



STATE OF THE UNION

Ecommerce Page Speed & Web Performance

Spring 2013



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Executive Summary

Depending on whom you ask, the idea that the speed of a web site correlates directly to that web site's success is either old hat or a complete revelation. For those in the “revelation” camp, it is crucial to understand that the speed with which a page renders in a visitor's browser affects every conceivable business metric, including page views, bounce rate, conversions, customer satisfaction, return visits, and of course revenue. These effects are felt at companies of all sizes – from multinational internet giant Yahoo!, which found that making pages just 400 milliseconds faster resulted in a 9% traffic increaseⁱ, to online auto parts retailer AutoAnything, which cut its page load times in half and experienced a 13% increase in sales.ⁱⁱ

Just a few seconds – and sometimes even fractions of a second – can make the difference between online success and failure, yet it can be difficult for site owners to gain a true understanding of their web site's performance. If you are a CEO or a developer, the chances are good that you're enjoying the responsiveness of your corporate LAN, thereby guaranteeing speedy load times for your own site.

The purpose of this research is to gain ongoing visibility into the real-world performance of leading ecommerce sites – to learn how these sites perform for visitors sitting at home using the internet under normal browsing conditions.

In December 2012, we tested the load times (in Internet Explorer 9, Firefox 17, and Chrome 23) and page composition of the home pages of 2,000 leading retail web sites, as ranked by Alexa.com. We then analyzed this data alongside previous benchmark tests performed on the same set of sites, dating back to December 2010.

The goal was to identify trends and find answers to the following questions:

- Given the assumption that page speed is an increasingly urgent issue for online retailers, has this urgency translated into faster pages over time?
- Similarly, how quickly have retailers moved to adopt core performance best practices, such as using content delivery networks (CDNs)?
- How do the top 100 sites perform relative to the top 2,000?
- How do different browsers compare in terms of page rendering speed?

Our findings are detailed in this report, and are summarized here:

Key Findings

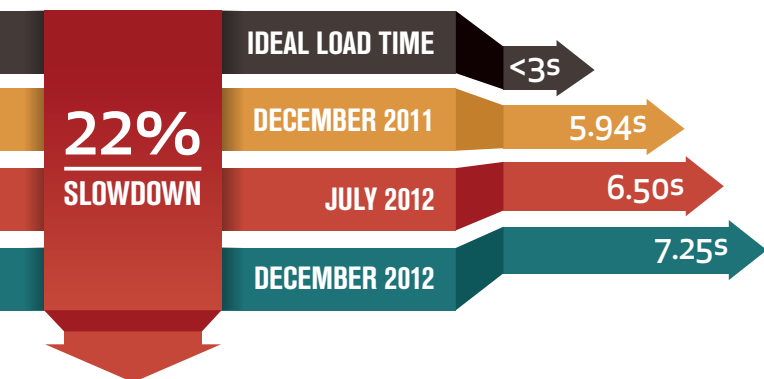
- 1. Load times have increased by 22% in just one year.** The median load time for a first-time visitor to a home page in the Alexa Retail 2000 was 7.25 seconds, compared to the median of 5.94 seconds recorded in December 2011.
- 2. Top retailers underperformed the rest of the pack.** The median top 100 site had a load time of 8.23 seconds, 14% slower than the overall median load time of 7.25 seconds. Top sites are also slowing down at a faster rate: 28% compared to 22% for the top 2,000 sites.
- 3. Many sites still do not follow core performance best practices.** Only 25% of the Alexa 2000 uses a CDN. At the same time, between 13% and 22% of sites fail to implement other relatively simple performance-enhancing techniques.
- 4. Firefox outperformed other browsers.** With a median load time of 6.64 seconds, Firefox was 8.4% faster than Internet Explorer 9, which had the slowest median load time (7.25 seconds).

The 10 Fastest Sites

All page load times are indicated in seconds. Highlighted numbers represent newcomers to the top 10.

DECEMBER 2012	SEPTEMBER 2012	DECEMBER 2011
1 CVS.com (1.02s)	Polo.com (1.93s)	Nike.com (2.27s)
2 Polo.com (1.90s)	eCrater.com (1.95s)	JCPenney.com (2.65s)
3 eCrater.com (1.95s)	BHPhotoVideo.com (2.30s)	Amazon.com (2.78s)
4 Abebooks.com (2.05s)	Adorama.com (2.72s)	eMusic.com (3.28s)
5 BHPhotoVideo.com (3.03s)	Abebooks.com (3.04s)	Etsy.com (3.40s)
6 JCrew.com (3.15s)	ShopBop.com (3.09s)	eCrater.com (3.54s)
7 Amazon.com (3.26s)	JCrew.com (3.09s)	WellsFargo.com (3.81s)
8 ShopAtHome.com (3.74s)	Audible.com (3.39s)	CDUniverse.com (3.81s)
9 Etsy.com (3.88s)	KodakGallery.com (3.41s)	Adorama.com (4.08s)
10 Gamefly.com (3.94s)	ShopAtHome.com (3.65s)	JCrew.com (4.24s)

Finding #1: Load Times Have Increased by 22% in Just One Year.

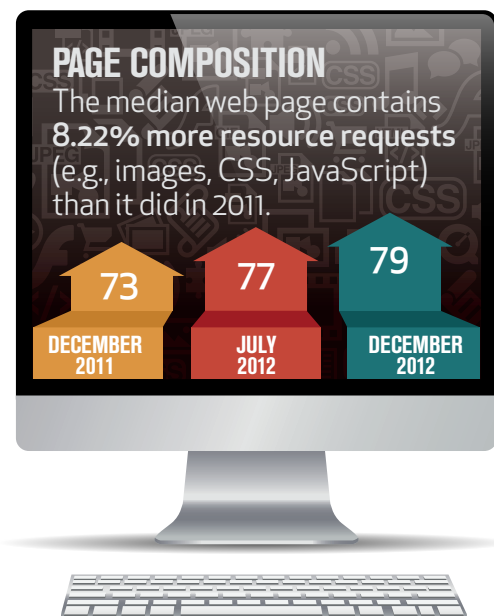


Except where specifically noted, the results discussed in this report are for pages tested on Internet Explorer 9. As of December 2012, IE9 enjoyed a market share of 26%ⁱⁱⁱ, making it the most widely used browser in the United States.

In December 2012, the median load time for a first-time visitor to a home page in the Alexa Retail 2000 was 7.25 seconds. This represents a 22% slowdown from the median load time of 5.94 seconds recorded in December 2011.

One only has to look as far as the median number of resource requests to understand the reason behind this slowdown.

In December 2012, the median page contained 79 requests (such as images, HTML, and CSS/JavaScript files), an increase of 8.22% from December 2011 median of 73 requests. Each page resource makes an individual round trip from the user's browser, which requests the file from the host server, which in turn delivers the file to the browser. Each round trip can take 20-50 milliseconds for desktop browsers – and up to a full second each for mobile users – numbers that add up quickly when pages contain dozens of resources.



What This Means

There is a sizable body of research demonstrating that the average internet user has a wait time threshold of **3 seconds or less**.^{iv} If pages continue to slow down, the gulf between user demands and page performance will continue to widen. At the current rate of slowdown, by the end of 2013 the median retail page could take as long as 9 seconds to load.

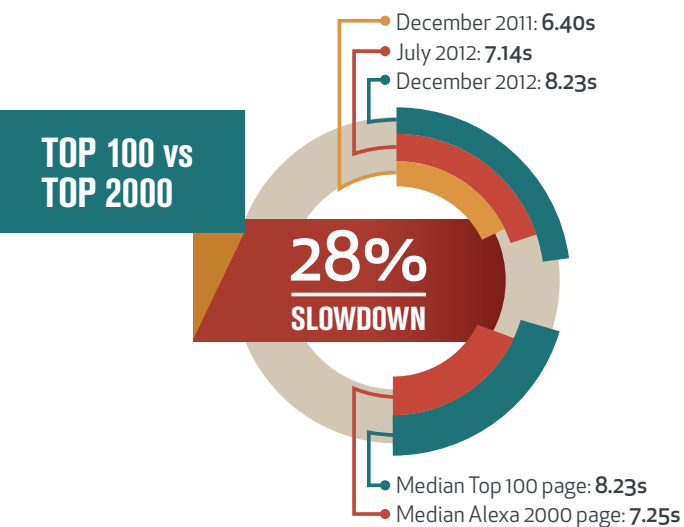
Mobile shoppers are even more seriously affected by page girth and complexity. Up to one-third of mobile users will choose to view the full site rather than the m.site on their devices.^v Given the performance challenges posed by poorer processor power and 3G networks, mobile users are most at risk of suffering significant usability handicaps. In a study similar to this one, performed last fall over mobile devices, top retail sites took up to 45 seconds to load on mobile devices.^{vi}

Why Has Page Speed Not Kept Pace with Technological Innovation?

As devices, browsers, and networks continue to evolve, there is a general assumption that, inevitably, page speed must also be improving. As our findings suggest, however, the opposite is taking place. This is in large part due to two challenges:

1. **Pages are getting bigger** – According to the [HTTP Archive](#), in December 2012 the average Top 1000 web page was 1163 kB in size. Just two years earlier, in December 2010, the average page was a mere 665 kB. This represents a growth rate of 75% in just two years. At this rate, the average Top 1000 web page will surpass 2 mB by the end of 2014. Images are a major contributor to page growth, accounting for more than half of a page's total payload.
2. **Pages are growing more complex** – Not only are pages larger than ever, they are also more complex, pulling resources from multiple servers housed in many locations. As an example, the average Internet Retailer 200 site contains seven third-party scripts, such as analytics, social tools, and advertising engines.^{vii} Each of these scripts pulls resources from a different server location, and each represents a single point of failure (SPoF) that has the potential to slow down pages or prevent them from loading altogether.

Finding #2: Top Retailers Underperformed the Rest of the Pack.



Looking at the results for the top 100 sites reveals that these home pages suffer from poorer performance than the Alexa Retail 2000. The median top 100 site had a load time of 8.23 seconds, 14% slower than the overall median load time of 7.25 seconds.

Not only are top sites slower than the rest of the pack, our findings indicate that they're slowing down at a faster rate. In just one year, the load time for the median top 100 site has slumped from 6.40 seconds to 8.23 seconds. This represents a slowdown of 28%, compared to the 22% slowdown experienced by the top 2,000 sites.

Page size and complexity could be partially to blame, as top pages are likely to contain more page resources than other sites. The median top 100 page contained 86 resources, compared to the median Alexa 2000 site, which contained 79 resources.



Finding #3: Many Sites Still Do Not Follow Core Performance Best Practices.

There are dozens of industry best practices that are recommended^{viii} for dynamic, complex web sites. We surveyed the Alexa Retail 2,000 for their deployment of three core techniques, two of which – enable keep-alives and compress text – are considered “low-hanging fruit” in terms of their ease of implementation:

- 1. Use a content delivery network (CDN)** – Allows site owners to cache static page resources in geographically distributed servers, so that resources are closer to end users, shortening server round trips.
- 2. Enable keep-alives** – Allows site owners to control how many times the TCP connection takes place. TCP connection is the process by which both the user and the server send and receive acknowledgment that a connection has been made and that data can begin to be transferred. Too many TCP connections will slow down a site.
- 3. Compress text** – Compressing page resources reduces the number of bytes sent over the network, and therefore speeds up rendering time.

Using a CDN can reduce load time by up to 30%. Implementing keep-alives and compression can have a similarly dramatic impact on page speed:

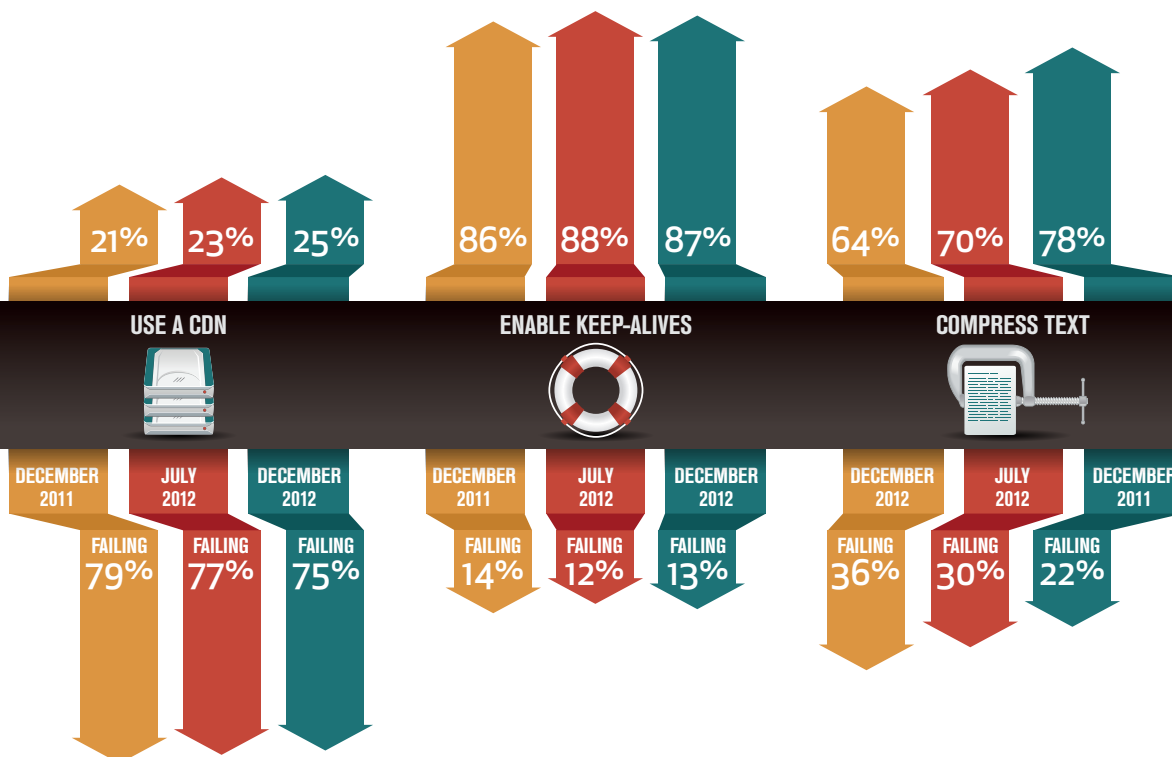
- Up to 52% improvement in start render time
- Up to 40% improvement in document complete
- Up to 31% improvement in time to fully load

Despite the proven benefits of adopting these three best practices, our survey revealed that many sites are not taking advantage of these opportunities. Only 25% of the Alexa 2000 uses a CDN. At the same time, 13% of sites fail to implement keep-alives, and 22% fail to compress resources.

While best practice adoption rates have improved somewhat since 2011, the changes are not significant across the board. This suggests a lack of understanding among site owners about their performance-boosting benefits. It is important to note here that, while using a CDN can be a costly undertaking, keep-alives and compression are two of the easiest-to-implement techniques available to site owners.

Perhaps not surprisingly, the top 100 retail sites were significantly more likely to follow core best practices.

Among the top 100, 78% used a CDN, 99% enabled keep-alives, and 91% compressed page resources.



Finding #4: Firefox Outperformed Other Browsers.

While this survey focuses primarily on Internet Explorer 9, we also tested the load times of the Alexa Retail 2000 on other popular browser versions – Firefox 17 and Chrome 23 – to gain a side-by-side performance perspective. Firefox experienced the fastest median load time, at 6.64 seconds. This was 8.4% faster than Internet Explorer 9, which had the slowest median load time, at 7.25 seconds.

What This Means

The question of which browser version is fast at this particular moment in time is less relevant than this question: is browser performance trending downward or upward? To answer this question, we looked at historical data showing the median load times of the Alexa Retail 2000 over a 6-month period.



For all three browsers, median load times had slowed down by anywhere from 3% to 12% in just six months.

This downward trend is not a browser development issue. Rather, it speaks to the fact that, despite the huge performance leaps made by vendors, development cannot keep pace with the demands placed by ever-growing and increasingly complex web pages.

Note: In recent years, speed has emerged as an extremely competitive issue among browser vendors. While our tests simulated how fast each site loads for a real user who is viewing only one site at a time within the browser, browser performance is nuanced and can't be summed up using a single metric such as load time. Our findings are only one part of a bigger picture.

Our tests did not include performance factors such as the following:

1. Browser performance under stress from having multiple tabs open simultaneously.
2. Browser performance degradation over time (i.e., the longer the browser remains open, its likelihood of crashing).
3. Browser performance when visiting sites that use HTML5 or Flash, or when watching videos.
4. Usability. This often comes down to personal preference. For example, while some users may prefer a more minimal look and feel, others might value the functionality of add-on features.

Takeaways

1. Ecommerce web sites are not rising to meet the performance expectations of today's online shoppers.

The majority of shoppers state they will leave a page that doesn't load in 3 seconds or less, yet a typical page on a retail site takes more than 7 seconds to load. This disconnect between expectations and reality represents a clear opportunity for site owners who are prepared to rise to the challenge of satisfying the demand for a speedy user experience.

2. Pages are getting slower at a dramatic rate.

In just one year, the median Alexa Retail 2000 home page has slowed down by 22% – from 5.94 seconds to 7.25 seconds. At this rate, the median load time could reach 9 seconds by the end of 2013. While the matter of one or two seconds may sound trivial, it is crucial to understand that, when it comes to performance, every second counts. One Aberdeen study found that a 1-second delay in load time could result in a 7% loss in conversions and a 16% decrease in customer satisfaction.^{ix}

3. Top sites are faced with significant performance challenges.

Despite their greater investment in performance-boosting strategies, such as using content delivery networks, the top 100 retailers suffered slower load times than the top 2,000 sites. This could be attributed to the fact that their pages contain more resources, and the resulting size and complexity hinders rendering.

4. Browsers are not keeping pace with the growing demands of modern web pages.

This is despite the rapid rate of browser development, and despite browser vendors' acute focus on speed as a feature.

5. Many site owners are failing to pluck the low-hanging performance fruit.

A significant number of sites have not adopted relatively simple best practices – such as enabling keep-alives and compressing resources – that could deliver performance improvements of up to 52%.

Methodology

The tests in this study were conducted using a tool called WebPagetest.org – an open-source project primarily developed and supported by Google – which simulates page load times from a real user’s perspective using real browsers. We tested the home page of every site in the Alexa Retail 2000 three times in a row. (The system clears the cache between page loads.) The median test result for each home page was recorded and used in our calculations.

The tests were conducted over a two-week period – December 3-14, 2012 – via the WebPagetest.org server in Dulles, VA, using the following browsers on a DSL connection:

- Internet Explorer 9
- Firefox 17
- Chrome 23

In very few cases, WebPagetest.org rendered a blank page or an error in which none of the page rendered. These instances are represented as null in the test appendix. Also, in very few cases, WebPagetest.org rendered a page in more than 60 seconds (the default timeout for webpagetest.org). In these cases, 60 seconds was used for the result instead of null.

About Radware

Radware (NASDAQ: RDWR), is a global leader of application delivery and application security solutions for virtual and cloud data centers. Its award-winning solutions portfolio delivers full resilience for business-critical applications, maximum IT efficiency, and complete business agility. Radware’s solutions empower more than 10,000 enterprise and carrier customers worldwide to adapt to market challenges quickly, maintain business continuity, and achieve maximum productivity while keeping costs down. For more information, please visit www.radware.com.

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