How To Deliver Fast, Engaging Responsive Web Design Sites
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Mobile Impacts The Bottom Line

Engaging mobile users with fast, quality web experiences has become a business requirement. For the 2012 holiday shopping season, U.S. Retailers saw as much as 24% of all Internet shopping traffic from mobile devices - versus just 6% two years ago.\(^1\) A poster child of mobile success, eBay, expects to exceed $20 billion in volume from mobile alone.\(^2\)

Mobile isn’t just about retail. Financial services companies like Bank of America surpassed 12.6 million mobile users in the first quarter of 2013, which is 30% higher than in the first quarter of 2012.\(^3\) Media companies like Hearst are recording overall mobile volume across its magazines’ web properties up nearly 200% year-over-year, with around 20% of all traffic coming from mobile devices.\(^4\)

Mobile is a global phenomenon. In certain regions mobile is starting to overtake desktop\(^5\) in terms of internet access.

FIGURE 1: According to StatCounter, mobile traffic in India surpassed desktop traffic in August 2012

These trends all point to a single business directive: ignore mobile users and risk losing a large and growing portion of your business.
Responsive Web Design Adoption is Growing Fast

One of the ways to engage mobile users that has gained traction is Responsive Web Design (RWD). Responsive Web Design is a web development approach that suggests web pages should respond to the context in which they’re loaded (primarily screen size) and change their user interface accordingly. The practice consists of a mix of flexible grids and layouts, images, and an intelligent use of CSS3 media queries. RWD pages contain the HTML required to display all versions of a website, including both mobile and desktop views. CSS and JavaScript run in the browser and hide or modify the content to fit the screen size. Large brands such as Microsoft, Time, Disney and Tommy Hilfiger have all launched RWD sites.

Responsive Web Design adoption is in part driven by the operational efficiencies due to the elimination of a different design and development phase for each new mobile device category that comes to market. With Facebook reporting that 7,000 different mobile device types access the site every single day and UK publisher The Guardian authoring articles entitled: “Fragmented world: what two years of traffic data teaches you about mobile”, the operational challenges of supporting an ever-growing deluge of mobile devices are clear.

While adopting a RWD strategy might seem simpler, the reality is that successfully engaging mobile users with RWD sites is not without its challenges. As mobile devices have grown more powerful, networks have become faster and more consistent, and so too have the expectations of mobile end users grown.
Fast, Quality Web Experiences are a Prerequisite For Success

A core component of the mobile user experience is speed. When considering how online experience influences behavior, users inherently know that fast is better than slow. In 2009, Akamai commissioned Forrester Research to ask consumers how fast they expect a website to load on their PC. 47% said 2 seconds or less. In 2011 Equation Research asked the same question, but of smartphone users: how fast do you expect a website to load on your smartphone? 34% said 2 seconds or less. In 2012 the same question was posed to tablet users. The result: close to 70% of end users expect websites to load in 2 seconds or less. That's the majority, and that's fast.

To Deliver Fast, Quality Web Experiences Is Not Easy

To deliver engaging, rich Responsive Web Design sites fast is difficult. Let’s look at the web applications themselves. Guy Podjarny, Akamai Technologies’ Web Experience CTO, performed extensive research on the composition of Responsive Web Design sites and their impact on web performance. He tested 347 RWD sites across different screen resolutions and compared the number of bytes required to download each page across each resolution. Podjarny found that 72% of RWD sites tested were roughly the same size across different screen resolutions and 22% were only slightly smaller.

What’s worse, not only do most pages deliver the same payload across different devices but that payload aligns to the general trend of pages becoming heavier, with the average page size close to 1.2 Megabytes.
How To Deliver Fast, Engaging Responsive Web Design Sites

One of the challenges associated with the larger, more complex pages associated with RWD is that they need to be delivered to end users' browsers which then need to process and render them. Often on underpowered mobile devices with limited computing power, this can adversely affect the user experience.

Designers and developers have become used to powerful PCs on high bandwidth, low latency wired cable connections. Even in this environment, it is challenging to deliver rich, fast and engaging web applications. Add the constraints associated with mobile devices to the mix, as well as unpredictable Wi-Fi or congested 3G networks, and this becomes even more difficult. Not only is the available bandwidth of cellular and wireless networks much lower, but latency and variability are generally much higher. This is bad news, as research has shown that when it comes to web performance, latency has a bigger impact than bandwidth.\(^\text{16}\)

![Average page size by file type per resolution across 347 RWD sites](image)

**FIGURE 6:** Average page size by file type per resolution across 347 RWD sites

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![Cellular and wireless networks tend to be low bandwidth, high-latency environments compared to consumer grade cable networks](image)

**FIGURE 7:** Cellular and wireless networks tend to be low bandwidth, high-latency environments compared to consumer grade cable networks
Most RWD Sites Not are Meeting End User Experience Expectations

So what does delivering large, complex pages to mobile devices mean from an end users’ perspective? Below is a snapshot of the experience of an end user visiting a U.S. retailer’s RWD site’s home page on a variety of different devices/networks. Performance metrics were captured with an empty browser cache using Safari’s remote debugging capability. Ten tests for each device/network were run with the median page load time (onLoad event) displayed below. The conclusion is obvious. The delivery of a relatively small 700KB site to a mobile device, over wireless networks, has resulted in serious performance shortcomings.

Unfortunately, the RWD site above is by no means unique. By their very nature many Responsive Web Design (RWD) sites tend to be complex and slow. Based on Podjarny’s research it is clear that the vast majority of RWD sites deliver virtually the same bloated pages no matter the end user’s unique situation. In fact RWD site performance has been acknowledged as a serious concern in the web development community.

FIGURE 8: Example RWD site does not meet end users’ performance expectations

FIGURE 9: RWD site performance is a much debated issue in the web development community

https://twitter.com/stephanierieger/statuses/245240465572642816
Fast, Quality Responsive Web Design Sites Will Improve The Bottom Line

At this point you might be wondering – does it even matter if Responsive Web Design sites are slow? The short answer: yes, it matters. When dissatisfied with website performance, close to 50% of mobile users are unlikely to visit the site again. Even more worryingly, close to 30% are less likely to purchase from that company – across all channels. Looking at survey data is good, but let’s look at real end user data from the field. Real-user monitoring data allows you to see how real consumers actually behave. The Gomez graphs below are across aggregate data from around 280+ websites and 271 million page views. The trend is clear: the slower the page, the higher the abandonment rate. And higher abandonment generally means less revenue.

FIGURE 10: The trend is clear: slower pages equal higher abandonment

Poor website performance has also been linked to a decrease in revenue, traffic, conversions and an increase in customer support costs.

How To Deliver Fast, Quality Responsive Web Design Sites

It is clear that delivering fast websites of all varieties, including RWD sites, is vital. However, optimizing RWD site performance is not easy and requires considerable expertise and resources. As illustrated earlier, RWD pages contain the HTML required to display all versions of a website, including both mobile and desktop views. CSS and JavaScript run in the browser and hide or modify the content to fit the screen size. On smartphones, this often means the browser downloads the entire content needed to display the desktop site, only to have CSS/JS hide the vast majority of it.

The first step to deliver fast, quality RWD sites is to focus on the actual page and the associated objects delivered to the end user. As web performance optimization guru Steve Souders likes to point out: “80-90% of end user response time is spent on the front end. Start there.”

FIGURE 11: The vast majority of load time for this RWD site is spent on the front end
There are a variety of options available to developers looking to overcome the challenges associated with delivering heavy RWD sites. To start with, move content as close to the end user as possible (i.e. use a Content Delivery Network (CDN)) and leverage optimal delivery mechanisms such as SPDY that are particularly relevant for wireless networks. Next focus on the components of the Responsive Web Design application: the HTML, images, JavaScript and CSS objects. To deliver faster pages, focus on:

- Reducing the number of requests
- Reducing the number of bytes
- Accelerating rendering

### Reducing the number of requests

The fastest request is the one that isn’t made. Each client HTTP request and server response combination represents at least one round-trip on the network. Depending on the end user’s situation and proximity to the origin server, a single round-trip request can take seconds to complete. A single web page can require dozens of HTTP requests before it can render content, with requests often delaying one another due to the number of connections limited by the specific browser. To reduce round-trips, use several techniques to eliminate unnecessary requests such as consolidating multiple CSS and JavaScript files, in-lining small images and leveraging new caching features in HTML5.

### Reducing the number of bytes

The math is simple: the larger a web page (measured by bytes), the longer it will take to deliver over a constrained network and the longer it will take a browser to process and render the content. Images in particular are an issue for Responsive Web Design sites. Keep file size in check by adjusting image formats, improving cache management, compressing files and removing data such as comments, whitespaces and image metadata. Automated solutions exist to help deliver the right image resolution to the right device and avoid excessively large images, maintaining image quality at the edge of what the user can perceive for both small and large screens. For example, a page can be optimized to only load the images that are visible within the current viewport. As the user scrolls down, new images are loaded on demand. Loading images on demand helps improve page load time and also reduces bandwidth for cases where a user doesn’t actually scroll down a page. For RWD sites in particular, this keeps pages from downloading hidden images meant for other display sizes or conditions.
Accelerating rendering

Processing a web page is a complicated process. Browsers employ complex logic during load time, making decisions such as which files to download serially vs. in parallel, which resource types block rendering and how to manage their connections. At the same time, they need to parse and execute complicated HTML, CSS and JavaScript code, which is often not well defined. Unfortunately, the browser doesn’t know sites in advance and is forced to employ generic logic when processing a page. This logic changes between old and new browsers, is limited by backward compatibility, and is not customized to a site. Techniques like deferring print style sheets, keeping social buttons from blocking rendering and prefetching the next page are ways to guide the browser into doing the right thing. As a result, users can get a truly fast user experience, attuned to their needs.

Optimize Responsive Web Design Sites With Akamai

Delivering fast RWD sites is not easy and requires considerable expertise and resources. Few organizations have developers or expertise in-house to take this on. As Responsive Web Design evolves new models for delivering fast, quality web experiences to all users are coming to light. In particular an approach called RESS (Responsive Web Design + Server Side Components) seems to combine the best current mobile delivery techniques while keeping performance in the forefront.

Whichever Responsive Web Design approach you adopt, Akamai can help make it faster, offload development resources and optimize infrastructure investments. Akamai enables companies to accelerate and optimize their RWD sites through caching, network and application optimization. In particular Akamai Front-End Optimization (FEO) improves the web experience by modifying the HTML and associated resources to reduce requests, the amount of data delivered and accelerate page rendering.

Akamai Front-End Optimization accomplishes this in real time at the edge closest to the end user, without modifying the original web content. Optimizations are applied in concert with existing Akamai acceleration technologies to reduce the total size of the web page and its parts by using more efficient formats, improving cacheability and removing unnecessary content. In addition, Akamai Front-End Optimization can improve page rendering by adjusting the order or timing of loading data resources. This can help eliminate bottlenecks and inefficiencies associated with third-party content or services that might otherwise delay critical content from being displayed first.

To learn more about how to deliver fast, quality RWD sites without a team of dedicated front-end performance engineers, contact Akamai today.