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Development of Website Solution for Association to Assist Young Professionals

Metropolia

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Modern world offers numerous capabilities for professional and personal development with technology and access to information. However, it is still not easy to find tailored support and orient within the ocean of opportunities. The Orbuculum association project aims to assist young professionals in the European Union, through personalized support providing video blogs, where professionals from various industries with an international experience share their knowledge and dispel some possible myths.

This thesis describes the development of a web application for the video database integration with priorities to build a modern website of high quality design. Also, the thesis discusses development aspects for future website expansion with minimum financial costs involved.

The web application project was started with searching and studying the web application architecture as well as reviewing possible software tools and techniques for website deployment, testing and launching. The decision was made to build the web application using the Bootstrap front-end CSS framework template modified in NetBeans IDE. The website deployment and launching were performed using the Heroku cloud application platform (PaaS).

The study includes the description of the application development process, definition of web application testing techniques, testing plan creation and launching of the website demonstration version, as well as the future development steps of the Orbuculum web application project and the definition of continuous maintenance. In addition, since the website content data will grow with the association progress, the study also discusses two ways to support this need: static HTML website integration to any CMS and reconstruction of the static website to a dynamic one.

Keywords	Bootstrap, CSS framework, front-end, PaaS

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Nykyaikaiset teknologiat ja informaation määrä internetissä tarjoavat laajat mahdollisuudet omaan ammatilliseen kehittämiseen, mutta tuosta suuresta määrästä on vaikea löytää mitään yksilöille räätälöityä ratkaisua. Orbuculum yhdistys tarjoaa tämän takia nuorille ammattilaisille EU:n alueella räätälöityä tukea videoblogien ja ammattilaisten kansainvälisten kokemusten muodossa mahdollisten myyttien hälventämiseksi.

Tässä insinöörityössä on kuvattu web-sovelluksen kehittäminen videoblogien julkaisua varten. Prioriteettina tässä oli suunnitella korkealaatuinen responsiivinen käyttöliittymä ja välttää suuria kustannuksia. Lisäksi insinöörityössä käsiteltiin web-sovelluksen mahdollista tulevaisuuden laajennusta.

Insinöörityön alussa käsiteltiin web-sovelluksien arkkitehtuuria, suunnittelu- ja valvontaohjelmistoja sekä laitteita. Orbuculum websivu päätettiin toteuttaa käyttämällä Bootstrap CSS web-sovelluskehystä ja NetBeans IDE:ä koodin muokkaamiseen. Verkkosivuston käyttöönotto ja käynnistäminen suoritettiin käyttämällä Herokun pilvipalveluympäristöä (PaaS).

Tämä insinöörityö sisältää web-sovelluksen kehittämisen kuvauksen, testaustekniikoiden määrittelyn, testaussuunnitelman luomisen ja verkkosivuston esittelyversion käynnistäminen, sekä Orbuculum -verkkosovellushankkeen tulevat kehitysvaiheet ja jatkuvan ylläpidon määrittelyn. Lisäksi on todennäköistä, että websivuston data kasvaa yhdistyksen kasvaessa, joten käytiin läpi myös kaksi jatkokehitysmahdollisuutta: staattisen HTML -sivuston integrointi CMS -järjestelmään, sekä staattisen verkkosivuston jälleenrakentaminen dynaamiseksi.

Avainsanat	Bootstrap, CSS framework, front-end, PaaS

Contents

List of Abbreviations

EU   European Union

CV   Curriculum Vitae

UI   User Interface

ITU   The International Telecommunication Union

CAGR   Compound Annual Growth Rate

CSS   Cascading Style Sheets

HTML   Hypertext Markup Language

IDE   Integrated Development Environment

JS   JavaScript

ICT   Information and Communications Technology

IT   Information Technology

DAM   Digital Asset Management

gTLD   Generic Top-Level Domains

ccTLD   A Country Code Top-Level Domain

ICANN   The Internet Corporation for Assigned Names and Numbers

PHP   Hypertext Preprocessor

URL   Uniform Resource Locator

HTTP   Hypertext Transfer Protocol

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IaaS	Infrastructure as A Service
PaaS	Platform as a Service
SaaS	Software as a Service
BI	Business Intelligence
DB	A database
SQL	Structured Query Language
DNS	Domain Name System
CNAME	A Canonical Name Record

1   Introduction

The world of today is characterized by tremendous opportunities for personal and professional development, firstly due to the progress in transportation technology allowing people to relocate rapidly from one geography to another and secondly due to easy access to information and knowledge through the internet. These world conditions of global mobility together with available web resources and tools can strongly contribute to the development of the unique talents of individuals, which is a critical factor for one's future career and life success.

However, there are several drawbacks that reduce the effectiveness of the opportunities provided by mobility and access to knowledge. Thus, one of the main drawbacks refers to the aptitude to travel for touristic purpose and not for studying and working. Moreover, digitalization with its rapid access to the society experience via the Internet often provides general facts and rarely personalized response.

Deeper analysis reveals two major groups of obstacles that prevent one's development via mobility: technical and psychological. Significant examples of technical obstacles are associated with e.g. information being available, but often general, not constructive, not filtered and not personalized enough, no visibility of the benefits and results of professional mobility during studying or working and waste and loss of focus while reading long texts with no visualization. Examples of physiological obstacles are associated with e.g. lack of personal support from someone more experienced and whom one can trust and follow, fear to go out of the comfort zone and visit another country to work alone and doubts about own capabilities and need to travel.

These barriers have been addressed by initiating an innovative project called Orbuculum and by registering a respective association in the EU. However, to maximally reach the target group of young students and experts, this project needs a web platform with its main purpose to motivate for professional mobility and to demystify the main roadblocks that usually prevent youth from going abroad.

Therefore, the goal of this thesis was to create a specific web solution with intuitive navigation and original style which will:

- Broadcast high-quality, structured, thematic, trustful, motivating and personalized videos obtained from dialogues and interviews with experienced students and young professionals who went abroad for studying or working and succeeded in finding a job according to their interests, talent and ambitions.

- Provide tools for two-way communication, enabling remote assistance for writing personalized CVs and motivation letters as well as direct communication with students and young professionals via seminars and workshops.

- Inspires to go abroad for studying or working, increases confidence and helps identifying a career path that matches best one's unique talent and interests.

- Assist young students and experts in identifying their unique potential and career path for successful and fulfilling professional life.

The novelty of the present study is reflected in applying an interdisciplinary approach for web solution creation where the understanding of the role of various expertise such as operational motivation, marketing, human resource, communication and social responsibility is necessary to build such a unique platform that will serve the ambitious goals of Orbuculum project. The actuality of the study is expressed with the utilization of IT expertise in constructing a tailored and exclusive solution that answers the specific needs of the customer.

Therefore, this report presents a web application solution for the purpose of the Orbuculum association project. In this Orbuculum web application project the main development aims efficiently to apply modern technologies and tools, selecting and adapting the most appropriate ones. This approach results in time saving and allows to balance financial aspects of startup without compromising quality of website design and structure.

In this thesis, first, static and dynamic web application architectures as well as possible tools and techniques for selected architecture are discussed. In the second part the Orbuculum web solution definition and its initialization and planning are covered. Further, the description of the front-end development process that consists of development, preparation, design definition, development planning, website building, video database solution and PaaS employment for web application deployment and testing is discussed. Finally, after the development stage was performed, to complete the web project the

realization testing and website demonstration version launching were realized, and they are described in the last part of the thesis.

2   Theory of Modern Website Architecture

Nowadays, there are various ways to develop and produce a web application. However, any website development starts with understanding what architecture to select – static or dynamic and the further determination of development tool and service. [1].

A static website consists of a set of several HTML, CSS pages that are linked together by hyperlinks. Dynamic website contains content located in the database and displayed "on the fly", directly on the user's requests [1]. Except for HTML and CSS pages the static website may include some front-end Java scripts, whereas the dynamic website contains a back-end scripts [2]. The front-end is a term that means client-side programming and the back-end server-side programming [3]. The front-end scripts are client-side scripting that is executed by a browser and the back-end scripts, i.e. server-side scripting is executed by a web server. Regarding a language the client-side scripting is JavaScript, whereas in the back-end scripting JavaScript, PHP, Python and many others are used. [4] Accordingly, server-side scripting works in the back end of a site, which the user does not see. It creates a scaffolding for the site to access its database, all the behind-the-scenes mechanics that organize and power a website. Client-side code, however, handles what the user does see. [4] Static website architecture is displayed in Figure 1.
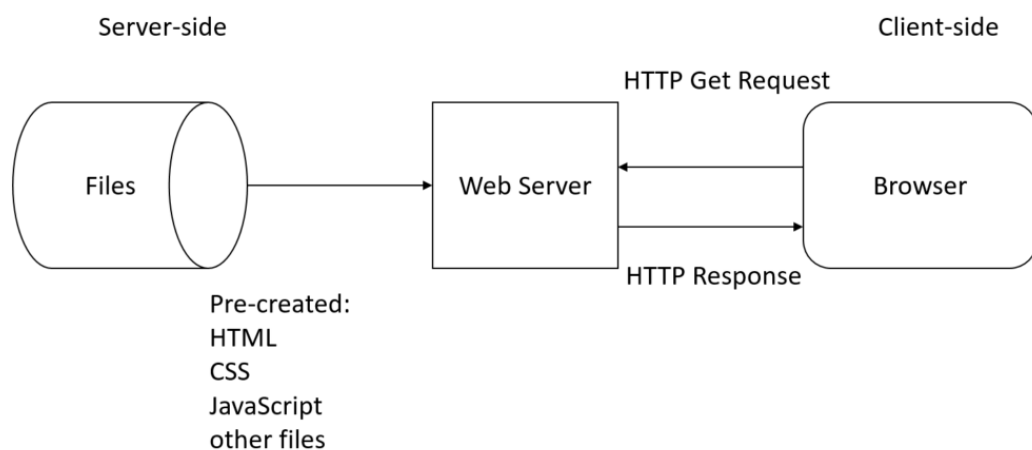

Figure 1.   Static website diagram [16].

In a static website when a user wants to navigate to a page, the browser sends an HTTP "GET" request specifying its URL. The server retrieves the requested document from its

file system and returns an HTTP response containing the document and a success status. If the file cannot be retrieved for some reason, an error status is returned. [5] Figure 2 shows a simple architecture for a dynamic website. As in the previous diagram, browsers send HTTP requests to the server, then the server processes requests and returns the appropriate HTTP responses. Requests for static resources are handled in the same way as for static sites. [5]
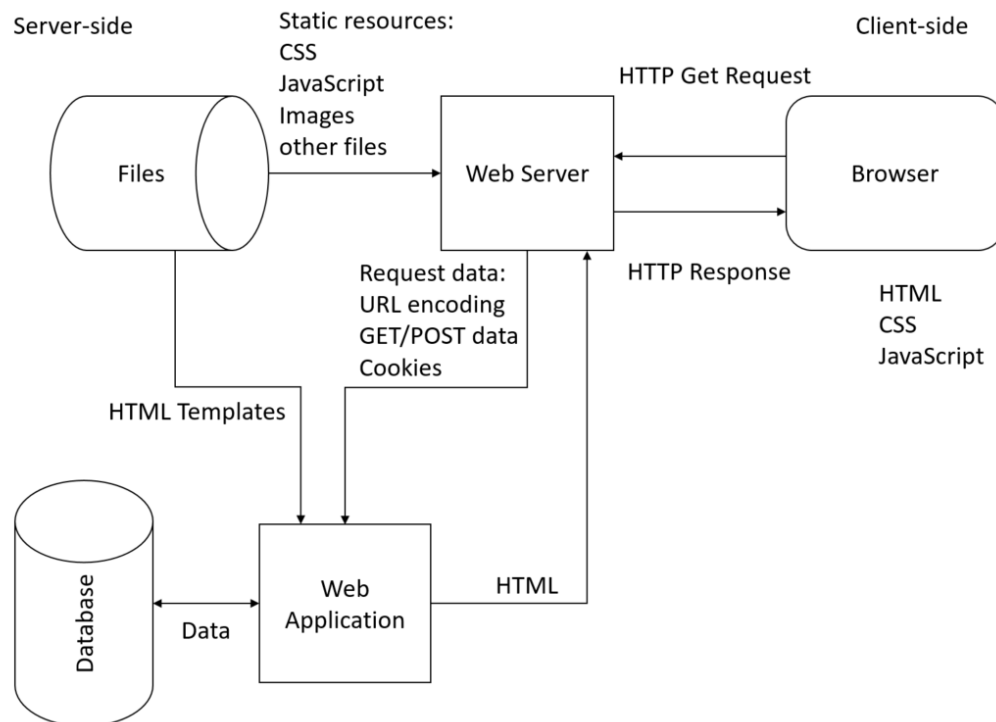

Figure 2.   Dynamic website diagram [5].

Analyzing both architectures, several advantages and disadvantages were identified. Thus, static website advantages include a simple and fast development process. The disadvantage reflected in the need to perform HTML and/or CSS code changes every time when updates for web pages are required. Moreover, in static website architecture, only informative content can be represented, whereas dynamic website architecture offers more functional and easier process for updates allowing work with dynamic data. However, the process of dynamic architecture requires involvement of more than one programmer to ensure the development of good working functionality and acceptable design.

The Orbuculum web solution project at this stage requires just an informational format website, without returning a response from a user. Therefore, a decision was made to make the static website demonstration version with JavaScript front-end scripting usage.

Today it is very popular to use web frameworks as web application development assistance. Web application frameworks usually provide user session management, data storage, and a templating system, these frameworks can be divided into two main groups: front-end and back-end. In Figure 3 examples of most popular web frameworks are illustrated.
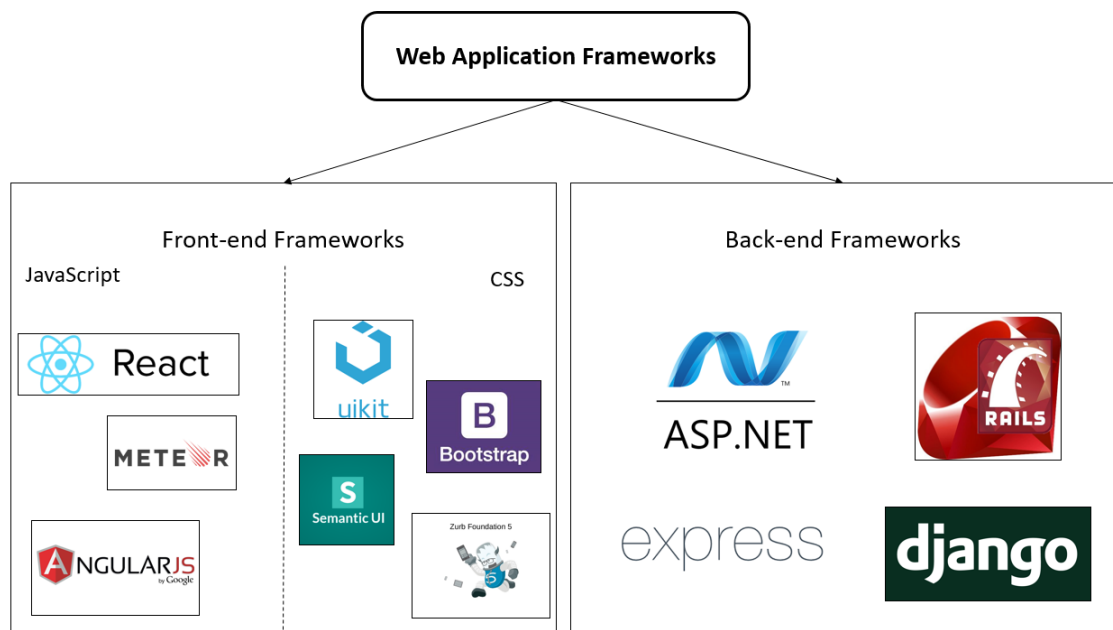

Figure 3.   Examples of web application frameworks.

Server-side web frameworks are back-end software frameworks that make it easier to write, maintain and scale web applications. They provide tools and libraries that simplify common web development tasks, including routing URLs to appropriate handlers, interacting with databases, supporting sessions and user authorization, formatting output (e.g. HTML, JSON, XML), and improving security against web attacks. Examples of the back-end frameworks are: ASP.NET, Django, Ruby on Rails, Express. [6]

Front-end frameworks are favored as they are helpful in the designing process and input of the various front-end features, including off-canvas, menus and models, which are the prerequisites for website development [7]. Front-end web frameworks can be divided into

two subgroups: JavaScript frameworks (i.e. AngularJS, ReactJS, MeterJS [8]) and CSS frameworks (i.e. Bootstrap, Foundation, SemanticUI, UIKit [9]). The JavaScript frameworks written in JavaScript language and include a library that offers functions to be called by its parent code, whereas a framework defines the entire application design. The CSS framework are usually consisting of a package made up of a structure of files and folders of standardized code (HTML, CSS, JS documents etc.) [10].

After the website architecture was identified, for static multi-tiered website it is necessary to choose services and/or infrastructure that enable to build, develop and deploy scalable, globally-available web application [11]. Thus, the cloud platform as a service for efficient, fast and low-cost solution was selected.

Cloud platform or in other words cloud computing offers processing power, database storage, applications and other IT resources on demand through cloud services [12]. There are several standard models of services that are available such as NIST Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) [13]. Detailed description of each service is presented in Figure 4.
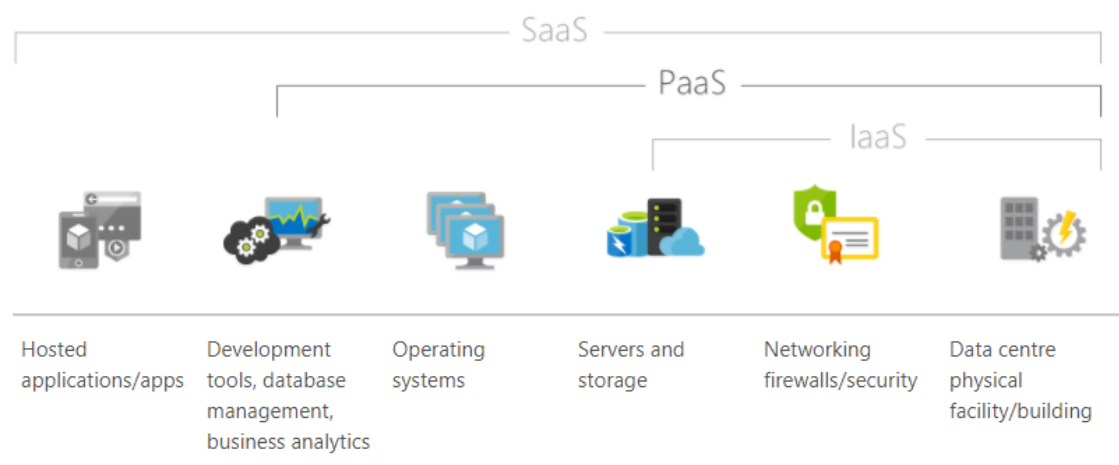

Figure 4.   Cloud services.

Specifically, IaaS and PaaS include infrastructure – servers, storage and networking – but also middleware, development tools, BI services, database management systems and more. The PaaS is designed to support complete web application life cycle: building, testing, deploying, managing, and updating and thus was selected for development and deployment of Orbuculum static website solution environment in the cloud. [14] Examples of PaaS providers include Heroku, Google App Engine, and Red Hat's

OpenShift [15]. Within the above-mentioned providers, the Heroku cloud platform was selected to host a static website that contains client-side technologies such as HTML, CSS, and JavaScript for its building, delivery/testing, monitoring and scaling.

3 Orbuculum Web Solution Description

The first part of this paragraph describes an approach for web solution initialization. The second part focuses on the planning of its realization to ensure delivery of the web solution within the defined time frame and content.

3.1 Web Solution Initialization

Modern word is characterized by high speed, digitalization, new technologies that regularly arrive in the market, the need in a simple, very effective, intuitive but at the same time not costly web solutions. Such conditions require from software engineers continuous monitoring and functional understanding of new tools, applications, communication channels as well as ability to select and adapt the most appropriate tools to create a product serving customer demands. Since the Orbuculum project has a need to communicate content in various formats such as infographics, short motivational blogs, presentations, posters, question and answer sessions as well as an extensive library of targeted, thematic videos creating only YouTube channel, without the website, is not an option. On the contrary, there is a need to build a platform enabling message delivery through various channels. In addition, this platform will serve as a two-way communication tool with association members and will grow in future as more requests from targeted audience will be identified. Therefore, the approach to building the web solution must be based on selection and integration of appropriate tools as well as on the need for the platform to have a significant capacity for its further continuous development.

3.2 Web Solution Realization Planning

To structure the development process and to control its progress proper project management software is required. Considering that stakeholders in this process are in different geographies, the project management tool needs to offer an online collaboration option. Several online tools such as Trello, Zoho, Basecamp [16] and others were evaluated and Zoho cloud software was finally selected as the most suitable and intuitive planning and process tool.

The web solution development started with understanding and capturing the customer's needs, agreement on planning and time frame as well as discussion and brainstorming about the website design. Figure 5 shows the Milestones list in Zoho.
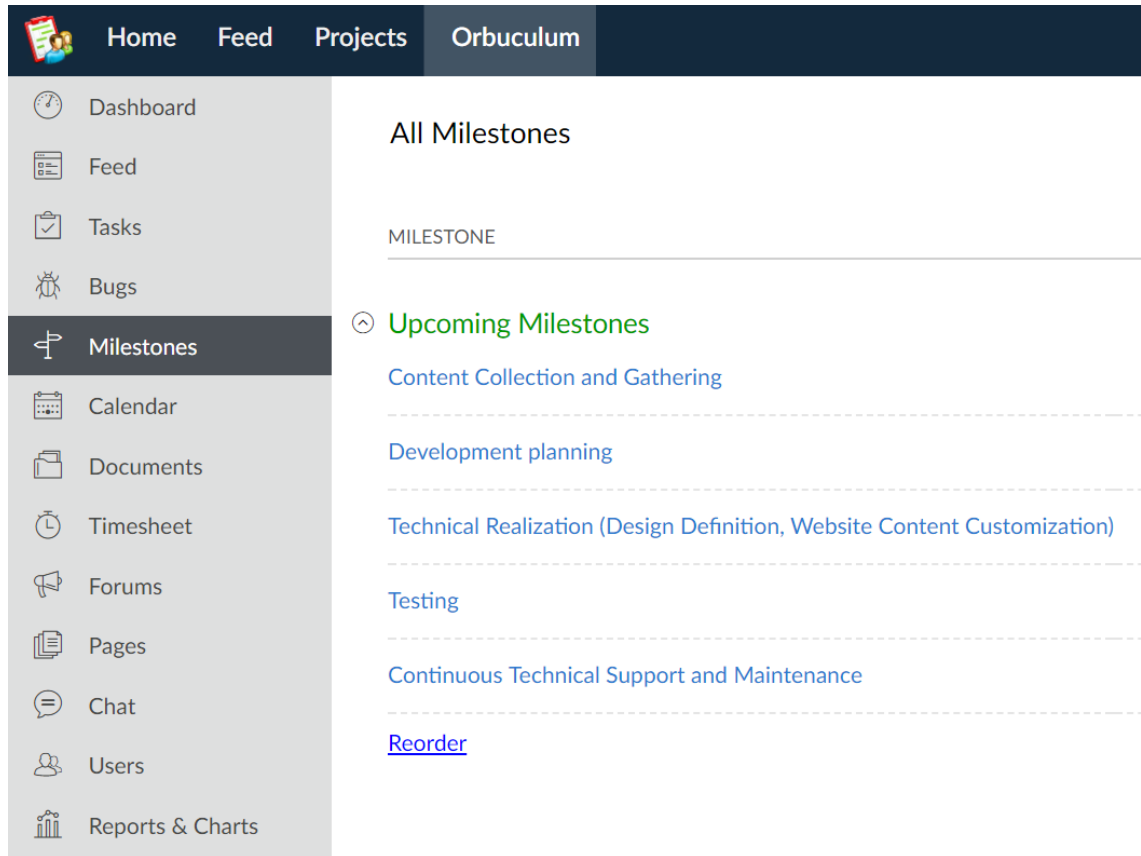

Figure 5.   Milestones list in Zoho

Next, the four main milestones of website development were defined and recorded in Zoho (cf. Figure 5):

- Content Collection and Gathering
- Development planning
- Technical Realization (Design Definition, Website Content Customization)
- Testing
- Continuous Technical Support and Maintenance

Each milestone contains a task list where all tasks have description, definition of priority and deadline for task completion. To monitor the process of the web solution

development and report on a regular basis to the customer the status of progress, Zoho Gantt charts were used.

4   Front-end Website Development

Considering the customer needs and modern capabilities of information technology industry, it was decided to use a software framework for the website front-end development. Object-oriented frameworks provide high productivity and shorter time-to-market for the development of object-oriented applications which is achieved through design and code reuse [17].

The front-end framework definition and types were described in Chapter 2. Considering the described framework specifications and the Orbuculum web application project needs, it was decided to use the CSS front-end framework. Figure 6 represents a comparison of five most starred front-end frameworks that were introduced in Chapter 2. According to this graph, Bootstrap has been in the leading position for the last five years.
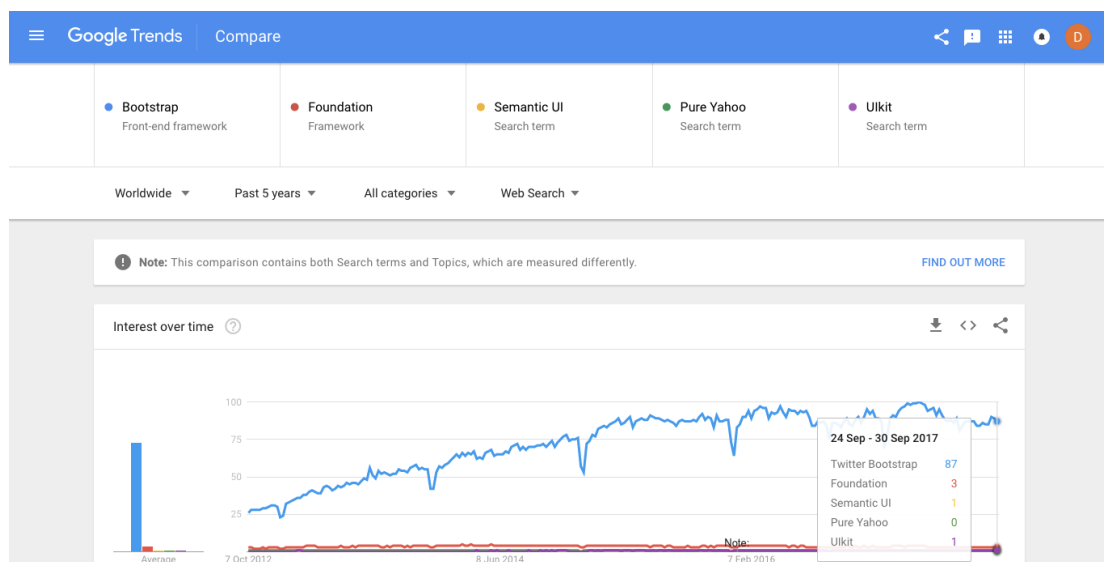

Figure 6.   Front-end Framework search statistics from Google Trends.

Bootstrap is a free and open-source CSS front-end web framework for websites and web application design. It contains HTML- and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Unlike many web frameworks, it concerns itself with front-end development only. Therefore, considering the Orbuculum web application demonstration solution this front-end framework was selected for the development of the website.

4.1 Development Preparation of Website

Bootstrap has numerous professional templates that can serve as a basis for development and be customized according to the project needs. Knowing the popularity of mobile device usage, practically the first and principal factor choosing a template must be its adaptability with both mobile devices and computers. Figure 7 demonstrates the dynamics of mobile-broadband subscriptions during last five years with more than 20% annual growth and expectations to reach 4,3 billion globally by end 2017.
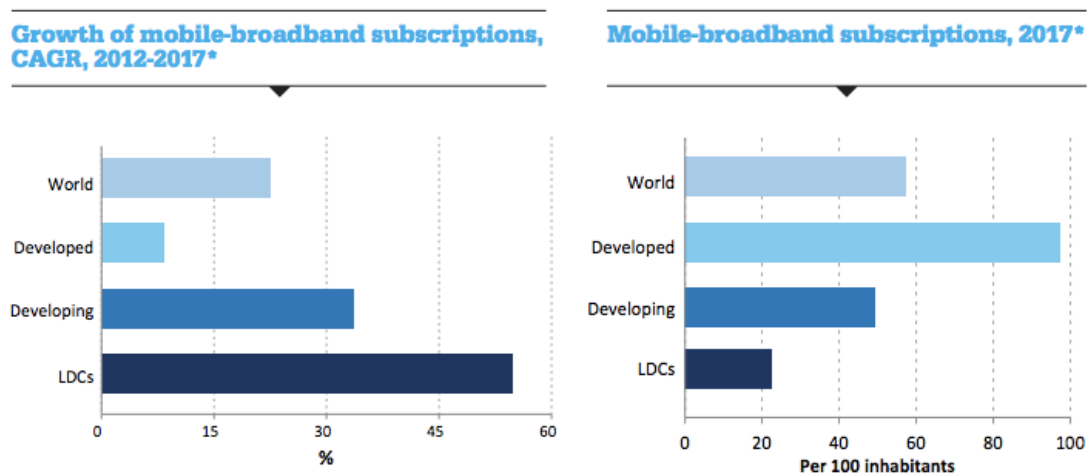

Figure 7.   Estimates CAGR refers to the compound annual growth rate. [18]

Thus, to develop a mobile first website it was decided to choose a mobile-first website template based on the Bootstrap framework. Bootstrap has responsive web design that is an approach to web design which makes web pages render well on a variety of devices and window or screen sizes. Different templates available in the Wrap Bootstrap marketplace were screened and evaluated for their intuitive, flexible and modern design. Finally, a short list of several templates was presented to the customer and the "Semantic - Minimal Portfolio Template" was accepted with a further license purchase. [19]

4.2 Design Definition of Website

This part describes the website layout, which contains the menu navigation and sections of the website. The layout of the website is simple as it includes only the following three sections: hider (navigation), content and footer (cf. Figure 8).

Figure 8.   Pattern of the website.

Figure 8 above represents the form of every website page which has a horizontal navigation bar, content blocks and contact information at the page bottom. This web page layout was created using CSS source codes from Bootstrap Framework.

4.3   Website Development Planning

Nowadays, it is very important to build logically intelligible and intuitive website. By combining the layout with the required data, a simple website structure was created (cf. Figure 9) including basic content where the information is placed in a logical sequence.
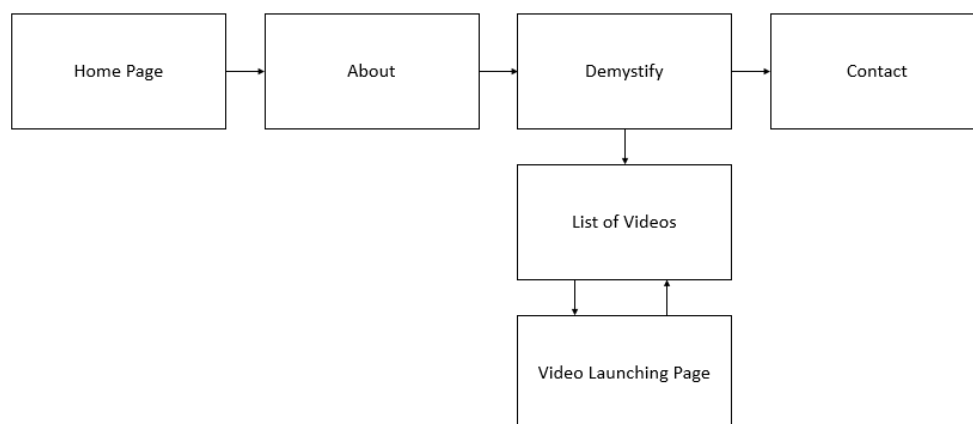

Figure 9.   Sitemap of the website.

The "home page" includes video background and a short description of the Orbuculum association. The "about" page contains the Orbuculum project description and presentation boards. The "demystify" page is the key webpage that holds the database of video blogs. These videos are filtered thematically. Every video covers the basic myths or fallacies, which interfere professional growth of young experts. The last page is "contact", where customers and potential sponsors or partners can find ways to contact the association.

4.4   Building Website Using Bootstrap Template

The code of the selected template for website development was customized according to the content and data of the website. The chosen Bootstrap website template provides flexibility in code customization which allows to create personal look. Therefore, website design customization was achieved by modifying the CSS template code and the web site content deployment was realized through adaptation of HTML code as well as appending new parts of HTML code. As support for code customization, NetBeans IDE was used.

Specifically, four HTML main pages were created for the website (cf. Figure 10). After that, source codes from the template were copied and placed into the created HTML pages, and finally the source code was customized according to the Orbuculum content.
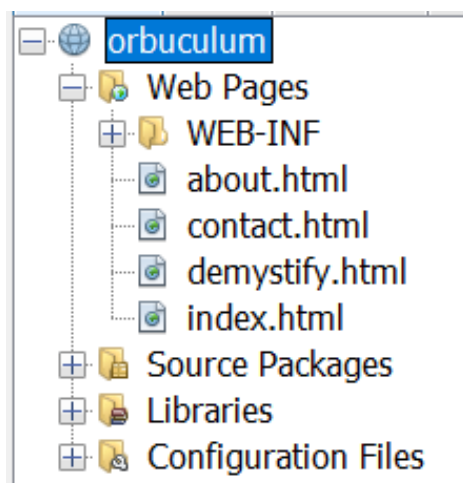

Figure 10. HTML source files of the website.

In the next development step, the required CSS and JavaScript source files from the template were added. The CSS file codes were customized to answer the website layout requirements; however, the original JavaScript source files were used since they perfectly matched the website structure. The only exception was a JavaScript file "contact.js file", therefore, this file was modified according to the own HTML contact form settings.

For the CSS and JavaScript files an "assets" directory was created and template "bootstrap" source files, "fonts", "bg" (background video file) and "img" (the images used on the website) were added. In addition, a "robots.txt" file which is called "The Robots Exclusion Protocol" was saved into directory to give instructions about site to web robots. The directory is presented in Figure 11.
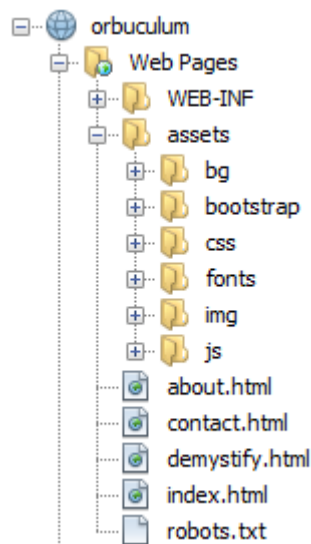

Figure 11. Source files of the website.

Every HTML page in the Website has a standard structure, including the following elements:

- head element which contains metadata
- "preloader" as the website home page is based on the video background
- navigation bar
- main content which contains blocks
- template sections modified accordingly to the website content

- footer at the bottom of the page which contains the copyright notices, social media links and contact information

These elements vary slightly depending on the content of the page. Specifically, the blocks structure and design in the main content.

As described above, CSS sources from the template were used with the need to perform some modification of the CSS codes in source files to enable successful content adaptation. Thus, CSS code changes and some of the bootstrap CSS code modifications were performed. The "style.css" file was modified by more than 60%, and the original template CSS files were used for fonts, pop-ups and animations.

4.5   Video Database Solution

It is critical that videos can be launched on the mobile devices. There are several solutions available that allow launching videos on the website. For example, video file storage for some databases such as MySQL, MongoDB, MariaDB [20] or media file storage for cloud based DAM software such as WebDAM, Canto, Libris [21] and many others. The good quality DAM software usage implies the monthly payment, which at this stage of the Orbuculum project is not an appropriate solution. Therefore, YouTube Embed was used as a temporary solution for responsive video file integration to the website. Moreover, budget restriction from the customer side dictated free hosting plan with a need to economize disk space and to save page speed.

Thus, YouTube channel for the video database storage seems a proper alternative for video storage. YouTube video-sharing tool allows integrating videos from e.g. own channel to the website, the YouTube video sharing technique is illustrated in Figure 12.

Figure 12. YouTube video sharing embed code.

Video sharing from YouTube to an own webpage performs throughout embed code that is a block of HTML which is embedded in the page-source and creates the video object. It needs to be obtained from a site already hosting the video, in this case YouTube, because the "embed code" points back to that site.

```
<div class='embed-container'>

<iframe src='https://www.youtube.com/embed/d_ks4vlzi0Q' frameborder='0'
allowfullscreen> </iframe>

</div>
```

Listing 1.   CSS video player embed code

Listing 1 above demonstrates YouTube embed code added to the HTML for video integration from the YouTube channel to the Orbuculum web application webpage.

```
.embed-container {
    position: relative;
    padding-bottom: 60%;
    height: 0;
    overflow: hidden;
    max-width: 100%;
}
.embed-container iframe,
.embed-container object,
.embed-container embed {
    position: absolute;
    top: 0;
    left: 0;
    width: 100%;
    height: 100%;
}
```

Listing 2.   HTML video player embed code.

Also in Listing 2 the CSS codes are displayed. This CSS code was added manually for the responsive video player launching on the Orbuculum web pages.

The key webpage purported to broadcast video material is webpage "Demystify" which is shown in Figure 13. All videos will be grouped into three filters such as "International Exchange", "Internship Abroad" and "First job after graduation". As it is demonstrated in Figure 13, users can find a list of the videos and short descriptions.
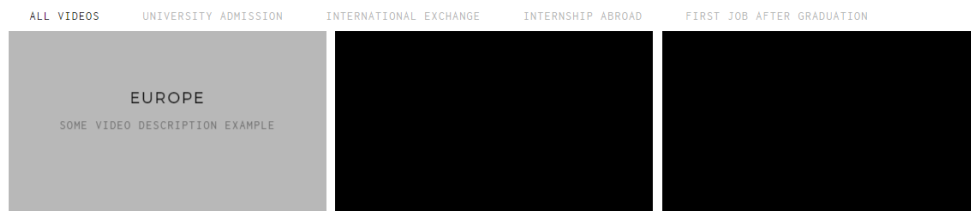

Figure 13. Webpage "Demystify" to broadcast video material and example of the list of responsive videos.

By clicking on every video description block the user automatically redirects to the video launching page. Figure 14 represents an example of the video launching page.
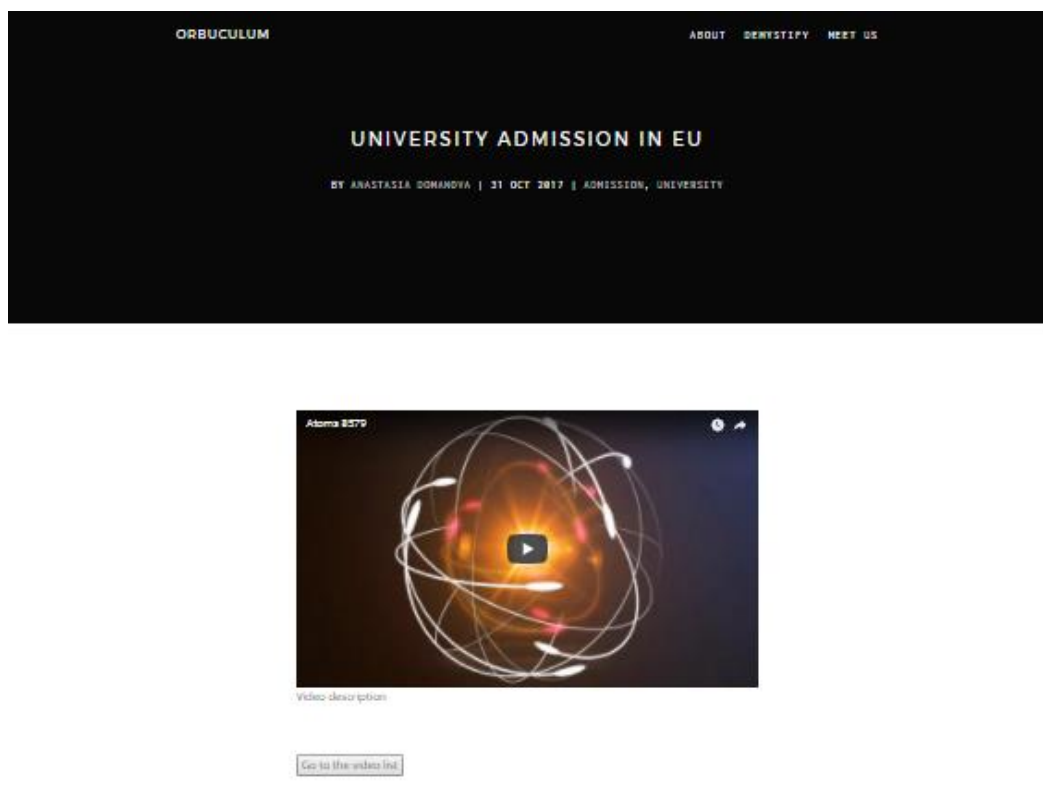
Figure 14. Video launching page example.

This video launching page allows users to watch the video and get more detailed information about the video. Also, this page has a redirection option to the video list.

4.6   Platform as a Service for Web Application Deployment and Testing

As described in Chapter 2, the Heroku Platform was selected as the service. After the first version of the web application was developed, the next step was the web application deployment and delivery of the hosting service for its launching and testing.

Heroku is a PaaS hosting for the web applications that supports several programming languages in the cloud, e.g. Ruby, Python, PHP and others. The "orbuculum" web application has a static website format after Bootstrap framework and theme modification and needed some preparation for Heroku deployment. In order to deploy a site Git – an open source version control system and creation of the two files to the website project: composer.json and app.json, were needed. The Heroku PHP Support will be applied to applications only when the application has a file named composer.json and app.json in the root directory. Even if an application has no composer dependencies, it must include at least an empty composer.json in order to be recognized as a PHP application [11]. File app.json is a manifest format for describing web apps and it declares environment variables, add-ons, and other information required to run an app on Heroku [22]. However, since the Orbuculum website application index page was implemented in HTML format, the browser redirects from index.php to index.html, was necessary to make a PHP code line. This code is presented in Listing 3.

```
<?php header( 'Location: /index.html' ) ;  ?>
```

Listing 3.   PHP code for index.html page redirecting.

After the web application was prepared for Heroku deployment, it had to be added to the Git. In the Git a repository for application code "commit" was initialized and then this code was tracked in a local Git repository. After that web application was completely prepared for a deployment. Thus, to perform deployment web application to Heroku, "git push heroku master" Git command was performed in command line.
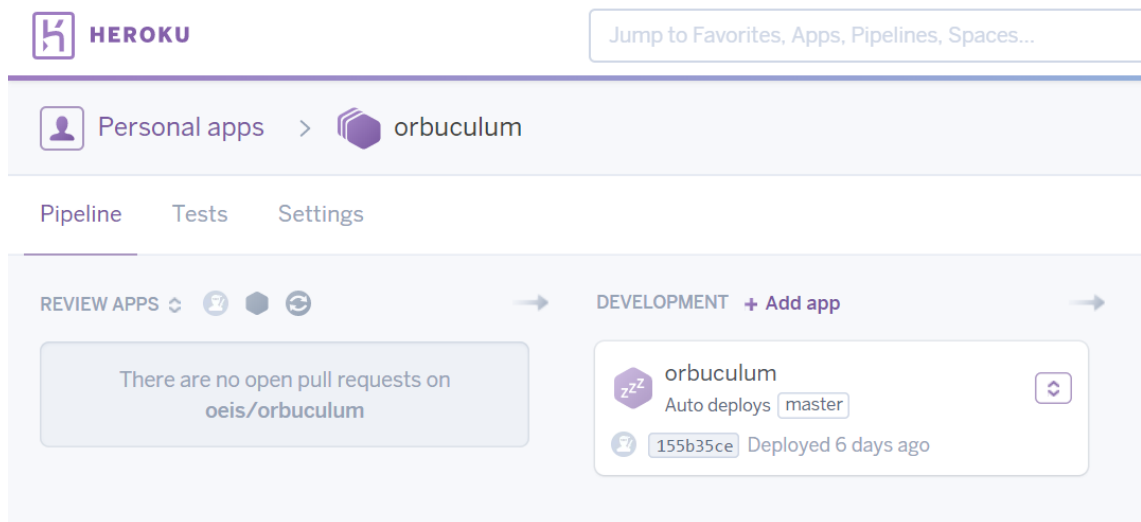
Figure 15. Web application hosted on Heroku

After the web application was deployed (cf. Figure 15) and hosted on Heroku the launching on the Heroku server at address: https://orbuculum.herokuapp.com and testing before launching on the internet by own domain name is possible.

5   Website Testing Plan

Web application testing is software testing which is necessary to be performed to have a successful website launching on the Internet. The main goal of the testing is to identify and further repair harmful bugs which can be achieved using various web application testing techniques. The most usable and important web application testing techniques are demonstrated in Figure 16 [23].
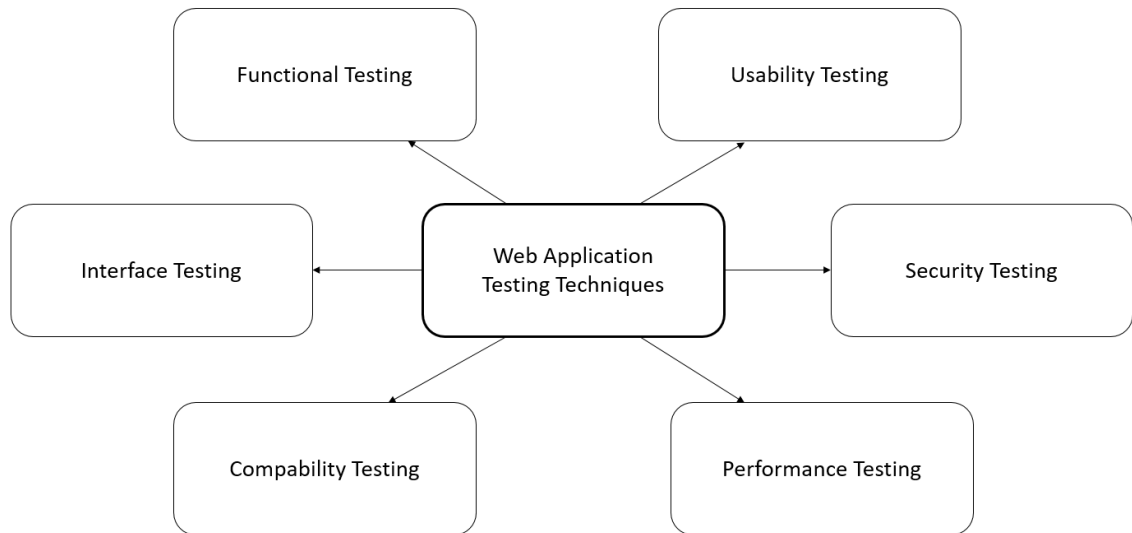

Figure 16. Web application testing techniques.

Specifically, the functional testing technique requires verification of the weblinks, forms and cookies [24]. Usability testing includes checking of the navigation and controls, content checking and user intuition capability. Interface testing verifies the interface and the data flow from one system to another. Compatibility testing performs the web application suitability with different operation systems, browsers and devices. [25] Performance testing is the verification of the server response time and throughput under various load conditions. And finally, security testing checks the security of the web applications [24]. To structure the process of bugs tracking, previously described Zoho software was applied, allowing to designate the bug location, status, classification and to determine the time frame for the bug correction solution.

The full web application test plan is available in Appendix 1. Appendix 1 presents the first version of the test plan. The test plan is a document detailing the objectives, internal beta team, and processes for a specific beta test for a web application product. Orbuculum

web application test plan text documents and tracks the necessary information required to effectively define the approach for testing of the product within the project.

6 Website Launching

After web application passed the test stage, the next step was to launch it on the Internet using an own domain name address. The Orbuculum project dictates the launching of website demo version which includes working layout, basic sitemap and video examples. These videos must work on the main desktop browsers such as Chrome, Firefox, IE, as well as on the different mobile devices, especially on android and iOS operating systems. For the solution launching, first, a domain name was registered, then a web hosting was selected and managed.

6.1 Domain Name Registration

Top-level domain name registration occurs through a domain name registrar accredited by gTLD registry and/or ccTLD registry. There are various accredited registrars and full list is available on ICANN official website. [26]

The criteria to select registrar was based on the monthly price of the domain name, client support quality and reliability. GoDaddy, a company with 17 million customers [27] was selected within various large domain registrars such as Namecheap, Bluehost, HostGator [28].

Usually the domain name registrars also provide acquiring of the TLS certificate. TLS certificate is to provide privacy and data integrity between two communicating applications [29]. Since the Orbuculum website is a demonstration version of association representation buying a certificate is not necessary at this project stage, but will be purchased later.

The domain name "orbuculum.com" was available and approached for the Orbuculum association project. The domain name monitoring, and configuration settings do not require any specific skills. All that is necessary to track are the domain name registration and TLS certificate expiry dates.

6.2   Management of Hosting Settings

Web hosting is a service that allows to post a website or web page onto the Internet. There are several web hosting types that can be selected according to the website needs and budget. [30] Web hosting types are demonstrated in Figure 17.
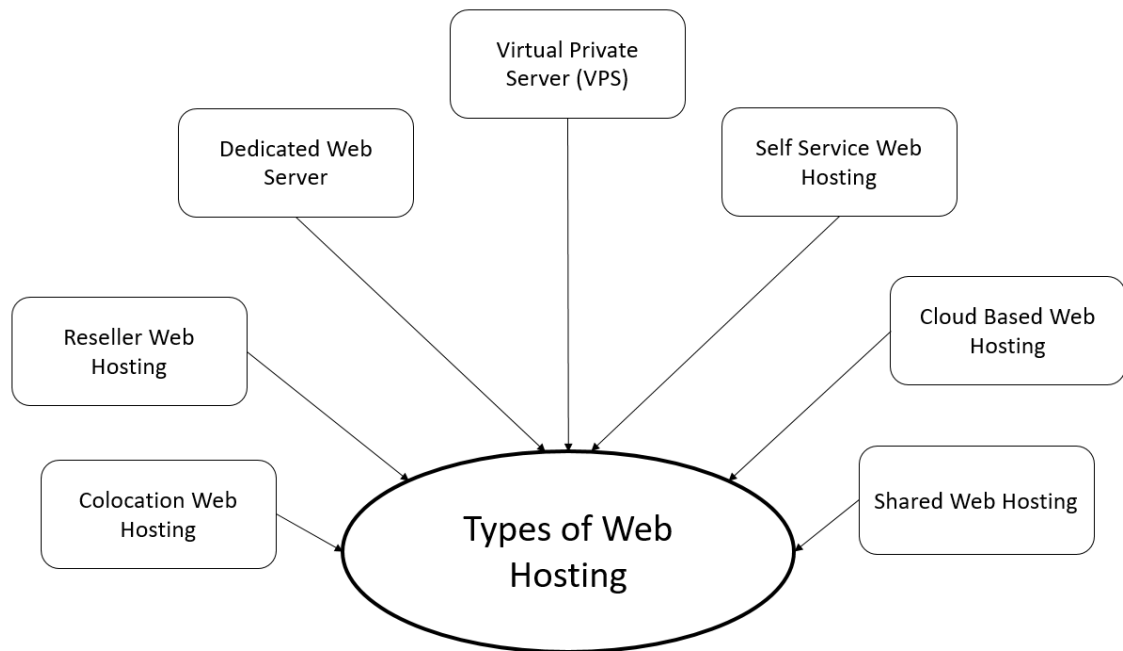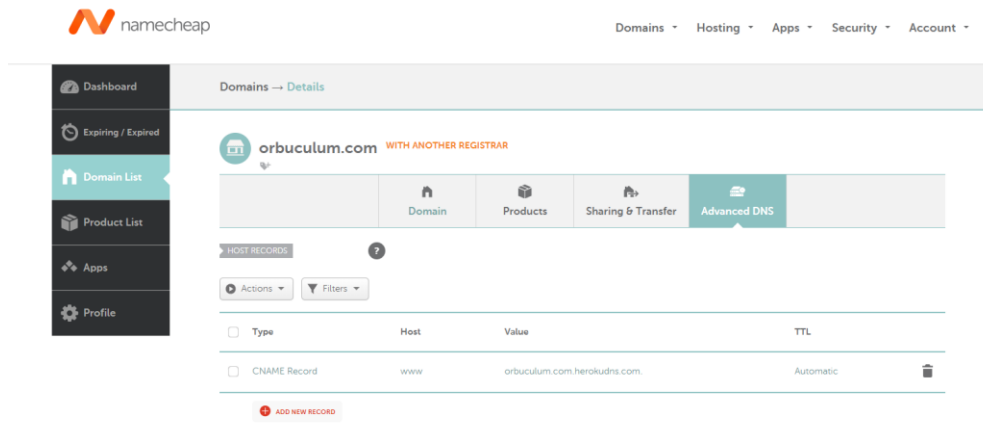

Figure 17. Web hosting types.

To provide hosting for the own domain on the Heroku platform, there was a need to set up a custom domain and DNS. GoDaddy registrar provides DNS records management, and this option is paid separately. However, there are some ways to manage DNS records for free using a free DNS hosting service, for example Namecheap.

Figure 18. Namecheap DNS hosting management.

Figure 18 shows DNS records management through Namecheap "Advanced DNS". To perform custom domain setting first the own domain in the project settings in Heroku needs to be added (cf. Figure 15) and the final DNS target "orbuculum.com.herokudns.com" as a CNAME record in Namecheap is added.

7 Orbuculum Web Solution Future Steps and Maintenance Definition

As was described previously, at this stage the Orbuculum web application is a demonstration version as the static website type. This decision was made for Orbuculum project launching, and changes will be implemented together with website material growth.

The static website type implies an informational site, with fixed content, but in the long term Orbuculum project will require a two-ways communication approach. There are two solutions for this realization: to convert the static website into dynamic or to use user authentication by an authentication framework in BaaS through social networks.

There are several possibilities to convert a static web project into a dynamic one: the first one is to move a static HTML website to any CMS, such as Drupal, Joomla, WordPress and the second one is to follow the following four steps:

- convert static web project into a dynamic
- import required J2EE modules
- create new server
- create mail servlet

In any case, website converting from static to dynamic requires full web project reconstruction and the decision of the necessity of the website converting will be taken later considering Orbuculum project needs and expansion.

However, to continue with the static website type, there is a need to resolve some issues, namely the impossibility to perform user authentication and data storage. These problems can be solved using BaaS services that allow developers to use logging service through the Logging API for the client to the BaaS server. BaaS is provided by different companies such as Firebase, Parse, Amazon, Backendless where Backendless offers service APIs access control for application's users and roles. [31].
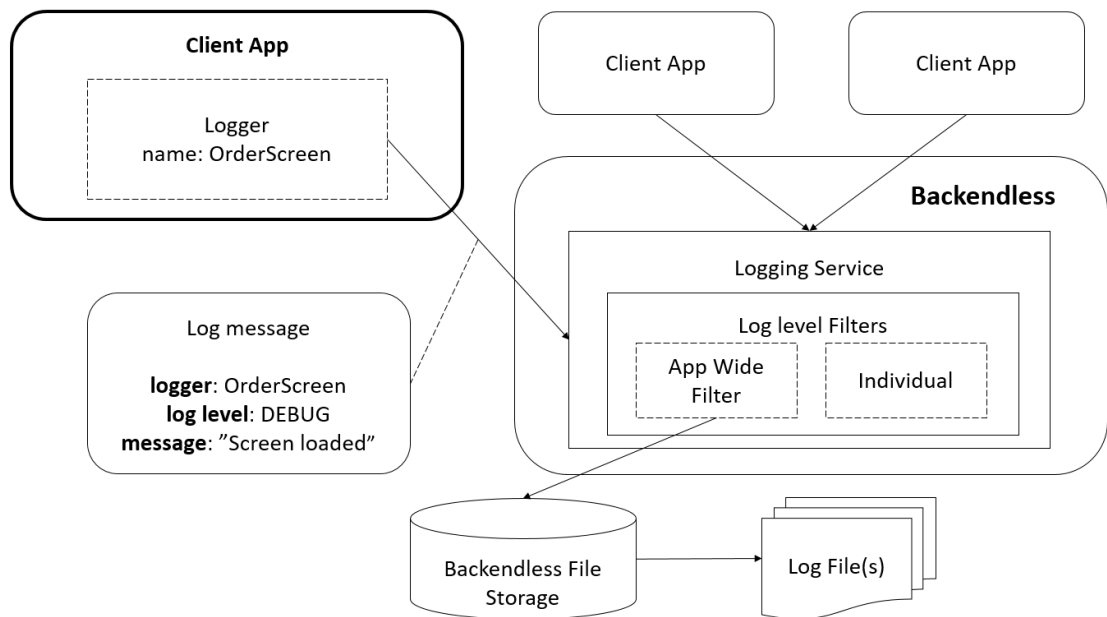
Figure 19. Backendless logging diagram. [32]

Figure 19 above illustrates the main concepts involved in Backendless logging [32]. The Logging API uses the concept of "Logger" as a "gateway" for all the client-side log message submission functionality. An app may have multiple loggers, each identified by a unique name which may represent a UI screen name or a functional area of the app. To minimize client-server log traffic (which otherwise may be very verbose), the Backendless API introduces the concept of "log buffer." [33]

8   Summary

The aim of this thesis was to determinate and develop a web application solution for the Orbuculum association project. The purpose of Orbuculum project is to assess young professionals in the EU through thematic videos (blogs and interviews), professional CV and motivation letter review services, as well as via specialized live seminars and workshops.

The idea of website development for the startup project stage is to develop a modern, high quality, responsive design website with the least financial costs and time. The result of this development had to be a working web site prototype which will be used as a demonstrative website version for potential customers and sponsors and serve as a basis for further Orbuculum project development. This thesis describes in detail the technique and tools for web application development and expansions and thus can be used as a professional guide for similar purposes.

It is important to mention that to start the development, initial understanding of the project idea and context as well as agreement with the customer on what needs to be done was achieved. After that, the theory of the web application architecture and possible tools for website development were examined and described.

Two general architectures: static and dynamic were found, and the static website architecture was selected as the most appropriate architecture to realize the Orbuculum demonstration web solution. Further, two main types of the frameworks, namely server-side (back-end) and client-side (front-end) frameworks were studied Also, the framework theory study demonstrated that the client-side (front-end) frameworks may be divided into two types: frameworks based on CSS and on JavaScript where finally the front-end framework, based on CSS was selected for web application client-side development. After the architecture and framework were studied and selected, the infrastructure that enables to build, develop and deploy scalable, globally-available web application was determined. Thus, the study describes the theory of cloud platform as a service and especially the following three main types: PaaS, IaaS, and SaaS. As a result, the Heroku cloud platform PaaS was selected to host a demonstration version of the website, and to build, deliver/test, monitor and scale.

The study describes the approach for web solution initialization. Since the main goal of the demonstration website version is to present the Orbuculum association project description and launch the video database, it was decided that YouTube channel video storage is not an option because Orbuculum project is directed to continuous development and will contain various data types in the future. The report further focuses on planning of the solution realization to ensure the delivery of the web solution within the predefined time frame and content. To structure the development process and to control its progress, the Zoho project management online tool was selected, and the main milestones were established, i.e. content collection and gathering, development planning, technical realization (design definition, website content customization), testing and continuous technical support and maintenance.

Following the milestones steps the next stage of the study was the front-end website development. Thus, the report describes the website preparation where the selected Bootstrap CSS based front-end framework was presented and analyzed in detail. Further, using CSS source codes, the simple layout of the website was built and considering this layout the website design was identified. Next, a development plan was created in a simple website structure, including the basic content where the information is placed in a logical sequence. The report then describes the Bootstrap framework customization process that was performed using NetBeans IDE. The Bootstrap template customization process required about 70% of HTML source code and more than 60% of the CSS source code changes. The paper also shows details of the video database integration from YouTube to the own web application using YouTube embed codes.

The study also outlines general information of the test plan, namely, what types of techniques were used. The following testing techniques are presented: functional, usability, interface, security, compatibility and performance technique. Detailed description of the test plan is available in Appendix 1 (Orbuculum RY, Web Application Test Plan).

After the development and testing stages were completed the next step was the website launching on WWW. The study describes the required conditions for web application launching. To launch a website on the WWW using its own domain name, it was necessary to register the website name though an official registrar and to select a web hosting service. Thus, GoDaddy registrar and Heroku web hosting service were selected.

Finally, according to the first demonstration version of the website and considering the Orbuculum project future ambitions, the study describes the future development steps and maintenance definition of the web application. Because Orbuculum future website needs exceed the static website architecture capabilities, this study considers two possible ways to improve and expand the website solution. These two ways to realize that goal is the static HTML website integration to any CMS and the reconstruction of the static website to a dynamic one.

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Orbuculum RY, Web Application Test Plan Draft

Orbuculum RY

Test Plan

Version 1.0

30 Nov 2017

Version History

Ver-sion	Implemented By	Revision Date	Approved By	Approval Date	Reason
1.0	Daria Han-nonen	30.11.2017	Daria Hannonen	30.11.2017	Test Plan Draft

Contents

1   Purpose of the Test Plan Document

The Test Plan document documents and tracks the necessary information required to effectively define the approach to be used in the testing of the project's product. The Test Plan document is created during the Planning Phase of the Orbuculum web application project. Its intended audience is the project manager and project team. Some portions of this document may on occasion be shared with the client/user and other stakeholder whose input/approval into the testing process is needed.

2   Compatibility Testing

Compatibility testing is non-functional testing type and the main purpose is to check the correct operation of the product in a certain environment i.e. browsers, browser versions, and OS versions.

2.1   Test Tools

Test can be performed manually using different pc, mobile devices and browsers.

Compatibility Testing can be performed for the following:

1.   Operating systems: Windows, Mac OS, Android, ios.

2.   Browsers: IE, Chrome, Firefox, Mozilla, Safari

2.2   Items to Be Tested

Item to Test	URL	Test Date	Responsi-bility
Home Page	https://orbuculum.herokuapp.com/		
About	https://orbuculum.herokuapp.com/about.html		

Demystify	https://orbuculum.herokuapp.com/demystify.html		
Contact	https://orbuculum.herokuapp.com/contact.html		

2.3   Test Pass / Fail Criteria

The test pass requires, that every page displayed correctly, and the website structure not broken.

3   Usability Testing

Usability testing is a technique used in user-centered interaction design to evaluate a product by testing it on users.

3.1   Test Tools

One possible tool is Optimizely platform: https://www.optimizely.com/, which allows users to track visits and conversions.

3.2   Items to Be Tested

Item to Test	URL	Test Date	Responsi-bility
Home Page	https://orbuculum.herokuapp.com/		
About	https://orbuculum.herokuapp.com/about.html		
Demystify	https://orbuculum.herokuapp.com/demystify.html		
Contact	https://orbuculum.herokuapp.com/contact.html		

3.3   Test Pass / Fail Criteria

The test pass/fail criteria will be described in next test plan version.

4   Functional Testing

Functional testing is a quality assurance (qa) process and a type of black-box testing that bases its test cases on the specifications of the software component under test. Test Tools

4.1   Test Tools

One possible software-testing framework for web applications: selenium (http://www.se-leniumhq.org/).

4.2   Items to Be Tested

Item to Test	URL	Test Date	Responsi-bility
Home Page	https://orbuculum.herokuapp.com/		
About	https://orbuculum.herokuapp.com/about.html		
Demystify	https://orbuculum.herokuapp.com/demystify.html		
Contact	https://orbuculum.herokuapp.com/contact.html		

4.3   Test Pass / Fail Criteria

The test pass/fail criteria will be described in next test plan version.

5   Interface Testing

In software engineering, graphical user interface testing is the process of testing a product's graphical user interface to ensure it meets its specifications.

5.1   Test Tools

The test tools will be described in next test plan version.

5.2   Items to Be Tested

Item to Test	URL	Test Date	Responsi- bility
Home Page	https://orbuculum.herokuapp.com/		
About	https://orbuculum.herokuapp.com/about.html		
Demystify	https://orbuculum.herokuapp.com/demystify.html		
Contact	https://orbuculum.herokuapp.com/contact.html		

5.3   Test Pass / Fail Criteria

The test pass/fail criteria will be described in next test plan version.

6   Performance Testing

Performance testing is the process of determining the speed or effectiveness of a web application.

6.1   Test Tools

Possible tools:

- WEBLOAD (https://www.radview.com/webload-download/)

- SmartMeter.io (https://www.smartmeter.io/)

- LOADVIEW (https://www.loadview-testing.com/)

6.2   Items to Be Tested

Item to Test		URL	Test Date	Responsi-bility
Home Page	https://orbuculum.herokuapp.com/			

6.3   Test Pass / Fail Criteria

The test pass/fail criteria will be described in next test plan version.

7   Compatibility Testing

Compatibility testing is non-functional testing conducted on the application to evaluate the application's compatibility with different environments. Web applications need to be tested for compatibility on various browsers, browser versions, and OS versions.

7.1   Test Tools

Test can be performed manually using different pc and mobile devices and browsers.

Compatibility Testing can be performed for the following:

- Operating systems: Windows, Mac OS, Android, ios.

- Browsers: IE, Chrome, Firefox, Mozilla, Safari

7.2   Items to Be Tested

Item to Test	URL	Test Date	Responsi-bility
Home Page	https://orbuculum.herokuapp.com/		
About	https://orbuculum.herokuapp.com/about.html		
Demystify	https://orbuculum.herokuapp.com/demystify.html		
Contact	https://orbuculum.herokuapp.com/contact.html		

7.3   Test Pass / Fail Criteria

The test pass requires, that every page displayed correctly, and the website structure not broken.

8   Security Testing

Security testing is a process intended to reveal flaws in the security mechanisms of an information system that protect data and maintain functionality as intended.

8.1   Test Tools

Possible tools:

- Metasplot (https://www.metasploit.com/)

- Wireshark (https://www.wireshark.org/)

- Kali Linux (https://www.kali.org/)

8.2   Items to Be Tested

Item to Test	URL	Test Date	Responsi-bility
Home Page	https://orbuculum.herokuapp.com/		

8.3   Test Pass / Fail Criteria

The test pass/fail criteria will be described in next test plan version.

Test Plan Approval

The undersigned acknowledge they have reviewed the Orbuculum RY Test Plan document and agree with the approach it presents. Any changes to this Requirements Definition will be coordinated with and approved by the undersigned or their designated representatives.

Signature: _____   Date: _____

Print Name: _____

Title: _____

Role: _____

Signature: _____   Date: _____

Print Name: _____

Title: _____

Role: _____