Responsive Web Design Frameworks : A Review

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ABSTRACT

As internet users continue to grow, numerous web application frameworks have been developed that best satisfy the user's needs. The responsive web design (RWD) framework is a framework that can dynamically adapt and fluidly display a webpage in different sizes and resolution. Many RWD frameworks are available in the market to facilitate the responsive webpage layout. This paper compares the top three frameworks available based on their CSS feature, their grid and responsiveness and user interface (UI) and widget. Bootstrap, Foundation and Skeleton was likened as the case study of this paper. We also discussed some demerits of responsive web design.

Keywords : Responsive Design, Framework, Application, Front-end, Library

I. INTRODUCTION

Nowadays, people possess more than one gadget and they expect a similar experience in all of those gadgets. For users to be guaranteed a similar experience websites must be perfect with the numerous gadgets and resolutions [4]. As indicated by Internet trend in 2013 about mobile phones[1], 30 percent of those phones were samrtphones. In 2014, 25 percent of web visit were from mobile phones. Additionally, customers invested more useful time on smartphones and tablets in 2013 than in 2010 and also invested less time using desktop computers [2]. Conventional sites are not intended to adjust the page format to different screen sizes and resolutions. This restriction of the conventional sites can prompt the loss of potential clients [3]. The introduction of the present day sites should be advanced to give redid website page format on every single cell phone.

Today there are different sizes that can connect online; developers have to consider support for many different resolutions when building applications. Responsive Web Design (RWD) is a design that reacts to any screen size, platform, and resolution. As the user changes from gadget to another, the site will naturally change to the resolution of that particular device [4].

At the moment, there are two primary methodologies in outlining and building up the versatile web application which are Adaptive Web Design (AWD) and Responsive Web Design (RWD) [6]. AWD is a technique, which uses the device information from users to detect and deliver the display via m dot URL [7]. Contents are optimized for each platform, for instance, m.yoursite.com on iOS may design all images align left while Android may design all images align right. Developers utilize the benefit of the information of the device in the management of contents (HTML, JavaScript and CSS). While RWD is a procedure where developers utilize media queries like HTML5, JavaScript and CSS to control and convey content that consequently adjusts on all screens, resolutions and gadgets.

RWD strategy is used to accomplish responsive design as it requires less effort than AWD offers. Besides, it enables customers and website's owners to have the best user experience. As a result, there are different RWD framework in the market today to help novice and professionals alike build wonderful websites [5].

This paper compares the top three frameworks available in a tabular form base on their responsive features and highlights some demerits of these frameworks. At the end, it present the best features and security for a comfortable user experience.

II. RESPONSIVE WEB DESIGN FRAMEWORK

Currently, there are many RWD frameworks released in the market. These frameworks reduce work load of

developers and shorten a front-end development process. Moreover, first version of web prototype can be delivered to client much faster by supportable components in framework. In the reminder of this section we provide additional information about three frameworks and they include [5]:

There are numerous RWD frameworks in the market today. These frameworks helps developer to quickly build website. The following bullet points provide extra information about these three framework [5]:

- Bootstrap: The Bootstrap framework which has become one of the standout framework was developed at Twitter in 2010. It is well utilized by well known website, for instance Newsweek.com and Vogue.com. Bootstrap utilizes fluid format as a framework for development. It contains libraries like CSS, fonts and JavaScript and it available for download. Bootstrap underpins numerous cutting edge programs, for instance, Chrome, Safari, Firefox, Opera and IE8-11 on four different working framework (Android, iOS, Mac OS X and Windows) and has a large community followers [9].
- Foundation: Foundation was created by ZURB in 2008. It utilizes fluid design like Bootstrap and it contains libraries for download similar to other frameworks. However, LESS which is a CSS pre-processor is not support by the framewo. LESS enables designers to code less and shorten development time. However, User Interface (UI) components and Widgets are also provided which help in the development process [10].
- Skeleton Framework: Skeleton is built for Mobile Development. It is packaged with a small collection of CSS files to facilitate the development of beautiful site that fit any screen size [11].

III. RESPONSIVE FEATURES

The following is a table comparing Bootstrap, Foundation and Skeleton based on their CSS feature, grid and responsiveness and UI and Widgets [12]:

1. CSS Feature

	Bootstrap 4.0.0-alpha	Foundation 6 New	Skeleton 2.0.1
Reset	reboot.css (reboot.scss)	normalize.css	normalize.css
LESS	N	N	N	
Sass/Scss	Y	Y	N	

2. UI and Widgets

	Bootstrap 4.0.0-alpha	Foundation 6 New	Skeleton 2.0.1
Alerts	Y	Y — Callout	N
Badges	N	Y — .badge	N
Breadcrumbs	Y	Y	N
Buttons	Y	Y	Y
Carousel	Y	Y — Orbit is back	N
Collapse/Accordion	Y — Collapse	Y — Accordion	N
Dropdown	Y	Y — Dropdown, Drilldown, & Accordion menus	N
Forms	Y	Y	Y
Form Validation	Y	Y — Abide	N
Grids	Y	Y	Y
Icons	N	Y — with download	N
Labels	Y	Y	N
Lists	Y	Y — Menu	Y
Lists (horizontal)	N	Y — horizontal is default in Menu	N
Media Object	Y — Media Object	Y — Media Object	N
Modals	Y	Y — Reveal	N
Navigation	Y	Y — Menu	N
Navigation - Sticky	Y — .navbar-fixed-	Y — Magellan	N
Navigation - Off Canvas	Y — Collapsible content	Y	N
Pagination	Y	Y	N
Panels	Y — now Cards	Y — Callout	N
Popovers	Y	Y — Tooltips	N

Print styles	Y	Y	N
Progress bars	Y	Y	N
Responsive media	N	Y — Interchange	N
Right-to-Left	Unknown as of Aug 29, 2015.	Y — Right-to-Left Support	N
Scrollspy	Y	Y — Magellan	N
Tables	Y	Y	Y
Tabs	Y	Y	N
Thumbnails	Y — now Cards	Y	N
Tooltips	Y	Y	N
Tour	N	N - coming back in v6.1	N
Typeahead	N	N	N
Typography	Y	Y	Y
Video scaling	Y	Y	N

3. Grid and Responsiveness Design

The most observable piece of a front-end structure is its grid system. With a framework, developers can model different formats and after that make any vital changes as they see fit. Foundation at the start was popular with the grid system, as it was the first among the three systems to go responsive. It also clearly spelt out the methodology of responsiveness for a while.

In any case, after some time, Bootstrap made up for lost time and has shut the hole. As it were, any slight favourable position that Foundation had toward the start with its lattice framework is essentially gone at this point.

In any case, there are a few particular grid highlights in Foundation worth saying. It is known as the block grid, and it engages designers to effectively separate the substance of unordered list into a grid that is equitably spaced. Furthermore, Foundation likewise makes it a secure to rapidly collapse columns and in addition remove gutters as a result of the collapse class. Then again, you can remove centre columns by utilizing centre column syntax.

Designers can deliver equivalent code snippets in any of the three frameworks that can similarly do the same thing. Even so, the syntax for building grids and responsiveness can be a bit unique, which implies that personal preference makes the difference in the end.

For flexibility and grid design, Bootstrap, Foundation and Skeleton has a default grid system that is absolutely in your grasp to customize with Less and Sass, separately. Bootstrap's has a default grid mode that gives static-sized widths that recedes when the viewport reaches it limit. However, if designers utilize the class .row liquid rather than the width, which depend on percentages, like Foundation [14].

IV. CHOOSING THE RIGHT FRAMEWORK

Choosing the right framework for a site is far from simple, for the following several reasons [11]:

1. Every site is unique in its own right, having different features and characteristics.
2. At present, there are not numerous critical contrast in the frameworks. They are easy to use and shorten development process. However, there are a few points to consider when choosing the right framework:
   - Speed of installation: some are extremely easy to use and install and start using. Others require more configuration time.
   - Ease of understanding: some are somewhat difficult to understand while others are simple and clearer.
   - Options: some frameworks are difficult than others and provides more choices, widgets options, widgets and interface alternatives. These will enable you to improve things with your site.
   - Ability to integration with other systems.
   - Long-term support: Some provides large community of professionals and availability of updates and continued support for effective development.

V. DEMERITS OF RESPONSIVE WEB DESIGN

Some of the demerits of responsive wed design include [13]:

1. Image Resizing

This is a noteworthy issue considering that every great planner must depend on pictures to outline its ideas. In responsive web design this is the most dangerous issue

in light of the fact that resizing a desktop picture to fit a cell phone's screen suggests downloading a picture that has been suited for a desktop situation. To see full pictures on a cell phone you have to download a pointless amount of file and resizing it to fit the screen.

2. *Resizing Pictures Forces CPU and Memory*

Displaying a responsive website on a mobile device constrains the CPU. It also constrains the memory devices while resizing the image since you are downloading a large image, uncompressing it in your telephone's memory and after that resizing it to fit a little screen. This procedure takes around 3 bytes for every pixel of memory, so a 1024×768 picture will take around 2.36 MB of memory. Most customers just demand 4 pictures in average at the time, however 9.44 MB is still a considerable measure for a page load. A prescribed file size for pictures in a mobile device setting could be 100×100, yet this is somewhat utopic since an appropriate picture for desktop sites surpasses that determination.

3. *Mobile Speed versus Desktop Speed*

There are several factors that affect mobile speed. With 3G connectivity, being the greatest feature the type of coverage. For this, there are as well several types like GPRS, or 2.5G, which has a download rate of 64 Kbps and a 20 Kbps upload rate. UMTS (Universal Mobile Telecommunications System) or 3G, which has a download rate of 14Mbps and is the most popular nowadays with several releases and updates. HSDPA (High Speed Downlink Packet Access) is the fifth revision and optimization of UMTS, also known as 3.5G, 3G+ or turbo 3G. It has a 14Mbps download rate. There is also HSUPA (High-Speed Uplink Packet Access), which is the 6th release of UMTS and the evolution of HSDPA, also known as 3.75 (3.75G) o 3.5G +; this technology offers improved rates of voice and data.

HSPA (High-Speed Packet Access) is the combination of previous releases, HSDPA and HSUPA, and it has a theoretical download speed of 14.4 Mbps and a 2Mbps upload rate. In addition, HSPA+ is an evolved state of HSPA. It was released in 2008 and has a download rate up to 84 Mbps and a 22Mbps upload rate. Finally, e-UTRAN (evolved UMTS Terrestrial Radio Access Network), possess low data transfer latencies and download rates up to 299.6 Mbps, not being yet widely implemented.

If we have the possibility to count on a good mobile internet connection, there is still a secondary factor for mobile speed to consider: the type of device in which we are connecting to the internet. These devices could be of any kind and they will be connected to the fastest network when the device and the network itself allow to.

There are still some other aspects that affect mobile speed like the intensity of the signal, which could be at its full potential depending on the coverage area and the obstacles the device finds while trying to reach a 3G node. The mobility of the user affects speed since the device has to leave a 3G node to reach a new one if the user is, let say, on a car or a bus. In addition, you have to add up the saturation of the network's 3G node Considering a WI-FI networks with a greater capacity to transfer voice or data thus making you web experience better. One might think a WI-FI network is a good choice, but it is actually worst because these are usually protected by its owner and because of its local condition, they are not everywhere; in order for you to find one, you'd probably have to go or get near to a café, an airport or a shopping mall, and this fact is not going to guarantee the connection is going to work fine. Because of all of these, mobile devices need to be resourceful. On desktop computers, we would not probably notice websites' latency unless poor planning results in a very slow website or because of a slow internet connection. However in mobile devices, even on iPhones –good handlers of internet content– mobile speed takes important place while loading a website, so is relevant for if to be appropriately built for a mobile device.

4. *CSS Media and Unnecessary Code (JavaScript and html)*

There are components working perfectly on a desktop version of a website, which will not show up in the mobile version; it could be a video, an embedded map or an image. CSS media queries work incredibly well in hiding things, but not that well removing them. CSS media queries won't remove any unnecessary script or html you won't use on mobile or desktop versions. It just leaves it there: hidden.

5. CSS Media Query is a Terrible Decision for Multiple Devices

Responsive web design's promise is to be compatible with every device, but this method relies on CSS media queries to achieve its goals; the bad news is that most mobile devices are not compatible with CSS media queries. Although the issues of compatibility of CSS with most mobile browsers and smartphones have been corrected on newer versions of popular mobile operating systems like Android Gingerbread and iOS4 it shows us that even with safari on iPhones, the styles are not updated when the resolution changes and CSS media queries do not work with most Nokia, Samsung and early versions of Android.

VI.CONCLUSION

From the table presented above, the following conclusions can be drawn. Firstly, Bootstrap 4.0.0-alpha has dropped Less support in favour of Sass in its CSS feature. Its JS plugins has been re-written in ES6 which has a customized reset CSS file known as Reboot. It also provides flexbox support through a Sass boolean variable. Secondly, it has greatly improved its grid system, which has also improved Bootstrap's display on mobile devices. It has converted from px-based to rem-based sizing all of which has improved its grid and responsiveness. Thirdly, optimizing web site can be done rapidly by UI elements and widgets that is available in Bootstrap.

Bootstrap provides styling for nearly every component that a typical website or web application would require, it also offers abundant documentation with examples and demo which make it easier for even a novice. Bootstrap also has a huge support community which help when one run into issues. Furthermore, Bootstrap itself is being continuously updated and offers themes. In the future, security issues as regard the three frameworks will be investigated.

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