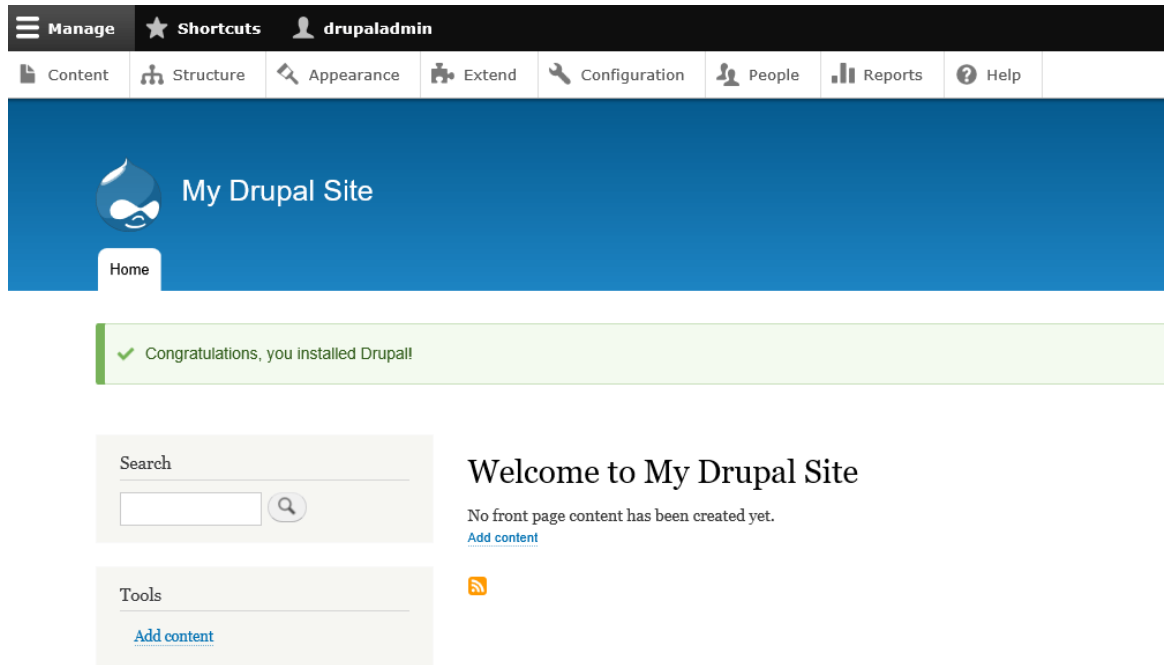


Figure 14. Drupal home page.

## 3.2. Development

With all the configuration ready, it was time to start the development of the website. For that purpose, the Agile methodology would be followed. The goal is to create a first working demo of the project as simple as possible and then start making upgrades to it with the knowledge that all work done so far is correct.

The idea is follows a very common Marketing strategy used nowadays for the enterprises, where a minimum viable product, MVP, is crated with all the basic functionalities of the product existing in the simplest possible way. This allows to test the product hypothesis with minimal resources, accelerate the learning, and reduce wasted engineering hours by detecting the mistakes as soon as possible.

To follow this methodology, the first demo would work as the minimum viable product and after testing it another upgraded version of it would be constructed on top of it. Finally, the second version of the product is tested and corrected in order to deliver the final product.

This way of software development is based on Agile methodology, where the feedback with the client is highly valued and listened in order to make constant upgrades to the product.

### 3.2.1. First Demo

#### 3.2.1.1. Back-end

The development of the project starts with the building of the first Demo. To do so first a back-end will be created and afterwards a front-end, both of them as simple as possible. The Drupal User Guide[10] was followed at the beginning as a starting point. Moreover, the Drupal docs[11] page was also visited at different moments in the process for guidance.

To start some basic site information is set. In order to do it, in the *Manage* administrative menu, from *Configuration > System > Basic site settings (admin/config/system/site-information)* the following values were introduced:

- Site name: Redzur
- Slogan: Redzur conferencing page
- Email address: [redzurfei@gmail.com](mailto:redzurfei@gmail.com)
- Default front page: /home

The second step was the creation of a new content type. A content type is the way Drupal stores and organizes data, which can be uploaded by the users to the website. Our goal is to create a content type called *Project* that allows the users to upload their projects to the platform.

To achieve this purpose, in *Structure > Content types (admin/structure/types)* a new content type is added to the web with the following fields:

- Abstract: A short text used as introduction to the project, 255 characters max.
- Poster: Image that will show the poster of the project.
- Description: A long text with the full description of the project.

Next, in *Configuration > People > Account Settings > Manage fields* two new fields were created for the authenticated users:

- Name: A short text to set the name of the user.
- Profile picture: An image to set as profile picture of the user, a portrait of Albert Einstein was set as default image.

Finally, the users permissions were modified in *People > Permissions* to give access to the authenticated users to post, edit and delete their own projects.

### 3.2.1.2. Front-end

When the basic back-end is ready, the building of a front-end starts. First of all, a view to display the projects is created.

To add a new view, the views tool from Drupal system is used. This tool allows to create views that can display content from Drupal in a list, grid or table format, all that using a simple and easy interface.

The view is created by going to *Structure > Views > Add view* and then configured with the following parameters:

Title: Projects

Format: Grid -> In Settings 3 columns are set

Show: Fields -> The fields are added in the respective order:

Project: Title -> Link to content

Project: Abstract

Project: Poster -> Link to content, image style Medium

Project: Authored by -> Link to author

Path: /projects

Pager: 200 items

This configuration provides a view that displays projects in a grid of 3 columns. Each project shows its title, abstract, poster and author in a list with this order. The title and poster of every project are linked to the content so when they are pressed the page is redirected to the view of the full project. The same happens when pressed in the author, the page redirects to the view of the user.

In the view, the image style for the poster is set to Medium, which displays the image in a smaller format of 220x220 pixels. This image style is also set in the project view itself, and to edit this it is needed to go Structure > Content types > Project > Manage display and then edit the Poster field.

This same process was done in the view of the users from Configuration > People > Account settings > Manage display and editing the Profile picture field.

The next step is to create a view where the users can see their own projects. As a way to, a copy of the projects view is created and slightly modified.

The first modification is to change the path to add a filter to only show the projects published by the current users. Also, the path is changed to /my\_projects, and finally the field authored by is substituted for published on. Since all the projects are from the same author, makes more sense to show the creation date.

Finally, to be able to access the created views the menus are modified. In Structure > Menus > Main navigation a new link is added to the Projects view, that is displayed in the top left corner, next to Home. On the other hand, in the User account menu two links are created and displayed in the top right corner next to My account. The first one is a link to My projects view and the second a link to Add project. Since the add project view is automatically created by Drupal the only thing to do is point the link to /node/add/project.

### 3.2.1.3. Testing

At this point, the first working demo is finished and ready for testing. The author does all the possible tests to verify the proper workflow of the website, including the followings:

- Create new account
- Add new project
- Edit project
- Visit profile
- Edit profile
- Display all the views
- Try all links

No errors were detected during the tests, which proved that the website works properly with what has been developed for now. Furthermore, the testing helped pointing out some conclusions for the necessary future upgrades of the project.

To that moment, the product is a functional website that provides a platform where users can use some features:

- See all projects uploaded to the platform
- Visit profiles of authors
- Create accounts with a profile picture and name



- Log in and:

Upload your own projects

View and edit your own projects

The biggest problem now is the way the whole platform is displayed and interacts with the user. Despite all these features work, the page doesn't provide a friendly user interface. To achieve our goal with the project, the next steps to upgrade the website are:

Improve the user interface:

Theme the whole platform.

Delete displayed unnecessary information.

Add more useful fields to projects and authors.

Add features for interaction between users:

Chat functionalities

Comments, Forums

### 3.2.2. Upgraded demo

After the feedback of testing the first demo, some upgrades can be done with the assurance that the project is going in the desired direction. As mentioned before, the goals of these upgrades are to provide more social network features as well as deliver a better user experience.

#### 3.2.2.1. Theming

The first step upgrading the project into the second demo was the theming process to deliver a better looking platform. This part included the installation of a new theme, as well as the addition of some HTML and CSS code.

Going into *Appearance > Install new theme* the Bootstrap 3 theme is installed using the following link: <https://ftp.drupal.org/files/projects/bootstrap-8.x-3.23.tar.gz>. Inside the theme, in Bootstrap settings there is the possibility of modifying the theme by using options provided by CDN[12], in this case the Spacelab theme was selected. Finally, the images are set as responsive and configured with rounded corners, also the navigation bar is set as fixed on top. All the other configuration options are set as default.

In order to be able to add CSS to the theme and modify it for personalization a subtheme is created. To do so, inside the folder `/drupal/themes/bootstrap/starterkits` there is a copy of the theme with the necessary modifications to be applied. This copy is added to the folder `/drupal/themes` and called `my_theme` and in all the files inside the name of the theme is set to `my_theme`.

Now going back to *Appearance* the new theme `my_theme` appears and is selected as default. This configuration allows us to modify the subtheme `my_theme` and keep the changes done to it while the main theme Bootstrap can be upgraded when a new version appears.

With the subtheme created, it is possible to improve some views adding some code. Going to the *Projects* view the fields are modified as follows.

Inside Style settings the option Customize field and wrapper with HTML is selected and the fields are set as:

Title: H3

Abstract: Default

Author: H5

Moreover, in the file `style.css` located inside `/drupal/themes/my_theme/css/` the class `project-abstract` is created. This file will continue to be updated during the project, and the code can be seen in the Appendices section.

The class `project-abstract` corrects the margins and aligns the text, and it is assigned to the field by clicking Create a CSS class inside Style settings and setting the name of the class.

This exact same process is applied to My projects view, but instead of modifying the field Author to an H5 style of HTML it is the Date field that this change is applied.

The next step of theming is the creation of a new view called Authors. Using the same process explained for the creation of the Projects view, the Authors view is set to show a grid of 4 columns with all the Authors, showing their name in a H4 style and their Profile picture below it. The link to the view is added to the main menu next to Projects.

To continue, a new image style is created and assigned to the Poster field of the Project content type in the Projects and My projects views. To create it is needed to go to Configuration > Media > Image styles > Add image style. The Poster small adds an effect of scaling and cropping the image to 336x237 pixels, making the image the exact size to fit in the space of the views.

This same process is replicated to create the Profile picture image style, with a size of 260x260 pixels and assigned to the profile picture field of the authors in the Authors view.

Finally, a new view called *New projects* was created in the form of a block. The view was configured exactly as the Projects view, but a filter to show the projects in order starting with the newest and ending with the older was configured. Also, the view was limited to show only 6 projects.

This block was placed in the Home page as content, below another block created with a text where an introduction to the platform is displayed. To create and locate this blocks, is needed to go to *Structure > Block Layout*.

### 3.2.2.2. Chat and comments

After the theming process the website had a cleaner and more modern look, which allows to start adding new features.

To make more of a social network, the chat functionalities were created. To do so, a large study in search of the best option was done. In this research the conclusion was install a new Drupal module that offers the functionalities needed. Three options were discovered that were worth giving a try, so all of them were tested to discover the best solution.

To install the modules, in the menu *Extend > Install new module* the corresponding links of the files with the module were set. This links can be found in the official Drupal page, in the pages mentioned in the next paragraphs. After this step, the module appears in the list of modules and can be selected to install.

The first module called DrupalChat[13] offers a small window in the left-bottom corner that contains a general chat and individual chats. Every chat opens in a new small window in the bottom, and in the general chat every user could participate. The problem was that for the 8 version of Drupal the module is still on development and only a beta can be installed. Since in this project Drupal 8 is used, the module was not working properly and had to be discarded.

The next option was Private message[14], a module that offers the possibility to send private messages between users, individually or in groups. This module is also still on development, but in a more advanced position than DrupalChat. Moreover, the module allows a lot of customization, so despite it didn't work perfectly when installed with some theming and customizing it was improved.

The customizing of the module started by the creation of a blank view that supports a list of blocks. The page was called Messages added to the menu in the top right corner between My projects and My account.

From *Structure > Block layout* in the content space two blocks were added: *Private Message Inbox* and *Private Message Actions*. In the configuration of the blocks, in *Visibility > Pages* both of them were configured to only appear in the view Messages created before. Finally, the Ajax refresh rate was set to 3 seconds.

To be able to use private message, the permissions of users were modified. The permissions of *Use private message system* and *View user information* were granted for the authenticated users.

The last module was RocketChat[15]. Rocket.Chat is an open-source solution for team communications. Its features include group messages and video calls, screen and file sharing and live chat. It provides webapp interface, cross-platform desktop client, iOS and Android mobile apps.

The RocketChat module allows access from the website to a RocketChat system through a widget in the platform. This module was tested but it wasn't possible to make it work properly. Anyway, RocketChat was installed and configured inside the server, and adding a link in the main navigation of the website it was possible to use it.

To install RocketChat and configure it the installation guide[16] and RocketChat docs[17] were followed. The installation of the chat to the server was done using snaps, with this two commands:

```
sudo apt-get install snapd > installation of snapd
```

```
sudo snap install rocketchat-server > installation of RocketChat
```

After some basic configuration the chat was ready to use and accessible through the port 3000 of the server.

Finally, in order to deliver the best user experience, the chat functionalities were set using two modules. The Private message module, allowing to send private messages to users in a very simple way, only offering a basic interface and the option to send text. And in the menu a link to the RocketChat solution was added. Inside RocketChat, since it is actually a different website it is needed to create a new user and log in, but the chat offers a very nice user experience, with the possibility to share files and create video-calls through Jitsi.

With this solution of a double chat, if only a simple message is needed to send to a user the Private message can be used. Instead, to establish a more complex conversation the RocketChat option delivers more features.

In order to add the possibility to create comments in the projects the module Comments was installed. This allows to create a field of type comments to the Project content type and now in all Projects comments from different Authors can be posted. Despite the functionality of it exists, the comments appear in an ugly look right now, so the user interface needs to be improved.

### 3.2.2.3. User interface

With all the features existing, this last part pretends to create a better user interface to deliver the best possible user experience of the platform. In order to achieve this goal two more modules were installed, Real name[18] and Display suite[19].

Real name changes username of the users for a defined value from the user profile every time it appears on the screen. After installing, it is configured in Configuration > People > Real name to show the field Name of the users. This allows the user to have better information about the authors and in consequence have a better experience with the web.

The Display suite module allows to customize the views of the website using an easy interface. Some default layouts from inside the module can be set to the views to organize them as preferred, also there is the possibility to create new layouts.

The first view upgraded using Display suit is the view of a project. To do so, is needed to go to *Structure > Content types > Project > Manage Display* and select the two column stacked layout for it. This layout offers a header, two columns with the same width and a footer.

Before relocating the fields in the new layout a few modifications are applied. First a new image style called Poster big was created. The style does the same as Poster small but with 550x337 pixels. The image style is set to the Poster field in Manage Display.

In *Structure > Taxonomy* a new vocabulary is created in order to be able to classify the projects between categories. To do so, the option Add vocabulary is selected and the name is set to Categories. Then 4 terms are added to it: Telecommunications, Audiovisuals, Telematics and Electronics.

Now we add a new field called ingredients to the Project content type. The field is set as a *Reference > Taxonomy* term and the created terms are added.

To organize the layout, the field of Poster is set to the left column. In the right column the Author, Post date, Project category and Abstract appear in the respective order. Finally, at the footer the Description and comments appear.

To improve the looking, tree CSS classes are added to the file style.css and set to the respective regions: profile-pic-region, poster-right-region and poster-bottom-region.

Continuing with the user entity, tree more fields were created in it:

University: As a small text, to set the enrolled university of the author.

Private message: as a link, to send a private message to the author.

Description: As a long text, to include more information about the author.

The user account view is selected in Manage display and the Fluid tree column stacked layout is selected. This layout offers a header, footer and tree columns with different widths. The first column has a width of 25% of the screen, the second a 50% and the third another 25%, also since it is fluid, when the screen of the following column is not used it can be invaded by the one on the left.

In the first column the Profile picture is set, in the second the Name, University and Description, finally in the third the private message link. Also the profile-pic-region class is set to the first column and the poster-right-region to the second.

To continue improving the user experience some existing views are modified. In the Authors view the field University is added below the Profile picture and customized with html, set as H5 type and adding the CSS class profile-university.

In the Projects and My projects views the same changes were applied. First, between the Abstract and the Poster the field Project category is included. To configure the field, the class project-category is set. Also, two filters were configured to offer the user searching options. The first filter is set as Search keywords engine, and the second a filter for project categories.

To improve the style of the chat, a few of modifications and theming were applied. In *Structure > Private Message > Private Message Settings > Manage display* the two column stacked layout is set as default. This layout has a header, two columns of equal width and a footer. In the first column the name of the author is located, in the second the date of the message and in the footer the message itself.

In the folder */drupal/modules/private\_message/css/* the files *private\_message\_thread.css* and *private\_message\_inbox\_block.css* were slightly modified. In both of them the code *border-radius: 5px* was added in the respective classes referring to the boxes that holds the message, to create a more modern interface. Also, some paddings were modified.

Finally, a similar process was done to upgrade the way comments are displayed. First, in *Structure > Comment types* a new comment type called Project comments was created. In Manage display of the new comment type the layout fluid two column stacked was selected. This layout is the same as two column stacked layout but the first column can take more screen over the second in case the second is not using it.

In order to improve the layout, from the folder */drupal/modules/ds/css/* the file *ds-2col-stacked-fluid.css* was accessed and modified. The change was to simply give a value of 20% of the display to the first column, and 80% to the second. With this modification, the columns provide a better width structure for the purpose.

A new image style called Profile picture small was created, showing the picture in a format of 50x50 pixels. Then in *Configuration > People > Account Settings > Manage display > Compact* the user compact view was set to only show the name and below the profile picture with the new image style. Now, at the left of the comment the name and small picture of the user can be displayed.

Finally, in the first column the user with the compact view was located, and in the second the comment with the links to edit or reply below it.

#### 3.2.2.4. Testing

Arrived to this point the second version of the product was ready for testing. This version includes all the features and the only difference to the final version is the correction of errors

and minor improvements that can be suggested after testing to deliver a better user experience.

In this process three people participated: the author, supervisor Gregor and Ivan Minarik, an organizer of the Redzur event. The idea was that the more people involved the higher the probability to find errors, and the better the final product would be.

The testing included every possible situation that could be thought of, from trying the chats and comments to creating new accounts and projects, going through all the views and pages of the platform. After the whole process, two errors were found that needed correction and some ideas of minor improvements appeared.

The first error was that for some error related to the image style of the profile picture it was not possible to create new accounts. The second, when trying to send a private message and selecting a user searched by the engine the message failed. This problem was probably related to the compatibility between the modules Real name and Private message.

Some of the suggestions for improvements included open some links in new tabs, such as the RocketChat, and the posters of the projects. Also the possibility to log in with the same user in both sites, Drupal and RocketChat. Due to the lack of time until the deliver final product and the lack of knowledge about how to make this update, this last suggestion was discarded.

### **3.2.3. Final product**

To create the final product, the correction of errors was done over to the second demo, as well as some small upgrades. Finally, an adapted version of the product was created to use in the 14<sup>th</sup> edition of the Redzur conference, taking place Friday 5<sup>th</sup> of June.

#### **3.2.3.1. Errors correction**

The first error to correct was the problem with creating new users. To solve it, looking into the error that appeared it was discovered that the Drupal core had a bug when an image was set as default for a new field that had an image style applied to it. The solution was to delete the image by default and require the user to upload the photo.

The next error was a more complex situation. The module Real name, substitutes the username of authors for their name every time it appears on the screen. In the Private message module, when selecting to send a private message a search engine appears to search the users to send the message. Since Real name changes the username for the name, this engine works with the names. Then, by the way the Private message module is programmed, the name selected in the engine is searched in the database to find the user and send the message. Since the module takes the name directly from the engine, it is searching the users by the name and not the username, which results in no users found.

To solve this, the code of the following files in JavaScript and PHP was modified:

`js/private_message_members_widget.js`

`src/Mapper/PrivateMessageMapper.php`

`src/Controller/AjaxController.php`

The files can be found in the folder `/drupal/modules/private_message/` and the modifications realized on the code can be seen in the Appendices section.

To summarize the changes done in the code, a new variable called *displayName* was created, so the user interface would keep showing the real name using the variable but in the back-end it would be working with the username so it is able to find the users to send the messages.

Into the improvements, the first thing was to delete the revision box that appears by default when creating a new Project. To do so, in *Structure > Content types > Project > Edit > Publishing options* the *Create new revision* option is deselected.

Moreover, profile picture image from the Authors view was linked to the author, and in the views related to projects, the poster of the projects was linked to the project. Finally, to open the link of RocketChat in a new tab, the module External Links[20] was installed.

Finally, a new field was added to the *Project* content type called priority. This field is an integer number that by default is set to 0, and the purpose of it is to organize the projects in a list. In the *Projects* view a new order filter is set referring to the priority field. The filter is configured to start at 1 and show the projects ascending from 1 to the highest number. This allows the Administrator to change the priority value to order the projects as desired, and make them invisible to the users by setting it to 0.

### 3.2.3.2. Last tests

After the correction of errors, the website was ready to launch public. The administrators of the server launched it at the link <https://www.mmclab.eu> and all the tests were run again to verify the proper workflow and full functionality of the platform.

Only one small error was found, when changing the name of the website by making it public the access to the database from a device outside of the server did not work. The problem was that Drupal was still pointing the link to the previous private name from inside the server. To correct this, in the file *settings.php* located in the folder */drupal/sites/default/* the following line of code was updated:

```
$settings['file_public_base_url'] = 'https://www.mmclab.eu/sites/default/files';
```

With this last correction, once the user clicks in a file of the website, such as a poster image, it will open in a new tab.

### 3.2.3.3. Adaptation for 14<sup>th</sup> Redzur edition

Arrived to this moment the platform was finished and ready to use, but due to the lack of time for the users to try the platform, some modifications were made to adapt it in a simpler version for the 14<sup>th</sup> edition of the Redzur conference.

The goal is to make the user adapt to the platform faster and easier by simplifying it and making some previous work for the users. The first thing, was to disable the block of *New projects* in the home page to avoid confusions.

The posters of this year were prepared to be displayed horizontally and the website is set to display them vertically, so the image styles Poster small and Poster big were modified to the values of 336x474 pixels and 370x523 pixels respectively.

For this year, the projects only included title and poster, and all of them were added to the platform by the administrator in the order provided by the organizers of Redzur. Also, to make it easier for the users, in the RocketChat a new public group for every project was created where participants could discuss every project. To make it easier, a new field in



form of a Link was added to the Project content type and set to display near the poster. This link was filled with the link of the discussion of the project in question in RocketChat.



## 4. Results

In this section the workflow of the platform will be explained in detail with the help of screenshots from the user view. The section will define the two products created, the final product, and the adaptation of it used in the 14<sup>th</sup> edition of the Redzur workshop. The goal is to describe and show the results achieved in the project.

### 4.1. Final product

To access the platform, from any browser search <https://www.mmclab.eu> and the following appears in the front page:

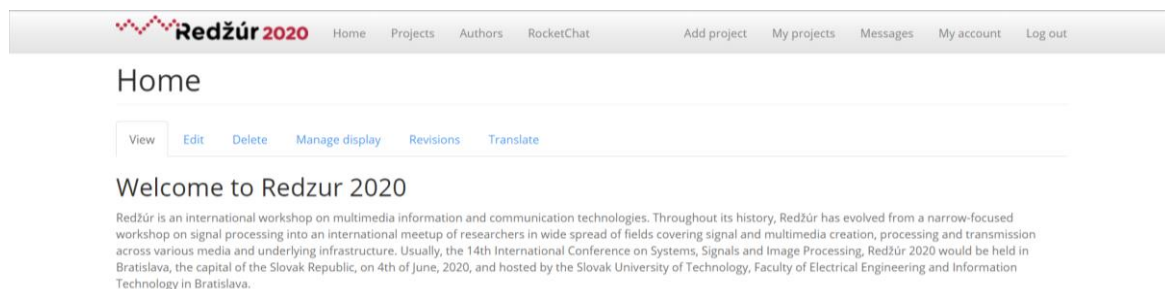


Figure 15. Home page website.

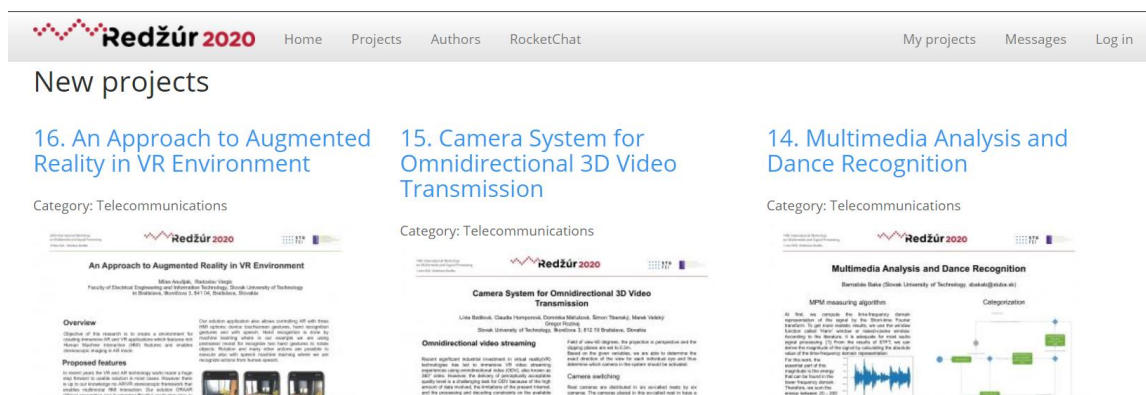


Figure 16. New projects block.

In the home page an introduction and the 6 latest projects uploaded can be seen, from there using the menu on top the user can go to all the other pages of the platform.

Then the user can go to Log in and create a new account, or log in with an existing one. Then the My account link in the menu appears with all the information about the user and the possibility to edit it. In the next figures this process is displayed.

## Log in

[Log in](#) [Create new account](#) [Reset your password](#)

**Username\***

Enter your Redzur username.

**Password\***

Enter the password that accompanies your username.

Figure 17. Log in page.

## Create new account

[Log in](#) [Create new account](#) [Reset your password](#)

**Email address\***

A valid email address. All emails from the system will be sent to this address. The email address is not made public and will only be used if you wish to receive a new password or wish to receive certain news or notifications by email.

**Username\***

Several special characters are allowed, including space, period (.), hyphen (-), apostrophe ('), underscore (\_), and the @ sign.

**Password\***

Password strength:

**Confirm password\***

Passwords match:

Provide a password for the new account in both fields.

**Name\***

**Profile picture**

Ningún archivo seleccionado

[Upload requirements](#)

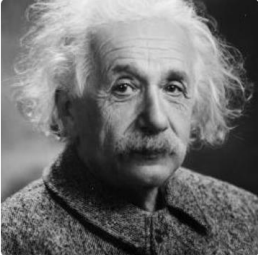
**University**

**Profile description**

Figure 18. Create new account page.

# Administrator

View Shortcuts Activity Edit Manage display



**Name:** Administrator  
**University:** Slovak University of Technology in Bratislava, STUBA  
**Profile description:**  
 Administrator of the website

Figure 19. My account page.

Then the user can also access to Add project where new projects can be created as seen in Fig. 20. The projects created will appear in My projects view, where the user can also go inside the project to view it full and edit it, Fig. 21 and Fig. 22.

Redzur Home Projects Authors RocketChat Add project My projects Messages My account Log out

Node / Add content / Create Project

## Create Project

**Project\***

**Project category\***

Telecommunications (4)

Set your project categories

**Abstract\***

Introduction to your project (255 characters)

**Poster\***

Seleccionar archivo Ningún archivo seleccionado

Add your poster here

Upload requirements

**Description\***

Description of your project

**Priority** Leave this blank

Don't touch this value

Save

Figure 20. Add project view.

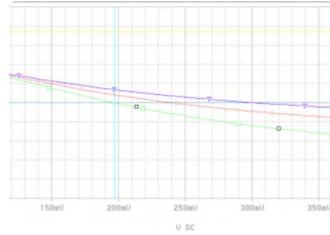
## Projects

Search:  Category:

### Test 4

Create a ds\_layouts folder (inside your theme folder) and then create a folder whose name will be used as key for the layout. The examples below need to be put in a folder named small\_left\_col.

Category: Audiovisuals

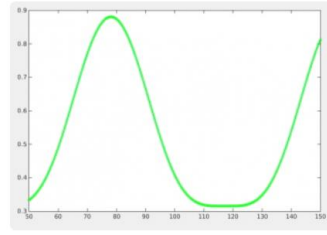


Published: Sunday, April 26, 2020 - 13:58

### Test telecos

This is only a test of the abstract I'm listening to the song creep right now, it's a cover a really good one, I never get tired of this song it's amazing in every way. How many characters left?????

Category: Telecommunications



Published: Thursday, April 23, 2020 - 19:58

### Test Electronics

This is only a test of the abstract I'm listening to the song creep right now, it's a cover a really good one, I never get tired of this song it's amazing in every way. How many characters left?????

Category: Electronics



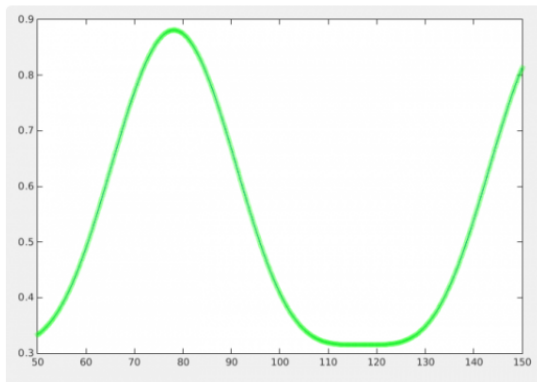
Published: Wednesday, April 22, 2020 - 12:34

Figure 21. My projects page.

Node / Test telecos

## Test telecos

View Edit Delete



Author: Jaume Sanso

Post date: Thursday, April 23, 2020 - 19:58

Project category: Telecommunications

Abstract:

This is only a test of the abstract I'm listening to the song creep right now, it's a cover a really good one, I never get tired of this song it's amazing in every way. How many characters left?????

Description:

Create a ds\_layouts folder (inside your theme folder) and then create a folder whose name will be used as key for the layout. The examples below need to be put in a folder named small\_left\_col.

### Add new comment

Comment\*

Plain text  [About text formats](#)

Figure 22. Own project view.

It is also possible to view all the authors and get in their profile by going in the Authors view, shown in Fig. 23. Inside the author view, Fig. 24, there is the possibility to send a private message to him.

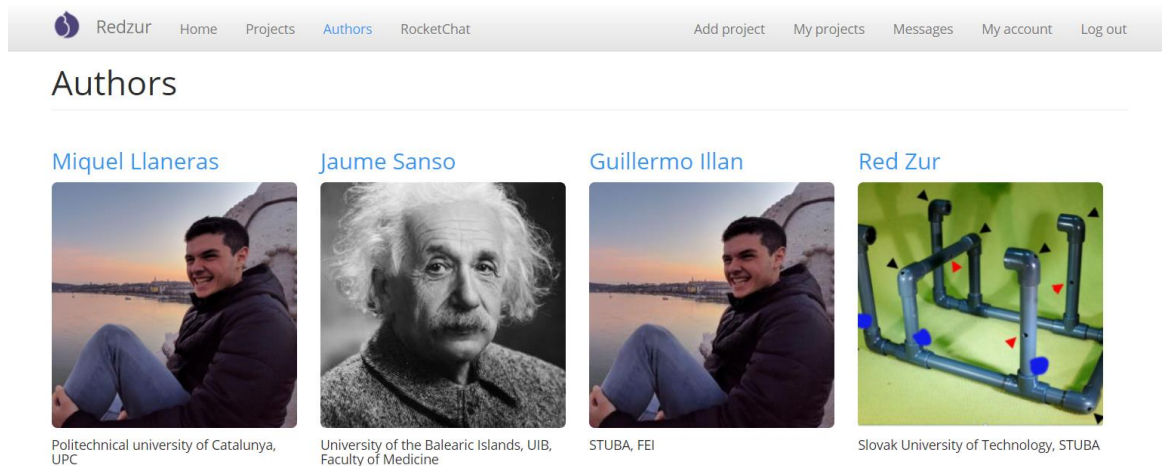


Figure 23. Authors page.

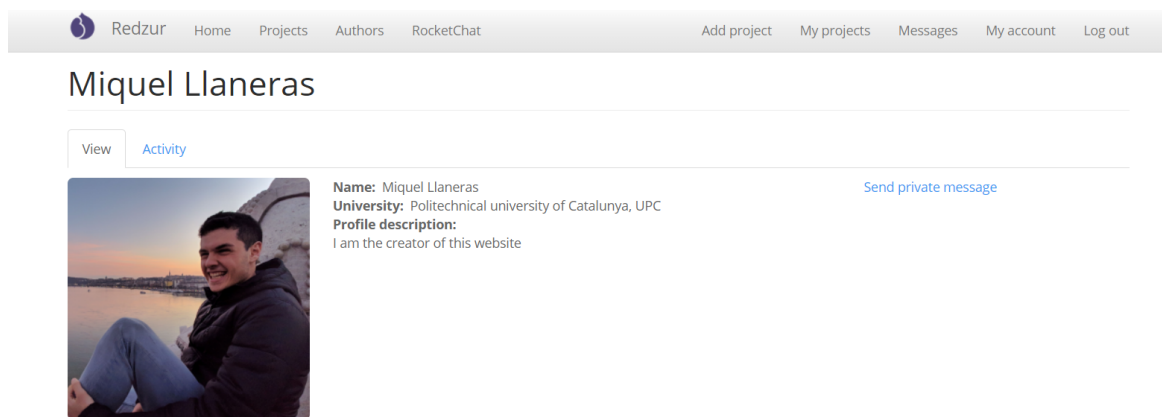


Figure 24. Author view.

In the Projects view, Fig. 25, all projects can be seen and fully displayed when clicking on them. The projects can be filtered using the search engines on top of the page, to facilitate finding a specific project, or group of projects.

In the view of a project, all the information about the project including the comments can be seen. If the user is logged in, the possibility to add comments will appear as shown in Fig. 26, Fig. 27 and Fig. 28.

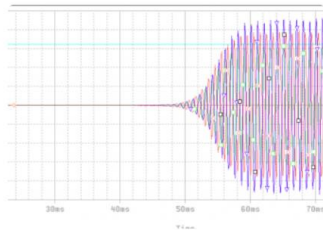
## Projects

Search:  Project category:

### Demo 5

Create a ds\_layouts folder (inside your theme folder) and then create a folder whose name will be used as key for the layout. The examples below need to be put in a folder named small\_left\_col.

Category: Telecommunications



Author: Miquel Llaneras

### Testing final

Error: Call to a member function transformDimensions() on null in template\_preprocess\_image\_style() (line 305 of core/modules/image/image.module). Error: Call to a member function transformDimensions() on null in template\_preprocess\_image\_style() (line 30

Category: Telecommunications

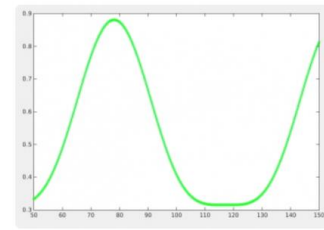


Author: Red Zur

### Test telecos

This is only a test of the abstract I'm listening to the song creep right now, it's a cover a really good one, I never get tired of this song it's amazing in every way. How many characters left?????

Category: Telecommunications



Author: Jaume Sanso

### Test 4

Create a ds\_layouts folder (inside your theme

### Test Electronics

This is only a test of the abstract I'm listening to the

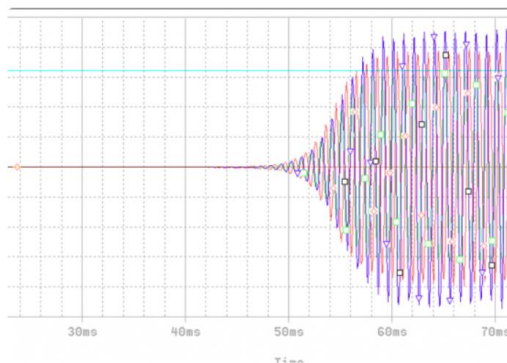
### Demo 1

This is only a test of the abstract I'm listening to the

Figure 25. Projects page.

Node / Demo 5

## Demo 5



Author: Miquel Llaneras

[Send private message](#)

Post date: Sunday, April 26, 2020 - 18:46

Project category: Telecommunications

Abstract:

Create a ds\_layouts folder (inside your theme folder) and then create a folder whose name will be used as key for the layout. The examples below need to be put in a folder named small\_left\_col.

Description:

The Ingenious Gentleman Don Quixote of La Mancha (Modern Spanish: El ingenioso hidalgo (in Part 2, caballero) Don Quijote de la Mancha, pronounced [el inxe'njoso i'ðalyo ðon ki'xote ðe la 'mantʃa] (About this soundlisten)), or just Don Quixote (/ˌdɒn kiː'hɒti/, US: /-teɪ/[1] Spanish: [don ki'xote] (About this soundlisten)), is a Spanish novel by Miguel de Cervantes. Published in two parts, in 1605 and 1615, Don Quixote is the most influential work of literature from the Spanish Golden Age and the entire Spanish literary canon. A founding work of Western literature, it is often labeled "the first modern novel"[2] and many authors consider it to be the best literary work ever written.[3][4]

The plot revolves around the adventures of a noble (hidalgo) from La Mancha named Alonso Quixano, who reads so many chivalric romances that he loses his mind and

Figure 26. Project view.

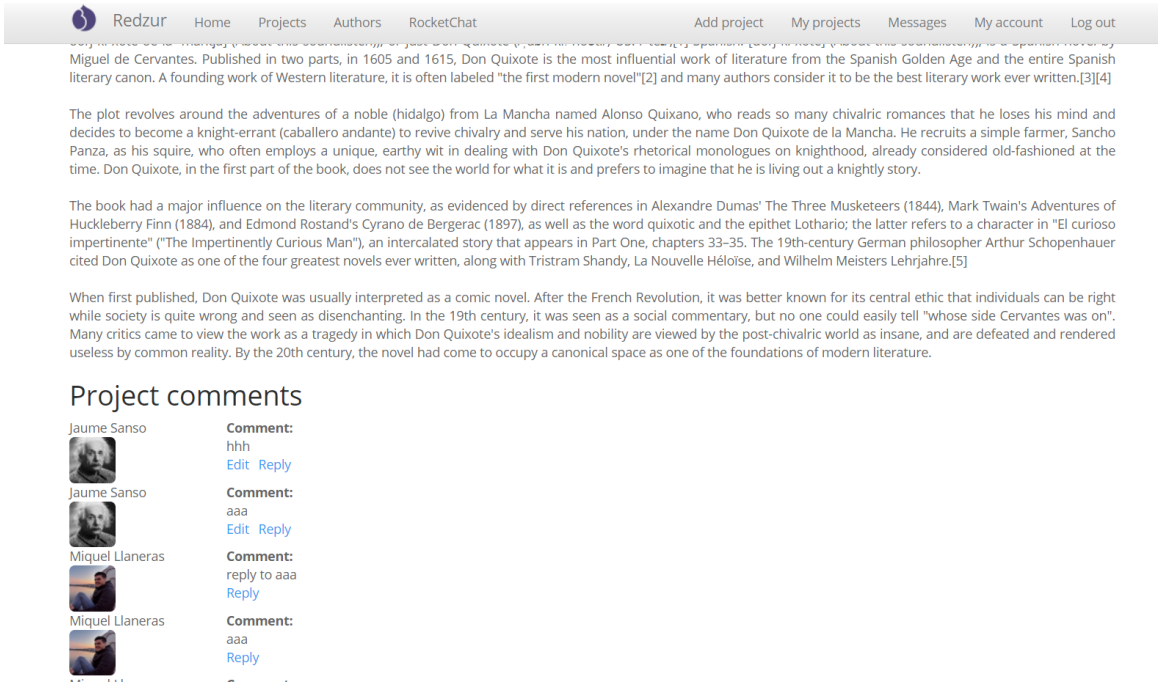


Figure 27. Project comments view.

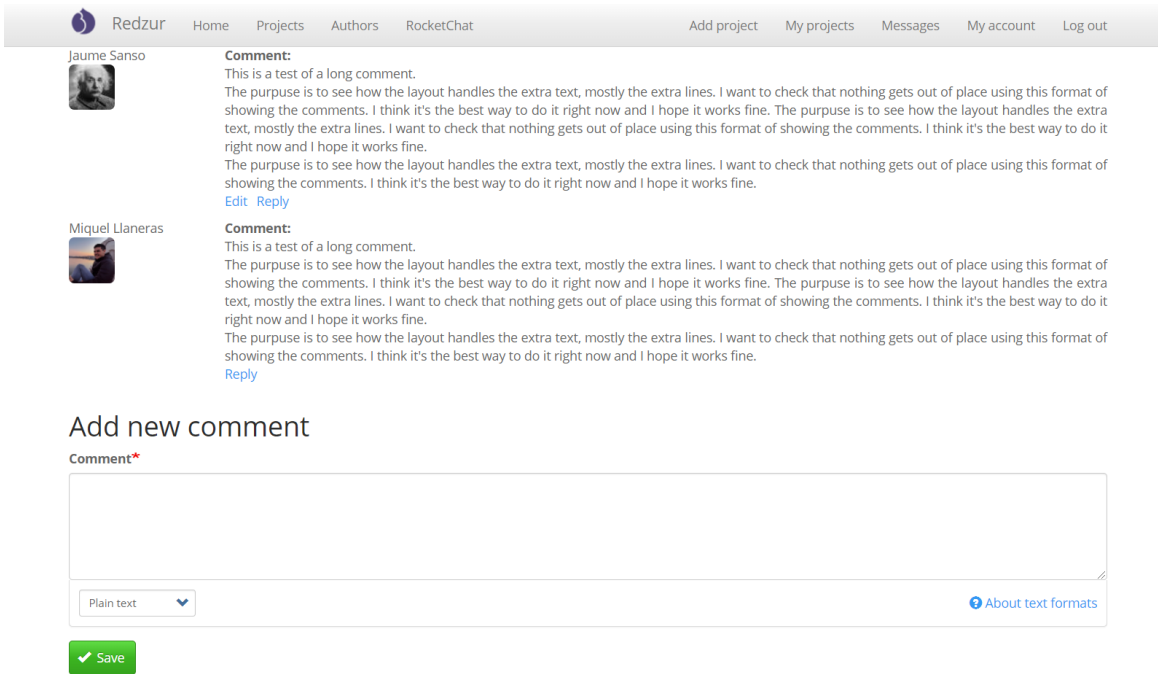


Figure 28. Add comment to project view.

The last feature a logged in user can use is the messages inside the website. The author can see their messages and send new ones going in the Messages page link on the menu. The page shows all the threads on course and a button to create new ones, as seen in Fig. 29. The view of a thread is displayed in Fig. 30 and the creation of a new thread in Fig. 31.

## Messages

- You, [Red Zur](#), [Miquel Llaneras](#), [Guillermo Illan](#)  
Mon, 06/01/2020 - 12:53  
**From:** [Miquel Llaneras](#)  
aa
- You, [Miquel Llaneras](#)  
Mon, 06/01/2020 - 12:14  
**From:** [Miquel Llaneras](#)  
kind of works
- You, [Miquel Llaneras](#), [Guillermo illan](#)  
Mon, 06/01/2020 - 11:56  
**From:** [Miquel Llaneras](#)  
kk
- You, [Guillermo Illan](#)  
Mon, 05/18/2020 - 13:31  
**From:** [Jaume Sanso](#)  
is this sending to everyone?

[Create Private Message](#)

Figure 29. Messages page.

[Private Messages](#) / Private Messages

## Private Messages

[Delete thread](#)

You [Miquel Llaneras](#) [Guillermo Illan](#)

[Load Previous](#)

- [Jaume Sanso](#)  
Hey 05/21/2020 - 17:28
- [Miquel Llaneras](#)  
How is it going? 05/21/2020 - 17:29
- [Miquel Llaneras](#)  
quite good 05/21/2020 - 17:29
- [Miquel Llaneras](#)  
and you? 05/21/2020 - 17:30
- [Jaume Sanso](#)  
perfeeeeectttt 05/21/2020 - 17:30
- [Miquel Llaneras](#)  
ty 05/21/2020 - 18:20
- [Miquel Llaneras](#)  
and you? 05/21/2020 - 17:30
- [Jaume Sanso](#)  
perfeeeeectttt 05/21/2020 - 17:30
- [Miquel Llaneras](#)  
ty 05/21/2020 - 18:20
- [Miquel Llaneras](#)  
kk 06/01/2020 - 11:56

Message\*

Message

Plain text  [About text formats](#)

Figure 30. Thread view.



Redžúr 2020 Home Projects Authors RocketChat Add project My projects Messages My account Log out

## Create Private Message

To:

Message\*

Message

Plain text  [About text formats](#)

Figure 31. Create new thread view.

If the user goes into the RocketChat link on the menu, a new window with the RocketChat system appears. In Fig. 32 the log in views can be seen, and in Fig. 33 the typical view of a chat showing the General channel is displayed.

In Fig. 33 can be seen how in the left all the channels and messages appear, as well as a top left menu where new channels and private messages can be created. Finally, in the top right corner, inside the chat, some options like initiating a new video call appear. When creating a new video call a new tab opens a new channel in the Jitsi platform where the call takes place, Fig. 34.

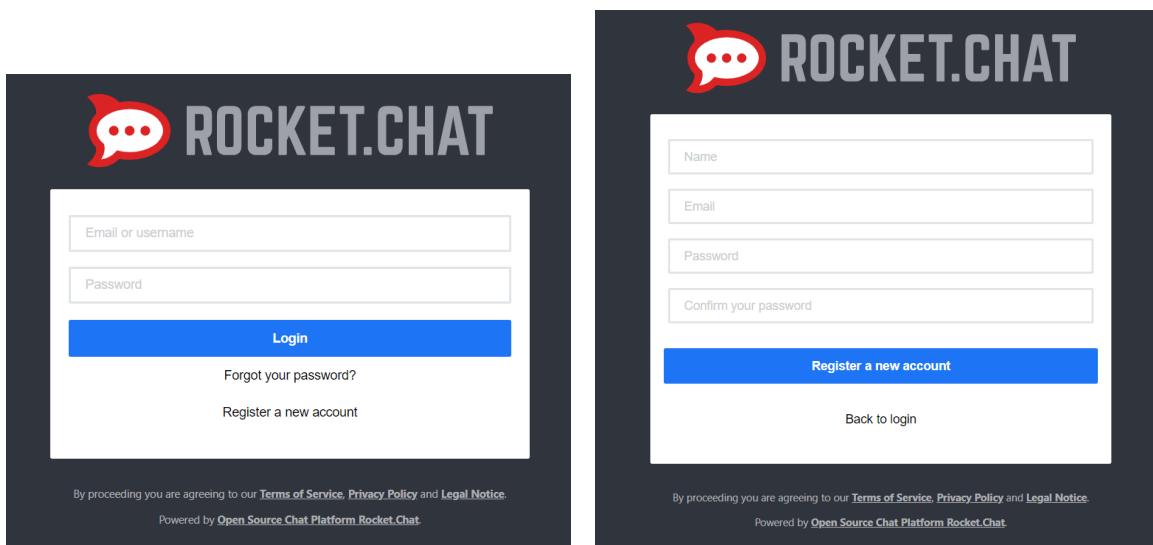


Figure 32. RocketChat log in and create new account.

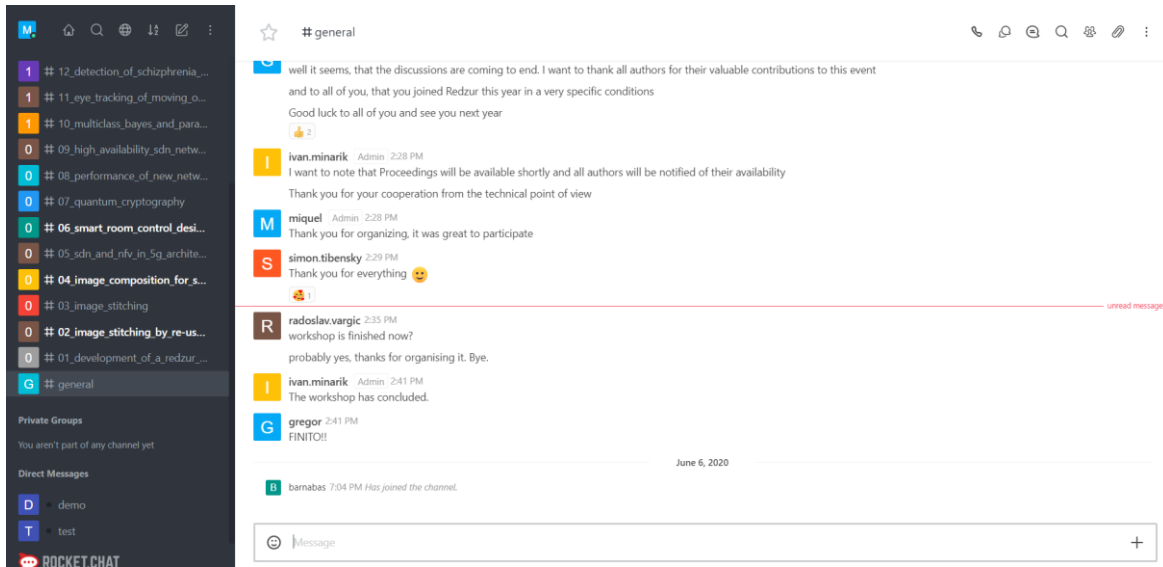


Figure 33. Chat in RocketChat.

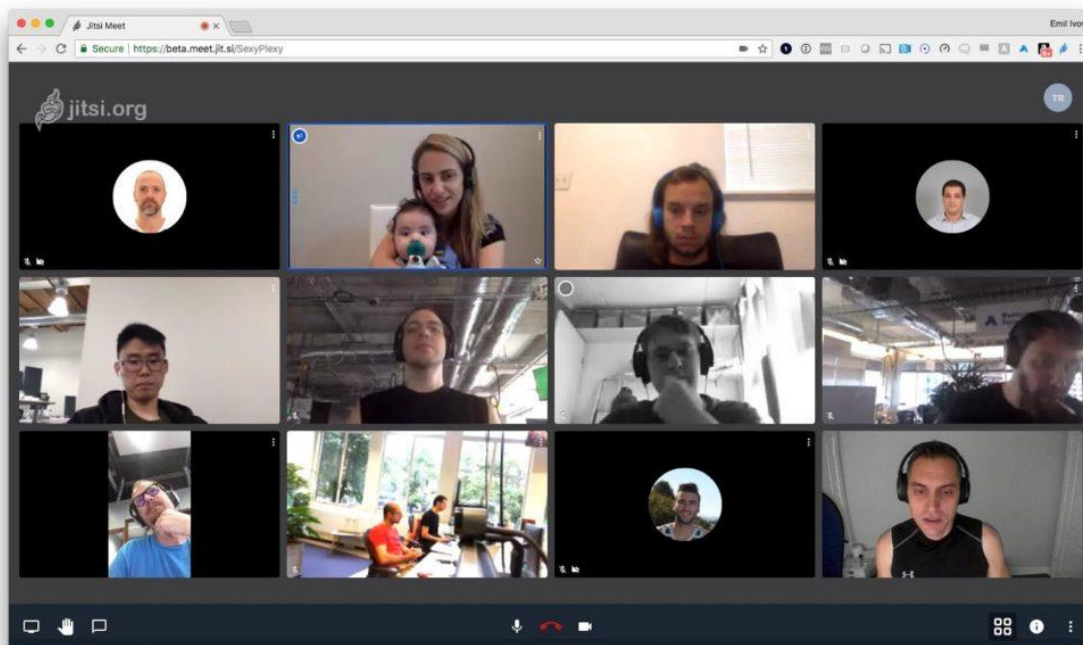


Figure 34. Jitsi video call example.

With this concludes all the result of the final product of the platform. To summarize, it is a social network that intends to support a platform where the users of Redzur International Workshop can interact and share their projects. The main functionalities are to upload projects and share them with others authors and comment them, as well as communicate with the authors either through text or videoconference.

## 4.2. Adapted version

As mentioned, an adapted version of the final product was created for the Redzur 14<sup>th</sup> edition to take place. The purpose was to simplify the platform a bit for the user, since the lack of time for them to get used to it.

To do so, the modifications mentioned in point 3.2.3.3 were applied, leading the results shown in the next figures. The figures only display the differences between this version and the final product.

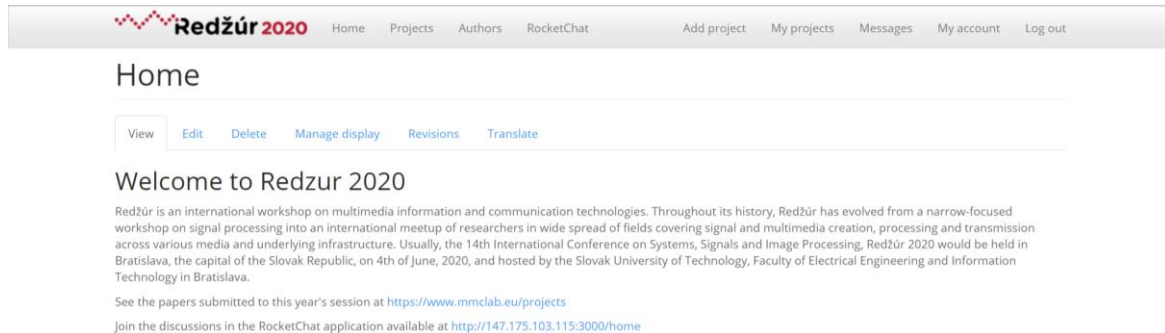


Figure 35. Adapted home page.

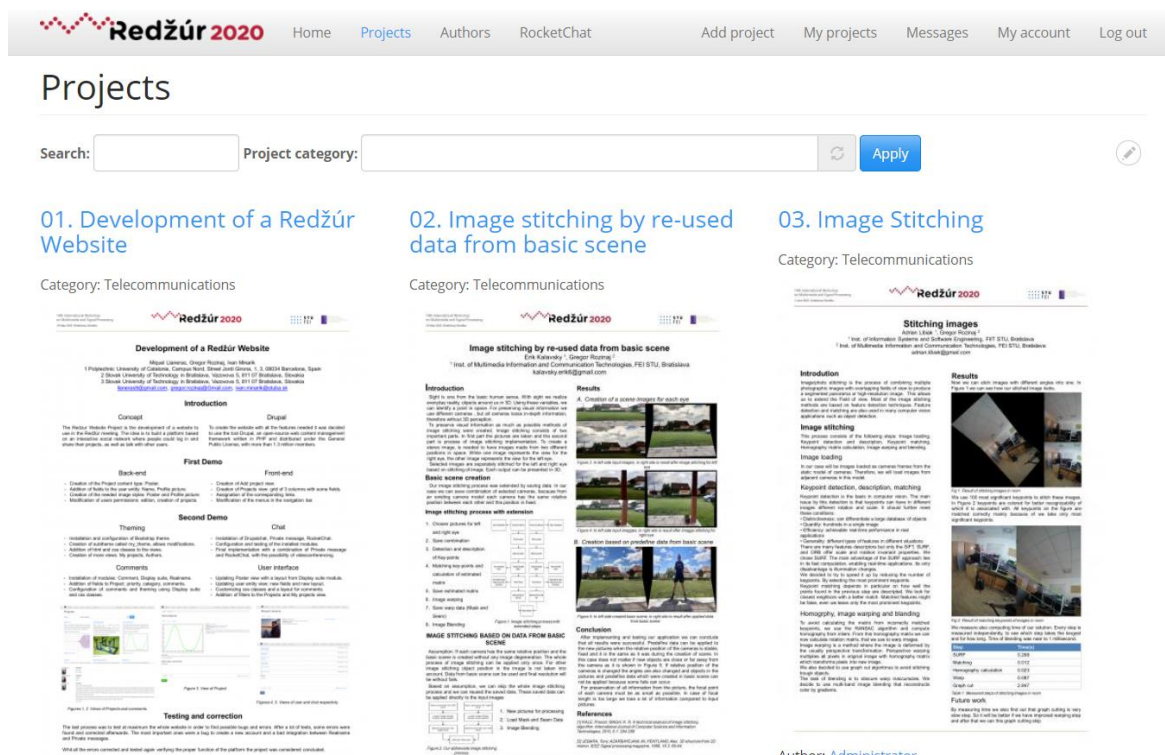


Figure 36. Adapted projects page.

Node / 01. Development of a Redžur Website

# 01. Development of a Redžur Website

View Edit Delete Manage display



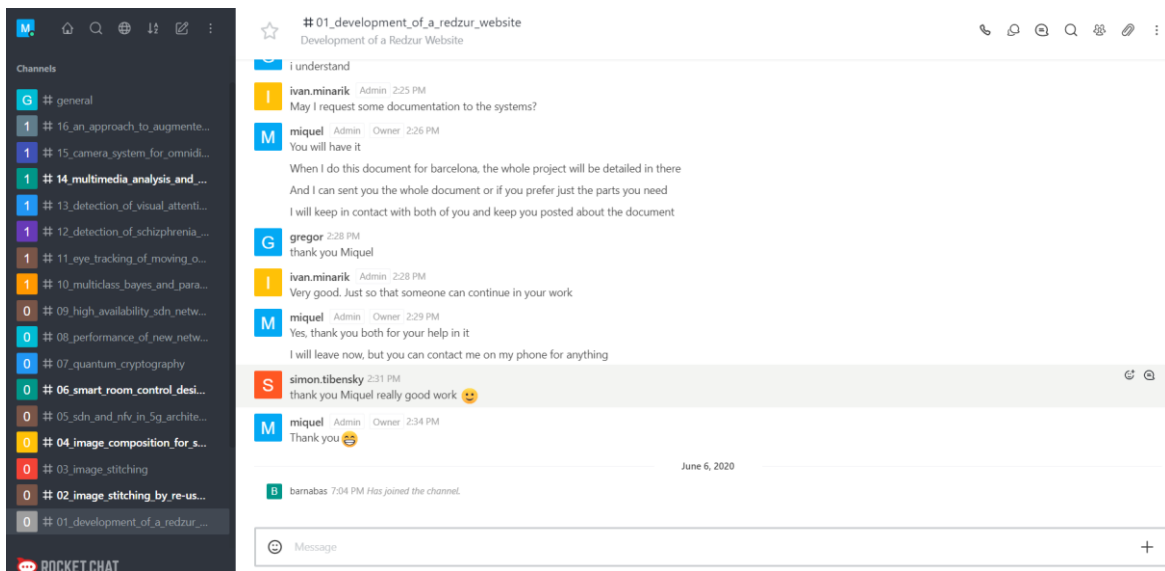
**Link to discussion:** [http://147.175.103.115:3000/channel/01\\_development\\_of\\_a\\_redzur\\_website](http://147.175.103.115:3000/channel/01_development_of_a_redzur_website)

**Author:** Administrator

**Post date:** Thursday, June 4, 2020 - 21:35

**Project category:** Telecommunications

Figure 37. Adapted Project view.



#01\_development\_of\_a\_redzur\_website  
Development of a Redzur Website

i understand

ivan.minarik Admin 2:25 PM  
May I request some documentation to the systems?

miquel Admin Owner 2:26 PM  
You will have it

When I do this document for barcelona, the whole project will be detailed in there  
And I can sent you the whole document or if you prefer just the parts you need  
I will keep in contact with both of you and keep you posted about the document

gregor 2:28 PM  
thank you Miquel

ivan.minarik Admin 2:28 PM  
Very good. Just so that someone can continue in your work

miquel Admin Owner 2:29 PM  
Yes, thank you both for your help in it  
I will leave now, but you can contact me on my phone for anything

simon.tibensky 2:31 PM  
thank you Miquel really good work 😊

miquel Admin Owner 2:34 PM  
Thank you 😊

June 6, 2020

barnabas 7:04 PM Has joined the channel.

Figure 38. Adapted RocketChat.

## 5. Budget

The costs of this project are divided in two parts, the hardware used and the human resources. As mentioned, all the software used has been open-source software, so no expenses appear in this part.

The hardware consists in a computer with a value of 1000€. Considering the computer can be sold after the project, the cost of the computer would be calculated to 1 year of usage through amortization. If the residual value of the computer is 100€ after 8 years, every year it depreciates:

Depreciation every year = (Total value – residual value) / years = (1000-100) / 8 = 112,5€

Since the computer is only used 1 year the cost of it is the depreciation of 1 year, because the computer will be sold with a value of it, minus the depreciation of 1 year, 887.5.

In reference to the human resources, only one person worked on the project with a total of 540 hours. If the salary of the author would be paid as a junior engineer, 9€ per hour, the salary would be  $540 \times 9 = 4860$ €. To this salary it is needed to calculate the social charges, being it a 33% of it, the cost of social charges would be  $4860 \times 0,33 = 1603,8$ €.

Finally, the whole cost of the project calculates as follows in Tb. 5:

Hardware	Human Resources	
Computer	Gross Salary	Social Charges
112,5€	4860€	1603,8€
112,5€	6463,8€	
<b>TOTAL COST: 6576,3€</b>		

Table 5. Cost of project.

## 6. Conclusions and future development:

To summarize, the project has been the development of a new web based platform with social network features that provides a space where the Redzur conference can take place. The website has been built on top of an Ubuntu server with the help of the CMS Drupal. The features include chats, video conferencing, Projects sharing, comments, etc. The successful 14<sup>th</sup> edition of the Redzur Workshop taking place in the platform provides proof of the success of the project.

As conclusions, the realization of this project has been a very enriching experience for the developer. It allowed the author to learn a lot as a student by doing a full big project on his own, as well as approaching him to a closer look of what the real work of a software developer is. It is a great way of ending the degree studies of Telecommunications engineering by having now the gained experience in the whole process, fully preparing the student to go out in the professional market and start working.

Moreover, this project shows an example of how powerful the sharing of knowledge can be, as it uses open-source software that helped with the building of the website. Also, since the purpose of the platform is to deliver a place for sharing projects and knowledge, it encourages the example followed for it building as well as the idea of faster and better progress by uniting communities.

Finally, despite all the good work and nice product delivered at the end there is still margin for future development. Some upgrades could be done to the project by continuing it for a few more months of work. For example, some option to make the Drupal account the same as the one in RocketChat could be developed. Also, more functionalities could be created to deliver a better user experience, as well as new fields in the user and project entities to provide more information to the visitors and personalization to the users. To finish, the user interface could also be upgraded with more theming to make the website more characteristic and friendly.

## **Bibliography:**

- [1] Drupal official website. [Online] Available: <https://www.drupal.org/>. [Accessed: 1 June 2020].
- [2] OpenVPN official website. [Online] Available: <https://openvpn.net/>. [Accessed: 1 June 2020].
- [3] PuTTY official website. [Online] Available: <https://www.putty.org/>. [Accessed: 1 June 2020].
- [4] WinSCP official website. [Online] Available: <https://winscp.net/eng/download.php>. [Accessed: 1 June 2020].
- [5] Sublime Text official website. [Online] Available: <https://www.sublimetext.com/>. [Accessed: 1 June 2020].
- [6] Ubuntu official website. [Online] Available: <https://ubuntu.com/>. [Accessed: 1 June 2020].
- [7] Linux official website. [Online] Available: <https://www.linux.org/>. [Accessed: 1 June 2020].
- [8] Bootstrap official website. [Online] Available: <https://getbootstrap.com/>. [Accessed: 1 June 2020].
- [9] RocketChat official website. [Online] Available: <https://rocket.chat/>. [Accessed: 1 June 2020].
- [10] Drupal user guide. [Online] Available: [https://www.drupal.org/docs/user\\_guide/en/index.html](https://www.drupal.org/docs/user_guide/en/index.html). [Accessed: 1 June 2020].
- [11] Drupal docs. [Online] Available: <https://www.drupal.org/documentation>. [Accessed: 1 June 2020].
- [12] CDN official website. [Online] Available: <https://www.bootstrapcdn.com/>. [Accessed: 1 June 2020].
- [13] DrupalChat module. [Online] Available: <https://www.drupal.org/project/drupalchat>. [Accessed: 1 June 2020].
- [14] Private Message module. [Online] Available: [https://www.drupal.org/project/private\\_message](https://www.drupal.org/project/private_message). [Accessed: 1 June 2020].
- [15] RocketChat module. [Online] Available: [https://www.drupal.org/project/rocket\\_chat](https://www.drupal.org/project/rocket_chat). [Accessed: 1 June 2020].
- [16] RocketChat installation. [Online] Available: <https://docs.rocket.chat/installation/manual-installation/ubuntu/>. [Accessed: 1 June 2020].
- [17] RocketChat docs. [Online] Available: <https://docs.rocket.chat/>. [Accessed: 1 June 2020].
- [18] Real Name module. [Online] Available: <https://www.drupal.org/project/realname>. [Accessed: 1 June 2020].
- [19] Display Suite module. [Online] Available: <https://www.drupal.org/project/ds>. [Accessed: 1 June 2020].
- [20] External Links module. [Online] Available: [https://www.drupal.org/project/external\\_links\\_new\\_tab](https://www.drupal.org/project/external_links_new_tab). [Accessed: 1 June 2020].

## Appendices:

In this section, the main code modifications of the project are included and explained. The first file is *style.css* which as mentioned, is part of the theming and helps creating a better looking user interface. This goal is to fix the margins using the functions *padding* and *margin* as well as to justify the text with *text-align: justify* option. The code is as follows:

```
.project-abstract {
  padding-bottom: 10px;
  text-align: justify;
  margin-right: 43px;
}

.project-category {
  padding-bottom: 10px;
}

.profile-pic-region {
  padding-top: 10px;
}

.poster-right-region {
  padding-top: 10px;
  text-align: justify;
}

.poster-bottom-region {
  padding-top: 10px;
  text-align: justify;
}

.profile-university {
  margin-right: 20px;
}
```

The next code includes the modifications made to the Private message module in order to fix the error with sending new messages, explained in the point 3.2.3.1. The code marked with the symbol '-' represents the actual code of the module, and the one marked with '+' the new version. The numbers between '@' are the lines of the file where the code can be found. The code includes comments with the explanations, and the full code of this files and the rest of the website can be found in the folder attached to this project.

```
--- a/js/private_message_members_widget.js
+++ b/js/private_message_members_widget.js
@@ -83,7 +83,8 @@
 * @param {boolean} validateName
 * Whether or not the name should be validated from the server.
 */
- function addUserToMembers(username, validateName) {
+ function addUserToMembers(username, validateName, displayName) {
+ var displayName = displayName || username;
  var found;
  var trimmedVal;

@@ -97,7 +98,7 @@

// Insert a textual representation of the username for users to see and
```



```

    // click to remove if necessary.
-   Drupal.theme('usernameDisplayItem', username).insertBefore(usernameInput);
+   Drupal.theme('usernameDisplayItem', username,
displayName).insertBefore(usernameInput);
    Drupal.attachBehaviors(usernameInput.parent()[0]);

    // Attempt to insert the username into an empty field in the hidden entity
@@ -205,8 +206,9 @@
    i = 1;
    $.each(autocompleteUsernames[string], function (uid) {
        var username = autocompleteUsernames[string][uid].username;
+       var displayName = autocompleteUsernames[string][uid].display_name;
        if (!insertedUsernames[username]) {
-           $('</li>', {class: 'ui-menu-item'}).append($('

```

```

        $user_info[] = [
            'uid' => $account->id(),
            - 'username' => $account->getDisplayname(),
            + 'username' => $account->getAccountName(),
            + 'display_name' => $account->getDisplayname(),
        ];
    }
}

--- a/src/Mapper/PrivateMessageMapper.php
+++ b/src/Mapper/PrivateMessageMapper.php
@@ -171,13 +171,29 @@ class PrivateMessageMapper implements
PrivateMessageMapperInterface {
    */
    public function getUserIdsFromString($string, $count) {
        if ($this->currentUser->hasPermission('access user profiles') && $this->currentUser-
>hasPermission('use private messaging system')) {
            +
            + $use_realname = \Drupal::service('module_handler')->moduleExists('realname');
            +
            $query = 'SELECT user_data.uid FROM {users_field_data} AS user_data LEFT ' .
                'JOIN {user__roles} AS user_roles ' .
            - 'ON user_roles.entity_id = user_data.uid ' .
            - 'LEFT JOIN {config} AS role_config ' .
            + 'ON user_roles.entity_id = user_data.uid ' ;
            +
            + if ($use_realname){
            +     $query .= 'JOIN {realname} AS rn ON rn.uid = user_data.uid ' ;
            + }
            +
            + $query .= 'LEFT JOIN {config} AS role_config ' .
                'ON role_config.name = CONCAT('user.role.', user_roles.roles_target_id) ' .
            - 'JOIN {config} AS config ON config.name = :authenticated_config WHERE ' .
            - 'user_data.name LIKE :string AND user_data.name != :current_user AND ' .
            + 'JOIN {config} AS config ON config.name = :authenticated_config WHERE ' ;
            +
            + if ($use_realname){
            +     $query .= '(user_data.name LIKE :string OR rn.realname LIKE :string) ' ;
            + } else {
            +     $query .= 'user_data.name LIKE :string ' ;
            + }
            +
            + $query .= ' ' .
                'AND user_data.name != :current_user AND ' .
                '(config.data LIKE :use_pm_permission ' .
                'OR role_config.data LIKE :use_pm_permission) ' .
                'ORDER BY user_data.name ASC';
@@ -187,7 +203,7 @@ class PrivateMessageMapper implements
PrivateMessageMapperInterface {
    0,
    $count,
    [
            - ':string' => $string . '%',
            + ':string' => '%' . $string . '%',
            'current_user' => $this->currentUser->getAccountName(),
            'authenticated_config' => 'user.role.authenticated',
            'use_pm_permission' => '%s:28:"use private messaging system"%',

```

## **Glossary**

UPC – Polytechnic University of Catalonia

ETSETB – Escola Tècnica Superior de Enginyeria de Telecomunicacions Barcelona

STUBA – Slovak Technical University in Bratislava

FEI – Faculty of Electronic Engineering and Informatics Technologies.

PHP – Hypertext Pre-processor

MySQL – My Structured Query Language

HTML – Hypertext Mark-up Language

JS – JavaScript

CSS – Cascading Style Sheets

CMS – Content Management System

WP – Work Package

OS – Operating System

VPN – Virtual Private Network

GPL – General Public License

SSH – Secure Shell

NATs – Network Address Translators

TLS – Transport Layer Security

SCP – Secure Copy Protocol

SFTP – SSH File Transfer Protocol

FTP – File Transfer Protocol

LTS – Long-term Support

RSS - Really Simple Syndication

API – Application Programming Interface

CGI – Common Gateway Interface

RDBMS – Relational Database Management System

W3C – World Wide Web Consortium

VM – Virtual Machine

IP – Internet Protocol

LAMP – Linux, Apache, MySQL and PHP

MVP – Minimum viable product