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Speed Matters

Tuesday, June 23, 2009

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At Google, we've gathered hard data to reinforce our intuition that "speed matters" on the Internet. Google runs experiments on the search results page to understand and improve the search experience. Recently, we conducted some experiments to determine how users react when web search takes longer. We've always viewed speed as a competitive advantage, so this research is important to understand the trade-off between speed and other features we might introduce. We wanted to share this information with the public because we hope it will give others greater insight into how important speed can be.

Speed as perceived by the end user is driven by multiple factors, including how fast results are returned and how long it takes a browser to display the content. Our experiments injected server-side delay to model one of these factors: extending the processing time before and during the time that the results are transmitted to the browser. In other words, we purposefully slowed the delivery of search results to our users to see how they might respond.

All other things being equal, more usage, as measured by number of searches, reflects more satisfied users. Our experiments demonstrate that slowing down the search results page by 100 to 400 milliseconds has a measurable impact on the number of searches per user of -0.2% to -0.6% (averaged over four or six weeks depending on the experiment). That's 0.2% to 0.6% fewer searches for changes under half a second!

Furthermore, users do fewer and fewer searches the longer they are exposed to the experiment. Users exposed to a 200 ms delay since the beginning of the experiment did 0.22% fewer searches during the first three weeks, but 0.36% fewer searches during the second three weeks. Similarly, users exposed to a 400 ms delay since the beginning of the experiment did 0.44% fewer searches during the first three weeks, but 0.76% fewer searches during the second three weeks. Even if the page returns to the faster state, users who saw the longer delay take time to return to their previous usage level. Users exposed to the 400 ms delay for six weeks did 0.21% fewer searches on average during the five week period after we stopped injecting the delay.

While these numbers may seem small, a daily impact of 0.5% is of real consequence at the scale of Google web search, or indeed at the scale of most Internet sites. Because the cost of slower performance increases over time and persists, we encourage site designers to think twice about adding a feature that hurts performance if the benefit of the feature is unproven. To learn more on how to improve the performance of your website visit code.google.com/speed. For more details on our experiments, download this PDF.