Speed matters

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How fast can the web be?
How fast is the web?

Average load time of a web page is 4.9 seconds

- Average size of a web page is 320 KB
- Average bandwidth of a user is 1.8 Mbps
- So, a typical page should load in 1.4 seconds

What's taking so long, then?
Elements of a page load

source: webpagetest

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Elements of a page

An average web page:

- is 320 KB in size
- uses 44 resources
- makes 7 DNS lookups
- doesn't compress a third of its content
Make the web faster
Faster browsers

source: betanews

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Faster browsers

Chrome:

- is state of the art (e.g.: HTML5, V8 javascript engine, DNS prefetching, VP8 codec)
- is open source
- spurs competition
Faster browsers

![Bar chart comparing average page load times for different browsers](chart.png)
TCP improvements:

- Fast start (higher initial congestion window)
- Quick loss recovery (lower retransmit timeouts)
- Makes Google products 12% faster
- No handshake delay (app payload in SYN packets)
TCP improvements:

![Bar chart showing absolute and percentage improvement for different categories: iGoogle, Images, News, Photos, Web-Search, Maptiles. The y-axis represents improvement in milliseconds (ms), and the x-axis represents the different categories. The chart shows significant improvements, with absolute improvements ranging from a few milliseconds to over a thousand milliseconds, and percentage improvements ranging from 2% to 18%.](chart.png)
DNS improvements:

- Propagate client IP in DNS requests (to allow servers to better map users to the closest servers)
SSL improvements:

- False Start (reduce 1 round trip from handshake)
  - 10% faster (for Android implementation)
- Snap Start (zero round trip handshakes, resumes)
- OCSP stapling (avoid inline round trips to certificate authority)
HTTP improvements (SPDY):
- Header compression
- Stream multiplexing and prioritization
- Server push/hints
- 25% faster
SPDY: Network efficiency

Test:
Download the same “top 25” pages via HTTP and SPDY
Network simulates a 2 Mbps DSL link, 0% packet loss

<table>
<thead>
<tr>
<th></th>
<th>FLIP</th>
<th>HTTP</th>
<th>% delta</th>
</tr>
</thead>
<tbody>
<tr>
<td># Pkts</td>
<td>8487</td>
<td>14142</td>
<td>-40%</td>
</tr>
<tr>
<td>Avg Pkt Size</td>
<td>943B</td>
<td>667B</td>
<td>41%</td>
</tr>
<tr>
<td>MB Transferred</td>
<td>8.0MB</td>
<td>9.4MB</td>
<td>-15%</td>
</tr>
</tbody>
</table>
SPDY: Header compression

On low-bandwidth links, headers are surprisingly costly. Headers alone can cost more than 1 second of latency.
Public DNS:

- Reduces recursive-resolve time by continuously refreshing cache
- Increases availability through adequate provisioning
1 Gbps broadband:
- Pilot project to fix “last mile” complaint
- Leapfrog: Huge increase of 100x
Hosting for popular files (jQuery, fonts, etc):

- Frees up web site's server resources and provides load balancing, low latency
- Improves caching on client (same URL across multiple sites)
More developer tools

- Page Speed
- Closure Compiler
More awareness

- Web search ranking
- code.google.com/speed
- Browserscope
- Site Performance data
Let us work together!
References

- TCP Initial Congestion Window:
  datatracker.ietf.org/doc/draft-hkchu-tcpm-initcwnd/

- TCP Retransmit Rate:
  tools.ietf.org/id/draft-paxson-tcpm-rfc2988bis-00.txt

- DNS Client IP in Requests:
  tools.ietf.org/html/draft-vandergaast-edns-client-ip-00

- SSL False Start:
  tools.ietf.org/html/draft-bmoeller-tls-falsestart-00

- SSL Snap Start:
  tools.ietf.org/html/draft-agl-tls-snapstart-00

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References


- YouTube bandwidth data (per user): [www.youtube.com/my_speed](www.youtube.com/my_speed)

- Webmaster Tools load time data (per site): [www.google.com/webmasters/tools](www.google.com/webmasters/tools)
  (go to Labs → Site Performance)

- Web page statistics (aggregate): [code.google.com/speed/articles/web-metrics.html](code.google.com/speed/articles/web-metrics.html)