




White Paper

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 US Retailers saw as much as 24 percent of all internet shopping traffic from mobile devices - versus just 6 percent two years ago.¹ A poster child of mobile success, eBay, expects to exceed \$20 billion in volume from mobile alone².

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 percent higher than in the first quarter of 2012.³ And media companies like Hearst are recording overall mobile volume across its magazines' web properties up nearly 200 percent year-over-year with around 20 percent of all traffic coming from mobile devices.⁴

Mobile is a global phenomenon. In certain regions mobile is starting to overtake desktop⁵ in terms of internet access.

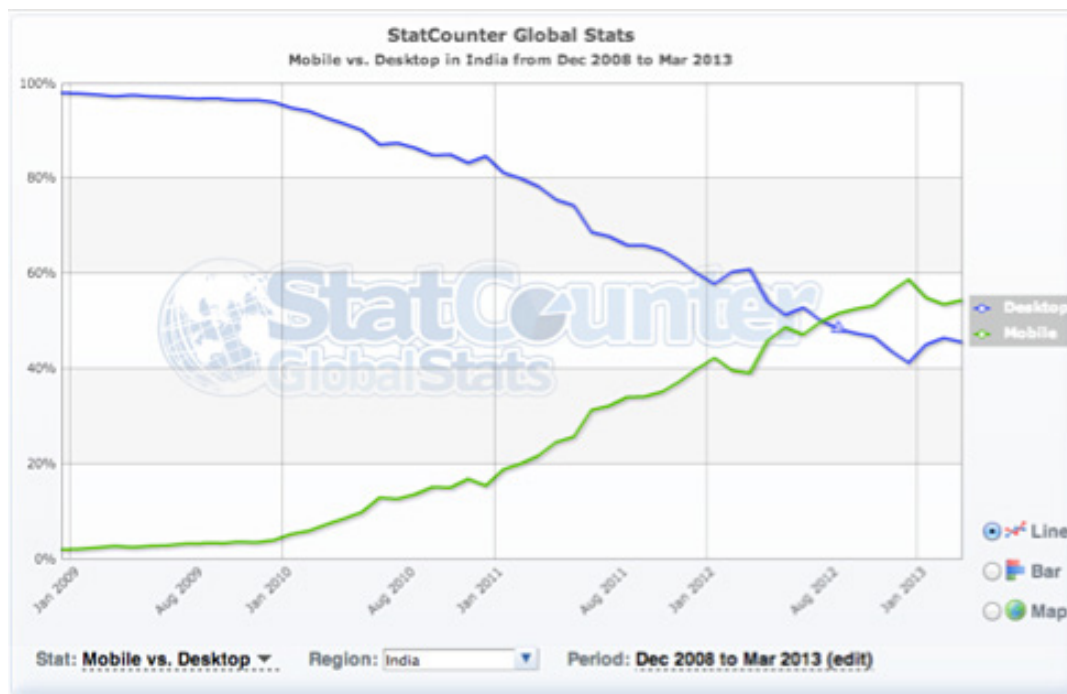


FIGURE 1: According to StatCounter mobile traffic in India surpassed desktop traffic in August 2012

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 Growing Fast

One of the ways to engage mobile users that has gained traction is Responsive Web Design (RWD). Responsive Web Design⁶ 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.

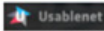










	Smartphone / Tablet Optimized Web Apps	Native Smartphone / Tablet Mobile Apps	Responsive Web Design Sites
Sample Vendors	       		
Overview	<ul style="list-style-type: none"> HTML/JS/CSS web apps tailored to smartphones and tablets Server side device detection and content adaptation 	<ul style="list-style-type: none"> Installable apps in Objective C for iOS and Java for Android Hybrid apps include web browser component which renders HTML/JS/CSS 	<ul style="list-style-type: none"> HTML/JS/CSS web apps with single response for all devices Client side device detection and content adaptation
Example			

FIGURE 2: Different approaches to engage mobile users

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 Facebook⁷ 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.

Handsets per manufacturer visiting guardian.co.uk

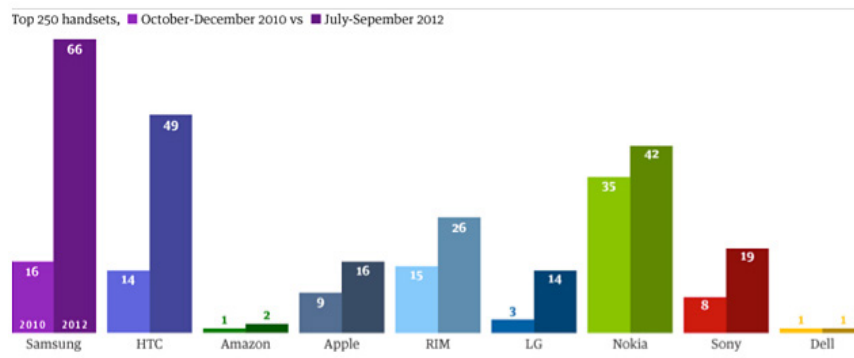


FIGURE 3: The Top 250 handsets per manufacturer visiting guardian.co.uk

While adopting a RWD strategy might seem simpler the reality is 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, so too have the expectations of mobile end-users grown.

Fast, Quality Web Experiences 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.⁸ In 2009 Akamai commissioned Forrester Research to ask consumers how fast they expect a website to load on their PC. 47 percent said 2 seconds or less.⁹ 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 percent said 2 seconds or less.¹⁰ In 2012 the same question was posed to tablet users. The result: close to 70 percent of end-users expect websites to load in 2 seconds or less.¹¹ That's the majority and that's fast.

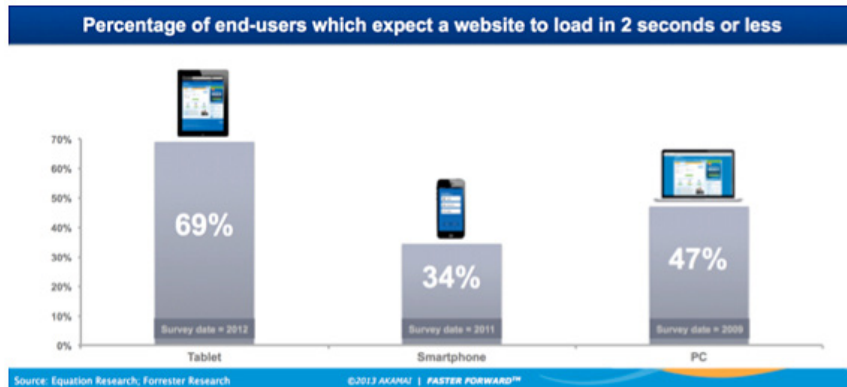
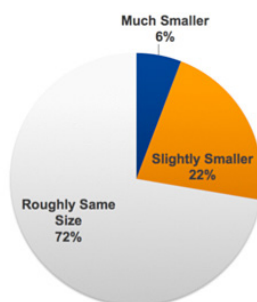


FIGURE 4: End-users expect fast, high quality web experiences across all devices

If you look at these survey results two things become clear. First, end-users don't care about the underlying technological challenges required to deliver fast, quality experiences to constrained devices over wireless and cellular networks. They just want sites to work and be fast. Second, end-user expectations just keep getting higher. Just as every time Apple releases a new smartphone, it has to be faster, thinner, and generally better in every way, web experience expectations are no exception. End-users expect Web applications to keep getting faster, richer and more engaging.¹²

To Deliver Fast, Quality Web Experiences Is Not Easy

Page Size Across 347 RWD Sites
Smallest Resolution vs. Biggest Resolution



To deliver engaging, rich Responsive Web Design sites fast is difficult however. Let's look at the web applications themselves. Guy Podjarny, Akamai Technologies' Web Experience CTO, performed extensive research¹³ on the composition of Responsive Web Design sites and the impact on web performance. He tested 347 RWD¹⁴ sites across different screen resolutions and compared the number of bytes required to download each page across each resolution.

Podjarny found that 72 percent of RWD sites tested were roughly the same size across different screen resolutions, and 22 percent were only slightly smaller.

FIGURE 5: Vast majority of 347 RWD pages tested download about the same number of bytes across resolutions

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 heavier¹⁵ with the average page size close to 1.2 Megabytes.

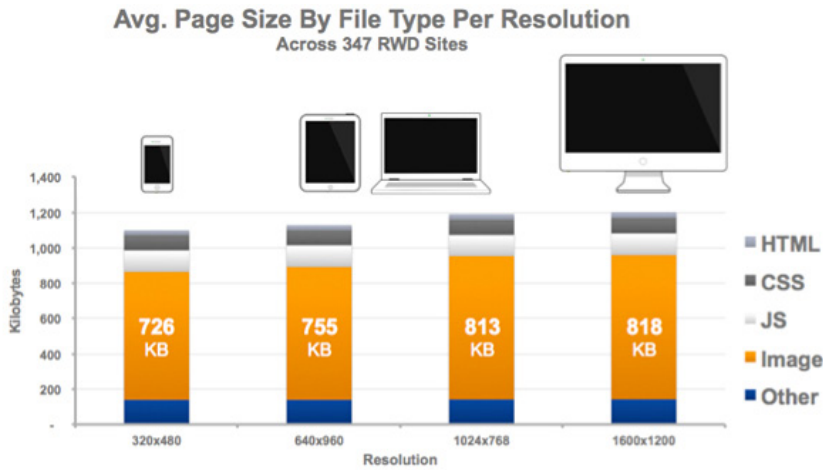


FIGURE 6: Average page size by file type per resolution across 347 RWD sites

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.¹⁶

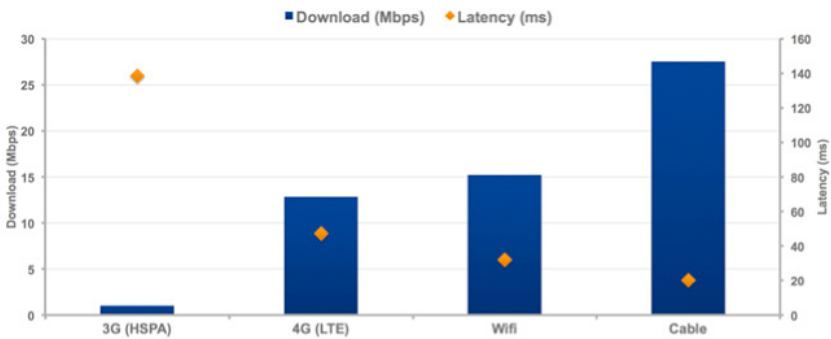


FIGURE 7: Cellular and wireless networks tend to be low bandwidth, high latency environments compared to consumer grade cable networks

Most RWD Sites Not 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 US 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.

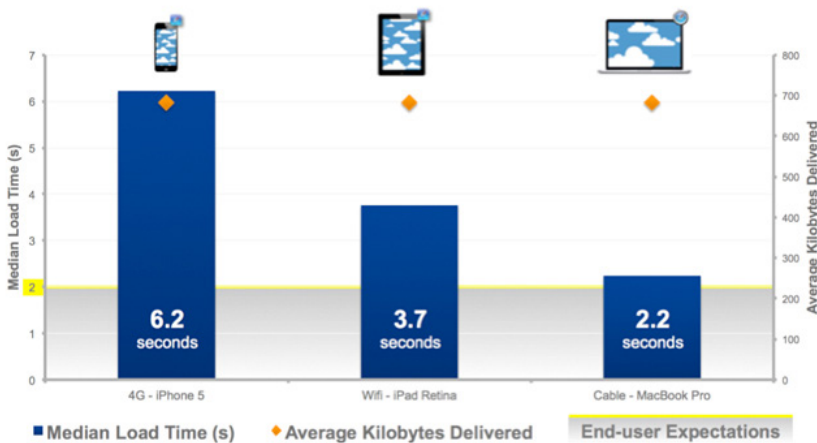


FIGURE 8: Example RWD site does not meet end-users' performance expectations

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.¹⁷ 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.



Stephanie Rieger
@stephanierieger



Shoot me now...responsive design has seemingly become confused with an opportunity to reduce performance rather than improve it. #performance

Reply Retweet Favorite More

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 percent of mobile users are unlikely to visit the site again. Even more worryingly, close to 30 percent are less likely to purchase from that company – across all channels.¹⁸ Looking at survey data is good but let's look at real end-user data from the field. Real-user monitoring¹⁹ 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.²⁰ The trend is clear: the slower the page, the higher the abandonment rate. And higher abandonment generally means less revenue.

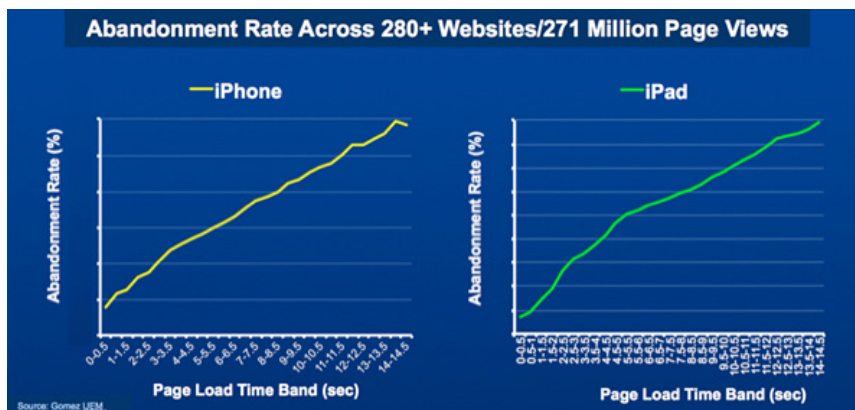


FIGURE 10: The trend is clear: slower pages equal higher abandonment

Poor website performance has also been linked to a decrease in revenue, traffic, conversions,²¹ and an increase in customer support costs.



How To Deliver Fast, Quality Responsive Web Design Sites

It is clear that delivering fast Web sites of all varieties, including RWD sites is vital. Optimizing RWD site performance is not easy and requires considerable expertise and resources²² however. 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 Souder's likes to point out: "80-90 percent of end-user response time is spent on the frontend. Start there."²³

FIGURE 11: The vast majority of load time for this RWD site is spent on the frontend

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)²⁴) and leverage optimal delivery mechanisms such as SPDY²⁵ 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.

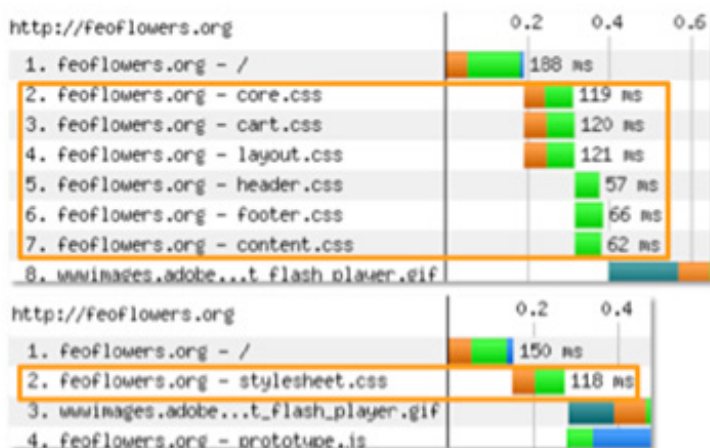


FIGURE 12: A simple optimization to reduce requests is to consolidate multiple CSS or JavaScript files into one

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.

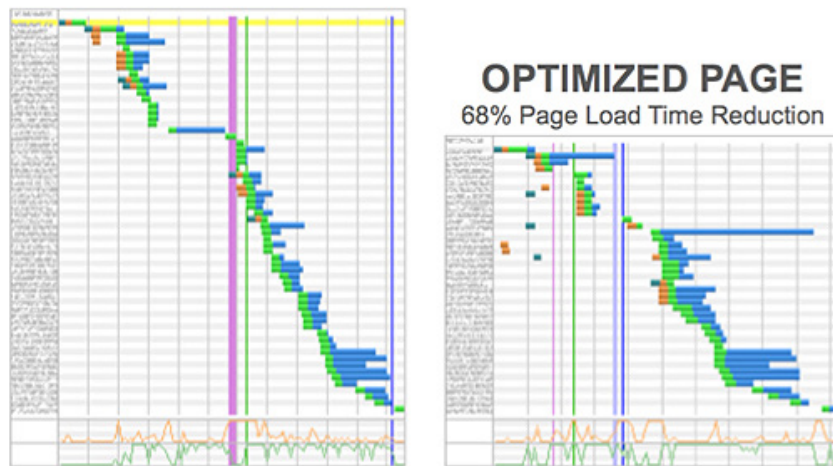


FIGURE 13: The optimized RWD site is significantly faster due to a reduction in bytes, requests and faster rendering

Optimize Responsive Web Design Sites With Akamai

Delivering fast RWD sites is not easy and requires considerable expertise and resources.²⁶ 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)²⁷ seems to combine the best of 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 cache-ability 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.

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Asia Pacific Headquarters	1 Raffles Place, #16 – 61 One Raffles Place, Singapore 048616	Tel +65.6593.8700	Fax +65.6593.8799
European Headquarters	Pfingstweidstrasse 60, 8005, Zurich, Switzerland	Tel +41.43.210.91.00	Fax +41.43.210.91.01
North American Headquarters	8 Cambridge Center, Cambridge, Massachusetts, United States 02142	Tel +1.617.444.3000	Fax +1.617.444.3001