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TOPIC:
BENCHMARKING DE LOS FRAMEWORKS OPENSOURCE: BOOTSTRAP Y UIKIT

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BENCHMARKING OF FRAMEWORKS OPENSOURCE: BOOTSTRAP Y UIKIT

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Summary— To simplify the complexity of the work to develop and design web pages, has been created a great variety of CSS frameworks have been created with HTML5, CSS3 and JavaScript components. The present benchmarking was done with the purpose of evaluate and compare the quality offered by this type of open source CSS frameworks; Bootstrap and Uikit have been taken as alternatives for this analysis and the construction of a quality model based on the ISO/IEC 25010 norm that classify product quality into eight characteristics and their subcharacteristics leaving a punctual result for your selection and use in web application development.

Keywords– Benchmarking, Bootstrap, Uikit, Frameworks CSS, Norm ISO/IEC 25010.

I. INTRODUCTION

In the evolution of the development of web applications has seen the need to begin to create applications with a better visual quality, coupling of all devices and browsers with the intention of improving the user experience. For the developers the design part it is a long and complex task, for this reason and to make work easier has been created a wide variety of CSS frameworks, software structures composed of HTML5, CSS3 and JavaScript components that facilitate the pages design speeding up the development process reusing existing code and promote good development practices. (Gutiérrez, 2014)

With so many options, it is necessary to find the best option to use. For this, has been made a Benchmarking taking two frameworks as alternatives in the web design that are Bootstrap and Uikit to evaluate its quality and to know which one offers more benefits and facilities to its users.

II. MATERIALS AND METHODS

The “Benchmarking” it is comparative analysis to look at quality that companies use to evaluate their products, services or process with the finality of win advantage in front of its rivals.

Competitive Benchmarking

It is the best known and difficult to perform because of the limited information that can be access, it is make when there is a lot of competition, comparing with its direct and stronger rivals.

Frameworks CSS (CNIC, 2013)

A css framework is a software composed of the customizable components HTML5, CSS3 and JavaScript that contribute to the programmer's most complicated task which is page layout and an option to streamline your work.

Table 1
Features CSS Frameworks

Features
Responsive web design
Mobile first web design
Grid system
Open source
Browser compatibility
Library integration

Bootstrap

Figure 1. Bootstrap logo
Source: (Bootstrap, 2016)

Bootstrap is the most popular Front-End Framework for Responsive open source of design composed of HTML, CSS and JavaScript that serves as a startup structure in the production of web applications, simplifying the long process of design the web pages. (Bootstrap, 2016)

Table 2
Features Bootstrap Framework

BOOTSTRAP	
Creators	Mark Otto y Jacob Thornton
Freed	2011
Last version	3.3.6
JS Framework	jQuery
Popularity	103.382 ★
Repository	GitHub
Preprocessors	LESS / SASS
Basic concepts	Responsive web design – Mobile first web design
License	MIT
Modular	Yes
Icon set	Glyphicons
JavaScript	Some elements
HTML5	Yes
CSS3	Yes
Grid	12 columns

Download Size	279 KB
Documentation	Full and detailed
Browser Compatibility	IE 8+/ Chrome +/ Safari +/ Firefox +/ Opera +
Customize	Basic GUI customizer

Uikit

Figure 2. Uikit logo

Source: (Uikit, 2016)

Uikit is an open-source, lightweight and modular framework for the development of fast and powerful web interfaces that offers a complete collection of HTML, CSS and JavaScript components that are easy to use, customizable and extensible. (Uikit, 2016)

Table 3
Features Uikit Framework

UIKIT	
Creators	YOOtheme
Freed	2013
Last version	2.26.2
JS Framework	jQuery
Popularity	7.741 ★
Preprocessors	LESS / SASS
Basic concepts	Responsive web design – Mobile first web design
License	MIT
Modular	Yes
Icon set	Font Awesome
JavaScript	Many elements
HTML5	Yes
CSS3	Yes
Grid	10 columns
Download Size	776 KB
Documentation	Good
Repository	GitHub
Browser Compatibility	IE 9+/ Chrome +/ Safari +/ Firefox +/ Opera +
Customize	Advanced GUI customizer

Quality Models

To evaluate the quality of a software, the ideal would be to use a without number of attributes. By to the large number of software dimensions that could be evaluated the known quality models have been developed, they aim is facilitate the evaluation of the software, organizing and defining the attributes of quality are most important to have the general quality of the software. (Durango, 2014)

Norm ISO/IEC 25010

The product quality model as determined by ISO/IEC 25010 consists of the eight quality characteristics shown below:

Figure 3. Quality characteristics defined by ISO/IEC 25010

Source: (Calidad, 2016)

Construction of the quality model based on ISO/IEC 25010

Table 4
Construction of the quality model

	Metrics	Bootstrap	Uikit
Functional adaptation			
Functional adaptation			
Create static web pages	*Yes =1; No =0*	*1*	*1*
Create dynamic web pages	*Yes =1; No =0*	*1*	*1*
Create responsive web pages	*Yes =1; No =0*	*1*	*1*
Create mobile first web pages	*Yes =1; No =0*	*1*	*1*
Functional correction			
Add functions by user	*Yes =1; No =0*	*1*	*1*
Add effects and animations	*Yes =1; No =0*	*1*	*1*
Add and create documents	*Yes =1; No =0*	*1*	*1*
Functional relevance			
Manipulate, modify files	*Yes =1; No =0*	*1*	*1*
Reusable components	*Yes =1; No =0*	*1*	*1*
Use templates	*Yes =1; No =0*	*1*	*1*
Responsive components	*Yes =1; No =0*	*1*	*1*
Grid system	*Yes =1; No =0*	*1*	*1*
Sizes in the Grid	*Yes =1; No =0*	*1*	*1*
Efficiency of performance			
Temporal behavior			
Client-server load time	*rango / tiempo(ms)*: 5 / 100; 4 / 200; 3 / 300; 2 / 500; 1 / 1000 +	***4.1***	***4.07***
- Load time in test	*ms*	*190ms*	*193ms*
Use of resources			
Necesita libraries	*rango / # librerías*: 5 / 1; 4 / 2; 3 / 3; 2 / 4; 1 / 5 +	***4***	***5***
- jQuery	*Yes =1; No =0*	*1*	*1*
- Respond.js	*Yes =1; No =0*	*1*	*0*
- Modernizr	*Yes =1; No =0*	*0*	*0*
- Normalize	*Yes =1; No =0*	*0*	*0*
JavaScript	*Yes =1; No =0*	*1*	*1*
- Number of components	*# components js*	***11***	***17***
Preprocessors	*Yes =1; No =0*	*1*	*1*
- LESS	*Yes =1; No =0*	*1*	*1*
- SASS	*Yes =1; No =0*	*1*	*1*
Incorporation of AJAX	*Yes =1; No =0*	*1*	*1*
Own icons	*Yes =1; No =0*	*1*	*1*
- Resize	*Yes =1; No =0*	*0*	*1*
Own font	*Yes =1; No =0*	*1*	*1*
Capacity			
Customize components	*Yes =1; No =0*	*1*	*1*
Number of components	*# components*	***21***	***11***
Grid columns	*# columns*	***12***	***10***
Compatibility			
Coexistence			
HTML5	*Yes =1; No =0*	*1*	*1*
CSS3	*Yes =1; No =0*	*1*	*1*
JavaScript	*Yes =1; No =0*	*1*	*1*
Interoperability			
PHP	*Yes =1; No =0*	*1*	*1*
Java	*Yes =1; No =0*	*1*	*1*
Python	*Yes =1; No =0*	*1*	*1*
Ruby	*Yes =1; No =0*	*1*	*1*
Usability			
Ability to recognize their suitability			
Real information on website	*Yes =1; No =0*	*1*	*1*
Update content	*Yes =1; No =0*	*1*	*1*
Learning capacity			
User guide	*Yes =1; No =0*	*1*	*1*
Content indexes	*Yes =1; No =0*	*1*	*1*
Documentation	*rango / calidad - cantidad*: 5 / Excelente; 4 / Muy buena; 3 / Buena; 2 / Regular; 1 / Mala	***5***	***2***
Tutoriales	*Yes =1; No =0*	*1*	*1*
Articles	*Yes =1; No =0*	*1*	*1*

Ability to be used			
Speed	*Yes =1; No =0*	*1*	*1*
Components	*Yes =1; No =0*	*1*	*1*
Templates	*Yes =1; No =0*	*1*	*1*
Support	*Yes =1; No =0*	*1*	*1*
License	*Yes =1; No =0*	*1*	*1*
- MIT	*Yes =1; No =0*	*1*	*1*
- GPL	*Yes =1; No =0*	*0*	*0*
- BSD	*Yes =1; No =0*	*0*	*0*
- MPL	*Yes =1; No =0*	*0*	*0*
- Apache	*Yes =1; No =0*	*0*	*0*
Protection against user errors			
Modification by user	*Yes =1; No =0*	*1*	*1*
Aesthetics of the user interface			
Source code	*rango / porcentaje*: 5 – 0%; 4 – 1%; 3 – 2%; 2 – 5%; 1 – 10% +	***2,47***	***3,61***
- Errors in CSS code	*lines – 100%*	***0,37%***	***0,31%***
- Errors in JavaScript code	*errors – x%*	***2,16%***	***1,08%***
- Total errors	*%errors = css + js*	***2,53%***	***1,39%***
Compressed code versions	*Yes =1; No =0*	*1*	*1*
Compilation of code	*Yes =1; No =0*	*1*	*1*
- Lexical	*Yes =1; No =0*	*1*	*1*
- Syntactic	*Yes =1; No =0*	*1*	*1*
- Semantic	*Yes =1; No =0*	*1*	*1*
Accessibility			
Size framework files	*rango / peso(KB)*: 5 – 50; 4 – 100; 3 – 150; 2 – 200; 1 – 250 +	***2,94***	***2,97***
- .min.css	*KB*	*119 KB*	*99 KB*
- .min.js	*KB*	*37 KB*	*54 KB*
- Total	*total KB = css + js*	***156 KB***	***153 KB***
Reliability			
Maturity			
Time of life	*# years*	***5***	***3***
Number of versions	*# versions*	***31***	***18***
Search	*rango / búsquedas*: 5 – 100; 4 – 75; 3 – 50; 2 – 25; 1 – 1	***4,94***	***1***
- Framework search number	*# search*	***94***	***1***

Popularity	*rango / popularidad(☆)*: 5 – 100.000 +; 4 – 50.000; 3 – 25.000; 2 – 10.000; 1 – 1.000 -	***5***	***1,7***
- Popularity on GitHub	*# stars*	***103.382***	***7.741***
Applications made	*Yes =1; No =0*	*1*	*1*
Implemented applications	*Yes =1; No =0*	*1*	*1*
Availability			
Uses CDN technology	*Yes =1; No =0*	*1*	*1*
Download the framework	*Yes =1; No =0*	*1*	*1*
Repository GitHub	*Yes =1; No =0*	*1*	*1*
Versions	*Yes =1; No =0*	*1*	*1*
Fault Tolerance			
Allows access to information with system failures	*Yes =1; No =0*	*1*	*1*
Backups	*Yes =1; No =0*	*0*	*0*
Recovery			
Capacity of recovery	*Yes =1; No =0*	*0*	*0*
Security			
Confidentiality			
Data protection	*Yes =1; No =0*	*0*	*0*
Access only to specific users	*Yes =1; No =0*	*0*	*0*
It is safe from the internet	*Yes =1; No =0*	*0*	*0*
Data encryption	*Yes =1; No =0*	*0*	*0*
Integrity			
Correct information in the database	*Yes =1; No =0*	*0*	*0*
Modifications of data	*Yes =1; No =0*	*0*	*0*
I dont repudiate			
Reliable client-server communication	*Yes =1; No =0*	*0*	*0*
Responsibility			
Is responsible for security	*Yes =1; No =0*	*0*	*0*
Authenticity			
Prevent impersonation	*Yes =1; No =0*	*0*	*0*
Authenticity generated by the user	*Yes =1; No =0*	*1*	*1*
Maintenance			
Modularity			
Modular	*Yes =1; No =0*	*1*	*1*
Create components	*Yes =1; No =0*	*1*	*1*
Delete components	*Yes =1; No =0*	*1*	*0*
Edit components	*Yes =1; No =0*	*1*	*1*
Reusability			
Components re-usables	*Yes =1; No =0*	*1*	*1*
Templates	*Yes =1; No =0*	*1*	*1*
Analyzability			

Identify errors in the code	*Yes =1; No =0*	*0*	*1*
Ability to be modified			
Open source	*Yes =1; No =0*	*1*	*1*
Free software	*Yes =1; No =0*	*1*	*1*
Ability to be tested			
Testing with templates	*Yes =1; No =0*	*1*	*1*
Portability			
Adaptability			
Internet Explorer	*Yes =1; No =0*	*1*	*1*
Google Chrome	*Yes =1; No =0*	*1*	*1*
Mozilla Firefox	*Yes =1; No =0*	*1*	*1*
Safari	*Yes =1; No =0*	*1*	*1*
Opera	*Yes =1; No =0*	*1*	*1*
Navegadores móviles	*Yes =1; No =0*	*1*	*1*
Ability to be installed			
Installation Manual	*Yes =1; No =0*	*1*	*1*
Support	*Yes =1; No =0*	*1*	*1*
Ability to be replaced			
Can be replaced	*Yes =1; No =0*	*1*	*1*
Updating versions	*Yes =1; No =0*	*1*	*1*

III. ANALYSIS OF RESULTS

The results obtained with the evaluation of the css frameworks Bootstrap and Uikit in the ISO/IEC 25010 quality model reflect in the accumulation of points, resulting as a better quality option to Bootstrap and recommending its use.

Table 5
Result of benchmarking accumulated points

Characteristic	Bootstrap	Uikit
Functional adaptation	13	13
Performance efficiency	56	52
Compatibility	7	7
Usability	28,41	26,58
Reliability	52,94	30,7
Security	1	1
Maintenance	9	8
Portability	10	10
TOTAL POINTS	**177,35**	**148,28**

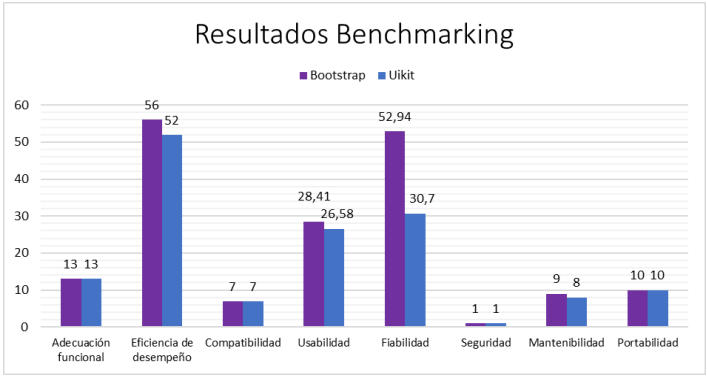

Figure 1. Graph of benchmarking results

IV. CONCLUSIONS

- The comparative analysis or benchmarking between the Bootstrap and Uikit frameworks facilitated the selection of the highest quality framework for the development of web applications.
- The compilation of the information available in the official Bootstrap and Uikit pages made it easier to know about CSS Frameworks and to define their characteristics and functionalities.
- The quality benchmarking proposed for the presented project has been completed without problems and leaving as a result to Bootstrap like the best option for the development of applications.

- The norm ISO/IEC 25010 was the axis for the comparative analysis of its characteristics to evaluate the quality of a software product, from which it was easy to start for the refinement of the factors and the evaluation in the project.

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