

Befekadu Mezgebu Temere

Responsive Web Application Using Bootstrap and Foundation

Comparing Bootstrap and Foundation Frontend Frameworks

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<p>The main purpose of this paper was to study the responsive web application designing method using Bootstrap and Foundation frontend frameworks. Moreover, the two frameworks were compared to choose the more productive and efficient one. As a result, a website for Daniel Mengistu law office was built and launched using the chosen framework.</p> <p>Even if there are frameworks with high quality typography, forms, buttons, and other interface components, Bootstrap and Foundation are popular frontend frameworks. They are written in HTML, CSS, LESS, SASS and JavaScript which makes designing a user interface simple. Moreover, online tools and parameters were used to measure the project website's loading speed, cross-browser compatibility, community, customization and other theoretical features.</p> <p>The outcome of the analysis and tests was that Bootstrap was best suited for this specific project and the planned goal for the thesis was achieved. However, the outcome does not dictate that Bootstrap is always better than Foundation. But it will help to give programmers a better insight about the two frameworks to make informed decisions. Furthermore, it is recommended that programmers conduct research before deciding the right frontend framework for themselves and compare other frameworks such as React and Angular as well.</p>	
Keywords	HTML, CSS, JavaScript, Bootstrap, Foundation, Frameworks, Frontend, Responsive

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Abbreviations and Terms

API	Application program interface
Ajax	Asynchronous JavaScript and XML
CERN	European Organization for Nuclear Research
CLI	Command Line Interface
CSS	Cascading Style Sheets
DOM	Document Object Model
ES6	ECMAScript 6
GPU	Graphics Processing Unit
HTML	Hypertext Markup Language
IE	Internet Explorer
IETF	Internet Engineering Task Force
JS	JavaScript
LESS	Write Less Do More Stylesheet Language
Mac	Mackintosh
MB	Megabyte
ms	milliseconds
px	pixel
SASS	Syntactically Awesome Stylesheets
UI	User Interface
URL	Uniform Resource Locator
W3C	World Wide Web Consortium
WHATWG	Web Hypertext Application Technology Working Group
XML	Extensible Markup Language

1 Introduction

Nowadays, web development is much simplified because of the emergence of different frontend frameworks. In the last few years, dozens of frontend frameworks have become available for web developers and to mention a few Bootstrap, Foundation and Semantic User Interface (UI) are some of them. This thesis will focus mainly on two frontend frameworks, which are Bootstrap and Foundation. They are Hypertext Markup Language (HTML), Cascading Style Sheets (CSS) and JavaScript frontend frameworks, which are retained to develop responsive websites.

Responsive website design is about building a website with a grid-based layout, resizable images and media queries. Responsive design frameworks began to emerge by incorporating those principles mostly on CSS and JavaScript. Many of these frameworks are open-source and quickly customizable. The most popular ones today are Bootstrap and Foundation and those will be the focus of this thesis.

The specific purpose of this thesis is to use Bootstrap and Foundation frontend frameworks in a website thus resulting in responsive behaviour on various computing devices. In order to achieve this, a practical project work was carried out to build the website of Daniel Mengistu Law office. The project utilized HTML5, CSS3, JavaScript, JQuery and the two front end frameworks mentioned above, and by using these frameworks two separate websites were built. At the end, the website with the most efficient performance was implemented and launched as the official website of the client.

To illustrate, the client website is called Daniel Mengistu law office and it is a legal practice firm founded in Addis Ababa, Ethiopia and it offers specialized legal services for both local and international clients. In this project, as informed by the client, the design of the website to be created is expected to look clear and be user-friendly. In addition, it has to be responsive as most of the local clients of the firm are using the phone to browse the web. Furthermore, the website loading speed is expected to be fast and cross-browser compatible.

2 Frontend Responsive Web Design Technologies

Frontend frameworks make the web development process efficient. Front end frameworks contain templates written in HTML, CSS, Stylesheet Language (LESS), Syntactically Awesome Stylesheets (SASS) and JavaScript that make designing a user interface easier. [1]

2.1 HTML5

HTML is the structure of the website. It is also being called the World Wide Web's markup language. HTML is used for structure and presenting content of the world wide web. An HTML document can provide information for browsers such as what style to use and where to get it. CSS is a stylesheet language that describes the presentation of an HTML document. [2]

The first HTML4 emendation took place in 1997. However, after that the world's internet traffic has increased by several hundred-folds, and constant HTML updates have become essential. Furthermore, websites like YouTube have gone mainstream and watching TV or listening to music online has become the norm and most web browsers have started to rely on plugins and other resource hogging elements. As a result, the upgrading of HTML4 to HTML5 took place which established a proper handling for new contents. [3]

The last version of HTML5 was released in 2008. In mid-2012, a new editing team was introduced at the World Wide Web Consortium (W3C) to take care of creating an HTML5 recommendation and prepare a Working Draft for the next HTML version. [2] In October 2014 HTML5 was devised with two things in mind. The first one was the importance of cascading interactive elements in websites and web applications and the second one was the need for audio and video tags due to the increased number of people accessing audio and video services through the web by using mobile phones. Furthermore, the emergence of HTML5 increased the performance and decreased the battery drain. [3]

The Web Hypertext Application Technology Working Group (WHATWG) continued working on a living Standard for HTML. This resulted in constant maintenance of the specification and improving the features of HTML5. [2]

With these improvements, browsers that support HTML5 now have better support for vector graphics which are commonly used for images other than photographs. Vector graphics can be resized without losing any quality making and their usage is increasingly popular in modern websites that are designed to be displayed correctly on everything from phone all the way to TV screen. Moreover, the improved HTML5 also offers better support for things like drag and drop and online documents. Besides these, the improved HTML5 has video editing which is increasingly important for emergence of more features on a web browser such as photo sharing and online file storage. [3] HTML DOM structure is shown in figure 1.

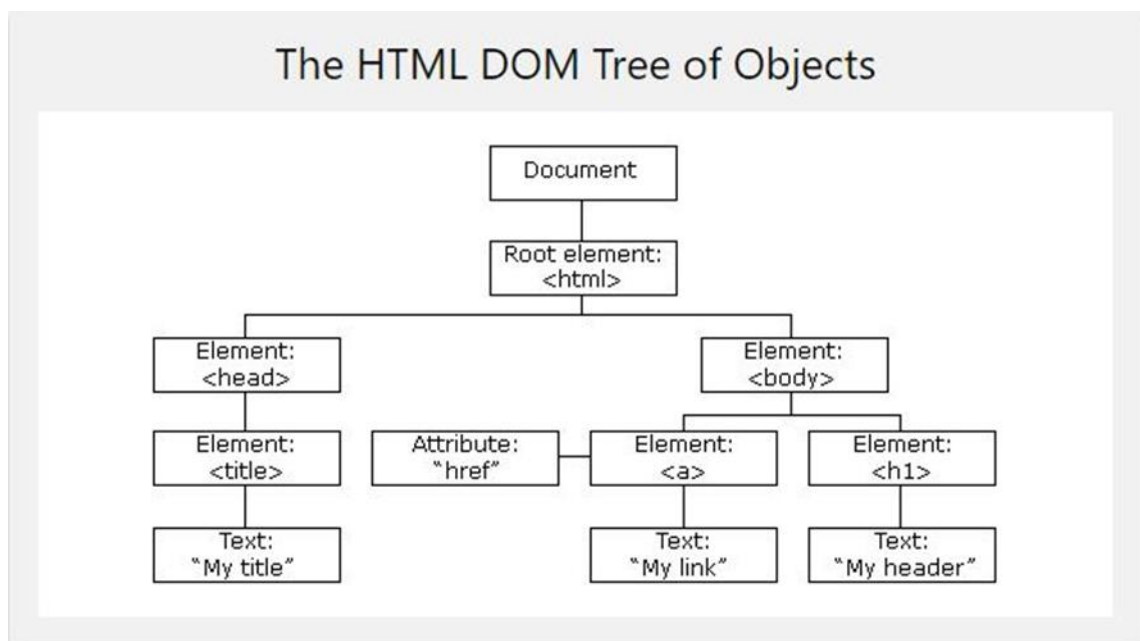


Figure 1 Document Object Model(DOM). Copied from w3school (2017) [4].

As illustrated in figure 1, HTML is the language of the web and it has a specific syntax and rules. The browser turns the HTML tag in to elements that form a tree. This is because HTML is utilizing Document Object Model (DOM) which is a standard convention for representing and interacting with elements in HTML. In addition, HTML5 semantic elements describe for browsers and developers the meaning of the elements. HTML5 semantic elements are shown in figure 2.



Figure 2 HTML5 Semantic Elements. Reprinted from W3schools (2017) [5].

As figure 2 illustrates, the new semantic elements of HTML5 has six elements. The top of the semantic is the header of the document followed by the navigation. Below the navigation, there are sections, articles and aside parts. Finally, the bottom part of the document is footer. Moreover, the HTML5 semantic is supported by all modern browsers and the semantic element explains its meaning for the browser, developer and accessibility users.

2.2 CSS3

CSS is the language which controls the presentation of HTML and its latest version is CSS3, which is completely backward-compatible with the earlier versions of the CSS. [6] Moreover, currently the CSS4 module is under development [7]. It helps to give a different design to the HTML presentation and to change the colours, layout and fonts of the application. In addition, CSS is the style of the website and it allows using a specific syntax and rules to change how the element looks like in the page, the size of the font, colour, background, border, positions and so forth. [2] The CSS Box model is shown in figure 3.

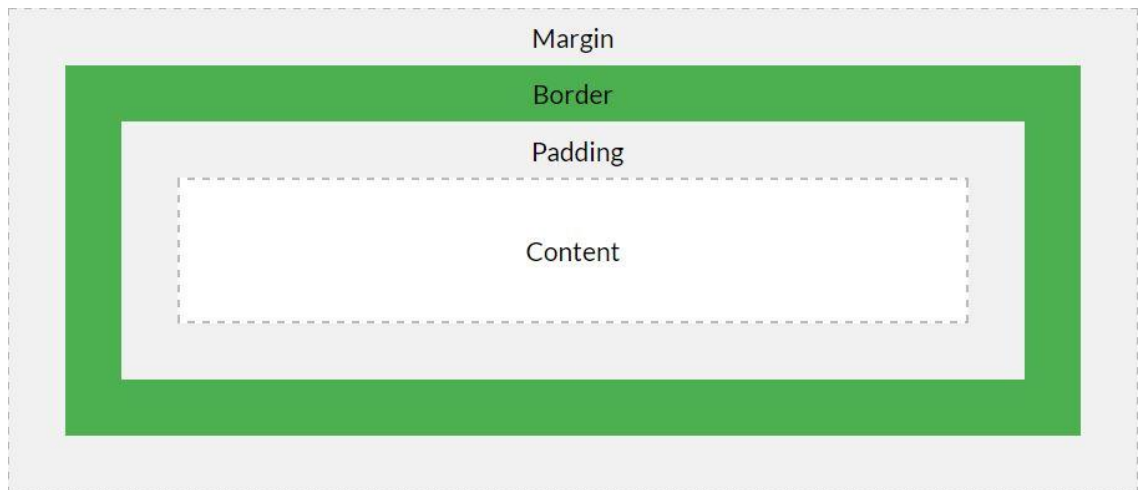


Figure 3 CSS Box Model. Copied from W3school (2017) [8].

As shown in figure 3, it depicts the diagrammatic representation of the CSS stylesheet. In other words, it is the way of representing HTML by different stylesheet and it is called CSS Box Model. Hence, it gives different styles to all HTML content such as padding, border and margin.

CSS has two essential tools that enable web developers to save time in building websites. These are CSS Framework and CSS preprocessors. These tools which are vital for CSS are explained in detail below.

2.2.1 CSS Frameworks

CSS frameworks are a collection of CSS classes that make page layout easy to implement. A framework is a package composed of structured files and folders code. In addition, it simplifies and supports the website design process and it is a base to start building a website. [9]

Choosing the right CSS framework consists of different criteria. Among these, the first one is the speed of the installation of the frameworks. Some are easy and fast to install and use, but others take time to install and configure. The second one is that easiness of learning about the specific framework. Some frameworks are complicated and difficult to handle but others are easy and straight forward. The third criterium for choosing the

right CSS framework is easiness in configuration options and integrability with other systems. The last criterium is the availability of long term support for the specific framework. It is better to rely on those frameworks that have continued updates and support. [9]

2.2.2 CSS Preprocessor

Developers use CSS preprocessors to build CSS faster. In addition, preprocessing is a method of extending the feature set of CSSs by first writing the style sheets in a preprocesses language. Following that, it compiles the code to pure CSS syntax using a computer compiler. A compiler is a computer program that transforms source code written in a programming language into another computer language, byte code. There are two types of CSS preprocessors: SASS and LESS. [10]

SASS stands for Syntactically Awesome Style sheets which is an extension of CSS. It adds nested rules, variables, mixins, operators, selector inheritance and more. Furthermore, it is translated to a well-formatted, standard CSS using the command line tool or web-framework plugin. [10]

On the other hand, LESS stands for Write Less Do More (LESS) language. LESS provides the following mechanism: variables, nesting, mixins, operators and functions. LESS is convertible to standard CSS through JavaScript or using an application. [10]

Variables in SASS and LESS are very important features of CSS. Web developers define variables using the \$ sign in case of SASS where as they use @ in the later case. Nevertheless, values are assigned using colon (:) in both applications. A screenshot of SASS and LESS variable application is shown in figure 4. [11]



Figure 4 How to use SASS(left) and LESS(right) variables. Copied from *htmlmag* (2014) [11].

As illustrated in figure 4, in both SASS and LESS the font-size variable is defined once and used throughout the document. [11]

On other hand, mixins is another important feature of CSS. Mixins are a category of definitions compiled which is depending on some parameters or static rules. Moreover, mixins are able to write CSS arrows or background gradients and other parameters. [11]

Sass	Less
<pre> @mixin bordered(\$width) { border: \$width solid #ddd; &:hover { border-color: #999; } } h1 { @include bordered(5px); } </pre>	<pre> .bordered (@width) { border: @width solid #ddd; &:hover { border-color: #999; } } h1 { .bordered(5px); } </pre>

Figure 5 How to use SASS(left) and LESS(right) mixins. Copied from *htmlmag* (2014) [11].

Screenshot of SASS and LESS mixins application are illustrated in figure 5. It is a set of definitions that compiles according to some parameters or static rules written on a cross-browser background. In both cases the border is defined in the CSS document. [11]

Nesting gives a structural and visual hierarchy in HTML. In addition, it improves the readability as well. This is because CSS is deficient in defining visual hierarchy in a process of working in child selectors. [11] Screenshots of SASS and LESS nesting application are illustrated in figure 6.

Sass	Less
<pre>\$link-color: #999; \$link-hover: #229ed3; ul { margin: 0; li { float: left; } a { color: \$link-color; &:hover { color: \$link-hover; } } }</pre>	<pre>@link-color: #999; @link-hover: #229ed3; ul { margin: 0; li { float: left; } a { color: @link-color; &:hover { color: @link-hover; } } }</pre>

Figure 6 How to use SASS(left) and LESS(right) nesting. Copied from *htmlmag* (2014) [11].

As can be seen in figure 6, SASS and LESS have similar nesting. The main purpose of nesting is to oversize selectors and to improve readability. This is possible because nesting gives more visual hierarchical features for the HTML. [11]

2.3 JavaScript and JQuery

JavaScript was created in May 1995 by Brendan Eich in just 10 days. JavaScript used to be called Mocha, named by Marc Andreessen, the founder of Netscape. Then the name changed again to LiveScript in September 1995. Moreover, in the same year when the trademark was registered, the current name, JavaScript, was finally adopted. [12]

Concerning its use, JavaScript is the interactive and functionality component of the website. Furthermore, it is an untyped language, unlike many other languages. Many JavaScript commands are known as event handlers, which means they can be embedded right into existing HTML commands. Regarding the function of JavaScript, it changes HTML content, attributes and CSS style. Besides, it hides and shows the HTML elements. [12]

Moreover, JavaScript runs where it is found in the HTML and stored in two ways: internally or externally. [8] Internally, JavaScript can be written either inside the head or body tag of an HTML document using `<script>` `</script>` tags. On the other hand, externally, JavaScript can be written in a separate document and saved as .js file. After that, the file extension should be included in the HTML document. [12]

JQuery is a fast and concise JavaScript library that simplifies an HTML document. Some of the functionalities of JQuery are traversing, event handling, animating and Ajax interaction. In addition, it goes much simpler with an easy-to-use Application Program Interface (API) that works across a multitude of browsers for rapid web development. Furthermore, it is a lightweight JavaScript library that simplifies programming with JavaScript. [13]

2.4 Twitter Bootstrap

Bootstrap was created by Twitter developers, Mark Otto and Jacob Thornton. It was initially released to the public in 2011 as an open source framework. It was also called as Twitter Blueprint. Now Bootstrap is a well-known open-source frontend framework in the world. It is used in the Twitter website. A screenshot of the original Twitter Blueprint is shown in figure 7. [14]

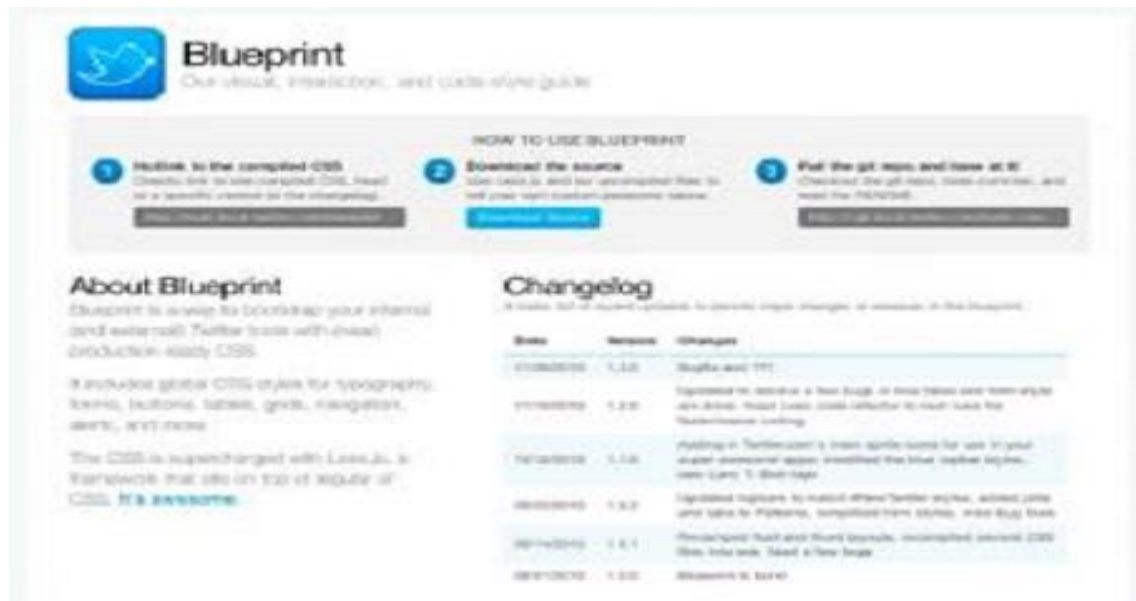


Figure 7 Twitter Blueprint in 2011. Reprinted from Chris Aniszczyk (2013) [15].

Bootstrap is a powerful frontend development framework that includes HTML, CSS and JS components. Moreover, it is used for building mobile first responsive websites of all size and complexity. Mobile first means web applications created with smaller screen sizes in mind first and then tweaked for larger screen sizes. In addition, it has ready to use responsive themes and templates as a starting point for any web project. [14]

In addition to that, the Bootstrap framework is upgraded constantly by the Bootstrap community. The current stable release of Bootstrap is version 3.3.7. However, Bootstrap 4 is in alpha version. Bootstrap is a constantly upgraded framework to use SASS as its CSS preprocessor. [14]

Bootstrap uses a 12-column responsive grid system and features, dozens of components, styles and JavaScript plugins. In addition, it has a basic global display, typography

and link styles. Moreover; by using the customizer Bootstrap can be suited for a specific web project by adjusting variables, components, JavaScript plugins and more. It is possible to expand Bootstrap by using a wealth of resources, including themes and interfaces and building tools. [14]

Bootstrap takes the one framework, every device approach. It can easily and efficiently scale websites and applications with a single code base. That means anything from phones to tablets and to desktops with CSS media queries. By using Bootstrap, extensive and beautiful documentation for common HTML elements can be found. In addition, dozens of custom HTML and CSS components and jQuery plugins are also found. [14]

2.5 Zurb Foundation

Foundation is created by the web design company Zurb. It is a web design company with over 15 years of experience in the web design industry. Foundation is an advanced enterprise framework. In addition, it is used as a frontend framework in websites like eBay, Facebook, and Firefox-Mozilla. [16]

Moreover, Foundation is used for building website frontends as well as user interfaces for web and mobile applications. More specifically, this means features like menus, buttons and lists. Foundation uses a mobile first design which is similar to a twitter bootstrap design pattern. Moreover, it gives faster user interface and user experience development, with no need to create all of HTML, CSS classes and styling from scratch. In addition, the style button also just pops in the class name and Foundation gives smarter and cleaner code. Further, it is very semantic which means it uses all the appropriate naming conventions and then the web elements are laid out nicely. [16]

Foundation is mobile first and runs on a SASS CSS pre-processor. The focus to build optimized websites is never lost with the use of Foundation. Some of the key features that Foundation came up with were for building lightning fast websites with data-interchange, Fastclick.js, Off Canvas Navigation and Graphics Processing Unit (GPU) Acceleration. The Foundation custom download table is presented in figure 8.

Customize Foundation

Pick and choose the features you want or have the whole enchilada.

Choose Your Components:

All Foundation Components

Grid:

Grid

Flex Grid

No Grid

General:

Typography

Forms

Float Classes

Visibility Classes

Controls:

Buttons

Close Button

Button Group

Slider

Switch

Navigation:

Menu

Drilldown Menu

Accordion Menu

Dropdown Menu

Magellan

Responsive Menu

Top Bar

Breadcrumbs

Title Bar

Pagination

Containers:

Accordion

Dropdown

Off Canvas

Tabs

Callout

Card

Media Object

Reveal

Table

Responsive Accordion Tabs

Media:

Badge

Label

Progress Bar

Tooltip

Responsive Embed

Orbit

Thumbnail

Plugins:

Sticky

Interchange

Responsive Toggle

Toggler

Abide

Equalizer

Motion UI

Set Your Defaults:

The Grid

of Columns

Total Gutter

Max-Width

Colors

Primary Color

Secondary Color

Alert Color

Success Color

Warning Color

Body Font Color

Header Font Color

Global Radius

Radius

Text Direction

Left-to-right

Right-to-left

Figure 8 Foundation Custom download table. Copied from Zurb Foundation (1998) [17].

Currently the latest stable Foundation framework is Foundation 6. This framework gives 40-50% code reduction compared to the previous version. [16] In addition, it has Custom download options as illustrated in figure 8.

2.6 Bootstrap Versus Foundation

To mention similar and a few different features of the two frameworks, SASS and mixins are used both by Bootstrap and Foundation and also both of them use the grid system. Moreover, `reboot.css`¹ is used to reset Bootstrap and `normalize.css`² is used for Foundation. In addition, the 12 columns fluid for both frameworks have the maximum width of 75em. [9] The overall theoretical summary of Bootstrap 4 and Foundation 6 frontend frameworks is illustrated in detail in table 1.

¹ Collection of element specific CSS changes in a single file. [14]

² Removes quirks in browsers in all Foundation websites which render elements consistently. [16]

Table 1 Summary and overview of Bootstrap 4³ versus Foundation 6⁴. Modified from Vermilion design and Digital (2015) [18].

	Bootstrap 4.0.0-alpha	Foundation 6
Summary	Updates in version 4.0.0-alpha: <ul style="list-style-type: none"> • Dropped Less in favor of Sass • Better grid system for mobile • Opt-in flexbox support - use Sass boolean to toggle • Wells, Thumbnails, and Panels have been replaced by Cards • New reset called Reboot (combination of the several normalize.css and Bootstrap base styles) • Dropped IE8 support • Moved from px to rem and em units • All JS plugins rewritten in ES6 • Completely rewritten and improved documentation 	Foundation 6 Updates: <ul style="list-style-type: none"> • 50% code reduction • Components built with more attention to Web Accessibility • Fewer default styles to override • Customizable Sass Grid • Flexbox grid toggling • Custom breakpoints • ZURB prototyping tools • Motion UI • More flexible navigation patterns
Version	4.0.0-alpha	6
Website	v4-alpha.getbootstrap.com	foundation.zurb.com/sites
Creator	Mark Otto and Jacob Thornton at Twitter	ZURB
Browser Support	Google chrome, Firefox, Opera, Safari, IE	Google chrome, Firefox, Opera, Safari, IE

³ <https://v4-alpha.getbootstrap.com/>

⁴ <http://foundation.zurb.com/sites>

As illustrated in table 1, Bootstrap and Foundation moved from pixels (px) to rem and then to em. Px is a static size measurement unit used for scaling of objects in a screen. The accustomed size unit was used by designers for several years due to its translatability. Furthermore, it is easy to resize the photo directly from photoshop to design. On the other hand, Rems are methods of setting font-sizes depending on the font-size of the root HTML tag. It helps to scale up or down the entire project only by changing the root font-size. Finally, em is used to perform in a similar way with rem until nesting comes. [14]

Both rem and em are flexible and scalable units translated by browser into px. In addition, em and rem are scalable units used for different screen sizes during responsive web application design. Moreover, the main difference between them is that in rem when the browser translates it to px, the root font size is multiplied by the number in the rem unit. However, in case of em, when the browser changes or translates it to px, the value is multiplication of the font sizes of the elements. [14]

3 Design Methods and Tools used in the Project

3.1 Designing phase and requirement specification

The web designing phases in this project were wireframing, layout and spacing, navigation, colours, fonts, icons, imagery and others. Wireframing is basically a visual guide for client presentation of the website and in this project the wireframe was created by Microsoft PowerPoint. The resources used for web font in this project were taken from Google fonts⁵ where there are tons of free and easy to use web fonts. In addition, colours used in the web designing process of this project were also taken from Flat UI colours⁶ and Adobe UI color-wheel⁷. Moreover, icons used in this web design project were taken from Iconicons⁸ and from Fontawesome⁹. Further, most of the images used in this project were taken from thestocks¹⁰ where all free categorized images for web design can be found in one place.

As wireframing is a visual guide for client presentation of the website which allows defining the information hierarchy of a web design. Further, it helps the client to see how the website looks at the end. A screenshot of the wireframing of this project website is depicted in figure 9 and the wireframing shown was drawn by using Microsoft PowerPoint.

⁵<https://www.google.com/fonts>

⁶ <http://flatuicolors.com/>

⁷ <https://color.adobe.com/create/color-wheel/>

⁸ <http://ionicons.com/>

⁹ <https://fontawesome.github.io/Font-Awesome/>

¹⁰ <http://thestocks.im/>

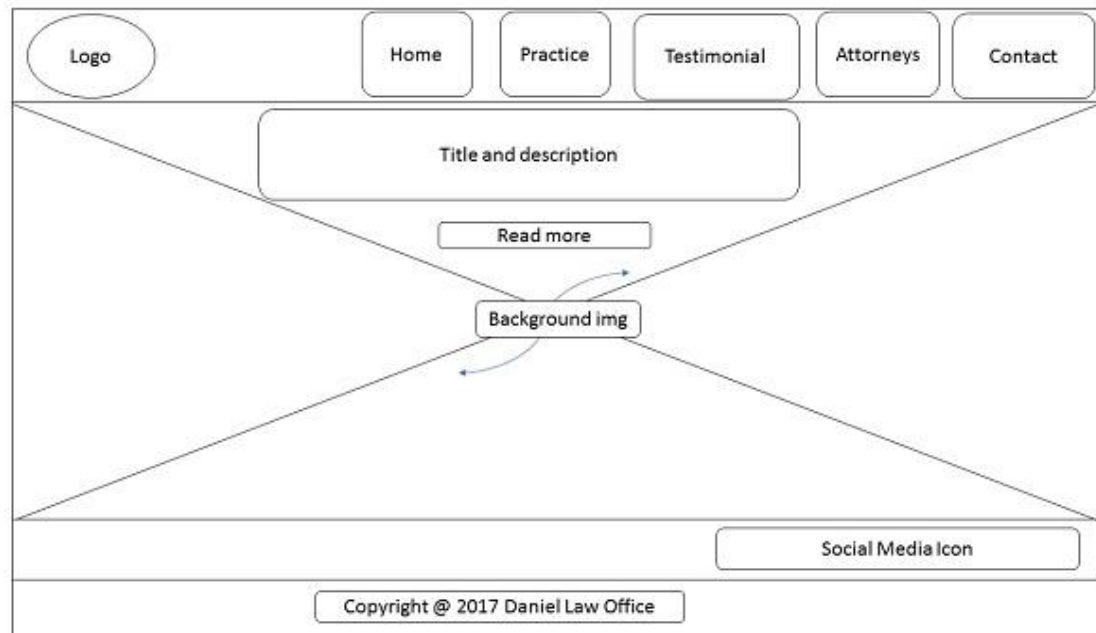


Figure 9 Screenshot of wireframe of the project websites with important components.

According to the wireframe design illustrated in figure 9, the websites will be built using the two frameworks having the following sections according to the wireframe: header, body and footer. The header will be on the top of the page which further will contain a navigation bar with navigation buttons and a logo. There will be a navigation bar which contains 5 navigation items such as home, practice, testimonial, attorneys and contacts. On the body of the page, there is going to be the title and description of the website with a background image. In addition, at the footer section, there will be social media and copyright icons.

Furthermore, the requirements or important things considered during the designing of this project were responsiveness and cross browser compatibility. In addition, customizability of the two frontend frameworks was considered. Moreover, the website loading speed of the project websites was also taken into account.

3.2 Software installation and development process

During the development process Windows 10 operating system, Windows 10 Command Line Interface (CLI), bracket editor and Google Chrome browser with its developer tool were used as a development environment. The different software, which are vital for the development of the project, were downloaded and installed to set up the development environment.

Once the programming phase started, the standard text processing application or code editor was downloaded and installed. Bracket editor was used in this project from a selection of code editors available online because it is an open source code editor with helpful features. Among these features, the first one is it has many extensions available to install which makes the web design process easy. The second one is that this editor has nice features built in colour highlighters like HTML, CSS and JS syntax while working out a long document. And the last one is that it manages multiple open documents in tabs. As a result, it is easily possible to work on several files at the same time which is an important feature in a web design process.

After describing the required features and preparing the development environment was completed, the next thing was downloading the latest Bootstrap 4 and Foundation 6 frameworks from the official websites of the respective frameworks. The download package contains everything in the framework including typography, grid, HTML elements, CSS components, CSS preprocessors and JQuery plugins. After that, important fonts were downloaded and saved in the same folder with the images and contents of the project folder.

Regarding browsers, any web browsing applications were possible including for example Chrome, Safari, Firefox or Explorer. However, the web browser used for this project was Google Chrome. Google Chrome contains developers' tools and helpful Chrome extensions and other features for a web design process [14].

To conclude, as discussed in chapter 1, the website built in this project is for Daniel Mengistu Law office. The requirement specifications for the website were provided by the company. As a result, the contents of the website are included in the same project folder.

3.3 Project file structures

Both Bootstrap and Foundation have default file structures. The default file structures are not mandatory but it is important to follow the common practice. In this project, the common bootstrap and foundation file structures were used. In figure 10, the file structures of the two frameworks are presented. They have almost similar listings with minor differences.

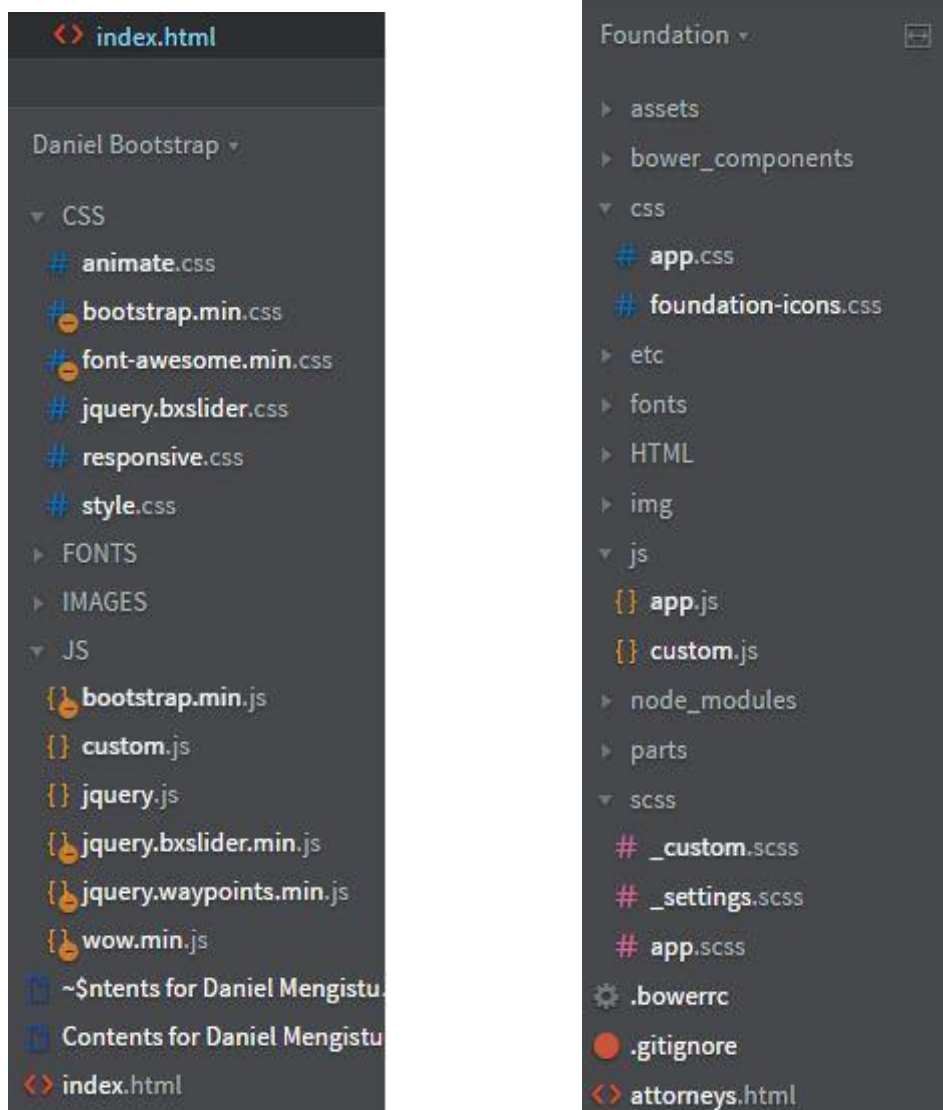


Figure 10 Comparison of file structures of the Bootstrap (left) and Foundation (right) project folders.

As shown in figure 10, both Foundation 6 and Bootstrap 4 consist of SASS CSS preprocessor. However, Bootstrap 3 dwells LESS stylesheets [11]. Bootstrap is a freely downloadable framework containing HTML, CSS and JavaScript. The downloaded folder composed of directories and files with minified CSS versions of them is also included as depicted in figure 10.

In addition, Bootstrap allows us to download the full package or the customized one. As a result, the customized one is downloaded according to the elements that are needed in any specific project. In the same way, Foundation has a customized download option. The customized download option, by decreasing the download size, improves the download speed of the website. However, in this project the full package Foundation and Bootstrap download was performed, as illustrated in the above directories and files. In addition, grouping JS and CSS together with minified versions were included in the download. All the folders and source codes for both Bootstrap¹¹ and Foundation¹² websites can also be accessed from the GitHub.

To conclude, the process of setting up everything for developing the websites was started by creating good folder structures where the files are kept in a very organized way. Following that, the real coding process was commenced by using bracket editor. After that, the project website sections were built step by step for both frameworks. The sections built in the project were “Header”, “Areas of practice”, “Testimonials”, “Attorneys”, “Contact” and “Footer”.

¹¹ <https://github.com/Befekadu-Mezgebu/Bootstrap-project-1>

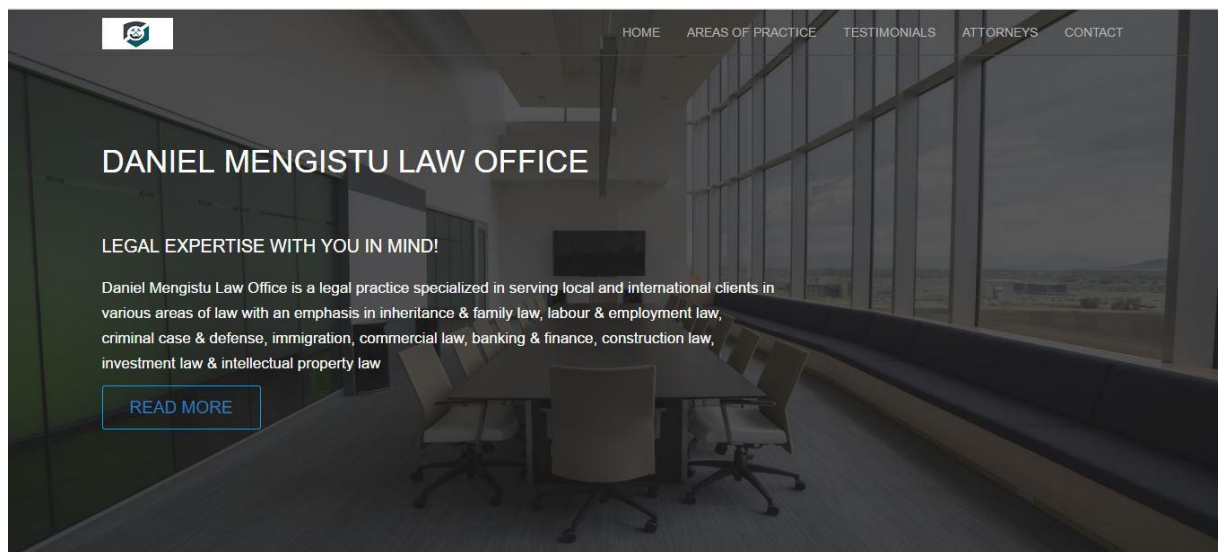
¹² <https://github.com/Befekadu-Mezgebu/Foundation-Project-1>

4 Test Results

The website designed for Daniel Mengistu Law office is a mobile first responsive design and the application user interface was designed by HTML5, CSS3, JavaScript, Bootstrap and Foundation frameworks. In this project only the frontend of the website was developed. In addition, the requirement set for the project in chapter 3 was applied during the development.

4.1 User Interfaces

The web application built was responsive to different screen sizes. Figure 11 presents the desktop view of the Bootstrap and Foundation websites consecutively. The mobile versions of the websites are available in Appendix III. As illustrated in figure 11, it shows the final desktop version of the real responsive websites and the websites built were working flawlessly.



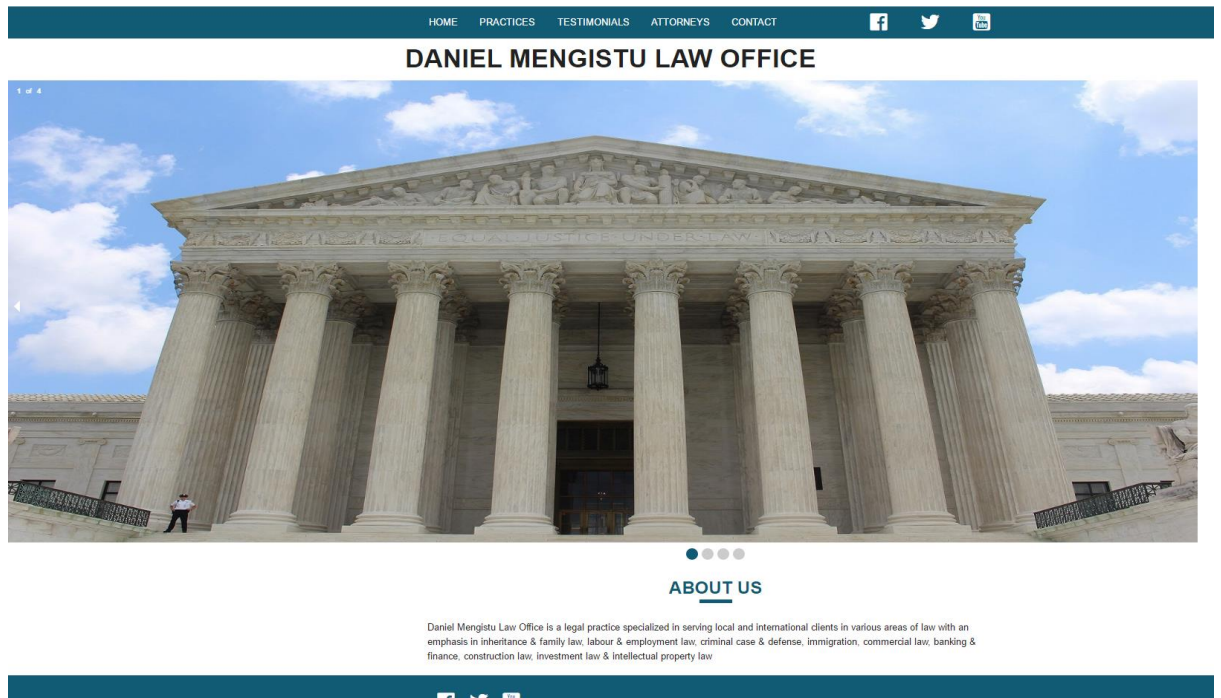


Figure 11 Screenshots of the desktop versions of the Bootstrap (top) Foundation (bottom) Websites homepage.

The website contains a header, a navigation bar, content and a footer. The navigation bar contains links to Home, Areas of Practice, Testimonials, Attorneys and Contact pages of the website. Moreover, on each page the content of the website contains title, description and background image for the website.

4.2 Performance optimization of the project websites

Enhancing page speed is the most important thing in a web development process. Website speed has real impact on user engagement because many users do not want to wait for slow websites to load. The two most basic techniques for speeding up websites are optimizing heavy images and minifying CSS and jQuery code. [1] Both the Bootstrap and Foundation websites had gone through the performance optimization techniques before they were tested. As a result, this step was performed before the implementations of the websites.

All the images in the project folders were optimized by reducing the file sizes of the images using online image compressor tools. From different compressor tools available

online, Optimizilla¹³ and Tinypng¹⁴ are used in this project. Tinypng is used for the Bootstrap website image optimization and Optimizilla for the Foundation website image. A screenshot of sample images optimized by using Tinypng is presented in figure 12.

ABOUT US.jpg	502.3 KB	Finished	228.1 KB	download	-55%
Attorney.jpg	441.1 KB	Finished	163.3 KB	download	-63%
Attorney2.jpg	453.2 KB	Finished	126.3 KB	download	-72%
Attorney3.jpg	512.2 KB	Finished	185.8 KB	download	-64%
benjamin-child-17946.jpg	12.5 MB	File is too large (max 5 MB)		Optimize now? Go Pro!	
Daniel_Gurara.png	68.5 KB	Finished	19.8 KB	download	-71%
favicon-16x16.png	1.5 KB	Finished	488 B	download	-67%
Lawyer.jpg	324.5 KB	Finished	120.8 KB	download	-63%
Lawyer2.jpg	632.0 KB	Finished	207.9 KB	download	-67%
logo.JPG	10.1 KB	Finished	2.1 KB	download	-79%
mari-helin-tuominen-38313.jpg	448.4 KB	Finished	123.6 KB	download	-72%
small logo.png	2.8 KB	Finished	1.6 KB	download	-43%
Testimonial 1 Daniel Gurara.png	32.9 KB	Finished	12.3 KB	download	-62%
Testimonial 2 Alemayehu-Geda...	8.0 KB	Finished	7.3 KB	download	-8%
Testimonial 3 Yoseph Amare.jpg	6.9 KB	Finished	5.3 KB	download	-24%



Figure 12 Screenshot of the optimized image of the Bootstrap website using Tinypng. Generated from Tinypng (2017) [19].

As can be seen in Figure 12, the size of the images of the Bootstrap website were minimized and the total optimization found using this tool was 65% or 2 MB of the total size. In the same way, the image sizes of the Foundation website were compressed using the same tools.

The other optimization technique used was minify CSS jQuery files. This basically reduced the size of the CSS and jQuery files by removing unneeded white spaces and

¹³ <http://optimizilla.com/>

¹⁴ <https://tinypng.com/>

optimizing the codes. The online tools used for this technique were minifycss¹⁵ and minifyjavascript¹⁶.

4.3 Community and support

GitHub stars, GitHub watch, GitHub Forks and Stack Overflow search results were used to measure the community and support of the frameworks. Table 2 compares the popularity of the two frontend frameworks. The GitHub activity of the two frameworks is used for this purpose.

Table 2 Bootstrap versus Foundation GitHub activity. Data collected from GitHub (2017) [20; 21].

GitHub activity	Bootstrap </>	Foundation </>
Number of watches	6,839	1,497
Number of stars	109,379	25,253
Number of forks or download	50,282	5,539

Both Bootstrap and Foundation frameworks are active on Github. As illustrated in table 2, Bootstrap has 4 times more stars than Foundation framework. In addition, Bootstrap has got twice the number of forks or downloads compared to the Foundation framework. Furthermore, Bootstrap has got about 5 times more watches than Foundation. The latest stack overflow activity results of Bootstrap 4 and Foundations 6 are shown in figure 13.

¹⁵ <http://www.minifycss.com/ZMVbZ/css-compressor/>

¹⁶ <http://www.minifyjavascript.com/LLcpZ/>

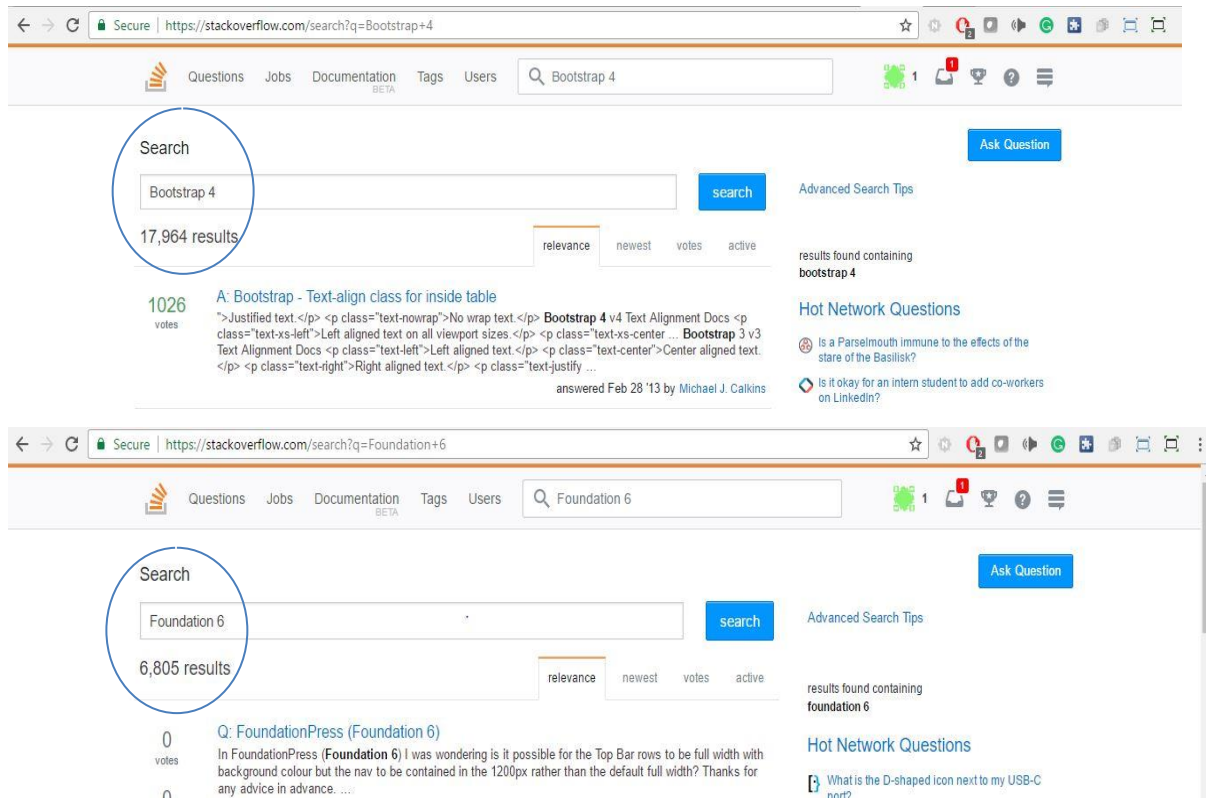


Figure 13 Screenshots of Stack overflow activities of Bootstrap (top) and Foundation (bottom) frameworks. Data collected from StackOverFlow (2017) [21;22].

As shown in Figure 13, the search results for Bootstrap 4 was about 3 times more than the Foundation 6 framework. This indicates Bootstrap is definitely more popular, hence naturally it has more support and references available. That means people can get support and help in an easier way.

4.4 Google trend and Builtwith trend

Interest over time graph for Bootstrap 4 versus Foundation 6 is illustrated in figure 14. The graph is a Google trend graph and the numbers represent the search interest results of the two frameworks. Moreover, the search interest is relative to the highest point on the chart for the given region and time.

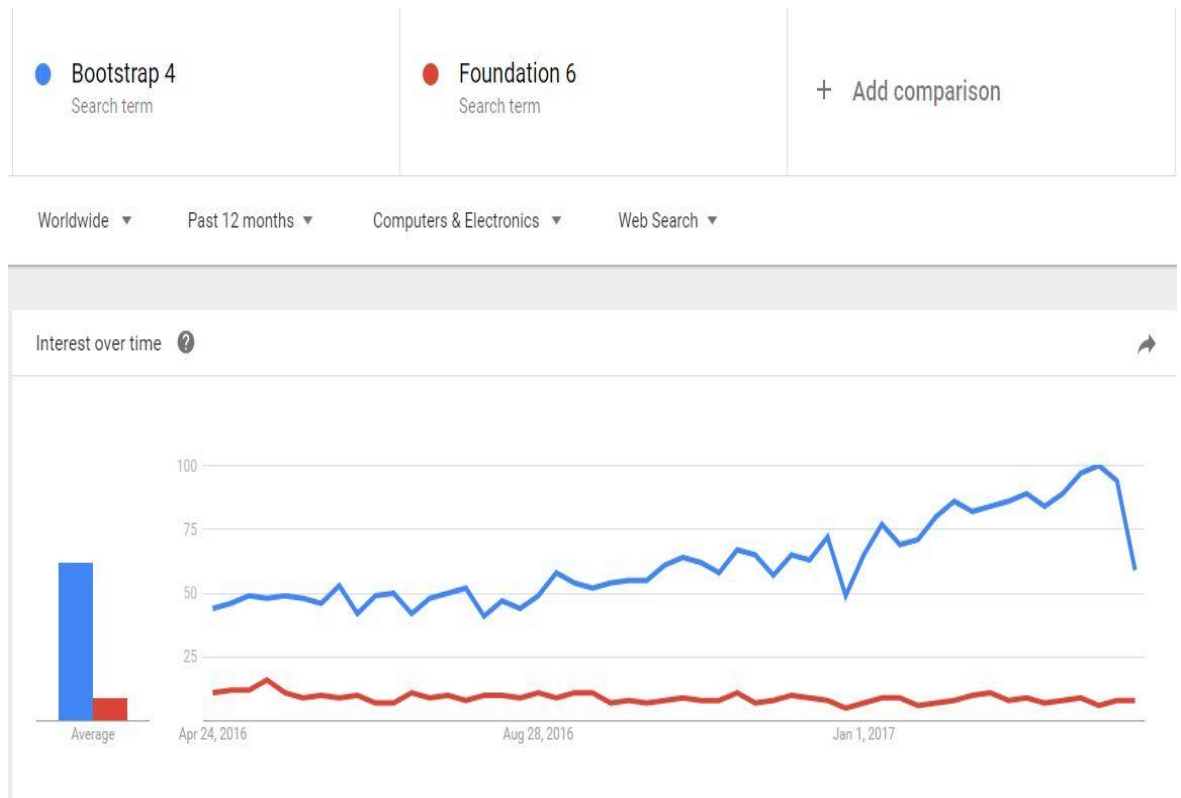
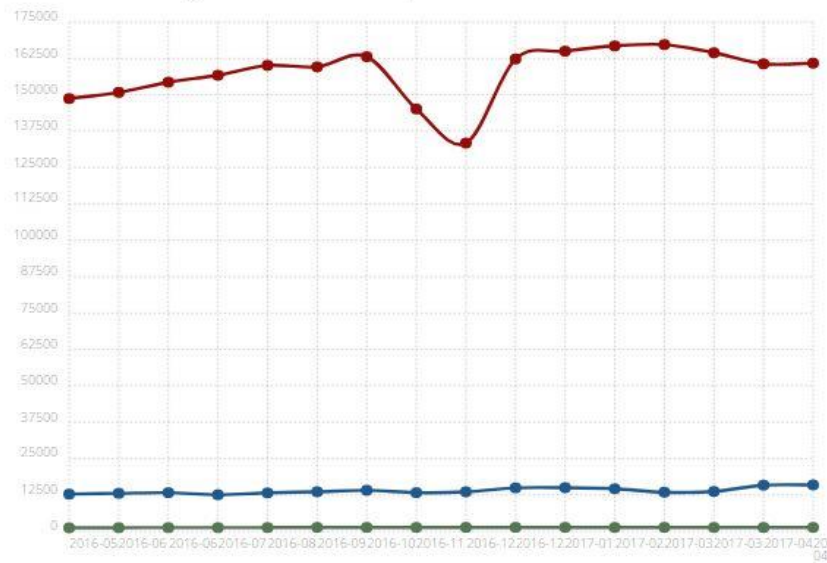


Figure 14 Interest over time google trend graph for Bootstrap 4 versus Foundation 6. Generated from Google Trends (2017) [23].

As figure 14 illustrates, a value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. Likewise, a score of 0 means the term was less than 1% as popular as the peak. Accordingly, the popularity of Bootstrap 4 versus Foundation 6 worldwide during April 24-30, 2016 was 44/11. This means the Google search interest result relative to the highest point in the chart of Bootstrap 4 for the given region and time was about 4 times the Foundation 6 result. In addition, during April 16-22, 2017, it was 59/8. This also means the Google search interest result relative to the highest point on the chart for the given region and time of Bootstrap 4 was about 7 times the Foundation 6 result. Moreover, figure 15 shows a BuiltWith trend graph which is a usage statistics online measuring tool.

Twitter Bootstrap Usage Statistics

Websites using Twitter Bootstrap



Download Lead List

Chart Data

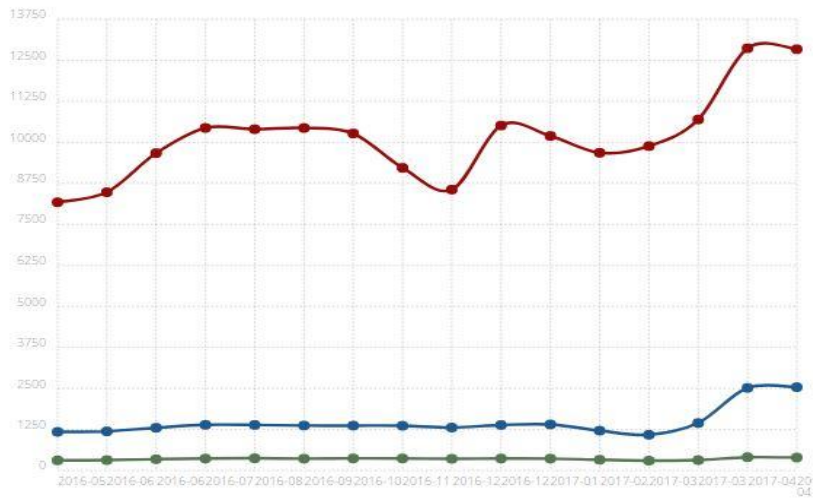
Source	Legend	Chart
Top 10k	●	<input checked="" type="checkbox"/>
Top 100k	●	<input checked="" type="checkbox"/>
Top 1m	●	<input checked="" type="checkbox"/>
Internet	●	<input type="checkbox"/>

Coverage Totals

Quantcast Top 10k 1,320 of 10,000	13.2%
Quantcast Top 100k 15,916 of 100,000	15.9%
BuiltWith Top Million 160,863 of 826,894	19.5%
Entire Internet 12,804,808 of 370,445,414	3.5%

Foundation Usage Statistics

Websites using Foundation



Download Lead List

Get a list of 466,177 websites using Foundation which includes location information, hosting data, contact details, 282,189 currently live websites and 183,988 sites that used this technology previously.

Chart Data

Source	Legend	Chart
Top 10k	●	<input checked="" type="checkbox"/>
Top 100k	●	<input checked="" type="checkbox"/>
Top 1m	●	<input checked="" type="checkbox"/>
Internet	●	<input type="checkbox"/>

Coverage Totals

Quantcast Top 10k 393 of 10,000	3.9%
Quantcast Top 100k 2,538 of 100,000	2.5%
BuiltWith Top Million 12,839 of 826,894	1.6%
Entire Internet 237,981 of 370,445,414	0.1%

Figure 15 Builtwith trend of Twitter Bootstrap (top) versus Foundation (down) Usage Statistics. Generated from Builtwith Trend (2017) [24; 25].

As illustrated in figure 15, 13.2% of the top 100,000 which is approximately around 1,320 websites out of 10,000 were using Bootstrap to power their websites. However, 3.9% of the top 100,000 which is also approximately around 393 websites out of 10,000 were using Foundation Framework. This means Bootstrap has got about 3 times more users compared to Foundation users to power their websites. In addition, as illustrated in figure 15, the statistics goes in similar way for the two frameworks when it comes to the total

coverage of the frameworks. Hence, Bootstrap usage out of the entire internet usage was 3.5% (which is around 12,804,808) and Foundation 0.1% (which is around 237,981).

4.5 Cross browser Testing

There are a lot of different common browser compatibility testing tools. Among these are CrossBrowserTesting, Browsershots and Browserling to mention a few. However, in this project the CrossBrowserTesting¹⁷ online tool was used. The outcomes of cross browser testing using the CrossBrowserTesting tool for both websites are shown in figure16.

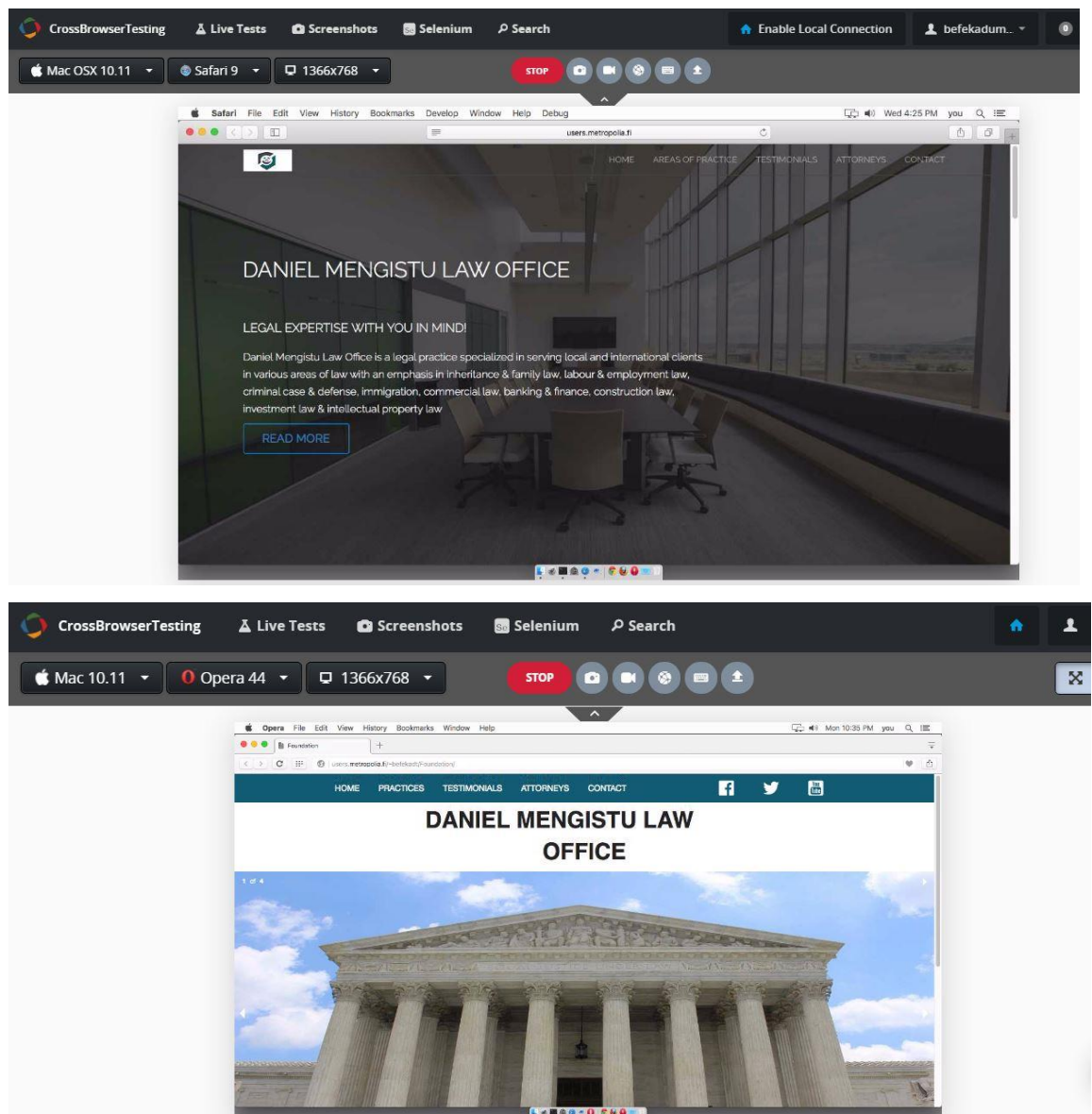


Figure 16 Screenshots of Cross browser testing of the Bootstrap website (top) versus Foundation website (bottom). Generated from CrossBrowserTesting (2017) [26].

¹⁷ <https://crossbrowsertesting.com/>

Bootstrap and Foundation provide browser support for browsers like Google Chrome, Firefox, Opera, Safari, IE. However, Foundation does not support IE8 which is the older browser but Bootstrap 3 supports it. (9) [9] To illustrate more, the Bootstrap website was tested using Mackintosh (Mac) 10.11 computer with Safari 9 browsers. However, the Foundation website was tested using Mac 10.11 computer with Opera 44 browsers.

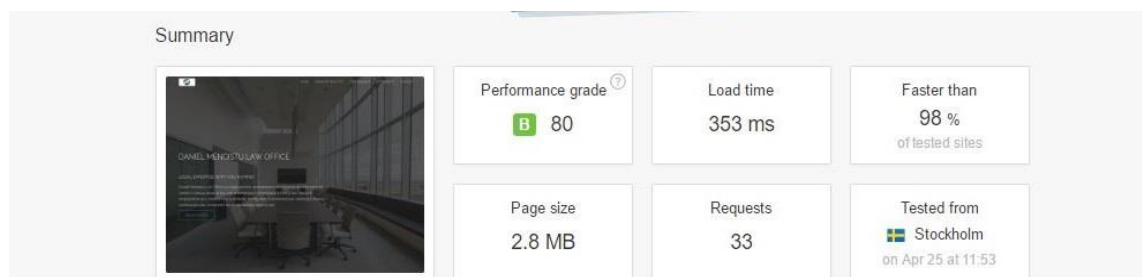
4.6 Webpage loading speed

Webpage loading speed is the most important parameter of website performance measure [26]. The webpage speed of the project websites got checked using different online testing tools. Webpage speed means measuring the amount of time it takes from the location of the client until the website loads and on the other hand, measuring the amount of time it takes to download the source code of a web page.

Page load time shows the time it took for the page to be fully loaded, including external resources such as images and scripts. In technical terms, it's the window on load event. Performance grade is the grade the webpage gets according to the Yslow test. In this thesis three websites loading speed tools were used and they were Pingdom, GTmetrix, Page Speed Insights consecutively.

4.6.1 Pingdom

The website speed test using Pingdom¹⁸ is to analyse the load speed of the websites. This was performed by entering a URL to test the load time of that page and then by analysing it and finding the bottlenecks. The performance rates for both Bootstrap and Foundation websites are illustrated in figure 17.



¹⁸ <https://tools.pingdom.com/>

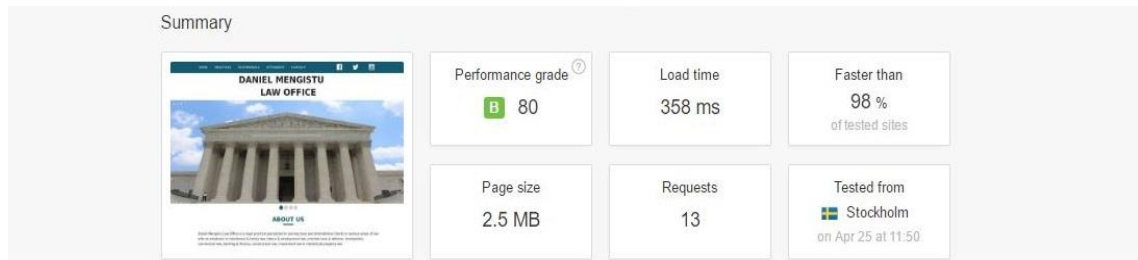


Figure 17 Screenshots of Pingdom Website Speed Test results for the Bootstrap website (top) versus Foundation website (bottom). Generated from Pingdom (2017) [27].

As figure 17 shows, the performance rate for both Bootstrap and Foundation websites were grade “B” on a grading system from “A” to “F” grading. The full-page loading time of the Foundation website was higher than the Bootstrap website in this test by 5 milliseconds (ms). However, the relative speed in both cases is so fast that it would be pointless to qualify one as loading faster than the other in this case.

4.6.2 GTmetrix

GTmetrix¹⁹ was developed by GT.net. This tool is for managed hosting customers to easily determine the performance of their sites. This tool gives also actionable insights on how to optimize the website speed. The GTmetrix Website speed test results for both Bootstrap and Foundation are illustrated in figure 18.

Compare Reports

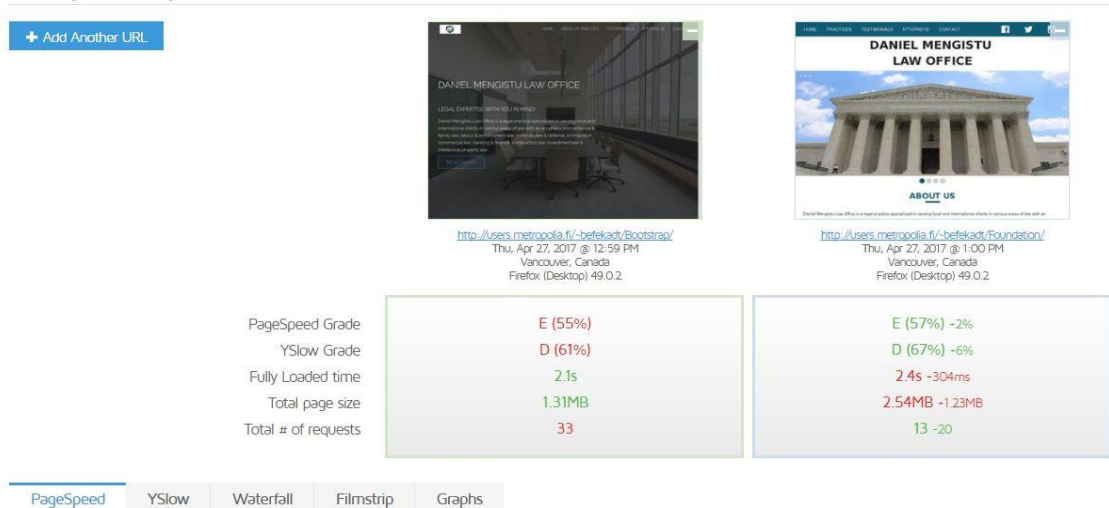


Figure 18 Screenshot of GTmetrix Website speed test results for both Bootstrap (left) and Foundation (right) websites. Generated from GTmetrix (2017) [26].

¹⁹ <https://gtmetrix.com/>

As can be seen in figure 18, the GTmetrix speed test showed the PageSpeed score for the Bootstrap website is 2% lower compared to the Foundation website. The Bootstrap website has also a lower fully loaded time than that of Foundation. In addition, the total page size of the Foundation website is higher than the Bootstrap website by 1.23MB.

4.6.3 Google Page Speed Insights

Google PageSpeed Insights²⁰ was the third tool used to analyse the speed of the two websites. As a result, it helps to optimize websites using the websites best practices. Web performance tools at Google are browser extensions and APIs for Insights, PageSpeed Service, and optimization libraries.

Page Speed Insights tests the page loading of a web in both mobile and desktop versions. It checks the URL twice, once as a mobile user and then as desktop user. This tool evaluates the filling of a website, then engenders comments for the web to perform better. The comparison for Google PageSpeed Insight results of the Bootstrap and Foundation websites are shown in table 3.

Table 3 Comparison for Google PageSpeed Insight results of the Bootstrap (left) and Foundation (right) websites. Data gathered from Google PageSpeed Insights (2017) [27].

Bootstrap website		Foundation website	
Mobile	Desktop	Mobile	Desktop
54/ 100	55 / 100	50 / 100	54 / 100
7 passed rules	6 passed rules	5 passed rules	4 passed rules

Finally, Google's PageSpeedInsight testing tool results were analysed according to table 3. The Page Speed result for both mobile and desktop is from a score of 0 - 100. A score of 85 and above indicates that the page is performing excellently. According to table 3, the Bootstrap website got a higher Page Speed score than the Foundation website on both mobile and desktop devices. Besides, the Bootstrap website got higher passed

²⁰ <https://developers.google.com/speed/pagespeed/insights/>

rules count than the Foundation website. As a result, there were fewer issues to fix and to improve scores for the Page Speeds of the Bootstrap framework.

5 Discussion

In this chapter, the significance of results found in the previous chapter of the project will be evaluated and discussed in detail. Also, the results of the project will be placed in the context of the theoretical background discussed in chapter 2 of this thesis.

As it has been discussed in the theoretical section of this paper, the two frameworks provide similar features with slight differences. Let us see summarized highlights of the most important points about the two frontend frameworks.

Both frameworks are open source HTML, CSS and JavaScript frontend frameworks and they operate with a SASS CSS preprocessor except in the case of Bootstrap 3. In addition, both are mobile first and 12 column grid responsive design frameworks. Moreover, both have optional flexible box support, ES6 JavaScript components and plugins. Both frameworks have pre-styled and ready user interface components.

In addition, Bootstrap and Foundation help to build the user interface faster for web and mobile applications. This means for example menus, buttons and lists for user experience development. There is no need to create all of HTML, CSS classes and styling from scratch. The style button just pops in the class name. As explained in chapter 2, both frameworks have many similar features and as a result it can be said that both frameworks do essentially the same thing in different ways.

According to the result of this research, among the categories that favour one framework over the other, it was the community and support where Bootstrap clearly got the upper hand. To mention some relevant facts from the results chapter, Bootstrap framework got 4 times more stars and 5 times more watches than the Foundation framework in GitHub. In addition, Bootstrap got 3 times more search results in StackOverflow than Foundation. As a result, Bootstrap got a huge following of designers and developers which means users are more likely to get support if there are any issues related to the framework.

Moreover, browser support and performance results were very good for both Bootstrap and Foundation websites with desktop and mobile platforms. The only exception was that Foundation does not support IE 8. Because IE 8 is an older version of IE, it might restrict the availability of support. However, only Bootstrap version 3.3.6 can support this older browser.

The website loading speed of the two project websites was tested by using three online testing tools. As a result, this enabled getting reliable test results. The full-page loading time of the Foundation website (358 ms) was found higher than the Bootstrap website (353 ms) in the Pingdom speed test. That means the Bootstrap website is loading faster than the Foundation website. In addition, it was found that the Bootstrap website had got lower fully loaded time (2.1 seconds) and total page size (1.3 Megabytes (MB)) compared to the Foundation website (2.4 seconds, 2.54 MB) using the GTmetrix online speed test tool. In this case, as well, the Bootstrap website was faster than the Foundation counterpart.

Finally, the Bootstrap website got a higher Page Speed score than the Foundation website in both mobile and desktop devices according to the PageSpeedInsights online speed test tool results. To mention a couple relevant facts from the results chapter, the Bootstrap website got a higher passed rules count (7) than the Foundation website (5) on mobile. As a result, this means lesser things to fix in order to get improved results of the Page Speed scores. Moreover, Bootstrap performed better in the website speed test results (Mobile 54% efficiency, Desktop 55% efficiency) than Foundation (Mobile 50% efficiency, Desktop 54% efficiency).

To conclude, based on the discussion above and on the results gained in the previous chapter, Bootstrap was the best candidate for the purposes of this project. Accordingly, the website was built using the Bootstrap frontend framework and launched as an official website for the client.

6 Conclusion

Frontend frameworks help to simplify designing process in powerful ways. Essentially, a frontend framework contains templates written in HTML, CSS, LESS, SASS and JavaScript that make designing a user interface much simpler. Bootstrap and Foundation are popular front-end frameworks. [1]

As a result, both save development time, are mobile first designs and are responsive applications for web application. The project web development process focused only on the frontend part of the website. The technologies used are HTML5, CSS3, jQuery and JavaScript where Bootstrap and Foundation frontend frameworks were implemented for responsiveness and interactivity of the website.

In this project, two responsive websites using Bootstrap and Foundation frameworks were built. Then different online website performance testing tools and parameters were used to choose the right front end framework for the project. The online testing tools and parameters used to measure the performance of the websites were loading speed and cross browser compatibility test. Moreover, the other parameters used for comparison were popularity & community, customization and other theoretical features.

At the end of the project, the better frontend framework for the project needed to be chosen. As a result, based on the test and theoretical discussion done in this thesis, the Bootstrap framework won over Foundation for the specific purposes of the project.

However, based on the result of this research it does not necessarily mean that Bootstrap is better than Foundation. The result of the research was such because the research was based on the specific purpose of the project and personal preference. Moreover, this thesis will help to give programmers a better insight about the two frontend frameworks and enable them to make an informed decision. Their decision should be based on their project at hand, personal preferences and comfort level. At the end, it is recommended that programmers will need to conduct research before deciding the right frontend framework for themselves. In addition, it is also recommended for programmers to compare other frontend frameworks such as React and Angular as well.

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Appendix I. Bootstrap Website HTML code

Index.html

```
1 <!DOCTYPE html>
2 <html>
3 <head>
4 <title>Daniel Mengistu law office - Legal Expertise with You in Mind </title>
5 <meta charset="utf-8">
6 <meta name="description" content="Daniel Mengistu Law Office is a legal practice specialized in serving international clients in various areas of
  Law">
7 <meta name="keywords" content="web, design, html, css, html5, css3, javascript, jquery, bootstrap, development">
8 <meta name="viewport" content="width=device-width, initial-scale=1">
9 <link href="https://fonts.googleapis.com/css?family=Raleway:500italic,600italic,600,700,700italic,300italic,300,400,400italic,800,900"
  rel="stylesheet" type="text/css">
10 <link href="https://fonts.googleapis.com/css?family=Source+Sans+Pro:400,300,300italic,400italic,600italic,700,900" rel="stylesheet"
  type="text/css">
11 <link rel="icon" type="image/png" href="IMAGES/favicon-16x16.png">
12 <link rel="stylesheet" type="text/css" href="CSS/bootstrap.min.css">
13 <link rel="stylesheet" href="CSS/font-awesome.min.css">
14 <link rel="stylesheet" type="text/css" href="CSS/animate.css">
15 <link rel="stylesheet" type="text/css" href="CSS/style.css">
16 <link rel="stylesheet" type="text/css" href="CSS/jquery.bxslider.css">
17 <link rel="stylesheet" type="text/css" href="CSS/responsive.css">
18 </head>
19 <body>
20 <header class="header" id="HOME">
21 <nav class="navbar navbar-default navbar-fixed-top">
22 <div class="container">
23 <div class="navbar-header">
24 <button type="button" class="navbar-toggle collapsed" data-toggle="collapse" data-target="#daniel-navbar-collapse-1" aria-expanded="false">
25 <span class="sr-only">Toggle navigation</span>
26 <span class="icon-bar"></span>
27 <span class="icon-bar"></span>
28 <span class="icon-bar"></span>
29 </button>
30 <a class="navbar-brand" href="#">
31 
32 </a>
33 </div>
34 <div class="collapse navbar-collapse" id="daniel-navbar-collapse-1">
35 <ul class="nav navbar-nav navbar-right">
36 <li><a href="#HOME" class="nav-item">HOME</a></li>
37 <li><a href="#AREAS" class="nav-item">AREAS OF PRACTICE </a></li>
38 <li><a href="#TESTIMONIALS" class="nav-item">TESTIMONIALS</a></li>
39 <li><a href="#ATTORNEYS" class="nav-item">ATTORNEYS</a></li>
40 <li><a href="#CONTACT" class="nav-item">CONTACT</a></li>
```

```
41 </ul>
42 </div>
43 </div>
44 </nav>
45 <div class="header-overlay">
46 <div class="container header-container">
47 <div class="row">
48 <div class="col-md-8">
49 <div class="header-text">
50 <h1> Daniel Mengistu law office</h1>
51 <h2> Legal Expertise with You in Mind!</h2>
52 <p>Daniel Mengistu Law Office is a legal practice specialized in serving local and international clients in various areas of law with an emphasis
    in inheritance & family law, labour & employment law, criminal case & defense, immigration, commercial law, banking & finance, construction law,
    investment law & intellectual property law</p>
53 </div>
54 <div class="header-btns">
55 <a class="btn btn-readmore wow fadeInLeft" href="#AREAS">Read More</a>
56 </div>
57 </div>
58 </div>
59 </div>
60 </div>
61 </header>
62 <div id="AREAS">
63 <div class="container">
64 <div class="row">
65 <div class="col-md-10 col-md-offset-1">
66 <div class="section-title">
67 <h2> AREAS OF PRACTICE </h2>
68 <p>Our Family Lawyers provide legal advice and/or representation on the preparation of valid Wills, Donations, Gifts, Succession Cases (Testate or
    Intestate) Inheritance and related legal issues.</p>
69 <p>Our Labour Law Attorneys provide legal advice and representation for local and foreign investors in Ethiopia; ensure legal compliance of
    employment relationships and avoidance of the occurrence of unnecessary court proceeding and labour & trade Union Disputes. We handle and ensure
    compliance in relation to employment of expatriate employees</p>
70 <p>Our Criminal Law Attorneys work on the protection of your rights by initiating criminal suits on behalf of you, upon your request, against the
    violation of such rights by infringers and violators. Accordingly our law office provides you its reliable legal advice and representation on
    every step of your case to avoid mistakes that could have irreparable ramification latter on</p>
71 <p>We provide legal advice on all immigration matters including visa related issues and all types of visas including Diplomatic Visa, Service
    Visa, Business Visa, Immigrant Visa, Tourist Visa, Student Visa, and Transit Visa</p>
72 </div>
73 </div>
74 </div>
75 </div>
76 </section>
```

```
77 <section class="testimonials" id="TESTIMONIALS">
78 <div class="testimonial-overlay">
79 <div class="container">
80 <div class="row">
81 <div class="col-md-12 wow bounceInDown">
82 <div id="carousel-testimonial" class="carousel slide" data-ride="carousel">
83 <ol class="carousel-indicators">
84 <li data-target="#carousel-testimonial" data-slide-to="0" class="active"></li>
85 <li data-target="#carousel-testimonial" data-slide-to="1"></li>
86 <li data-target="#carousel-testimonial" data-slide-to="2"></li>
87 </ol>
88 <div class="carousel-inner">
89 <div class="item active text-center">
90 
91 <div class="testimonial-caption">
92 <h2>Daniel Gurara</h2>
93 <h4><span> Sr. Economist , </span>International Monetary Fund</h4>
94 <p>"The lawyers in this law firm are exceptional. They are very detailed and efficient, and are very good at explaining the law."</p>
95 </div>
96 </div>
97 <div class="item text-center">
98 
99 <div class="testimonial-caption">
100 <h2>Pr. Alemayehu Geda</h2>
101 <h4><span> Senior Lecturer and Researcher, </span>Addis Ababa University</h4>
102 <p>" The lawyers in this firm are very professional and courteous lawyers.They provided me with very precise details about my case through email or by phone"</p>
103 </div>
104 </div>
105 <div class="item text-center">
106 
107 <div class="testimonial-caption">
108 <h2>Yoseph Amare</h2>
109 <h4><span> Assistan Manager, </span>Ethio Telecom</h4>
110 <p>"I am especially recognised this firm for their experience in the outsourcing and procurement related issues related to my company."</p>
111 </div>
112 </div>
113 </div>
114 </div>
115 </div>
116 </div>
117 </div>
118 </div>
```



```
119 </section>
120 ♪ <section class="attorneys" id="ATTORNEYS">
121 ♪ <div class="container">
122 ♪ <div class="row">
123 ♪ <div class="col-md-10 col-md-offset-1">
124 ♪ <div class="section-title">
125 <h2> Attorneys and Lawyers </h2>
126 <p>Daniel Mengistu law office is an efficient service attorney office and focused on quality. The company is operated by two attorneys and two
    lawyers. Our office is open on weekdays from 9 to 16.
127 </p>
128 </div>
129 </div>
130 </div>
131 </div>
132 ♪ <div class="screen-slider wow bounceInRight" data-wow-duration="2s">
133 ♪ <div class="container">
134 ♪ <div class="row">
135 ♪ <div class="bxslider">
136 ♪ <div class="item">
137 
138 ♪ <div class="attorneys-caption">
139 <h2>Daniel Mengistu</h2>
140 <h4><span> Attorney, </span>Founder & Manager</h4>
141 <p>Phone:+251911423386 <br>Email:danielmengistu712@yahoo.com</p>
142 </div>
143 </div>
144 ♪ <div class="item">
145 
146 ♪ <div class="attorneys-caption">
147 <h2>Henok Challa</h2>
148 <h4><span> Attorney, </span>Criminal Law</h4>
149 <p>Phone:+251911423386 <br>Email:danielmengistu712@yahoo.com</p>
150 </div>
151 </div>
152 ♪ <div class="item">
153 
154 ♪ <div class="attorneys-caption">
155 <h2>Menbere Tadesse</h2>
156 <h4><span> Lawyer, </span>Family & Property Law</h4>
157 <p>Phone:+251911423386 <br>Email:danielmengistu712@yahoo.com</p>
158 </div>
159 </div>
160 </div>
161 </div>
```

```
162 </div>
163 </div>
164 </section>
165 <section class="contact-us" id="CONTACT">
166 <div class="container wow bounceIn">
167 <div class="row">
168 <div class="col-md-10 col-md-offset-1">
169 <div class="section-title">
170 <h2>Contact Us</h2>
171 <p>Our office is located right in the center of Addis, with excellent means of communications. Come and visit us and do not hesitate to be in touch!</p>
172 </div>
173 </div>
174 </div>
175 </div>
176 </div>
177 <div class="contact-us-form wow bounceIn">
178 <div class="container">
179 <form role="form">
180 <div class="row">
181 <div class="col-md-4">
182 <input class="form-control" id="name" placeholder="Name" required>
183 <input type="email" class="form-control" id="email" placeholder="Email" required>
184 <input class="form-control" id="subject" placeholder="Subject">
185 </div>
186 <div class="col-md-8">
187 <textarea class="form-control" id="message" rows="25" cols="10" placeholder="Message Text..."></textarea>
188 <button type="button" class="btn btn-default submit-btn form_submit">SEND</button>
189 </div>
190 </div>
191 </form>
192 </div>
193 </div>
194 <div class="container">
195 <div class="row">
196 <div class="col-md-12 wow bounceInLeft">
197 <div class="social-icons">
198 <ul>
199 <li><a href="https://www.facebook.com"><i class="fa fa-facebook"></i></a></li>
200 <li><a href="https://twitter.com"><i class="fa fa-twitter"></i></a></li>
201 <li><a href="https://www.youtube.com"><i class="fa fa-youtube-play"></i></a></li>
202 </ul>
203 </div>
```

```
204 </div>
205 </div>
206 </div>
207 </section>
208 <footer class="footer">
209 <div class="container">
210 <div class="row">
211 <div class="col-md-6">
212 <div id="copyright">
213 <p>Copyright &copy; 2017 <a href="#"> - Daniel mengistu law office</a></p>
214 </div>
215 </div>
216 <div class="col-md-6">
217 <div class="scroll-top">
218 <a href="#HOME" id="scroll-to-top"><i class="fa fa-angle-up"></i></a>
219 </div>
220 </div>
221 </div>
222 </div>
223 </footer>
224 <script src="JS/jquery.js"></script>
225 <script src="JS/bootstrap.min.js"></script>
226 <script src="JS/jquery.bxslider.min.js"></script>
227 <script src="JS/jquery.waypoints.min.js"></script>
228 <script src="JS/jquery.counterup.min.js"></script>
229 <script src="JS/wow.min.js"></script>
230 <script src="JS/custom.js"></script>
231 </body>
232 </html>
```


Appendix II. Foundation Website HTML code

Index.html

```
1 <!doctype html>
2 <html class="no-js" lang="en">
3 <head>
4   <meta charset="utf-8" />
5   <meta name="viewport" content="width=device-width, initial-scale=1.0" />
6   <title>Foundation</title>
7   <link rel="stylesheet" href="css/app.css" />
8   <link rel="stylesheet" href="css/foundation-icons.css" />
9   <script src="bower_components/modernizr/modernizr.js"></script>
10 </head>
11 <body class="index">
12
13   <header class="contain-to-grid">
14     <nav class="top-bar" data-topbar role="navigation">
15       <ul class="title-area">
16         <li class="name show-for-small">
17           <h1><a href="#">Navigation</a></h1>
18         </li>
19         <li class="toggle-topbar menu-icon">
20           <a href="#"><span>Menu</span></a>
21         </li>
22
23       </ul>
24
25
26       <section class="top-bar-section">
27         <ul class="left">
28           <li><a href="index.html">Home</a></li>
29           <li><a href="practices.html">Practices</a></li>
30           <li><a href="testimonials.html">Testimonials </a></li>
31           <li><a href="attorneys.html">Attorneys</a>
32         </li>
33           <li><a href="contact.html">Contact</a></li>
34         </ul>
35
36         <ul class="menu-social right">
37           <li><a href="http://www.facebook.com"><i class="fi-social-facebook"></i></a></li>
38           <li><a href="http://www.twitter.com"><i class="fi-social-twitter"></i></a></li>
39           <li><a
40             href="http://www.youtube.com"><i class="fi-social-youtube"></i></a></li>
41         </ul>
42
```

```
43     </section>
44     </nav>
45 </header>
46
47 <!-- Title-->
48
49 <div class="header-text">
50     <h1>Daniel Mengistu law office</h1>
51 </div>
52
53 <div class="slider">
54     <ul class="orbit" data-orbit>
55         <li class="active">
56             
57
58         </li>
59         <li>
60             
61
62         </li>
63         <li>
64             
65
66         </li>
67         <li>
68             
69
70         </li>
71     </ul>
72
73 </div>
74
75 <section class="main-content">
76     <div class="row">
77         <div class="large-12 columns">
78             <h2 class="text-center">About us</h2>
79
80             <p>Daniel Mengistu Law Office is a legal practice specialized in serving local and international clients in various areas
81             of law with an emphasis in inheritance & family law, labour & employment law, criminal case & defense, immigration,
82             commercial law, banking & finance, construction law, investment law & intellectual property law</p>
83         </div>
84     </div>
85 </section>
86 </div>
87 </body>
88 </html>
```

```
83     </div> <!--.row-->
84
85 </section>
86 |
87
88 <footer>
89
90 <div class="row">
91
92 <div class="large-4 columns">
93
94 <!--.newsletter -->
95
96 <div class="social-menu-footer">
97 <ul class="menu-social">
98 <li><a href="http://www.facebook.com"><i class="fi-social-facebook"></i></a></li>
99 <li><a href="http://www.twitter.com"><i class="fi-social-twitter"></i></a></li>
100 <li><a href="http://www.youtube.com"><i class="fi-social-youtube"></i></a></li>
101 </ul>
102 </div><!--.social-menu-footer -->
103
104 </div>
105
106 </div>
107
108 <p class="reserved text-center">Copyright &copy; 2017 <a href="#"> - Daniel mengistu law office</a></p>
109
110
111 </footer>
112
113 <script src="bower_components/jquery/dist/jquery.min.js"></script>
114 <script src="bower_components/foundation/js/foundation.min.js"></script>
115 <script src="js/app.js"></script>
116 </body>
117 </html>
118
```

Appendix III. Bootstrap(left) and Foundation(Right) Websites Mobile View