

AMP versus Bootstrap

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Abstract

We present a comparison between two web technologies, AMP - Accelerated Mobile Pages and Bootstrap. Since a website must have special features to be well usable and usable by all devices, there is more interesting in finding solutions for mobile website optimization. AMP and Bootstrap are new solutions for designing responsive web pages.

Keywords: responsive design, optimization, search engine optimization, SEO.

1.Introduction

In a constantly evolving digital world, the creation of professional websites is a complex thing. The increase in speed is considerable and increasing the speed of use of the contents improves the SEO accordingly. Joorabchi et al (2013) mention that websites are now viewed with terminals ranging from smart phones to connected TVs, tablets and desktop computers. If a web page does not adapt to its screen, the user may pass his way and very unlikely to turn into a customer or simply to capture the message that we would like to transmit. The loading time is also an essential factor in the success of a website/web application. The multiplicity of terminals and connections make the development of a website a complex project requiring a relatively high level of expertise like in Leff et al (2001).

There is a lot of talk about web performance - especially when it comes to the performance of the web on mobile devices. The world of the web is constantly evolving and almost all of online users have a mobile device, or as commonly defined, a smart phone or a tablet, and almost all of them use it regularly for online searches and to visit websites. By now it has become clear that a website must have special features to be well usable and usable by these devices like Arnbak et al (2013) mention in their work.

Begu and Mândru (2009) highlight the idea that in order to improve the quality of the websites one can apply the "strategy of small steps" that presumes low costs for the company and improvements, even small, have a very strong effect on long - term due to continuous accumulation of new changes. Business success does not come unexpectedly in a company; many factors are implied in achieving it (such as employees, processes, management, strategies, etc) and it presumes efforts, wise strategies, risk assuming, etc. like the authors Albu, Mândru and Suciu (2017) mention in their paper. In information technology, a very valuable strategy is that object oriented like is mentioned in the paper Carstea (2016). Also there are mathematical models that reflect some phenomena, like in Florea (2018), Marin, Abbas, and Carstea (2017), and Florea (2019).

Web sites can be used successfully in teaching, using the techniques and materials suggested by the authors in the paper Florea and Purcaru (2016).

Complex informatics systems may also use web technologies in order to achieve their goals, like in Carstea (2015) and Carstea (2011). Also web technologies can handle management features, as the authors highlight in the paper Carstea and Sabau (2013).

The optimization of mobile websites and web applications has become a priority, and the big names in the digital world are thinking of new solutions to make navigation easier.

One of these new solutions are named AMP - Accelerated Mobile Pages, sustained by Google like the author mentions in O'Donoghue (2017) and the Bootstrap Framework used to develop Responsive Web pages like in the paper Stelea et al (2018).

2. Bootstrap Framework & Responsive Web Design

Responsive design is an important element of accessibility, which also takes into account numerous other factors, focusing not only on devices but also on user characteristics (such as cognitive abilities, vision, physical difficulties, and so on).

Responsive web design allows developers to adapt the layout of a website to the screen size that is used to view the site using *media queries* like in Bryant et al (2012). A very large monitor can display a site with multiple columns of content, while a small screen can have the same content presented in a single column with text and links that are large enough to display correctly on a smaller display, as shown below in Fig.1:

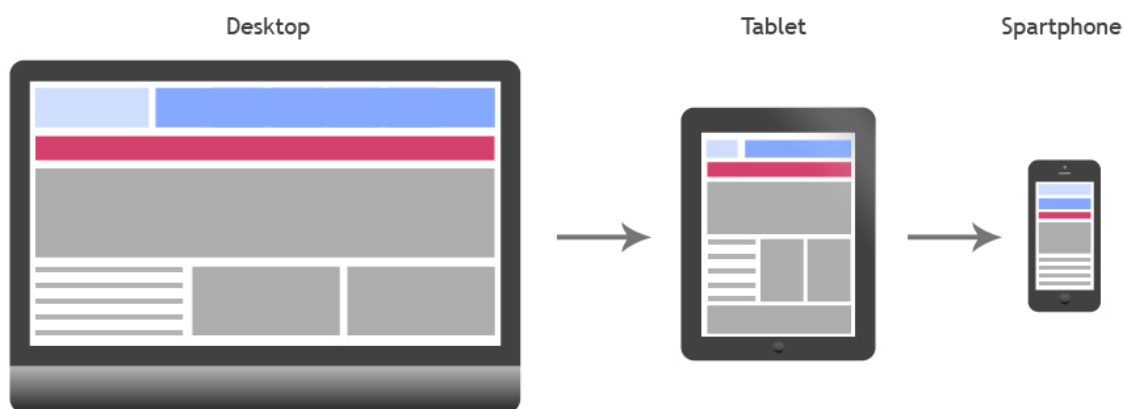


Fig.1 - Responsive web design content layout adapt

Bootstrap is an open source framework used to develop responsive web sites and applications. It contains design templates based on HTML and CSS, both for typography, and for the various components of the interface, such as modules, buttons and navigation, as well as some optional JavaScript extensions like in Myers (2015).

Hassan et al (2013) highlight that Bootstrap was developed by Mark Otto and Jacob Thornton at Twitter as a framework that uniformed the various components that made the web interface, given that the presence of several libraries had led to inconsistencies and high maintenance costs.

Developing web pages using Bootstrap is a great alternative to creating a mobile version. This solution makes it possible to develop a single version of a website, because all users, regardless of their device, view the same pages. The screen adaptation of the user is done with CSS rules, media queries as showed in Fig. 2.

```

@media (min-width: 1111px) {
#wrapper {margin-top:10px; border-radius: 17px 17px 0px 0px;}

.navbar {border-radius: 17px 17px 0px 0px;}
}
@media (max-width: 770px) {
.navbar-collapse{ display:none;}
.navbar-top-sub {display:none !important;}
.deskApp { }
}
@media (min-width: 770px) {
.mobileAPP { }
}
.tableNamesList tr td {text-align:center; vertical-align:middle !important;}
.tableNamesList tr th {text-align:center !important; vertical-align:middle !important;
font-size:13px !important;}

@media (max-width: 450px) {
.navbar-brand {font-size:16px;}
}

```

Fig.2 – CSS3 media queries

The key principle of Responsive Design is based on sizing expressed as a percentage of the screen size and not in pixels. This technique is also used by modern mobile versions.

This coding makes it possible for example to place a side column under the main content when the width of the screen of the user is small. To reduce the loading time of these adaptive pages, it is recommended to propose resources adapted to the various terminals. For the majority of web pages, images are the most demanding resources in terms of connection. Although they have long penalized sites that have adopted Responsive Design, a solution has been provided by HTML5.

Responsive web design is important for 3 basic reasons, listed below:

- Adapting the website/web application to different devices
- Easy management and updating of contents
- Greater visibility online and on search engines

Differentiating between mobile and desktop platforms usually leads to huge technical complications and higher costs. The use of responsive web design technologies ensures greater ease of management and lower maintenance costs of multiple different web platforms optimized for different devices. Today responsive web design is a very important online positioning and visibility factor and it is fundamental for all the SEO strategies, as it will surely be able to advise you also your trusted SEO agency.

Building a responsive web page using the Bootstrap Framework it allows optimal viewing and interaction (easy reading and navigation) of content on a web page. The layout adapts to the screen size of the terminal, using CSS and HTML, allowing for fluid and flexible viewing.

Fluid grids - designates the layout, which changes with screen size. This can squeeze a layout into a small phone and stretch again in a giant screen.

RWD – Responsive Web Design suggests that the design of a website should be able to respond to the behavior of users and the environment like in Bryant (2012). For example, if a user switches from iPhone to a laptop, this should automatically detect the web page.

A theme of particular interest for responsive design is that of compatibility. Not all browsers and devices, in fact, recognize the most used instructions for the smooth resizing of content or support the necessary technologies. It is also essential the correct detection of the device, to provide the relevant graphic layout and identify the level of compatibility possible. The browsers of the first mobile phones are not able to interpret functions such as media queries or JavaScript like in Looy (2016), and it is therefore more convenient to create a layout specifically adapted to display on smartphones and computers, rather than attempting a "gradual degradation" to adapt a complex site and load of images to most phones.

The identification of the user agent, that is the browser, and the identification of the mobile device are two ways of deducing if JavaScript and some instructions of the HTML and style sheets are supported. The use of JavaScript libraries such as Modernizr, jQuery, and jQuery mobile can be useful for this purpose, directly verifying the characteristics and user agent used by the user.

3.AMP – Accelerated Mobile Pages

Bryant (2012) mention that AMP is an open source project launched by Google in 2015. Its goal is to develop lighter web pages, able to load instantly on all devices. AMPs are mobile pages that use optimization techniques that make them super light and significantly reduce their loading times. Basically it is a clean form of HTML, within which for example you can not use certain classical html tags, or elements such as form etc. Below in Fig. 3 is presented the AMP integration in a HTML5 web page document:

```
1 <!doctype html>
2 <html>
3 <head>
4 <meta charset="utf-8">
5 <link rel="canonical" href="index.html">
6 <meta name="viewport" content="width=device-width,minimum-scale=1,initial-scale=1">
7 <style amp-boilerplate>body{-webkit-animation:-amp-start 8s steps(1,end) 0s 1 normal
both;-moz-animation:-amp-start 8s steps(1,end) 0s 1 normal both;-ms-animation:-amp-start 8s
steps(1,end) 0s 1 normal both;animation:-amp-start 8s steps(1,end) 0s 1 normal both}@-
webkit-keyframes -amp-start{from{visibility:hidden}to{visibility:visible}}@-moz-keyframes -
amp-start{from{visibility:hidden}to{visibility:visible}}@-ms-keyframes -amp-
start{from{visibility:hidden}to{visibility:visible}}@-o-keyframes -amp-
start{from{visibility:hidden}to{visibility:visible}}@keyframes -amp-
start{from{visibility:hidden}to{visibility:visible}}</style><noscript><style amp-
boilerplate>body{-webkit-animation:none;-moz-animation:none;-ms-
animation:none;animation:none}</style></noscript>
8 <script async src="https://cdn.ampproject.org/v0.js"></script>
9 </head>
```

Fig.3 – Accelerate Mobile Pages integration

If responsive web design is a method of organizing and designing websites aimed at making them usable on any type of device, from the PC to the smart phone, and its purpose is therefore flexibility like in Myers (2015), the aim of the AMP project is to distribute content instantly, and therefore everything focuses on speed. In addition, AMP pages can be included in an existing site, while responsive web design build with Bootstrap replaces an old site entirely.

Websites with an AMP structure are able to respond to the users and integrate advertising with a lot of flexibility. The goals of AMP are:

1. Improved content reading experience on mobile phones
2. Content is easily distributed
3. Effective advertising monetization in the mobile web

AMP consists of three different parts:

1. AMP HTML
2. AMP JS
3. Google AMP Cache

The AMP HTML is basically HTML, but with some limitations for better performance and enhancements to the encoding of content. AMP JS has a library that ensures a fast load of AMP HTML pages while the Google AMP cache is used to load cached AMP HTML pages like in Myers (2015). This allows AMP pages to prioritize the content to be rendered in the viewport, while ignoring custom elements for non-textual content from the browser, allowing AMP to determine the order of asset loading and rendering itself.

The average loading time for content developed with AMP is estimated to be 0.7 seconds. Non-AMP pages, on the other hand, have an average of 22 seconds. A remarkable speeding, which meets the behavior of most users of the web. In fact, most users do not have the patience to wait for a page to load and leave it in a few seconds.

AMP pages are developed in HTML5. This is an extended HTML with custom properties. To promote the speed of loading content, AMP technology implements a series of strategies:

1. Use of a shared script library to avoid their continuous downloading. AMP JS libraries allow the use of optimized javascript code to improve performance and to support HTML AMP tags. All resources are loaded externally and asynchronously so as not to block the display of content in the rendering process of the page.
2. Asynchronous JS code performs processes that slow down the display of content after it is shown to users enhancing the optimization of the loading speed.
3. By indicating the size of each element within the code, AMP technology, based on the resolution of the device used by the user, will load only the elements optimized for the page.
4. To prevent the loading of element styles conditions the speed of display of the page, the AMP technology allows only the use of CSS online.
5. Like the responsive web design in the Bootstrap Framework, AMP analyzes the elements that will be downloaded and downloads them by placing them in a queue with different priorities.

In addition, AMP requires the use of programming techniques favoring an ultra-fast loading of the pages. To make the passage of AMP to the owners of websites, Google has created in early 2016 an AMP cache like in Leff (2001). Internet users access the AMP pages of a website from Google's servers and no longer from the "origin" server of the site. If hosting a site's content by Google poses many questions, it is still recommended to follow the instructions and technologies put forward by the search engine. AMP pages indexed and saved by Google are featured in Google News when searches are made from mobile devices.

One can choose to use AMP for all web pages, whether they are responsive or not, without necessarily redesigning the whole site, which is not possible using the responsive approach with the Bootstrap Framework. AMP pages currently work only for static content, and are ideal for news and blog posts, while responsive web design is suitable for any type of site and can include elements such as forms and applications of various kinds. In Fig. 4 is presented the AMP – Accelerated Mobile Pages architecture, accessed by desktop and mobile devices:

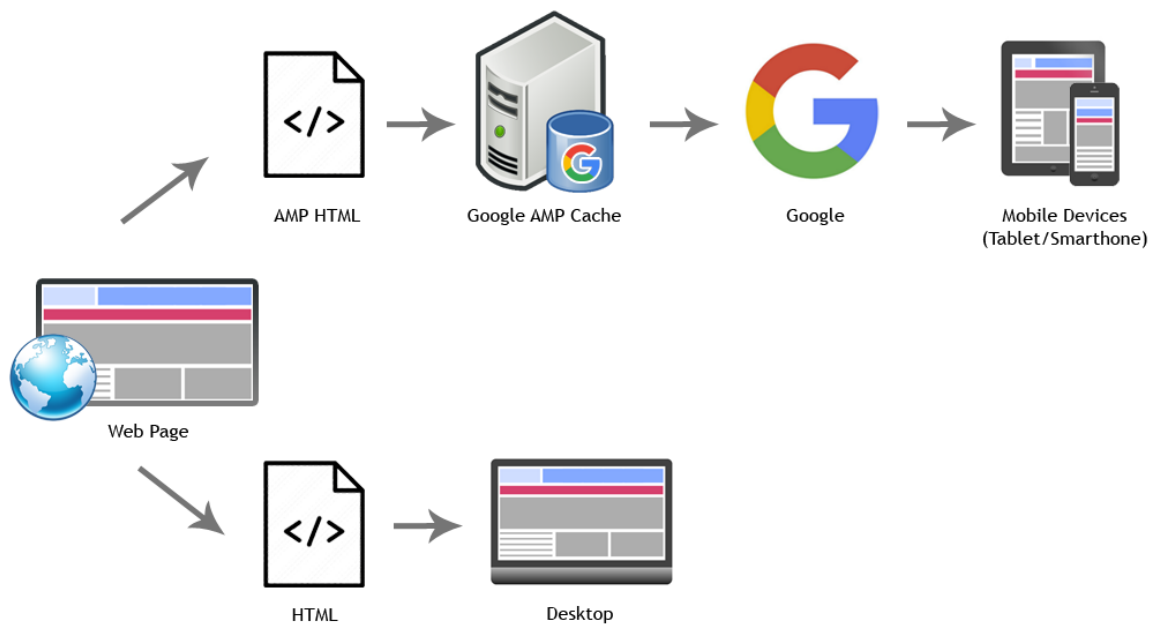


Fig.4 – AMP Architecture

4. Accelerated Mobile Pages vs Bootstrap Responsive Web Design

Both the AMP pages and the Bootstrap responsive websites work on mobile devices, but they have different objectives.

Bootstrap focuses primarily on rendering content that works with all devices, whether it's a desktop or mobile phone, unlike AMP, which is only for mobile devices. That's why responsive web design is more flexible today. However, it has the following issues:

- It requires a website to be redesigned for each device.
- The loading speed is slower making it less user-friendly.

Pages that contain data tables are a challenge for Bootstrap. If the data tables are wide and try to reduce the size of the screen, it will be so small that the user can barely see it. Zooming the table also becomes a problem because the users have to scroll both vertically and horizontally to read the content. This problem would be legalized by formatting the data table into a pie chart or mini-chart.

Looy (2016) mention that offering a good user experience is important both for the human factor (users will be more likely to browse the web site or web application) and because Google's algorithm favors the most usable sites, according to two main parameters: being mobile-friendly and the speed. Building a responsive web design with Bootstrap solves the first question, but is often lacking in speed. And that's where the AMP pages intervene.

Lately the websites enhanced with responsive web design and optimized in navigation and loading speed appear prominently among the search results of Google, in carousels or boxes dedicated to them composed of image, link of the article etc. Using AMP it is possible to browse the results without opening the web pages, and clicking on them instantly loads the content remaining within the search engine (Google claims that the pages created with AMP are loaded on average four times faster than traditional mobile pages and use up to 10 times less data).

Since in most cases these boxes appear on queries related to news, the implementation of AMP is currently more urgent for web pages who distribute content related to news and current events, such as online newspapers and magazines. Visibility and greater benefits are achieved only when one is

among the first to adopt new technologies . Therefore the goal of Accelerated Mobile Pages is to favor the instantaneous display of static content. Examples are news articles containing texts, info graphics, videos, advertisements and multimedia content. To these pages Google has reserved a separate display to carousel, positioned before even sponsored paid ads [22]. The user can click on the news without leaving the Google page, passing from one result to another with a simple "swipe". The AMP pages load much faster than the responsive pages and it is possible that in the not too distant future AMP will eventually be favored and can become an important ranking factor even though on this Google has not yet expressed a position Official.

5. Advantages and disadvantages of Accelerated Mobile Pages

Using a lightened code, AMP technology also implies limitations. For example, with regard to landing pages, marketers are very limited in what they can create using AMP.

The JavaScript functionality is very strict, this means that it is impossible to use analytics and other forms of monitoring to create targeted advertising experiences. With the lighter version of JavaScript, elements that require data transfer, such as landing page forms, can not be created. This means that if is needed to create landing pages in AMP, two-step process has to provided. In the first, users are invited to click on a link, which makes them land on a non-AMP page and on this page the user can then release the data.

However, there are also significant advantages in using the AMP pages. Among them, the fact that such pages can get better SEO ranking. The algorithm of Google, in fact, considers between the positioning criteria the loading speed of the sites and their performance on the mobile. The faster a site is loaded on mobile devices, the higher it will be ranked in search results. Other advantages includes HTML compression, JavaScript limitation and compression, image size adjusting to display and content reduced to a minimum cached on a proxy server in the CDN – Content Delivery Network

Among other advantages, the most important is certainly the possibility of providing a better user experience (UX) to its users. In Fig. 5 is presented the “almost” instant page loading by prerendering in the cache just the first view port display of the content:

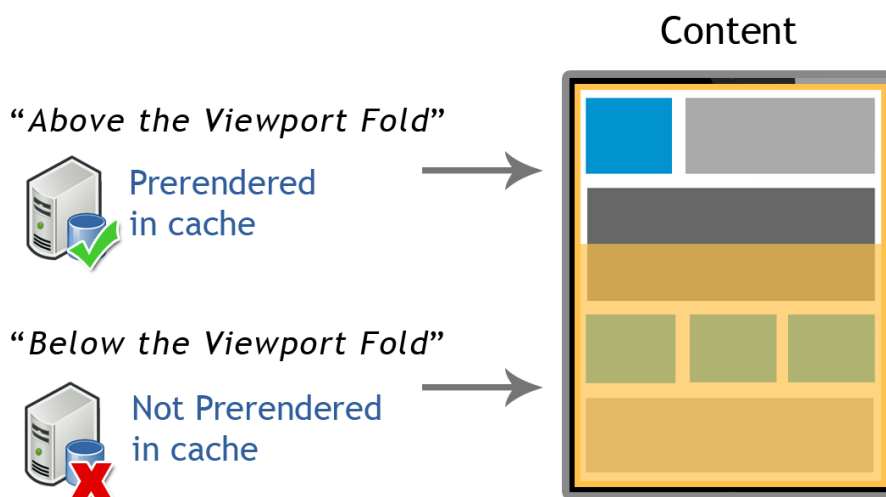


Fig.5 – Cache prerendering of the view port content

6. Conclusions

AMP technology is a very large project, which aims to become a shared standard for mobile. And it is only a matter of time before it also involves social networks, ecommerce sites (eg. Ebay) and the rest of the web market. The substantial difference: Responsive web design powered by Bootstrap is reactive or adaptable, while AMP is focused on speed. AMP can not keep up with Bootstrap in terms of design and if AMP can display pages at lightning speed, the technical constraints it imposes makes it very difficult to create an AMP version of some websites. However, the high speed of loading makes it a serious alternative for blogs, articles and online editors who pay little attention to images and more to content. Sites whose pages are based on many Javascript functions will have to make specific developments to offer the same services to AMP users.

A website must offer today to the user whatever its terminal and its connection adaptive pages and quick to load. Responsive Design using Bootstrap is a global response to this problem.

While the techniques and best practices of this method are appropriate for TVs, desktops and tablets, they may be insufficient for smart phones whose connections may be very limited because Bootstrap do not make it possible to obtain the same level of excellence for the loading time. To provide mobile users with a quick and enjoyable navigation, the creation of an AMP version of a site could become unavoidable. If this technology has not yet become a standard, it must already be deployed by the websites since the Google already favors in the results of its search engine.

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